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the technical journal of the broadcast-communication's industry

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December, 1969 • Volume 11, No. 12

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

Pictured on the cover is a heavy duty emergency generator plant. For the last part of a series of articles dealing with emergency broadcasting, see the article on page 22.

DEPARTMENTS

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

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Robert E. Hertel, Publisher

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DIRECT CURRENT FROM D. C.

December, 1969

By Howard T. Head

Commission To Require CATV Program Origination

The Commission has amended its CATV regulations to require that all CATV systems having more than 3,500 subscribers originate local program material. Smaller systems may originate program material on a voluntary basis.

No restrictions are placed on the type of material which may be transmitted over the system, and the operator may employ as many channels of programming as desired. Commercial messages will be permitted, although these are to be restricted to "natural breaks" in the program material.

The broadcast requirements for equal time, sponsor identification, and the fairness doctrine will be applied to CATV originations. No technical standards are adopted, but it is apparent from the Commission's order that the use of quite inexpensive studio equipment is comtemplated.

All of these requirements will be subject to further review as experience is developed in the area of CATV program originations. Of particular interest will be future restrictions on the number of program channels permitted to individual operators, as well as the limit of subscribers (now 3,500) above which program origination is mandatory rather than voluntary.

What To Do When The Subcarrier Fails

An increasing number of FM stations broadcasting in stereo are becoming concerned by the distribution of FM stereo receivers which use the absence of the pilot subcarrier to mute the audio output. Additionally, there are some signal-seeking FM stereo receivers on the market which pass over channels where the pilot subcarrier is absent.

Monaural material consisting of such things as newscasts and commercials are commonly interspersed among stereo musical selections. Although the Commission's Rules are silent with respect to the transmission of the pilot subcarrier with monaural material, the Commission has loosely applied a "rule of thumb" of five minutes as the amximum period during which monaural material may be transmitted without shutting off the pilot subcarrier.

One enterprising station is reported to have circumvented the problem neatly by playing faint stereo guitar music in the background of its newscasts.

(Continued on page 6)

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(Continued from page 4)

FAA Re-Examining Proposed Daytime Tower Lighting Requirements

Following the receipt of comments on its proposal to require daytime lighting of tall television towers, the Federal Aviation Administration (FAA) has re-examined the technical aspects of the proposal. This restudy has led to the conclusion that the lighting system originally proposed was not satisfactory, and that further development was needed (see October, 1967 Bulletin). The FAA now plans to call for new comments when a revised system has been successfully developed. This may be as early as six months, but techniques for daytime lighting of tall towers have a long history of failure.

Subaudible AM Telemetering Authorized

The Commission has adopted new regulations permitting standard broadcast (AM) stations operated by remote control to transmit telemetry signals on the broadcast carrier. Such a system was first proposed in 1967 (see October, 1967 Bulletin), employing telemetry tones in the frequency band from 20-36 Hz with a modulating amplitude not to exceed 10 per cent.

Extensive testing indicated that in some cases these values caused some degradation of home reception. Consequently, the frequency range was reduced to a maximum modulating frequency of 30 Hz (no lower limit) with a maximum modulation amplitude of 6 per cent. Tests indicated that these values would provide satisfactory telemetry.

There had been some concern that this type of telemetry might interfere with special emergency alerting signals (see August, 1969 Direct Current). The Commission pointed out, however, that all of the emergency systems now being seriously considered employ considerably higher modulating frequencies.

FM Allocations Still Under Study

The Commission continues to study the possibility of establishing an assignment table and allocations standards for non-commercial educational FM stations (Channels 201-220) following the same general lines as those for commercial FM stations. Discussions are continuing with the Canadian Government regarding the allocation of the non-commercial band (U.S. and Canada already have a treaty covering the commercial FM band), and in addition discussions are getting under way with the Mexican authorities looking toward an agreement between the U.S. and Mexico covering the entire FM band.

Short Circuits

The Commission has proposed tighter radiation limits on the local oscillators of UHF television receivers; average field strengths over the band would not exceed 350 uv/m at a distance of 100 feet compared with the present limit of 1000 uv/m . . . The Commission has authorized a carrier-current campus radio station to employ AT&T lines for networking with other stations, and has authorized another such station to connect with the local CATV system; in both cases, the Commission has asked for reports within a year to provide guidance for future regulation . . . The Commission has refused to require a South Carolina VHF translator to provide protection to the reception of a station 98 miles way, holding that the distant signals were not "regularly used" in the area . . . The Commission has proposed to require that non-commercial educational FM stations be subject to the same annual performance requirements as commercial FM stations.

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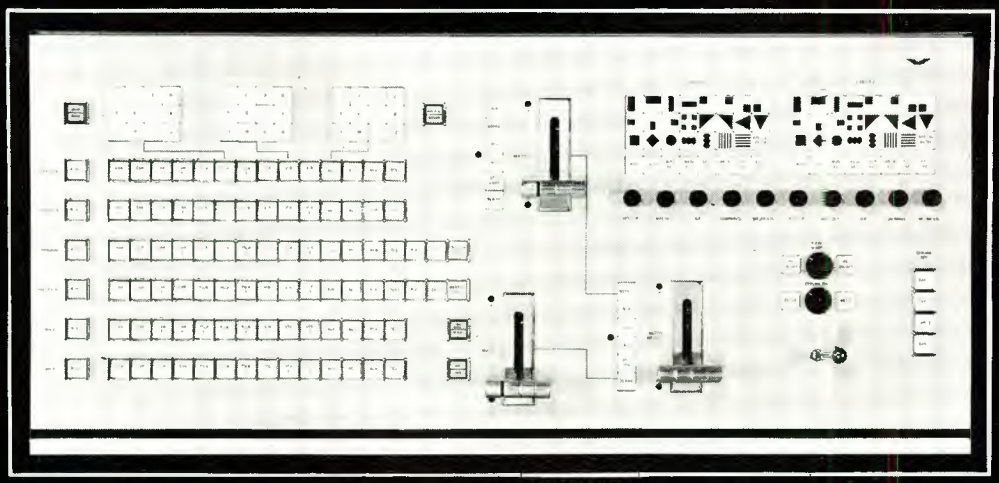

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LETTERS
TO THE EDITOR

After being personally involved with the sale and installation of several thousand standby generators over the past 15 years there are few new wrinkles which come up. Invariably each customer feels his situation is unique, while in fact, his problem is just a combination of problems previously solved.

A basic requirement of any standby system is fuel. Given my choice, I would select natural gas on units up through 150 KW and diesel for the larger generating plants. Where there is reason to worry about the natural gas supply, provide for combination carburetion, either gasoline or LPG as standby fuels. If gasoline is used, install a one quart day tank which keeps a reservoir of fuel at the carburetor. If LPG is selected, be sure the system can deliver the required cubic feet per minute at the lowest anticipated temperatures. Weekly exercise periods will keep accessory equipment in good condition and fresh fuel at the carburetor.

Specification sheets generally show speed regulation as being from NO LOAD to FULL LOAD. In practice, few loads vary to these extremes. On a typical 200 KW diesel, the NO LOAD to FULL LOAD regulation is given as 1.8 cycles maximum. Steady state frequency regulation is given as ±0.3 cycles when the standard governor is used. Before you go dashing out to spend

Gates has a new line-up of VHF-TV Transmitters see pages 18-19

a thousand dollars or more for special governors, check the frequency regulation of your commercial source. Something better than a vibrating reed meter is required to accomplish this test. You may be surprised at the results.

Better governors are available, but may not give the desired results. Speed regulation is dependent on governing and other engine design parameters. I recall a recent case where an engineer insisted on a special $1500 electronic governor. Tests, before and after, convinced us this was a wasted expenditure on this particular engine design.

As I stated in my article (August, BE), a prospective purchaser will be well advised to seek the assistance of an experienced standby generator representative. You wouldn't want me to design your new TV station from my old copy of FINK. Don't design a standby system from your old school texts.

Loren Mages
Forces, Inc.
Northlake, Ill.

Electronic Components Convention Call for Papers

A call for papers for the 20th annual Electronic Components Conference has been issued. The conference, which will be held in Washington May 13-15, is sponsored by the Electronic Industries Association and the Parts, Materials and Packaging Group of the Institute of Electrical and Electronic Engineers.

Materials, passive components, hybrid integrated circuits, interconnection and packaging, filters and networks and new functional devices will be covered at the conference.

Four copies of an extended abstracts of a minimum of 250 words, plus a list of the papers, salient concepts and features, should be sent by November 15 to Darnall Burks, Sprague Electric Company, Marshall Street, North Adams, Mass., 01247. Notification of acceptance of papers will be made by January 1. Final manuscripts will be due March 1. Papers will be published in the Conference Proceedings which will be available at the start of the conference.

INDUSTRY NEWS

SCA Filing Procedures Amended

To simplify the procedures in filing for the assignment or transfer of an existing Subsidiary Communications Authorization (SCA), the Commission has amended Sections 73.294(a) and 73.594(a) of the rules by deleting the requirement for filing FCC Form 318, Request for Subsidiary Communications Authorization. Under the amendment, the request may now be made in the necessary main station application for assignment or transfer.

Sections 73.294(a) and 73.594(a) both require the formal filing of FCC Form 318 at the time of assignment or transfer of a SCA and do not permit a simple request for assignment or transfer as part of the main station's transfer or assignment application.

Under present rules when a main station is being assigned or transferred, the application filed on FCC Form 314, Application for Consent to Assignment of Radio Broadcast Station CP or License, Form 315, Application for Consent to Transfer of Control of Corporation Holding Radio Broadcast Station CP or License, or Form 316, Application for consent to Assignment of Radio Broadcast Station CP or License, or Transfer of Control of Corporation Holding Radio Broadcast Station CP or License, must give the exact instruments of authorization to be assigned or transferred. An SCA cannot be authorized independently of the main station and must be given up along with the main station's license by a licensee transferring or assigning a main station.

The Commission noting that the Form is misunderstood by the industry and burdensome and unnecessary to its own operation, said it was abolishing the requirement for the filing of FCC Form 318 at the time of transfer or assignment of an SCA and replacing it with a more simple procedure.

The rule became effective October 24, 1969.

1968 Edition
International Regulations In Print

The International Radio Regulations (1968 Edition) is now available from the Secretary General, International Telecommunication Union, Geneva, Switzerland.

This edition includes the 1959 Radio Regulations and takes into account the partial revisions made by the following conferences: Extraordinary Administrative Radio Conference (EARC) to Allocate Frequency Bands for Space Radiocommunication Purposes (Geneva, 1963); the EARC for the Preparation of a Revised Allotment Plan for the Aeronautical Mobile (R) Service (Geneva, 1966); and the World Administrative Radio Conference (WARC) to Deal with Matters relating to the Maritime Mobile Service (Geneva, 1967). The 1959 Radio Regulations constituted the final acts of the ITU Administrative Radio Conference in 1959.

Price for the 850 page volume is $6.54 paper-bound and $7.01 in loose-leaf binder. Orders should be addressed to the General Secretariat of the International Telecommunication Union, Place des Nations, Geneva, Switzerland. They should specify whether the English, French, or Spanish language edition is desired and should include payment in advance by international check or money order.

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Find out how Collins' 212V-1 Audio Console lets you combine economy with solid-state reliability. Contact a Collins representative or write Broadcast Communication Division, Collins Radio Company, Dallas, Texas 75207.

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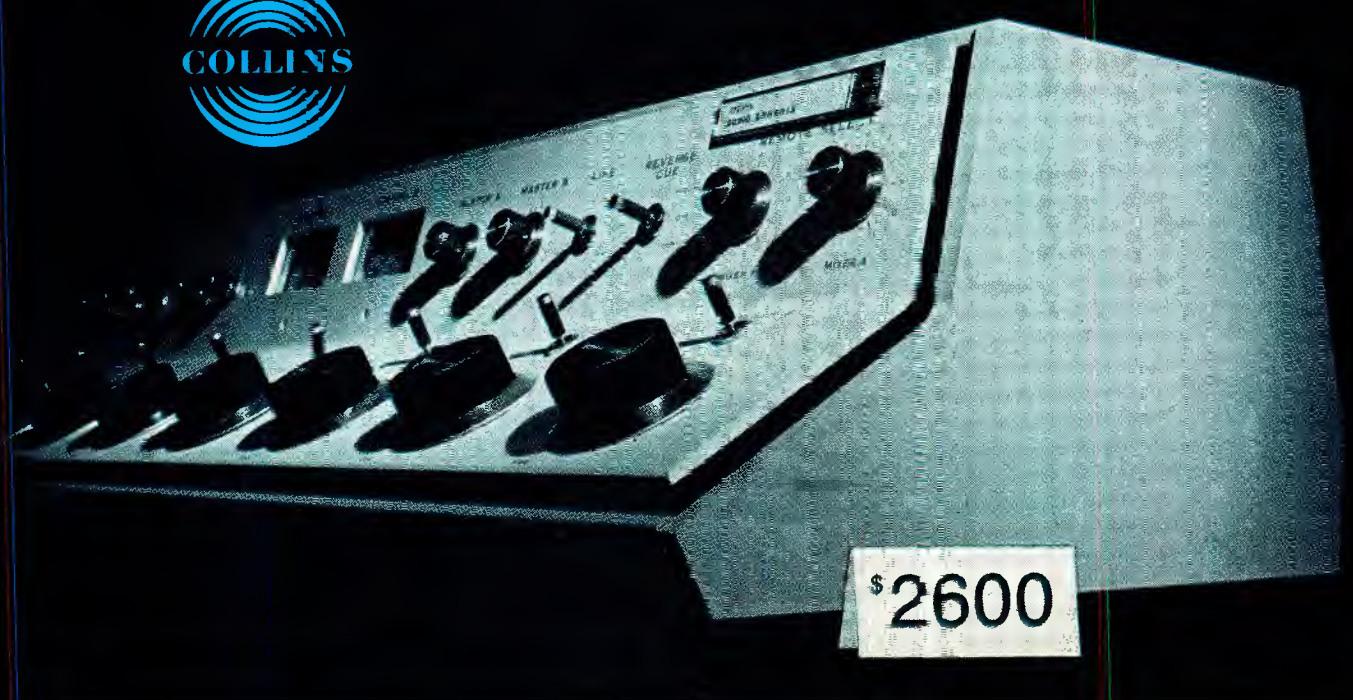

Sponsorship Idents Waived For MBA

A request by the Montana Broadcasters Association (MBA) for waiver of the sponsorship identification requirements of Section 317 of the Communications Act to permit operation of the association's "Non-Commercial Sustaining Announcement Plan" has been granted by the Commission under Section 317(d) of the Act. (Section 317(d) authorizes the Commission to waive identification requirements when the Commission determines that an announcement is not required in the public interest.)

In a letter to the Commission, the Association stated that it had established a sustaining announcement plan under which the Association would receive cash contributions from unspecified non-profit organizations in exchange for assistance in the preparation and distribution of public service announcements. The Association, which said that it consists of 25 radio and seven television stations and 17 associate members, asked for waiver of the rules if the Commission found Section 317 applicable to announcements for organizations from which contributions are received by MBA.

The Commission noted that the Association will process all requests from public service, non-profit organizations in the same way, whether or not a contribution to the Association is made; that non-profit organizations have been apprised of this fact; and that only the Association's executive committee and executive secretary, not the Association's member stations, are aware of whether or not a contribution to the Association has been made.

The Commission found Section 317 applicable and granted the waiver request in accordance with decisions on similar requests from the Southern California Broadcasters Association (24 RR 284) and the Kansas Association of Radio Broadcasters (4 FCC 2nd 267, 7 RR 2nd 727).

FCC Issues New Equipment Listing

The latest listing of Radio Equipment Acceptable for Licensing, dated September 16, 1969, has been issued by the Federal Communications Commission.

This list includes equipment for the Domestic Public Radio Services other than Maritime Mobile; Radio Broadcast Services; Experimental, Auxiliary and Special Broadcast Services; Stations on Land in Maritime Services; Stations on Shipboard in Maritime Services; Public Fixed Stations and Stations in the Maritime Services in Alaska; Aviation Services; Public Safety Radio Services; Industrial Radio Services; Land Transportation Radio Services; and Citizens Radio Service.

The transmitters listed are considered acceptable for licensing in the various services provided that their operation is in accordance with Commission rules and that the specifications for this equipment are not exceeded. The list also includes frequency and modulation monitors that are type approved for use in the radio broadcast service. Equipment is listed alphabetically by manufacturer and numerically by type number.

Inquiries about equipment listing may be addressed to Technical Division, Technical Standards Branch, Federal Communications Commission, Washington, D. C. 20554 (Telephone 632-7093, area code 202). Copies of the list are available for reference at the Commission offices at 1919 M Street N. W. in Washington, D. C., and at FCC field offices. Copies may be purchased from Cooper-Trent, 1130 19th Street N. W., Washington, D. C. 20036 (Telephone FE 8-3800, area code 202).

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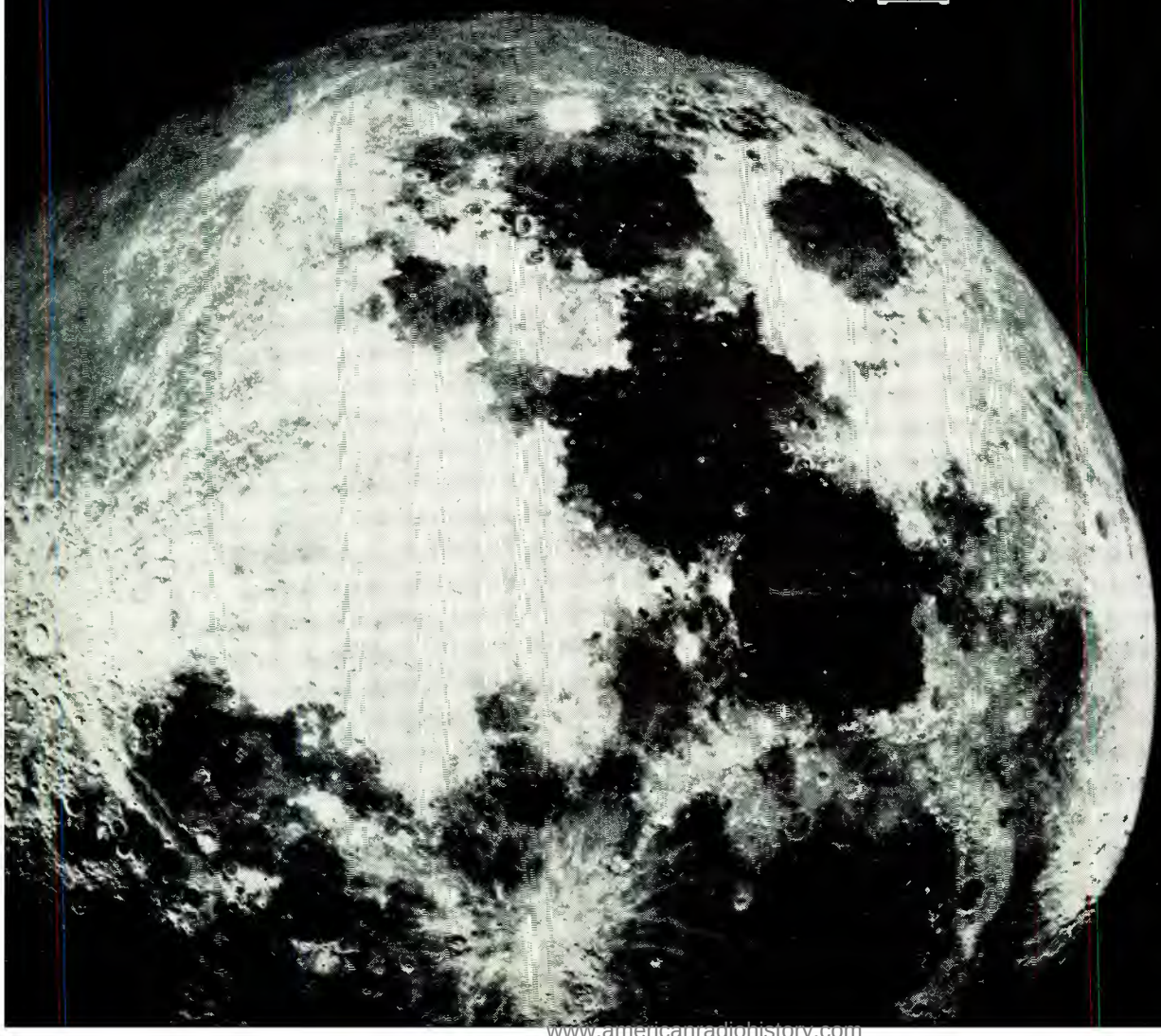
NOTES: †types feature separate mesh electrode construction *indicates Type II photoconductor		
And, RCA has many other types for industrial, commercial, and educational closed circuit TV—such as 4478, 7262A, 7735, 7735A, 3134 and 8573A.		

Join the Big Phone-In. Call your RCA Industrial Tube Distributor. He supplies dependable RCA Vidicons – plus technical data in the newly revised catalog CAM-700A.



Plans Announced For NAB 1970 National Convention

Vincent T. Wasilewski, NAB president, will officially open the convention on Monday, April 6 with a keynote address before a general assembly. A ceremony will follow in which Mr. Wasilewski will present NAB's Distinguished Service Award, the broadcasting industry's highest honor. On Monday afternoon separate radio, televison and engineering sessions are scheduled.

On Tuesday morning, April 7, a radio conference is planned along with engineering sessions for both radio and television. A television session and an engineering conference is scheduled for Wednesday, April 8, followed by a general assembly.

Separate luncheons for management and engineering will be held on Monday and Tuesday, with a joint management-engineering luncheon scheduled for Wednesday.

Exhibits by associate member equipment manufacturers will be displayed on Sunday 10:00 AM—7:00 PM; Monday and Tuesday, 9:00 AM—7:00 PM and Wednesday, 9:00 AM—5:00 PM. Exhibit fees were fixed at $6.00 per square foot.

Workshops

The Convention Committee of the National Association of Broadcasters announced the 1970 NAB Convention in Chicago will include a new feature — "early bird" workshops.

Designed to cover many different aspects of the broadcasting industry, the workshops will cover such topics as audience measurement, small markets, aquisition and retention of personnel, fair employment practices and standardization of paperwork.

The committee said advance registration and hotel reservation forms will be mailed to NAB members shortly after Jan. 1 and will be accepted only during that month. Others eligible to attend may make advance registration and hotel requests starting Feb. 1.

Advance registration fees were fixed by the committee at $35.00 per person for full participation or $20.00 per person for registration without luncheon tickets.

NY State Committee To Make CATV Study

The New York State Assembly Committee on corporations, public utilities and commissions, has agreed to conduct a study on a bill which would limit origination of programs and subject cable television to regulation by the State Public Service Commission.

The study will be particularly concerned with the effectiveness of current FCC regulations, the need for states to establish rates and service controls, the legitimacy of regulating the industry as a utility and the differing problems faced by CATV systems in upstate New York and New York City.

The Secondary Market Television Committee of the NAB announced that it is supplying a broadcaster-cable negotiating committee with suggestions on a proposed agreement between the two media in order to assure full representation of the viewpoints of the licensees of television stations in markets smaller than the top 100.

IEEE Solid State Conference Set For Feb.

The 1970 IEEE International Solid-State Circuits Conference will be Feb. 18-20 in Philadelphia, Pa. on the campus of the University of Pennsylvania and at the Sheraton hotel.

The 1970 sessions are expected to feature new circuit techniques and device applications and the realization of complete system functions through novel integration concepts. Areas of application include medical, computer, communications, military, consumer and industrial electronics and their interfaces with optical, acoustical, mechanical and biological systems.

Varian klystrons hold back the cost of doing business.

You might say that UHF TV klystrons from Varian cost about a buck an hour. Although Varian warrants its UHF TV klystrons for 5,000 hours video, their average operating life is 8-9,000 hours . . . at an average cost of about $9,000 per tube. If that's not a bargain, think of the UHF stations that get 20,000 hours per tube, or the one in Texas that's logged over 30,000 operating hours on one tube.

It's a fact that since the first commercial UHF TV station went on the air back in the '50's, Varian has more than doubled the operating life of UHF TV klystrons. And the price hasn't changed much since then. No wonder over 90% of the stations use Varian tubes.

You can get all the figures on Varian klystrons from any one of the more than 30 Electron Tube and Device Group Sales Offices around the world. Or write the Palo Alto Tube Division, 611 Hansen Way, Palo Alto, California 94303.

varian
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Circle Number 36 on Reader Reply Card

EDUCATIONAL BROADCASTING

Looking Inside Non-Commercial Broadcasting

By Mike Smith

FCC Moves In On Educational FM Measurement Requirements

In response to a request by WBAI-FM, Inc., licensee of FM Station WBAI, New York City, a non-commercial educational station operating on an unreserved or "commercial" channel, the Federal Communications Commission has ruled that such stations are subject to educational FM rules except for allocations and assignments and equipment performance measurement requirements.

In an associated action, the Commission proposed to extend equipment performance measurement requirements to all educational FM stations on reserved channels with the exception of 10-watt Class D stations.

As of September 30, there were 2,053 commercial FM stations and 385 educational FM stations on the air. Under FCC rules, educational FM stations operate on certain reserved channels. Eighteen educational FM stations, however, one of which is WBAI, operate on "commercial" channels. Because of this arrangement, there have been questions as to whether they were to operate under educational or commercial rules in certain areas.

WBAI asked for a declaratory ruling after it was cited for violation of three sections, under the commercial rules, involving program logging, annual equipment performance measurements and station identification. It said that these citations were in error since it operates under educational rules.

The Commission said the rules were ambiguous and therefore it would not be "appropriate to impose any penalty on the licensee or its parent organization, the Pacifica Foundation. It ordered amendment of Part 73 of the rules to specify that non-commercial educational stations on unreserved channels come under the educational FM rules, including provisions for program logging and station identification.

They also emphasized that its new rules will apply only to stations "truly non-commercial educational" and complying with the rules with regard to the service being rendered. It does not apply to other stations "even though their service may be largely non-commercial in character. . . ."

In its Notice of Proposed Rule Making to extend equipment performance measurement requirements to educational stations, the Commission noted that while the measurements are necessary to "insure proper station operation and a good quality of broadcast output," educational stations on reserved channels have not been included in the requirements because it was felt that the expense involved would handicap the development of the service.

It was noted, however, that growing interest and greater availability of funds is expected to result in more stations with greater coverage area and that operation with improper or malfunctioning equipment would be more serious than has been the case. Increased economic support, the Commission added, would make the "relatively small expense" involved in annual equipment performance measurements less of a burden and would not "substantially hamper the development of this service."

The Commission said it was not applying the requirement to 10-watt educational FM stations because they are designed to be very inexpensive operations and "in view of the low power involved, it appears that continuing exemption from this requirement should be granted for them."

Educators Have Helical Scan Meet Set For January 25

The success of two Educational Broadcasting Institutes on the maintenance and operation of helical scan video recorders-reproducers has prompted the National Association of Educational Broadcasters to schedule another Institute on this subject in Raleigh, N. C., January 25-28. The meeting will be held at the Sir Walter Raleigh hotel.

The Institute on video tape recorders is an intensive 30-hour course designed by the NAEB primarily for the audiovisual technician who is responsible for the operation of such equipment. The course assumes no prior training in video recording on the student's part and only an elementary knowledge of television systems in general.

Send Non-Comercial Station News to:
Mike Smith
c/o Broadcast Engineering

FCC Authorizes WNYC To Experiment With TV Multiplex System

The City of New York Municipal Broadcasting System, licensee of station WNYC-TV, Channel 31, New York City, has been authorized to conduct experiments in cooperation with Educasting Systems, Inc. during nonbroadcast hours, using up to 4 subcarriers multiplexed on main aural carrier of its authorized auxiliary transmitter for the period October 15, 1969 to April 15, 1970.

The experiment is being conducted to determine the technical feasibility of subsidiary type communications via TV broadcast multiplex transmission system. The program would provide educational TV broadcasting stations with subsidiary-type transmission facilities to be used for Multilingual aural broadcast to accompany a common video broadcast; broadcast of educational courses for credit with simultaneous lesson testing, and provide supplementary channels for police and fire service. The authorization was made under the Commission's Experimental operation rules (Section 73.666).

Manufacturers Work On ETV Problems

Matsushita Electric Corporation of America, through its Panasonic trade name, showed a high speed video tape duplication device for its ½" tapes at the DAVI Convention in Portland, Oregon, last April. The device operates by a contact printing method.

While the idea of contact printing is not a new one, Matsushita claims to have solved the major physical problems which blocked successful, high resolution video contact printing in the past.

Basically, contact printing works like this. A master tape and a blank tape are transported on a device so that they are pressed together, oxide to oxide, as they pass through a magnetic transfer field. Magnetic flux from the master tape acts as the signal field, and the externally applied transfer field acts as bias. The master tape must be made in a mirror image on a special recorder so the copy will be normally oriented.

New IO Camera

MTI's image orthicon television cameras are readily adaptable to situations in which extremely low light levels are present or low image retention is required. The sensitivity of the "Orth" series cameras (1000 times more sensitive than Vidicon cameras) is the result of circuit designs which utilize the full performance characteristics of available image orthicon tubes. The cameras incorporate a variety of tubes having different spectral responses from infra-red to ultra-violet.

Other features are positive and negative horizontal shading correction, multiple scan rates, solid state sweep protection and a focus wobbler, low noise high gain preamp and regulated power supplies. High performance image orthicon TV cameras can be internally synchronized with strobe lighting, video tape recorders and disc recorders.

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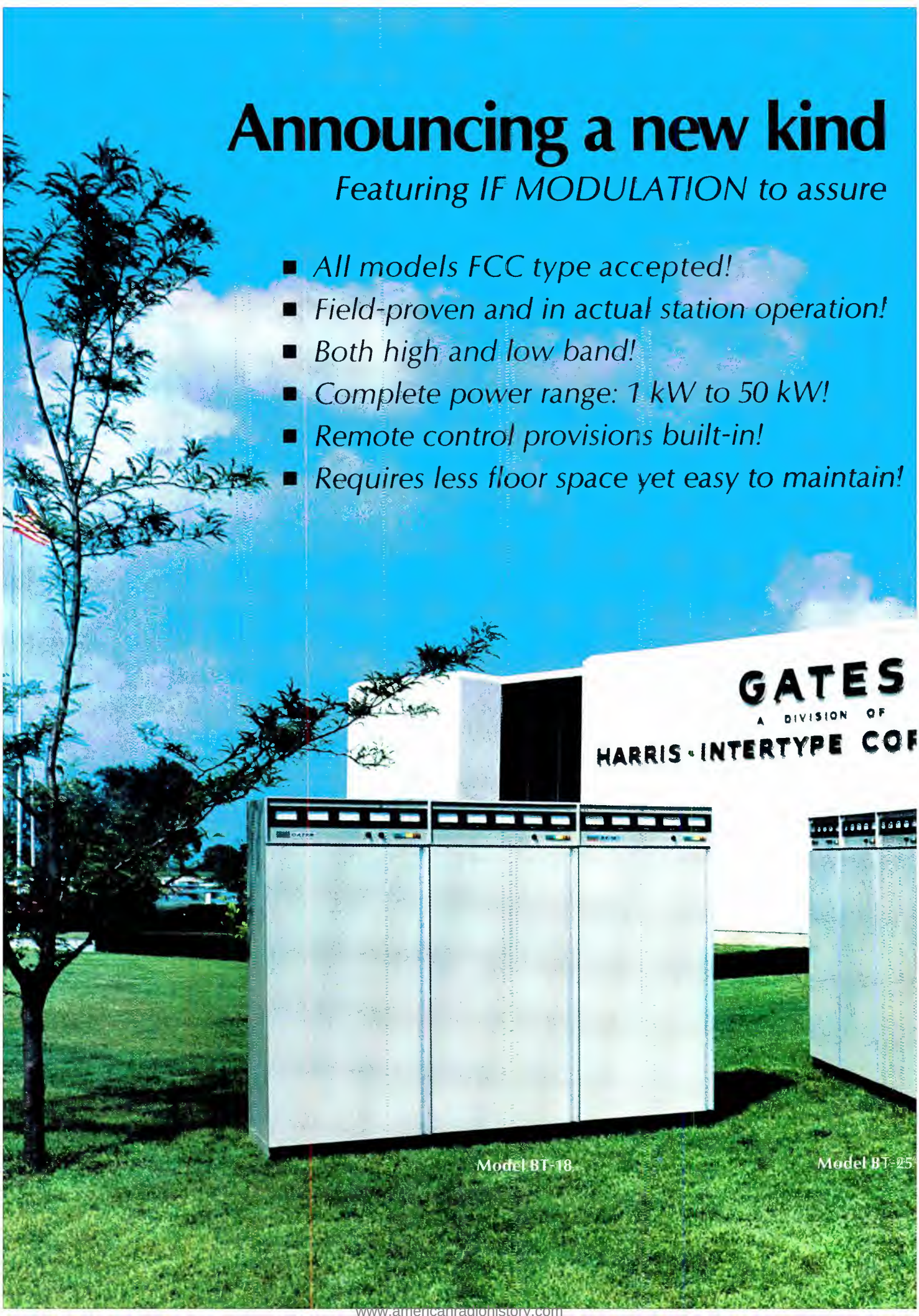

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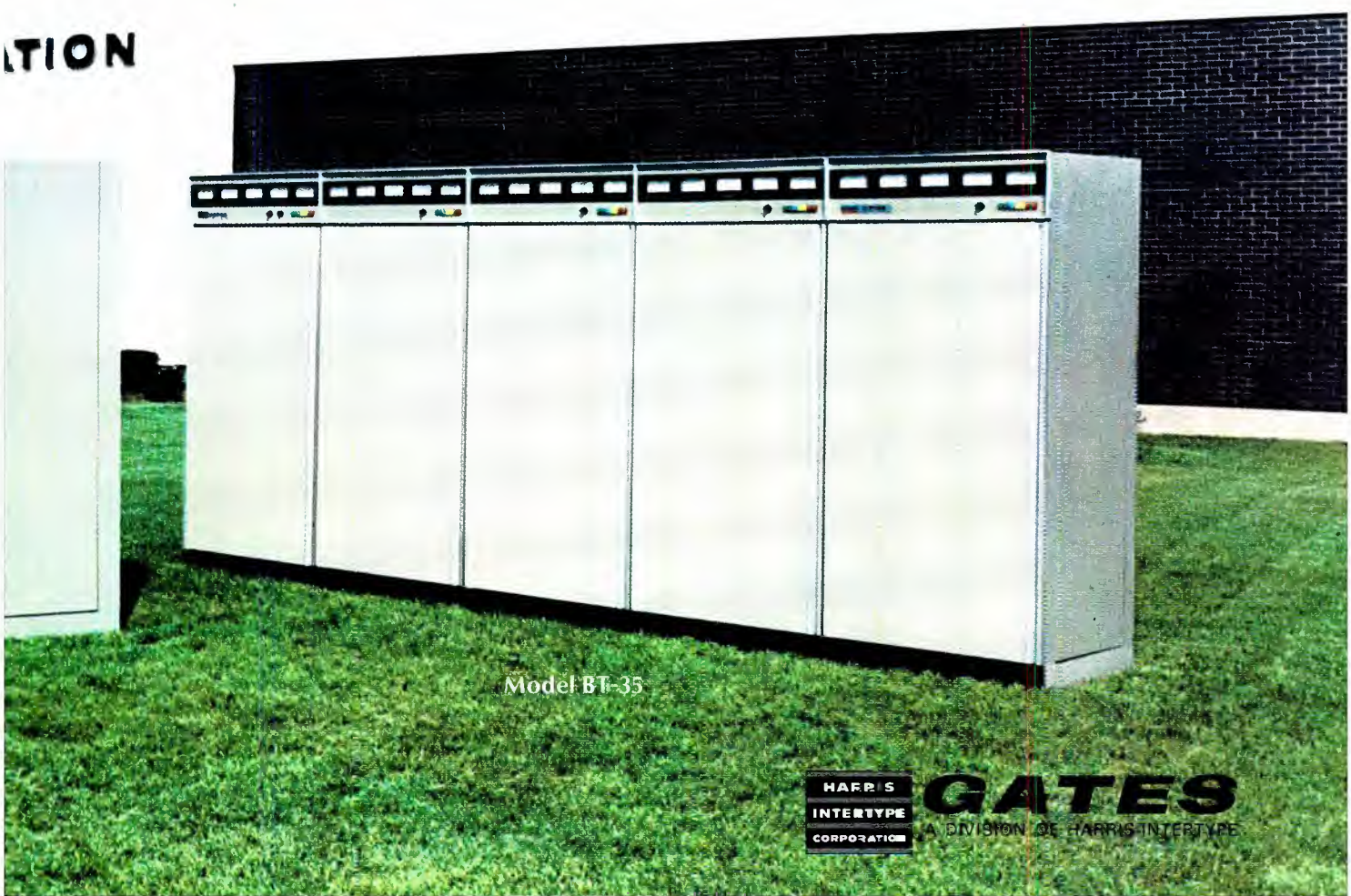

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SCANNING THE CATV SCOPE

By Harry Etkin

Trends Demand New Equipment

Striving for the advantages provided by cable television has resulted in a large increase in number, size and complexity of CATV distribution systems. As the distribution systems increased in size, better head-end performance becomes an absolute necessity.

The modern head-end equipment, introduced by the CATV industry, has kept pace with the advances in distribution equipment. Antennas are now more ruggedly constructed and better designed for distant signal reception. Microwave links and equipment bring in signals originating hundreds of miles away. Modern mast-mounted pre-amplifiers provide higher output capability with better noise figures than ever before. Single channel signal processing units completely process incoming signals from the antenna transmission line down-leads or other sources and provide pin-point control of signal levels at the units outputs. These processing units are a far cry from the many relatively simple single-channel strip amplifiers used in the earliest of CATV system head-ends.

Earlier CATV systems, at first utilized only the limited frequency spectrum between 54 MHz to 88 MHz, and then expanded in both directions to encompass a greater use of the spectrum of frequencies available by using coaxial cable. This expanded use of the frequency spectrum of a CATV coaxial cable system normally depends upon the signal handling capabilities of the system electronic components such as the RF amplifier and the cable characteristics involving attenuation and frequency response.

In the beginning, strip amplifiers had a narrow 6 MHz active bandwidth and was designed to handle only one of the TV channels 2 through 6 occupying the frequency spectrum between 54 MHz to 88 MHz.

The broadband amplifier soon was developed and designed to handle, simultaneously, all five low-band TV channels 2 through 6. To cope with the expanding state of the art, the all band amplifier was developed with an extended band width to accept at one time not only all low-band channels 2 through 6, but all high-band channels 7 through 13. This then provided the CATV system with a 12 channel capability. Recent CATV developments in amplifier design have provided the CATV systems with amplifiers which have pushed the higher limits of the frequency spectrum from 216 MHz to 240 MHz to a 20, 32 and even a 40 channel capability.

Charlotte Picture In Telco Muddle

CATV in Charlotte, N. C. has run into quite a few problems since its appearance here two years ago. The two companies, Jefferson-Carolina Corp. and Cox Cosmos, Inc. report that business is "very good" and see an even brighter future.

Non-exclusive franchises from cable systems in Charlotte and Mecklenburg were first given to Jefferson-Carolina and Cox-Cosmos in April 1957. The former was then owned by Carolina Telephone and Telegraph and Jefferson Standard Broadcasting Company. Later United Transmission bought Carolina T & T. Cox Cosmos is owned jointly by Cox Broadcasting and Cosmos Broadcasting.

A problem which has affected the two CATV systems is the FCC ruling concerning the telco firms which must obtain certificates of convenience and necessity. This ruling has caused a freeze in the Jefferson-Carolina cable system construction since its entire system was being built by Southern Bell. It only partially affects Cox-Cosmos construction since the telco built only half the system. Cox-Cosmos has filed a petition with the FCC charging Jefferson-Carolina and Southern Bell with unfair practices in bringing CATV to Charlotte. Southern Bell's application for a Certificate and Cox-Cosmos' protest against it are now pending before the FCC with about 30 similar cases ahead of it.

Concerned About System Reliability?
See Page 30
For Ideas How To Maintain Quality

NCTA Replies To FCC Rule Making

The National Cable Television Association has previously filed reply comments on Parts III and IV and recently NCTA was among those who filed reply comments to Part V of the FCC Docket 18397 of December 13, 1968. Part V of the "Notice of Proposed Rule Making and Notice of Inquiry" deals with broadcast/CATV relationships, the FCC role in regulating cable TV and its limits of regulation, and the part CATV and other technologies will play in the future of America's communication system.

NCTA informed the FCC that if the CATV industry is given the opportunity to develop an economic base it will develop and expand the technology so that innumerable services can be provided to meet the public demand. If this opportunity cannot be achieved the CATV technological capacity will be halted. The reply indicated that the FCC should reject its present policy of protectionism and encourage and permit the free entry of all newcomers into the communications complex in an atmosphere of free competition. The Commission was warned against devising a master plan for guiding development of new services, and advised that with the exception of licensing of radio frequency spectrum, the area of physical facilities should be left to the local governments and private citizens.

The NCTA suggested an appointment of a government-industry advisory committee to study and recommend technical standards to provide CATV systems compatible for interconnection and intergrated TV and CATV performance standards.

Justice Department's Position

The Anti-Trust Division of the Justice Department recently filed comments at the FCC in which it made regulatory recommendations which could affect some of the most basic elements of CATV operations.

In the CATV-Telco rulemaking the Justice Department asserted that Telcos may thwart the development of an independent CATV industry and recommended quick decisions on the FCC's CATV-Telco policy. It has termed as "overly protectionist" the proposed agreement between NCTA and NAB.

FCC Rules On Distant ETV Signal Requests

Section 0.289 of the FCC Rules has been amended by the Commission, effective October 3, 1969, to delegate authority to the Chief of the CATV Task Force to act on unopposed proposals to import distant educational television signals into the 100 largest television markets. This action was taken as a result of the substantial number of petitions for waiver of the hearing provisions of Section 74.1107 filed involving unopposed proposals to bring these distant signals into the top 100 market.

Fig. 1 It couldn't happen in Dallas, Texas, but it did. This is the KDTV tower after a twister hit the transmitter site.

Installation and Repair of Emergency Power Generators

By Loren Mages*

Are you guilty of kidding yourself that the standby emergency electric generating system installed at your facility can pass the test of a true emergency? The finest equipment ever sold may fail to meet performance specifications unless the equipment has been properly installed and maintained. Winter ice storms, high winds, spring tornadoes, an earthquake, fall hurricanes, mud slides, summer electrical storms, a flooding creek, or the next highway vehicle accident may interrupt electric utility service to your facility.

A standby generating system needs food, air, water, provision for the elimination of waste, and protection from the elements. Your standby engine generating system needs an ample supply of clean fuel of proper grade, an adequate volume of air to support combustion and cooling, pure water (if liquid cooled), and provision to handle waste air, water, heat and exhaust gases. Failure to provide any one of these essentials can lead to a system breakdown, especially if these basics lack careful planning and attention.

"Selecting Standby Generators" (August 1969, Broadcast Engineering) discussed the factors to be considered when planning a standby system. This article will cover basic needs to insure operation of the system.

*Forces, Inc., Northlake, Ill.

Fuel Feed and Tank Location

An ample supply of fuel must be provided, enough fuel to operate the engine for the duration of the longest anticipated power interruption. The fuel must be fresh, uncontaminated, delivered at proper pressure, be of suitable grade, and be correctly fed.

When fuel is to be stored on the site, a tank meeting local fire codes and properly installed is required. This tank is sized to provide a volume of fuel equal to at least the hourly consumption of the particular engine times the hours of operation desired. It is good practice to provide at least a 20% reserve.

Tanks may be installed above or below ground (gasoline or diesel oils). Fuel tanks should be properly weighted and strapped to prevent flotation. There is a danger that the fuel may be contaminated unless fill and vent pipes are high enough and adequately supported. Fill pipes should be locked to prevent vandalism, emptying of fuel for unrelated purposes, or deliberate contamination.

Above ground tanks should be fastened down so that wind and storms cannot dislodge the tank from its moorings. Fill and vent pipes are protected in the same manner as underground tanks. Additional protection to prevent physical damage to the tank and fuel lines from falling objects—rocks—rifle shots—should be provided. And since storms usually prevail from one direction, the outside generator and fuel supply system should be lo-

cated opposite the storm path. In fact, buildings withstand storms better when they present a corner rather than a wall to the storm front.

Natural gas fueled engines are often employed where on-site fuel storage is inconvenient or against local codes. It may be desirable to provide a combination type carburator on a gas or gasoline engine. A small amount of gasoline or LPG can be used as a standby fuel. Codes generally allow a small supply of prohibited fuels, if properly contained. A natural gas fueled engine might use either gasoline or LPG vapor as a standby fuel. Engines not now equipped for dual fuel operation can usually be converted at nominal expense.

Proper Venting

Air is required for both combustion and cooling. Engines operating in confined spaces where adequate ventilation has not been provided will shut down either because of lack of combustion air or overheating. Wall openings or air ducts of ample size must be cut through walls or housings. These openings must be designed to protect the equipment against flooding or heavy rain storms.

Beware of the basement window well which can flood out equipment during a downpour. Also, excessive water in the well or high winds may break the window. If the openings are protected by screens or grills, the opening must be increased in size to keep the static pressure as low as possible. If automatic shutters have been installed be sure the actuator motor is powered by the emergency generator. More than one system has shut down because the louver motor had been connected to utility company power lines. The problem did not show up on routine testing because both commercial and standby power was available.

Where flooding is a possibility, basement located emergency power generating equipment must be protected in such a way that (1) the sewer cannot back up into the room, (2) air and exhaust vents exit at the highest points possible, (3) doors and windows are sealed, and (4) air pressure inside and outside can be equalized when the radiator vents are temporarily closed.

Cooling and Exhaust

A liquid cooled engine using a closed radiator type cooling system should have antifreeze (where required). Where a city water cooling system is employed, a suitable sewer is required to take waste water away. This same sewer may back up and flood the engine generator space. Sump pumps, powered from the emergency generator and properly installed, will protect against flooding if the room drain cannot be blocked.

Cooling systems dependent on city water pressure are vulnerable to wide area power outages. City water pressure may drop. A water well on your property can be used as a standby water source. But be sure to power the pump from an emergency circuit.

Exhaust systems should be protected by a rain cap to prevent rain, leaves, and birds from blocking the exhaust piping. Avoid long exhaust runs as the colder pipe will act as a condensor, condensing water vapor in the exhaust gases. A condensate trap must be installed. Condensate or rain flowing back to the engine may lead to extensive engine damage. A water lock (water trapped between the piston and cylinder) can crack pistons or cylinder walls if the engine is cranked. And water in the cylinders can cause valve and valve spring rusting.

Reactivating Submerged Plant

Broadcasters whose standby engine generator sets have been submerged by hurricane tides, flooding rivers or overloaded basement sewers can minimize equipment damage by taking timely action. The following step by step procedures applied as soon as possible after waters receed will save the equipment from permanent damage.

Fig. 2 The WDSU transmitter site showing side location of fuel tank.

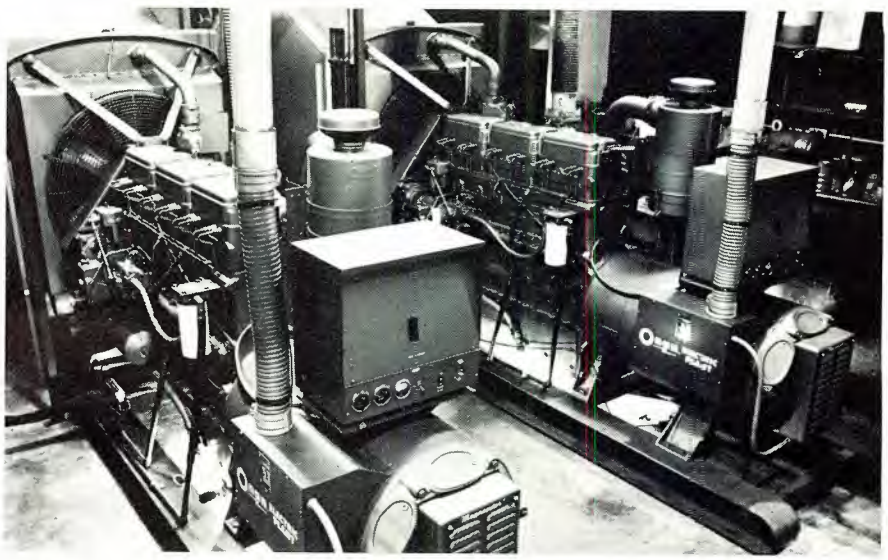

Fig. 3 Here is a dual generator system for WDSU FM and TV transmitters. Note the extensive use of flex lines.

1. Discard the lead acid starting batteries. Don't make an effort to salvage the old batteries.
2. Remove the starter motor and battery charging generator/alternator. Bake in an oven at 300 to 400 degrees until throughly dried out.
3. Take covers off voltage regulators. Dry out the regulators, clean contacts, etc. Replace with a new regulator if corrosion is severe.
4. Remove crankcase oil plug and drain oil from engine. Flush lubrication system by pouring fuel oil through the oil fill pipe and allowing the oil to drain right out. Under no circumstances run the engine with flushing oil in the crankcase.
5. Replace oil filter elements and fill with fresh oil.
6. Service the ignition system. Clean and dry wires, distributor, and coil tower.
7. Remove spark plugs and turn over engine either by hand cranking or electric cranking. This will drive out any water that might be trapped in the cylinders and prevent damage due to hydrostatic lock. Replace plugs with new ones if necessary.
8. Drain water from fuel tanks.
9. If governor is oil filled, drain and replace oil.
10. Replace paper air cleaner if used. Clean and refill oil bath type air cleaners.
11. The main generator is usually well insulated, and probably need not be baked to dry. However, brush holders and brush rigs should be cleared of debris, cleaned and dried. A megger test of the generator may be in order just to be certain water has not penetrated the main generator windings.
12. Fill engine with fresh lubricating oil and run the engine with an electrical load applied, for several hours after operating temperature has stabilized. Running the engine in this manner will pick up any water that had collected in engine passages.
13. Shut down the engine, drain the crankcase and fill with new oil. Replace the oil filters.
14. Run the machine again for several hours. Test all instruments and safety shut downs.

If your engine generator is powered by a diesel engine, the only

Generator Manufacturers

Company	Address	Portable	Stationary
Ajax Corp.	Box 262 Rochester, N. Y. 14601		X
B & L Mfg.	Box 486 Winnebago, Minn. 56098	X	
Burnworth Tester Co.	815 Pomona Ave. El Cerrito, Calif. 94530	X	X
Caterpillar Tractor Co.	100 N. E. Adams St. Peoria, Ill. 61602	X	X
Cobra Chain Saws, Div. Coronet Corp.	Box 97 Crystal Lake, Ill. 60014	X	X
Cummins Engine Co.	1000 Fifth St. Columbus, Ind. 47201		X
Detroit Diesel Engine Div. General Motors Corp.	13400 W. Outer Drive Detroit, Mich. 48228	X	X
Deutz Diesel Corp.	90 Alpha Plaza Hicksville, N. Y. 11802	X	X
Ernest Doe & Sons Ltd.	Ulting, Maldon, Essex, England	X	
Dyna Technology	2201 E. 7th St. Sioux City, Iowa 51102	X	X
Empire Generator Corp.	6480 N. Industrial Rd. Milwaukee, Wis. 53223	X	X
Fairbanks Morse Engine Accessories Oper., Colt Ind.	701 Lawton Ave. Beloit, Wis. 53511	X	X
Forney Mfg. Co., Div. of Forney Industries, Inc.	Box 563 Fort Collins, Colo. 80522	X	
GenerAC Corp.	Box 8 Waukesha, Wis. 53186	X	X
Goodall Div. Foley Mfg. Co.	3300 Fifth St. N. E. Minneapolis, Minn. 55418	X	
W. W. Grainger, Inc.	5959 W. Howard St. Chicago, Ill. 60648	X	X
Homelite Div. of Textron, Inc.	Riverdale Ave. Port Chester, N. Y. 10573	X	
ITT Marlow, Fluid Handling Div. of IT&T Corp.	Box 200 Midland Park, N. J. 07432	X	X
Kato Engineering Co.	1438 First Ave. Mankato, Minn. 56002	X	X
Katolight Corp.	1st Ave. at Chestnut Mankato, Minn. 56002	X	X
Kohler Co.	Kohler, Wis. 53044	X	X
LST Mfg. Co.	Box 493 Oshkosh, Wis. 54901	X	X
The Lima Elec. Motor Co., a Subs. of Consolidated Diesel Elec. Corp.	Lima, Ohio	X	X
Lincoln Elec. Co.	22801 St. Clair Ave. Cleveland, Ohio 44117	X	X
McCulloch Mite-E-Lite, Inc.	354 Brooklyn Ave. Wellsville, N. Y. 14895	X	X
Mercantile Mfg. Co., Inc.	Box 895 Minden, La. 71055	X	
Merc-O-Tronic Instr. Corp.	215 Branch St. Almont, Mich. 48003	X	
Meter-Man—B & L Mfg.	Box 486 Winnebago, Minn. 56098	X	
Miller Elec. Mfg. Co.	Box 1087 Appleton, Wis. 54911	X	X
Milwaukee Elec. Tool Corp.	13135 W. Lisbon Rd. Brookfield, Wis. 53005	X	
Motor-Light, Inc.	110 W. 19th St. Kansas City, Mo. 64108	X	
Ohler Machinery Co.	Box 820 Waterloo, Iowa 50704	X	
Onan, Div. of Studebaker Corp.	1400 73rd Ave. N. E. Minneapolis, Minn. 55432	X	X
PINCOR-Pioneer Gene-E-Motor Corp.	5841-49 W. Dickens Ave. Chicago, Ill. 60639	X	X
Porta-Gen-Mercantile Mfg. Co.	Box 895 Minden, La. 71055	X	
Porta-Power Co. Inc.	5301 Laurel Canyon Blvd. Suite 128 N. Hollywood, Calif. 91607	X	X
Power Chief—LST Mfg. Co.	Box 493 Oshkosh, Wis. 54901	X	X
Scot Pump Co., Inc.	262 Highland Dr. Cedarburg, Wis. 53012	X	
Skil Corp.	5033 Elston Ave. Chicago, Ill. 60630	X	
Slanzi Tractor & Engine Imports, Inc.	5910 W. Chicago Ave. Chicago, Ill. 60651	X	X
T & J Mfg., Inc.	Oshkosh, Wis. 54901	X	X
Twentieth Century Mfg. Co.	9250 W. Bloomington Freeway, 35 W Minneapolis, Minn. 55431	X	
Universal Motor Co.	1552 Harrison Oshkosh, Wis. 54902	X	X
Waukesha Motor Co.	Box 379 Waukesha, Wis. 53187	X	X
Winpower Mfg. Co.	Newton, Iowa 50208	X	X
Zeus Portable Generator Co.	12435 Euclid Ave. Cleveland, Ohio 44106	X	X

change in procedure is do not turn the engine over electrically! Use a cranking bar and hand crank the engine over a few times. Any water trapped in the cylinders will be pushed past the rings into the crankcase. If electric cranking is attemped, a hydrostatic lock will probably tear the starter motor right off its mounts.

The most important consideration is prompt action. If water is allowed to remain in the engine the cast iron rings will rust to the cast iron block which locks the crankshaft. Valves will be rusted tight to their guides, and a complete engine rebuild will be necessary.

Some consideration to the security of the entire system should be provided. Access to the standby equipment should be restricted to authorized personnel only. If located outside the building, perimeter protection may be needed to protect against vandalism.

Regular testing, preferably under load, is your only assurance that the system is completely functional. Testing also affords an opportunity for personnel to be trained in operation of the equipment. A maintenance log should be maintained. If station personnel are not qualified, or if other duties prevent adequate maintenance and testing, arrange for the equipment supplier to provide inspection services.

The time to re-examine your system is now. Double check to insure that your standby generating system is getting all its necessities of life, and ask what can be done to insure none of these essentials will be denied. Your real test may come later today!

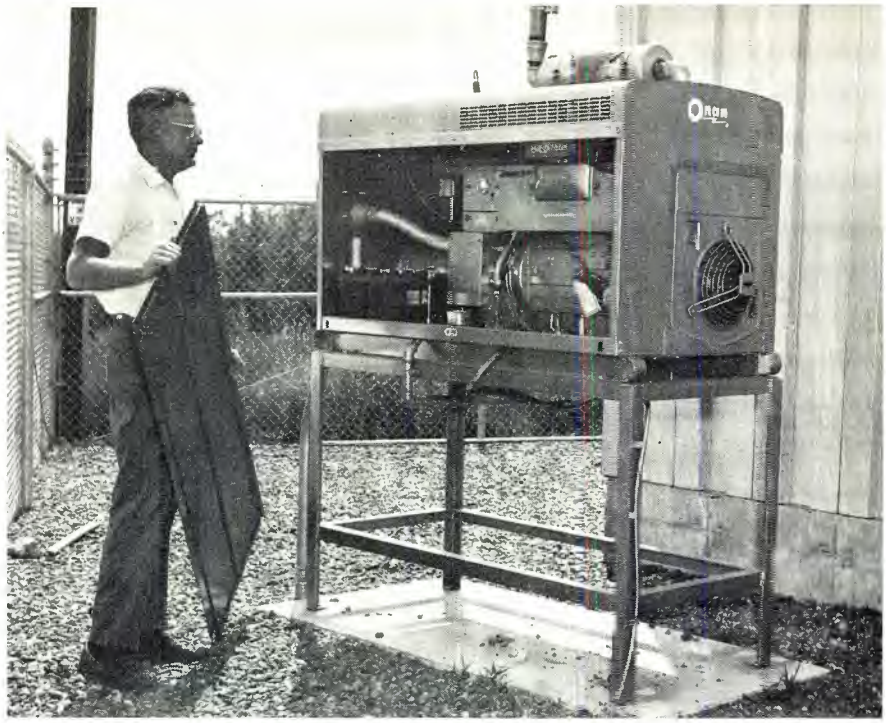

Fig. 4 Since it was necessary to place this generator outside the building, it was given extra protection by mounting it well above high water levels.

3M HAS FORTY-FIVE MAJOR THESE ARE SOME

EBR-100 Electron Beam Recorder Now you can transfer live or tape TV to 16mm film electronically and get prints with 1000-line resolution. This is the first system to produce monochrome film copies comparable to the original live or video tape original. It has no optical components. Direct electron bombardment transfers image to film without faceplate halation or camera-lens light losses. Uses low-cost, fine grain film that can be projected after processing on any 16mm projector. Far superior to kinescope techniques. Opens new horizons for mass distribution of TV training and educational footage. Write for brochure.

Dropout Compensator (DOC) for Color Video This is where hi-band color dropouts get turned off, and clarity and sparkle restored to damaged tape content. The 3M Brand DOC detects the dropouts as they occur, replaces the "lost" signal with stored information from the previous scan line of the same field. Provides precise color match and complete freedom from switching transients. Disturbance to time correction unit is eliminated. Proc amp and servo stability allow tape to play in full intersync or pixloc mode. Write for booklet.

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

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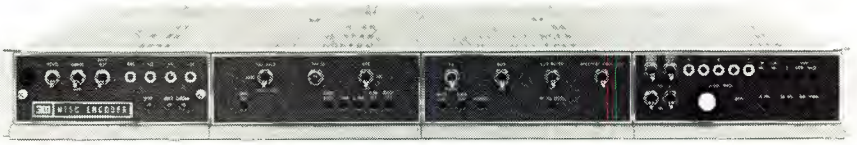

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Extending VT Head Life

By Donald L. Balcom*

The state of Michigan does not change to daylight savings time which means that WWJ-TV, Detroit, video-tapes and then delays almost all network programming during the summer months. This extra taping load plus normal taping requirements amounts to about 7000 hours of head use over a 26-week period.

An analysis made during the month of May revealed that in some cases the longevity factor was less than 100 hours of life per head. Head costs were approaching $6.00 per hour, or nearly $42,000 for the six machines involved over the summer taping period.

Further study indicated that head life was runing much shorter in the summer than in the winter months. A graph comparing the two periods serves to illustrate the difference in dramatic detail (See Figure 1).

In light of the serious drop in head life during warm weather, an elaborate and painstaking check of both atmospheric conditions and operating procedures was made according to the following check list:

1. Check humidity and temperature by means of a humidity and temperature recorder placed in the tape room.
2. Constant check of head tip coloring by microscopic examination.
3. Daily readings of tip projection for each machine recorded on graphs. The lowest tip was logged.
4. Check vacuum and reel tensions.
5. Check house air. (WWJ-TV uses house air in place of pressure pumps).
6. Dust check of room air in tape room.

Here is what we found after our one month check:

1. Relative humidity was running about 60%. It has been possible to reduce this by 10%. Temperature remains at 72 degrees, plus or minus 5%.
2. The microscopic examination showed some abrasive tapes. (Most of these had to be played, however, as they contained programming).
3. Daily logging of tip projection, and the resultant graphs has proved very useful. During network delay, 90-minute reels are used without removal from the machines. This provides an ideal condition for checking head wear and tape life. When a dip in the graph is noted, the tips are inspected with the microscope. If the tips are shiny, the tape is changed.
4. The vacuum and reel tensions were found to be normal. Continual care is taken to prevent any increase.
5. Filters and dryers for the house air are used in place of pressure pumps. The resulting air condition is considered very satisfactory.
6. The dust check shows that WWJ-TV's air conditioning approaches "clean room" conditions.

One conclusion reached as a result of these checks is that a major improvement could be made by lowering the relative humidity to winter conditions. Unfortunately, no records of relative humidity are available during the winter months, but an educated guess would estimate that ideal conditions would call for a relative humidity of 30%. A reduction to this level would be all but impossible at WWJ-TV, so other solutions were required if longer head life and lower operating costs were to be achieved.

Fortunately, a "hunch", developed as a result of the close check of operation and paid off in surprising fashion. The contact of the head wheel to the tape, a standard procedure had repeatedly suggested an undue source of wear. Following this idea, the tape guide was backed off from the headwheel by 0.5 mils. This meant that instead of tip penetration equalling tip projection, penetration becomes tip projection minus 0.5 mils. The results were astounding. Head life increased tremendously without noticeable difference in quality. No head loading or excessive dropouts were experienced.

VT 14 and VT 15 at WWJ-TV are used for programming and are operated at full tip penetration. Figure 2 compares these machines with VT 16 and VT 17 which have tip penetration reduced by 0.5 mils. The conclusion seems inevitable that headwheel contact with the tape with full tip penetration increased head wear.

One solution to the problem might be to change the standards so that the headwheel does not touch the tape. This would require new test tapes. Also, when a head developed tips worn to 1 mil., it probably would not play back because the tip penetration into the tape would be only 0.5 mils. This probably would not be enough tip to tape contact and the results would be unsatisfactory. Even if the heads were returned at 1.2 mils, however, the head life would be much improved over the present method.

Another solution, if it can be accomplished, is to under-cut the headwheel by 0.5 mils on a radius. This would give the same amount of tip penetration and the headwheel would not contact the tape. It is understood that when standards were being established in 1959 and

*Chief Engineer, WWJ-TV, Detroit

1960, the headwheel contacting the tape was believed to be desirable because of the polishing effect of the headwheel on the tape. Since that time headwheels have been improved and tape is of better quality. No adverse effects have been noticed at WWJ-TV by operating in this manner, using Scotch 399 and Scotch 400 tapes and Mark Ten headwheels.

It may be that the headwheel, in contacting the tape, increases the tension on the tape, thereby increasing the pressure on the tips. Perhaps the tape gets more sticky with high humidity which would increase the tension even more. If this is the case, perhaps the head life will not vary with the humidity if the headwheel does not contact the tape.

From the graphs, it can be seen that WWJ-TV's head costs for July will be approximately $1.25 per hour compared wtih almost $6.00 per hour for May. Based on 7000 hours of head usage over the 26-week period, this means a savings of about $33,000. This figure is based on a 500-hour head life for each head, and it is believed this can be accomplished if one of the afore mentioned suggestions are followed.

In any case, this is a record of WWJ-TV's experience under the conditions and procedures noted, and hopefully, it will be of value to others striving to extend video tape head life.

Author's Note: The reference for the assumption that tip penetration equals tip projection is the K. B. Benson paper presented at the 1960, April convention.

Tapes sent out-of-house must be recorded as determined by standard test tapes. Otherwise, a hodge-podge of standards will exist which would be detrimental to the industry.

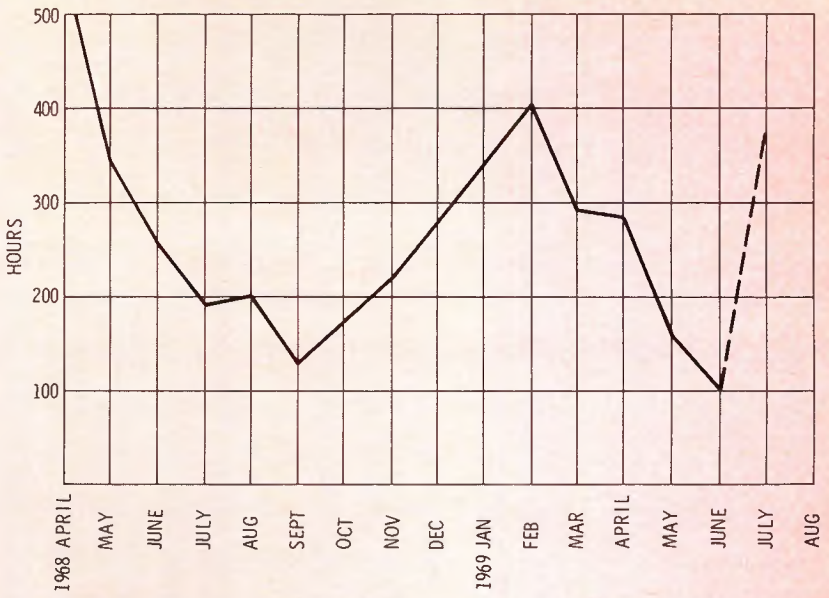

Fig. 1 Time and study of head life shows great difference between winter and summer months. Note that late 1969 months show results of tip adjustments.

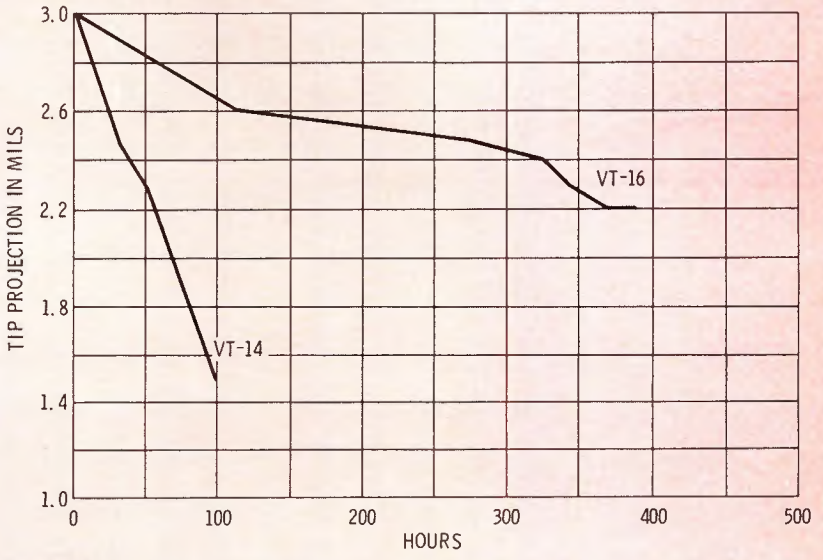

Fig. 2 Comparison of machines with full tip penetration against those of penetration reduced by 0.5 mils.

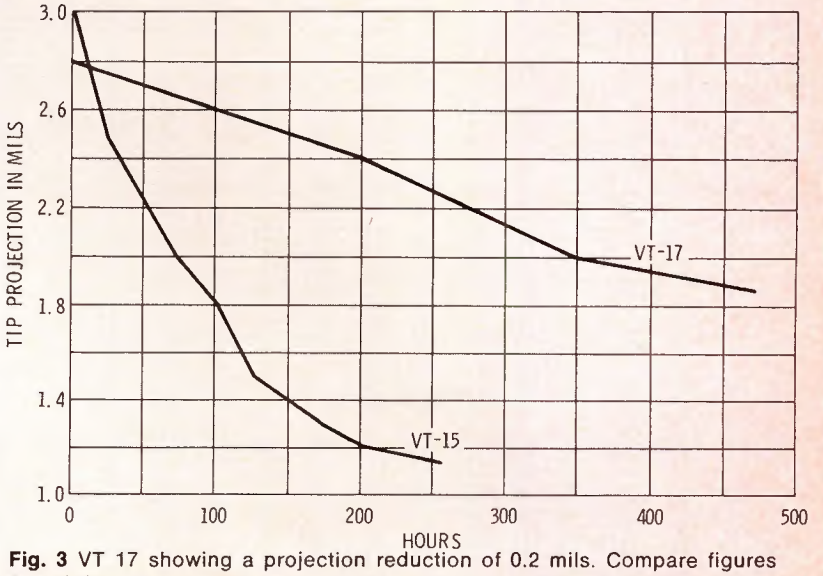

Fig. 3 VT 17 showing a projection reduction of 0.2 mils. Compare figures 2 and 3.

CATV System Reliability

Part 2 of 2-Part Series

By Harry Etkin*

After equipment for a new CATV system has been evaluated and selected, the engineer or systems operations personnel should prepare a simple line diagram covering the units of the CATV system from antenna, program originating equipment to distribution system. This will provide a functional check list to assure that the system is complete and the design meets the desired specifications. This diagram will also be helpful in installing the equipment and finally testing and maintaining the system for proper operation. Operating engineers and technicians should become familiar with the equipment on hand, the proper interconnections, terminal designations and adjustment procedures, and signal paths through the system.

*BE CATV Editor

Maintenance Records

The importance of keeping maintenance records cannot be over-emphasized. It is important that these maintenance records become an integral part of the CATV system procedure. The maintenance log will include the daily inspection and periodic testing of the operating equipment by a responsible engineer or technician. An up to date and accurate set of records should include the engineer's notation to the effect that all operating parameters reflect in-tolerance performance and the necessary repairs described.

The log is also the key to pinpointing the cause of trouble and keeping maintenance to a minimum. The log will give a record of past performances and failures, providing trouble shooting clues.

A maintenance log book should be maintained for every CATV system. Record keeping described here only suggests the kind of data which might be included in the makeup of the maintenance log book. The major items of record forms in this group would be the:

1. Antenna installation check list
2. Antenna signal measurement
3. Head-end tests
4. Lime amplifier
5. Line amplifier extremity tests
6. Line extender amplifier
7. Feeder extender amplifier extremity tests
8. Television receiver
9. Temperature variation test
10. Trouble shooting ticket

Standard test setups, as shown in the figures, should be kept in a test procedure-log book. At least every six months, these tests and the tests included in the first part of this series should be run. Between tests, keep a sharp eye on the equipment and clean it during daily and weekly inspections.

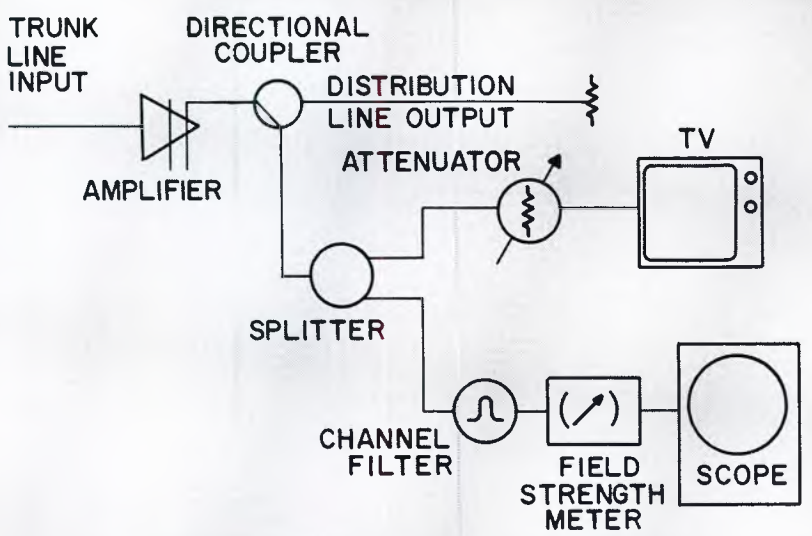

Fig. 1 Cross-modulation measurement of a CATV system.

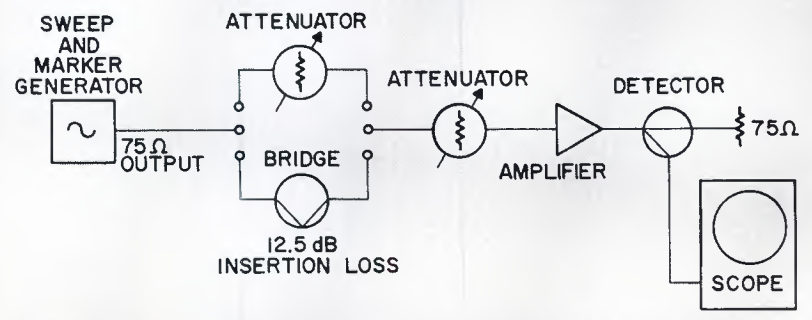

Fig. 2 Measurement technique for return loss using the bridge method.

CATV System Proof

Periodically, the system should be thoroughly tested. This system test should be similar to the Proof-of-Performance tests required of the commercial stations by the FCC. And here's why.

A Proof should do what it implies: prove that the system does not degrade the signal and meets industry standards. Just as we know that not all commercial stations provide the highest quality signals every hour they are on the air, we also know CATV systems do not always perform perfectly. But the ball bounces from commercial sta-

Now there are 14 different Plumbicon* TV Camera Tubes.

The Plumbicon family, which made its commercial debut only three years ago with the "Emmy-winning 55875," has grown to include many new and needed types for the expanding TV industry.

The line, now in production or development, includes tubes for both conventional and 'miniature' TV Plumbicon cameras, for retrofitting in Vidicon cameras and for image-intensification and other specialized requirements for medical, industrial and educational Closed Circuit Television applications.

55875: The original, Emmy-award winning TV camera tube; magnetic deflection and focus; integral mesh; 1.25 inch diameter.

XQ1020: Separate mesh version of 55875.

XQ1023: Extended-red-spectral-response version of XQ1020.

XQ1025: Similar to XQ1023 with addition of infra-red cutoff-filter.

7XQ: Fiber-optics faceplate version of XQ1020, for use with image intensifier in low light level television.

7XQ/ACT: Same as 7XQ but with "anti-comet-tail" gun to eliminate "blooming" of super-highlight images.

16XQ/XQ1070: One inch retrofit for most vidicon cameras.

19XQ: "Anti-comet-tail" gun version of 16XQ/XQ1070.

30XQ: Fiber-optics faceplate version of 16XQ/XQ1070.

31XQ: Ruggedized version of 16XQ/XQ1070.

3XQ: 30mm. tube with electrostatic focus and magnetic deflection.

15XQ: 30mm., all-electrostatic tube for cameras of reduced size and weight.

12XQ: ⅝ inch tube with electrostatic focus and magnetic deflection...for miniature cameras.

21XQ: Extended-red-spectral-response version of 12XQ.

Selected versions of several of the fourteen types shown above are available for educational, industrial and medical closed circuit TV systems. To learn more, contact us by mail or by phone: Electro-Optical Devices Division, Amperex Electronic Corp. Slatersville, R.I. 02876 Telephone: 401-762-3800

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tion to CATV operator when signal quality becomes a problem. Just whose falt is it?

Proof-of-Performance measurements at either end will help solve the problem on some channels, but not all of them. What of local origination? In this case, it is even more important that Proof measurements be made and routine checking and logging be complete. The subscriber knows the picture is not coming from a local commercial station. And nothing stunts the growth of a system more than word-of-mouth negative advertising. If local origination and special programming is going to be the long suit of Cable TV, the signal quality must at least match over-the-air signal quality. After all, not everyone is bursting to spread the gospel of CATV. And even if they were, the Proof would still stand as a measure of quality control—a requisite for integrity and good business.

Since the FCC regulations do not stipulate the limits within which the parameters must fall, it would be of equal importance for the CATV technical staff to become familiar and adherence to the definitions, terms, test methods and suggested techniques recommended in the NCTA "Technical Guidelines for Evaluating Degradation of TV Broadcast Signals within a CATV System" and other NCTA proposed and finalized CATV technical standards.

Along with this must come some cooperation with future technical considerations aided by the interchange of ideas between the FCC, NCTA, CATV industry and cable operators. As one factor cannot be expeditiously resolved without the other, the IEEE has recently organized an IEEE Cable TV Task Force whose sole purpose is to develop proposed technical standards in the areas of measurement techniques and electrical requirements. With the use of proper techniques some CATV engineers may not only monitor and test their systems but also the signals off the air and the signals out of the head end, to assure that the picture quality delivered to the subscribers is substantially the same as that received. Some experts believe that the future in testing of CATV systems should involve the techniques of measuring the following parameters and should be the subject of standardization for CATV systems:

1. The minimum input signal delivered to each subscriber
2. The quality of signal levels as between channels
3. The isolation between any two system outlets
4. The frequency response on a channel
5. The signal-to-noise ratio at a subscriber outlet
6. The permissible compression of the synchronous pulse
7. The radiation from a cable system

Future Maintenance

Technical innovations have been undergoing a rapid advance in CATV technology. Rapid equipment obsolescence is unduly expensive. Therefore, good engineering practice would require the exercise of considerable maintenance planning of a procedure which is intended to increase CATV system reliability in order that CATV subscribers will receive uninterrupted service.

Meanwhile, the CATV industry is developing a performance monitoring system. This system will probably include monitoring devices, telemetry and receivers, signal carriers and display panels. The installation of remote monitors situated at strategic amplifier locations throughout the distribution system will continuously analyze signal quality and transmit data to a centrally located display panel. The system monitoring operator should then have an audio/visual presentation indicating the location and nature of the fault. The system operator could then take immediate action to remedy the malfunction instead of receiving complaints from subscribers. And it would also be possible to spot incipient problems before a major breakdown occurs.

The future CATV system maintenance will surely involve the use of these techniques, but the system Proof should not wait for future developments. It should be emphasized that utilization of the performance monitoring system will provide a precise automated control of the CATV system without ever cutting the signals or the system off the air.

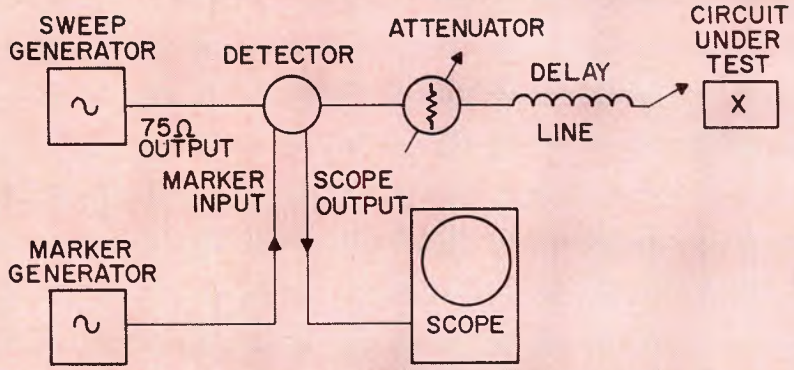


Fig. 3 Delay line technique for measuring return loss.

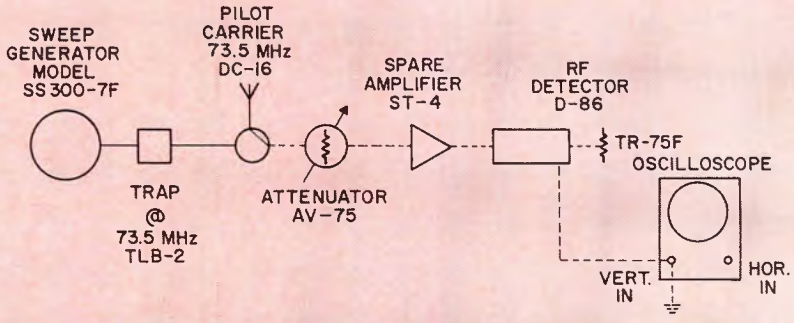
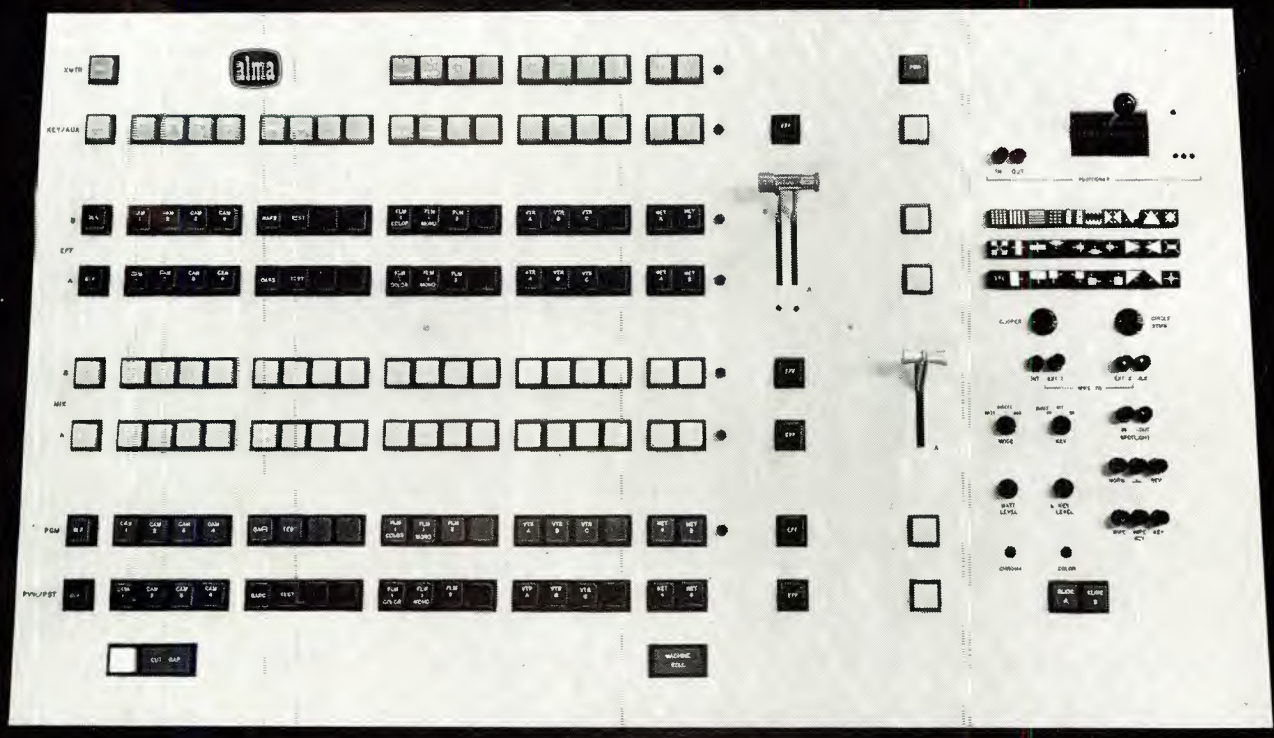


Fig. 4 System frequency response test setup. The equipment connected by dotted lines will be removed during actual sweep alignment. It is connected here to set up a reference.



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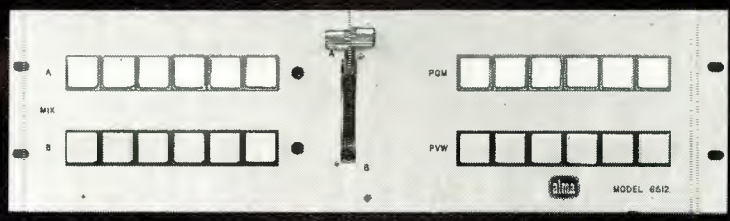

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A Survey of application ideas for IC's

Part 3 of a 3-part series

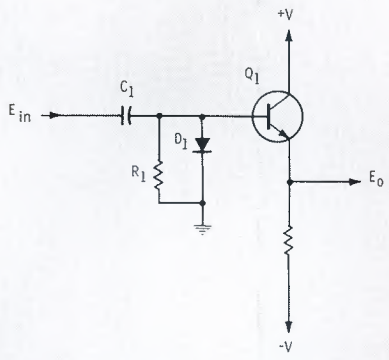

Fig. 1a Positive clamp buffered output.

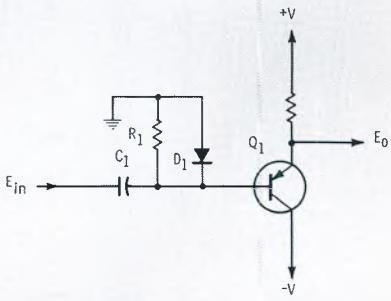

Fig. 1b Negative clamp buffered output.

In part one of this series, we ran into a few gremlins. On page 27 in the September issue you will note that we were discussing a high output swing voltage follower. One long paragraph beginning with "Line regulation is almost entirely . . ." on page 27 actually belongs on page 29 immediately preceding the section on the Current Regulator.

On page 26, Figure 1a, pin 6 must go to Q3's base. Also, to complete the identification, the IC used in Figure 5 is an LMX71.

By Walter Jung*

*Senior Engineer, MTI, a division of KMS Industries

In this final part of the three-part series on TV applications of IC's, a variety of specialized video circuits will be discussed. Although the previous two parts have dealt with many oscillator and amplifier circuits, this section will bring home the true impact of monolithic technology upon video processing functions. Among the functions and circuits to be discussed are; clamping and DC restorer circuits—both positive and negative with programmable restoration level; amplitude clipping circuits—both positive and negative (or white and black); gamma correction circuits with laws <1<; level comparators and sync strippers; and sync and blanking insertion as part of a full scale video processing section.

In all of these circuits, consideration is given to DC stability and temperature drift, voltage offsets, interfacing impedances and flexibility. The matching characteristics of IC differential amplifier techniques provide solutions to these problems.

DC Restoration And Clamping Circuits

DC restoration is a basic video processing requirement. An AC signal (video or otherwise) is given a DC reference on either positive or negative peaks to a known voltage. (For a general review of clamping techniques, see "Reviewing Video Clamp Circuits", Roy K. Brandt, Broadcast Engineering, November, 1968.) Although the voltage to which a signal is clamped is usually ground level, this is by no means a basic requirement. The reference level can be positive, negative or ground. And the clamping action can occur on either positive or negative peaks of the signal waveform. Additionally, it is desirable that the clamping level be independent of temperature drifts so that the stability of the newly introduced DC level be as high as possible. Circuits illustrating these considerations are presented in the following section.

Positive And Negative Ground Referenced Clamps

In its simplest form, a DC restorer can consist of a capacitor, resistor and diode, such as C1, R1, and D1 of Figure 1a. On positive peaks, D1 conducts and charges C1. DC restoration is accomplished, since the charge imparted on C1 will cause it to act as a battery if the discharge time constant is sufficiently long.

A disadvantage of this simple circuit is the temperature sensitivity of the diode D1, which causes the clamping level to vary −2mv/°C about the nominal +.6V diode drop. But by adding an emitter follower Q1, two advantages are gained. First, the temperature dependent diode offset is cancelled by the identical base-emitter threshold of Q1 which shifts positive signal peaks to ground (same level as D1's cathode) and second, a buffered low impedance output is attained which improves clamp acion by making the time constant less dependent on external loads. And, as you might

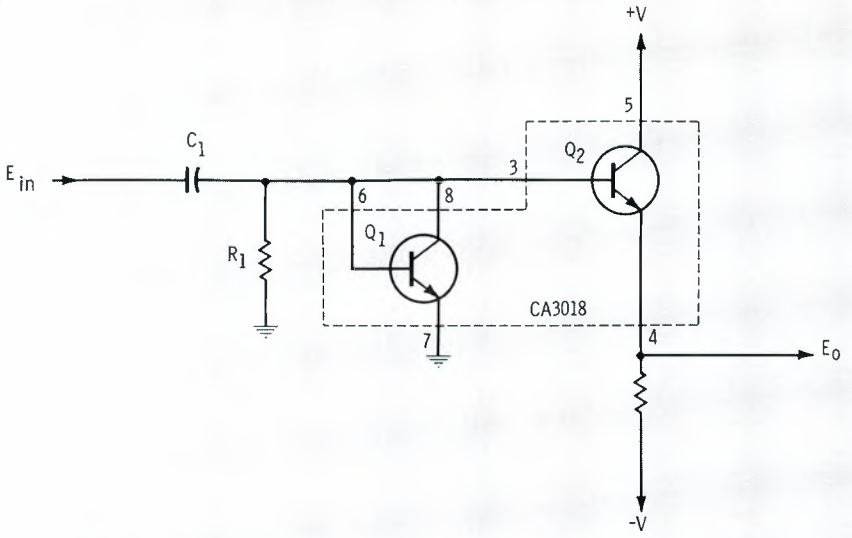

Fig. 1c Positive clamp, buffered output, using monolithic transistors.

have expected, all of these statements are also generally true of Figure 1b, which is similar clamp circuit arranged for clamping on negative signal peaks.

Carrying the clamp/emitter follower matching technique one step further, matched monolithic transistors can be used as the clamp diode and emitter follower. This is illustrated by Figure 1c, a positive clamp similar to 1a but using a matched pair from a monolithic array.

Unfortunately, the negative version of 1b is not directly transferrable to IC's, as monolithic PNP transistors are not generally available. A version using all NPN transistors is shown in Figure 1d. In this circuit Q1 and Q2 perform the functions of clamping and buffering. Two additional diode connected transistors, Q3 and Q4, are used solely for offset cancelling purposes. The drift of Q1 is cancelled by Q4, and VBE of Q2 cancelled by Q3. The output signal from Q2 is a DC restored waveform with negative signal peaks referenced to ground potential.

Positive And Negative Variable Reference Level Clamps

The above two classes of circuits have shown how positive and negative signal peak clamping can be accomplished, with the signal peaks in either case referenced to ground. However, it may not be desirable to use ground potential as a clamp reference in all situations. The next section will describe positive and negative signal peak clamps with restoration to a variable DC potential.

By borrowing on a portion of the clipper circuit in Part II of this series (Figure 9a), a positive clamp circuit is evolved which can restore AC inputs to a variable DC level (see Figure 2a). This circuit operation is very similar to the positive clipper portion of Part II. In fact, the internal arrangement of the IC is identical. Only the external arrangement of components provides the difference.

In this circuit, diode connected Q2 performs the DC restoration function, conducting on positive signal peaks. The voltage introduced at Q2's emitter is a low impedance source, so signal variations due to Q2's conduction do not appreciably affect this potential. Also, the various diode drops in the circuit are arranged so that the potential introduced via Rp (clamp level pot) is the same level at which Q2 conducts. As a result, all Vbe temperature coefficients of the circuit cancel, allowing predictable, temperature stable operation. The voltage applied to pin seven can be either manually adjusted (as shown) or an externally derived DC function as part of a large system.

The circuit of 2a does have the disadvantage of an unbuffered output. If a low impedance output with the same desirable temperature characteristic is needed, the circuit of Figure 2b can be used. This circuit, another arrangement of the CA3018 array, uses a diode connected clamp (Q1) and compensating emitter-follower (Q2) similar to Figure 1c. In this circuit a variable clamping voltage is supplied by Q3

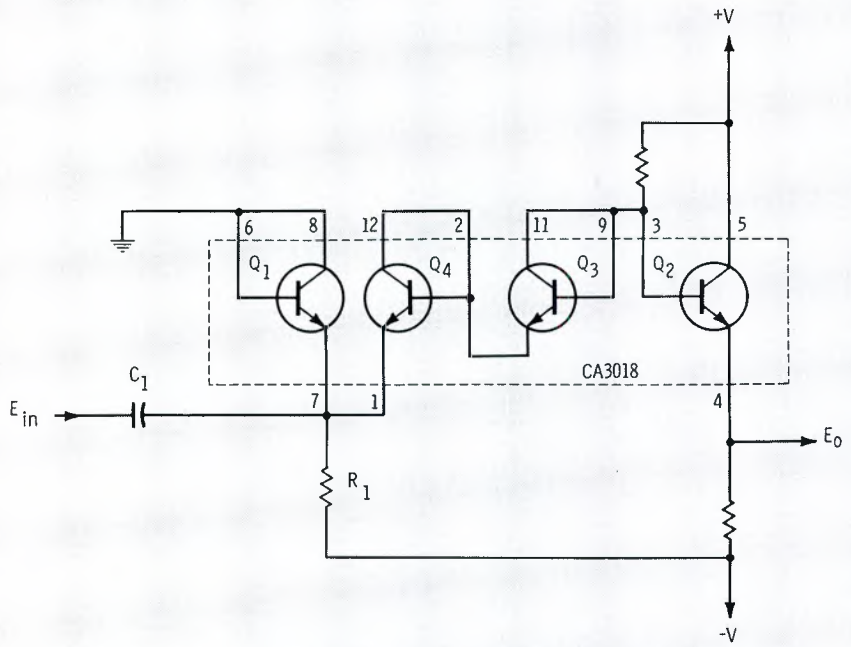

Fig. 1d Negative clamp, buffered output, using monolithic transistors.

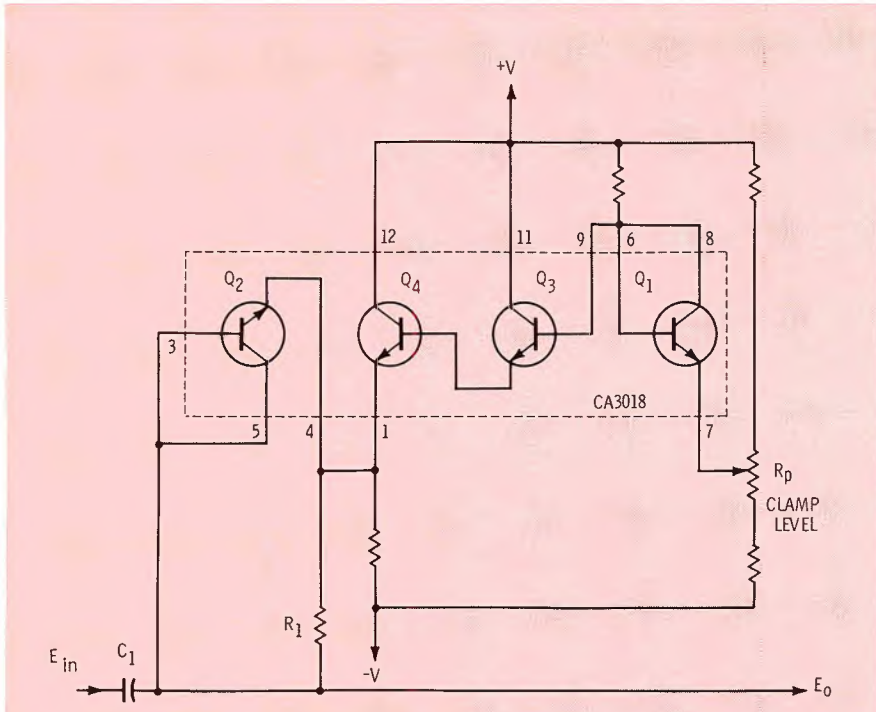

Fig. 2a Positive clamp with programmable reference level.

and Q4. Q4 is a low output impedance emitter-follower (same theory as Q4 of Figure 2a), and the collector base junction of Q3 is used to compensate Q4's Vbe. Again, the voltage introduced by the clamp level pot Rp is the same potential to which the output is DC restored on positive signal peaks.

To clamp negative peaks to a variable potential, we must look again at the technique introduced in Part II. Referring to Figure 2c, this circuit is basically the same as the negative clipper introduced in Part II. The IC's external circuitry determines the difference, as was true for Figure 2a.

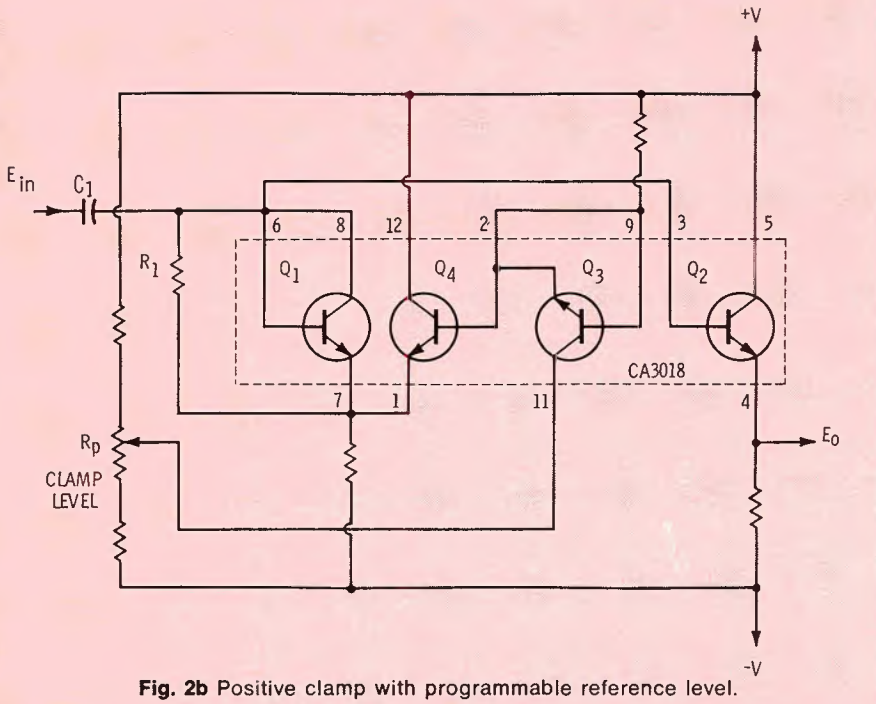

Fig. 2b Positive clamp with programmable reference level.

Diode connected Q4, which conducts on negative signal peaks, forms the DC restorer along with C1 and R1. An emitter-follower (Q3) provides a low impedance source to dynamic signal flow in Q4. Overall temperature compensation is provided by the series diodes (or diode connected) Q1 & Q2 which match the series Vbe's of Q3-Q4. As a result, the negative signal peaks at the output are referenced to the voltage supplied by Rp.

These variable reference level clamps provide versatility of function. Both positive and negative signal peak clamping is possible at voltage levels above or below ground for either or both classes of clamps. The temperature performance and predictability of these circuits is very important, as the performance functions such as level comparison, black and white clipping, gamma correction, sync separation and processing operate on an amplitude sensitive basis. Therefore, good DC and amplitude stability are necessary to accomplish these operations with predictable results.

Positive And Negative Amplitude Limiting Circuits

In amplitude limiting or clipping circuits, a DC referenced input signal is measured or compared against a stable DC voltage, and everything above or below (depending on which type, positive or negative) this voltage is eliminated. The DC potential(s) to which the input signal is compared become the new positive and/or negative signal limits. Popular expressions for this technique are "white clipping" (white being positive) and "black clipping" (black negative). To illustrate further, refer to Figure 3a, which graphically pictures a DC referenced input (top waveform) and the positive and negative limited output (bottom waveform). Everything above and below the respective limit potentials is eliminated.

Additional features desired of a limiting system are: good temperature stability and precise predictability of clipping level; the ability to program clipping levels with a DC voltage; a high degree of limiting or "hard" limiting when the limiter is active; and a minimum of distortion or response degradation

when the limiter is not in its active region.

Depending upon the constraints of a particular system design, clipping may be necessary at various points. Simultaneous positive and negative limiting may not be necessary or desirable in all cases. The three varieties of clippers discussed here will be presented with consideration as to how they might best fit into a system, and how their attributes are best put to use. Their characteristics allow usage either singularly or in combinations.

Series Operated Negative Limiter

This first limiter circuit is a threshold-biased emitter-follower which operates normally for signal inputs above its threshold, but "opens" for negative going peaks below this threshold. The level at which this clipping occurs can be electrically adjusted.

This circuit, shown in Figure 3b, uses the emitter-coupled pair of a CA3046 and a monolithic current source which provides a common-mode range comparable to an LMX-71. With input signals applied to Q1 which are considerably higher than the voltage on Q2's base, Q2 is completely off and Q1 functions as a normal emitter-follower, so the signal passes through in conventional fashion. When negative peaks approach the level on Q2's base, Q2 begins to turn on and absorb some of the constant emitter current supplied by Q3. As a consequence, Q1 must conduct less current.

Further negative increases in signal turn Q1 completely off, and the output level rests at a static potential during this period. The region of current sharing between Q1-Q2 is of course the transistion width[2] and since this region is about 100 mv, relatively large input amplitudes (2-3v) will result in rather abrupt switching, and thus effective clipping of negative peaks. This is graphically illustrated in the figure by the input-output waveforms which show how everything below the clip level is removed in the output waveform.

Temperature compensation of the input clipping level is provided by the matched pair Q1-Q2. However, if the Q1-Q2 emitters (pin 3) are used directly as an output, the −2mv/°c Vbe drift of Q1-Q2 is effectively in series with the output signal. To compensate this drift, a discrete PNP (Q5) is used as an additional emitter-follower. Although its junction drop cannot precisely match the static Vbe of the monolithics, it does provide compensation for the drift they introduce.

[2]See Part II and reference 6 of bibliography.

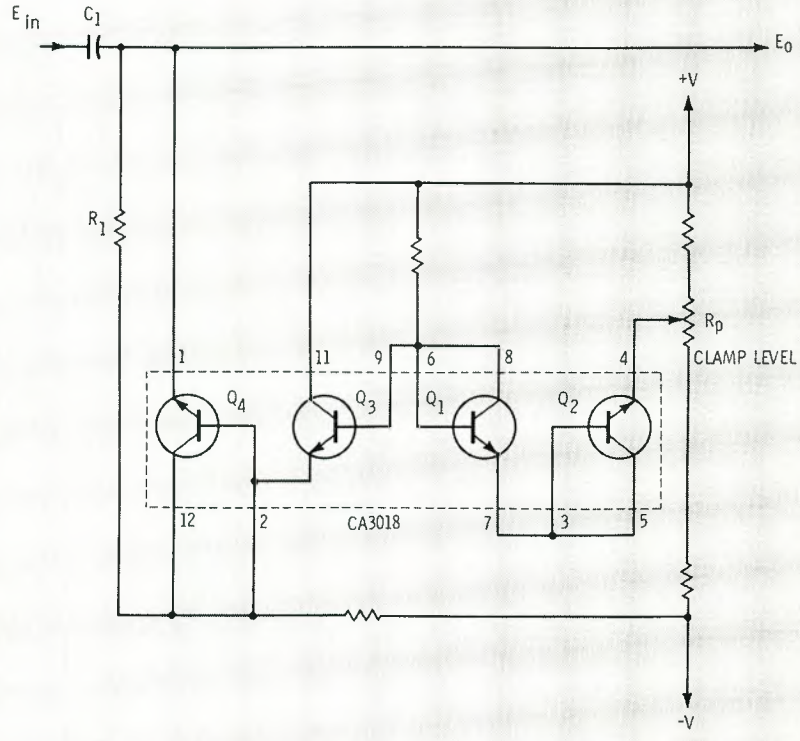

Fig. 2c Negative clamp with programmable reference level.

This circuit provides electrically programmable clipping of negative peaks by isolating the input from the output during the clipping interval. It can be driven easily from other circuits because of its high input impedance and provides a low output impedance from itself. A wide latitude of clipping potentials are possible because of the high common-mode range provided by the integrated circuit.

Shunt Operated Positive Limiter

The second version of a limiter circuit is a shunt or parallel operated configuration which limits signal amplitude in the positive direction by presenting a low impedance path to voltage levels above its threshold. The clipping level is electrically variable or programmable and the circuit possesses a low temperature coefficient due to the use of a matched differential pair as the operational element.

Referring to the circuit (Figure 3c) the emitter coupled pair of an LMX71 is used as a clipping diode biased by an emitter-follower. Diode-conected Q1 performs the clipping function, and Q2 is the emitter follower which buffers the clipping potential applied to pin seven.

The circuit operates in this manner. With voltage inputs less than the voltage applied to Q2, Q1 will be back-biased and the input signal will be undisturbed. When signal peaks rise above Q2's base potential, diode Q1 conducts heavily, shunting current into the low impedance of Q2's emitter. Because of the matched properties of Q1 and Q2, their respective Vbe's cancel, providing a clipping level which is stable and predictable.

To interface this circuit into an amplifier system, any of the three input configurations (Qa, Qb, Qc) shown can be used. However, it should be understood that the limiter can only absorb as much signal current as that provided by Q3, the current source of the IC. Another way of stating this is that Q2 must not be allowed to turn off (all of Q3 current into Q1), or there will be no control of the signal. In fact, it

(Continued on page 40)

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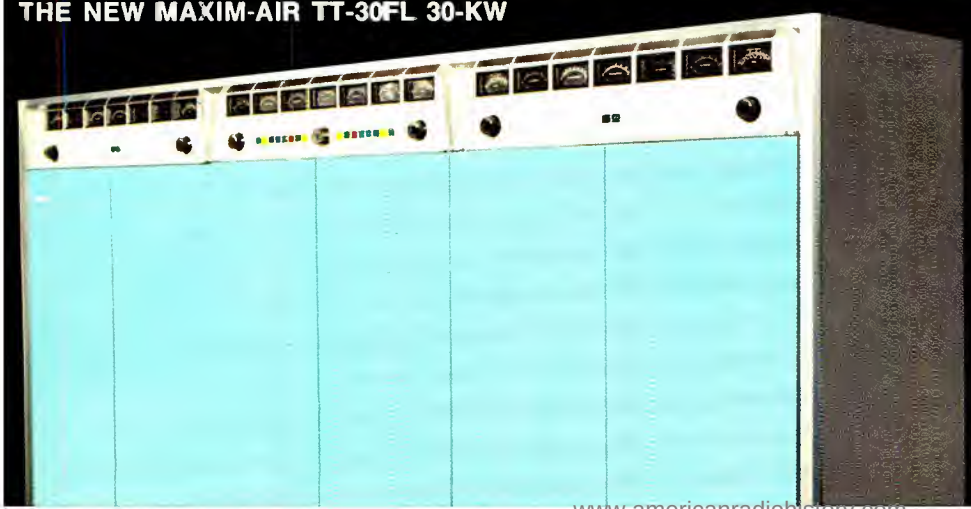

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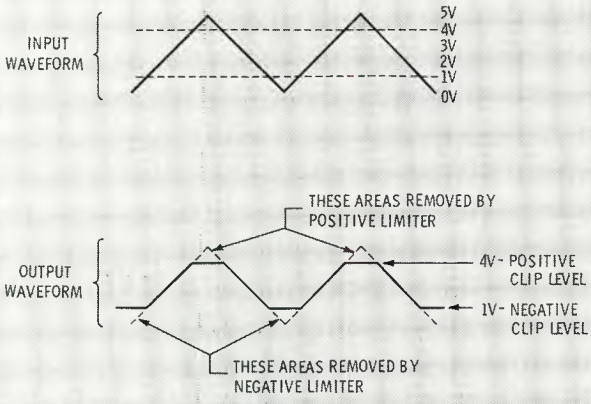

Fig. 3a Positive and negative signal switching.

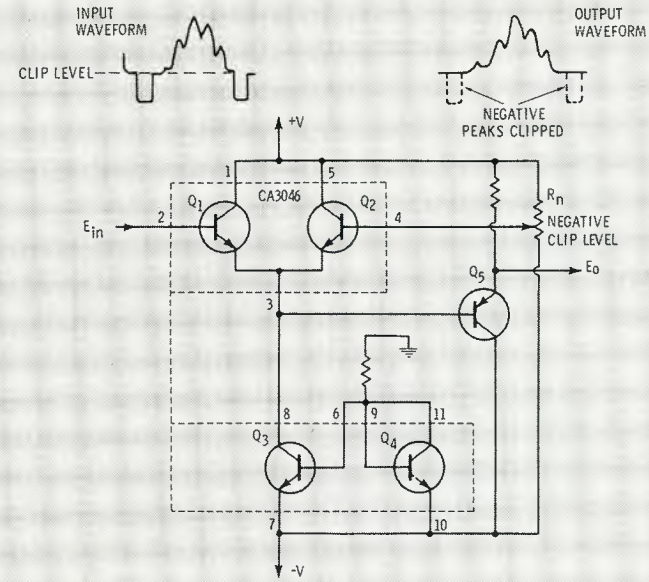

Fig. 3b Negative (black) limiter.

is desirable to keep the ratio of Q2 to Q1 current reasonably high ($\approx$ 5 to 1) so the dynamic variations of Q1's conduction will be a small percentage of Q3's output.

Another virtue of this circuit is the fact that the extremely large common mode range of the LMX71 (discussed in Part I) will allow clipping levels to be adjusted almost to the very limits of the supply potentials, a factor which enhances application suitability. In general, this circuit is useful where positive going signals must be clipped, but the range of current to be "sunk" by the IC is limited, such as the output of an NPN transistor or other current limited stages (such as those with source impedance shown as Rs). To cite one example, the output of the previously described negative limiter (Figure 3a) can drive this limiter directly and the combination forms a negative and positive peak limiting system.

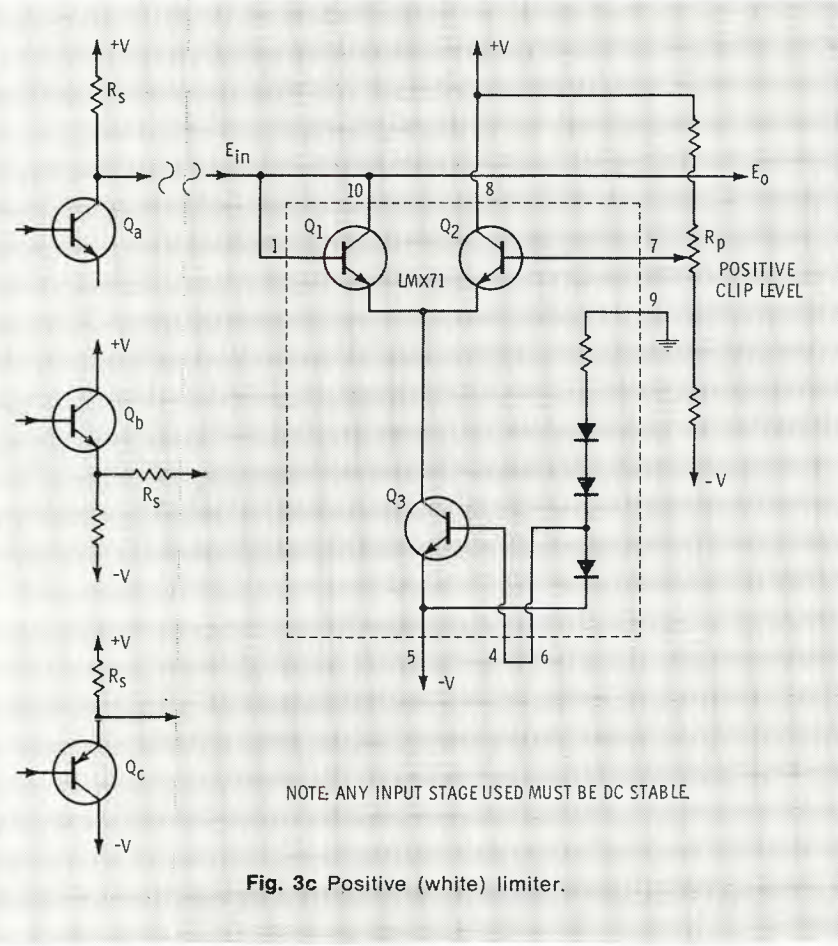

Fig. 3c Positive (white) limiter.

Bi-directional Clipper

The third clipping circuit to be described provides both positive and negative shunt clipping in a simultaneous fashion. This is yet another use for the bi-directional clipper circuit introduced in Part II.

This version of the circuit (Figure 3d) is the same as the original version, except that it contains no series resistance in the shunt arms (Q2 top and Q4 bottom) to soften clipping action, as an abrupt clipping effect is desired.

As with the previous positive limiter, this circuit needs a series input impedance to work against, since it operates by shunting signals away from the output. This resistance (shown as Rin) must be provided for the circuit to operate properly, but it can be part of a preceeding stage. Insofar as output drive considerations are concerned, a buffer circuit such as one of Part I's voltage followers is desirable, as the output must necessarily be fed through an input series resistance (Rin). If a voltage offset can be

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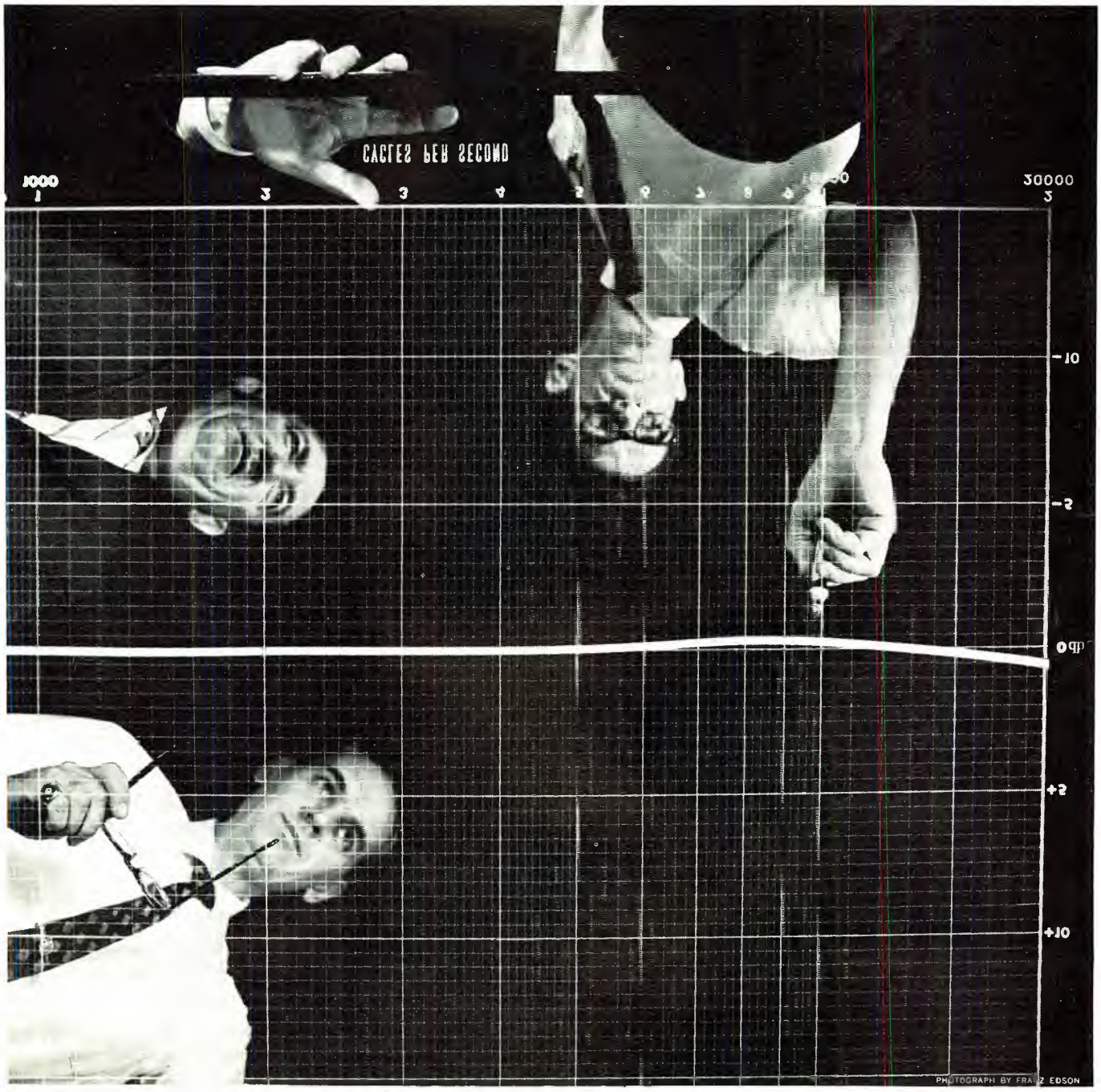

Circle Number 25 on Reader Reply Card

tolerated (or cancelled elsewhere) a simple emitter follower will suffice.

Gamma Correction Circuits

The function of a gamma correction circuit is to modify a normal linear input/output signal relationship into a predetermined law or relation. This common TV practice can necessitate either of two classes of circuits, gamma greater than 1 or gamma less than 1. Figure 4a graphs various output versus input curves which illustrate these gamma laws.

In this figure, the straight line curve (gamma=1) is the normal curve from a linear amplifier. A gamma value less than 1 (lower curve) has a compression-like characteristic. The upper curve (gamma greater than 1) is an expansion characteristic—gamma values of this nature are typical of kinescopes.

To mate various devices in a system and end up with an overall linear characteristic, it is often necessary to modify some device's electrical output to a different gamma characteristic. One example is a lead-oxide tube camera displayed on a conventional monitor. The monitor gamma is between 2 and 3 and the PbO tube is unity. The gamma of this combo will be that of the kinescope with the PbO tube being unity, and the overall gamma of 2-3 will result in unnatural gray scale reproduction. Modification of the PbO tube's output to a gamma of .5 will result in a linear overall transfer curve.

Electrical circuits to accomplish this gamma correction are generally some form of non-linear circuit element to approximate the desired curve. The techniques described here are multi-section approximations using level sensitive "losser" networks. This is by no means a new method, but the approach described here offers some unique advantages.

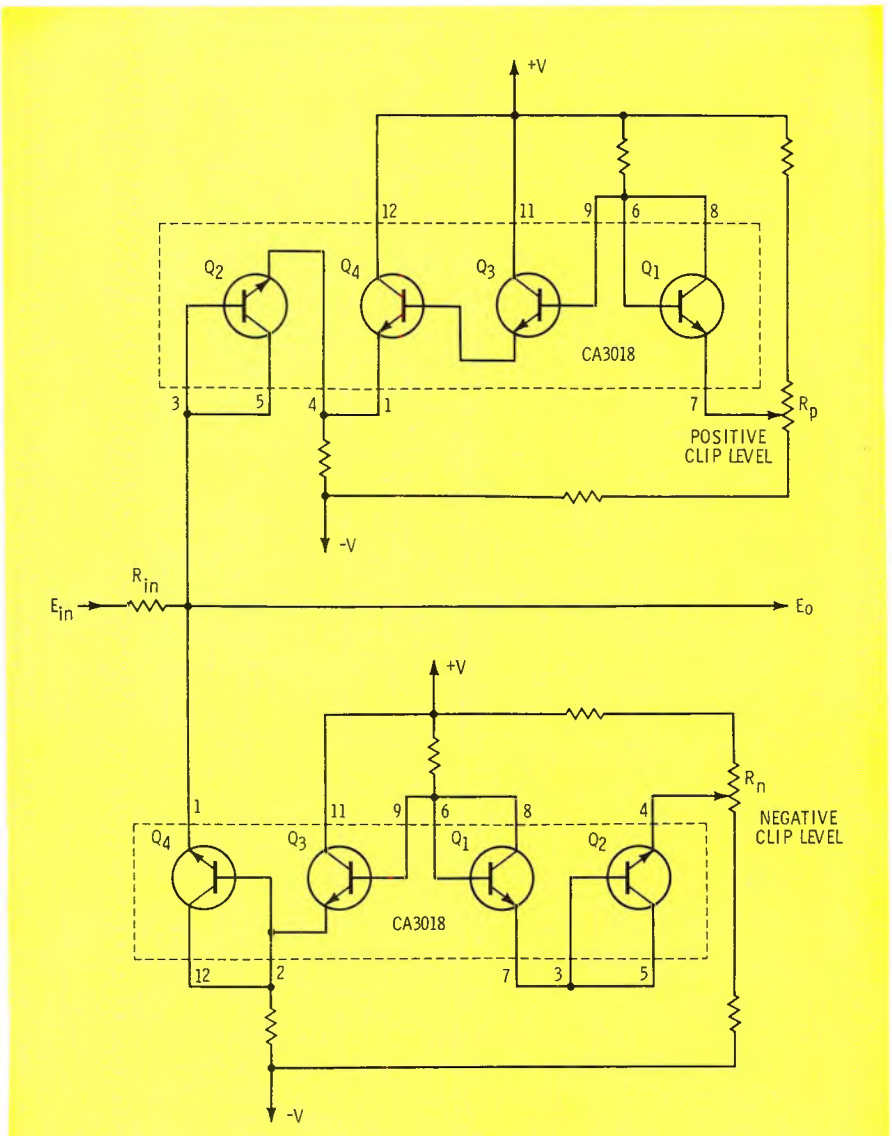

Fig. 3d Bi-directional clipper.

Gamma Correction—Values Less Than One

The circuit which is used to simulate a gamma curve of less than one (compression) is a combination of positive limiting circuits which introduce breaks in a normal linear output curve at predetermined levels (see Figure 4b). To visualize this action, assume a linearly rising sawtooth input Ein applied through the resistance Rin. At low voltage levels the resistance, Rin is virtually unloaded because of high impedance buffer amplifier A, and the signal passes unattenuated to the output. On the curve of 4b, this is slope #1. At a voltage level corresponding to break point number one, Positive Clipper #1 conducts, and places Rb1 in parallel with the signal. This reduces the slope of the signal, and the output will now rise at a rate equal to slope number two. This continues until break point number two is reached, and Positive Clipper #2 conducts and introduces a third slope, causing the output to rise at an even slower rate.

Although this process can be continued by adding as many sections as desired, it should be obvious that this technique is introducing a compression-like characteristic to the signal. With suitable adjustment of clipping levels and slopes and sufficient sections to provide resolution, this technique can closely approximate any curve with slope less than unity.

The beauty of this approach is that completely temperature compensated break points are possible by using a Positive Clipper such as 3c or the positive half of 3d as the clipping elements, one clipper circuit for each break point. And of course, the break point voltages are very predictable due to the IC's matched monolithic parameters. Even remote programming is possible.

A circuit of this type, since it depends upon precise signal amplitudes to match a mathematical curve, is very sensitive to output loading. Therefore, a high input im-

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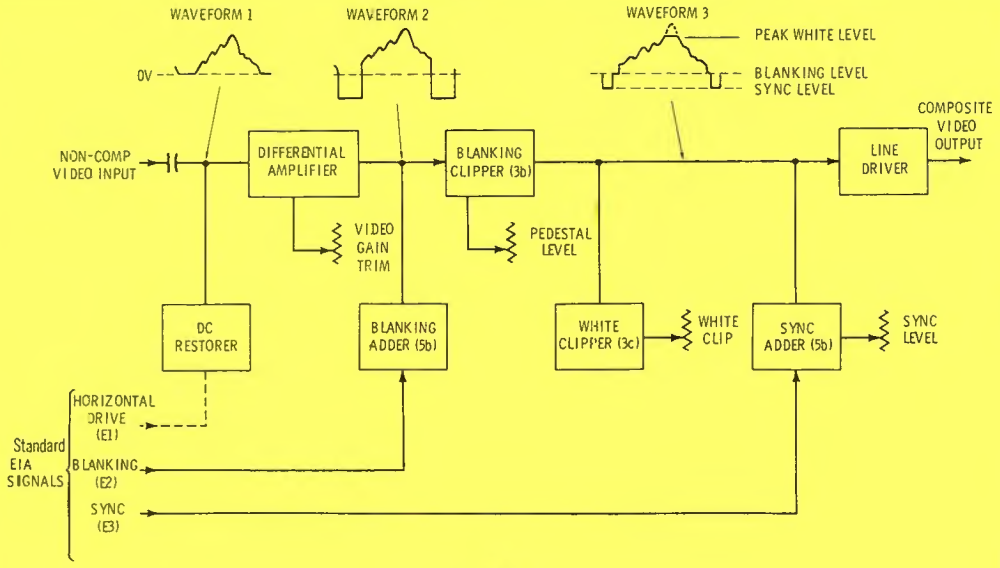
some standard video processing functions. The functions involved are DC restoration, video gain trim, black level control, composite blanking, white clip, composite sync insertion and a video line driver.

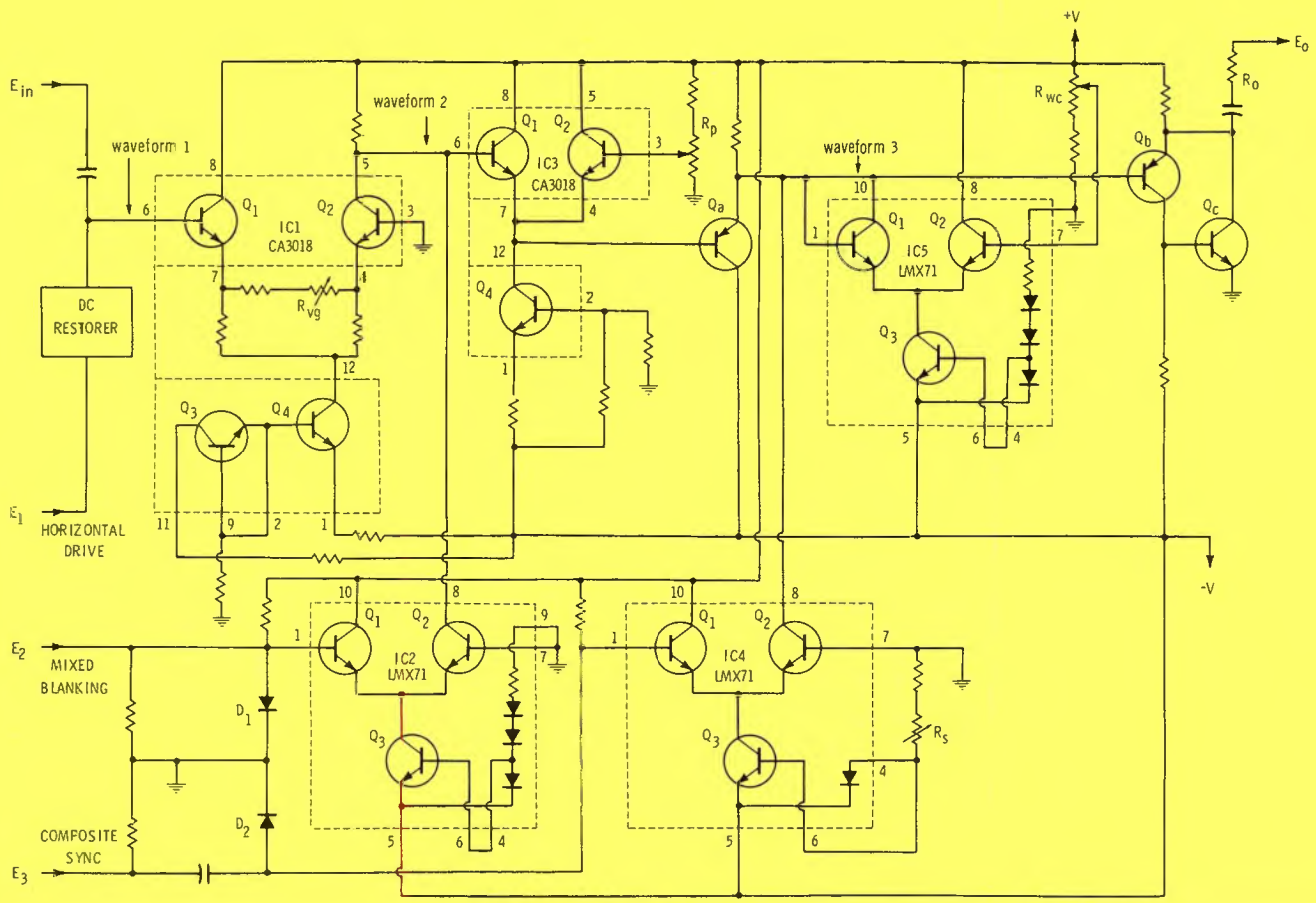
The functional diagram of this system is shown by Figure 6a. This block diagram indicates the various processing functions and also the particular circuits on which they are based along with explanatory waveforms.

Referring to Figure 6b, the video waveform applied to the DC restorer as Ein is a black negative signal, with peak-to-peak amplitude of a few volts. The DC restoration function is not detailed here, but can be any of the previous clamping techniques or preferably, a solid state driven clamp operating during horizontal blanking interval (using the horizontal drive signal E_1 shown



(A)

Fig. 6a Block diagram of video processor. (6b) Video processor system.



(B)

dotted). The signal applied to the base of ICI-Q1 then, is a black negative one with black peaks referenced to ground (See waveform 1).

This signal passes through 1C1-Q1 which serves two purposes. It serves as a buffer element to the clamp and minimizes loading. It also forms one-half of a differential pair with 1C1-Q2 and provides temperature compensation. The video signal path from 1C1-Q1 to 1C1-Q2 is made variable and the video trim control (Rvg) allows the signal applied to 1C1-Q2 to be precisely adjusted. At the collector of this transistor, a non-inverted signal (still black negative) is present, but it now rides around a higher quiesient DC level. The stability of 1C1-Q2's operating point is held constant by the regulated emitter current supplied by 1C1-Q4. This stability is necessary so that the subsequent stages can clip signal levels accurately.

Composite blanking pulses are supplied by 1C2, an LMX71 which limits the EIA blanking pulses (E2) and applies negative pulses to 1C1-Q2's collector. The LMX71 is used here essentially as a comparator, with the right side referenced to ground and negative going pulses applied on the left via pin 1. Since normal EIA levels of 4 volts will overdrive this comparator, the output signal is quite independent of input amplitude variations over normal tolerances. At the base of IC3-Q1 then, the video signal has composite, negative going blanking signals added to the waveform (See waveform 2).

IC3 is a negative clipper, similar in concept to Figure 3b. The clip level control (Rp) is adjusted so the negative clipping point is just below black video peaks. This cleanly removes the large amplitude blanking pulses, and establishes a flat blanking level along with the proper setup (blanking to black level).

The output of Qa is fed to two stages, a shunt operated white clipper (IC5) and a sync adder, IC4. The white clipper formed by IC5 operates exactly as described in 3c, and peak video excursions are adjusted by Rwc. The sync adder is another limiter, exactly similar in concept to IC2, and adds sync pulses to the video signal at Qa's emitter. Since the current supplied by IC4 is variable by adjusting Rs, this control serves as a sync pulse amplitude control. Due to the current limiting action of IC4 Q1-Q2, the sync level is independent of input levels, as was true for the blanking adder.

At this point the video signal is fully processed with sync, blanking, setup, and amplitude level controlled (waveform 3). All that remains is to apply the composite waveform to a line driver (Qb-Qc) and thence the output signal line. Qb-Qc form a unity gain, high current buffer with sufficient current capacity to drive a transmission line. The output signal is source-terminated by a resistor Ro, as the feedback pair Qb-Qc is essentially a zero-impedance source.

With this system, several important goals have been accomplished. All processing functions have been done with what amounts to zero temperature coefficient circuitry. The operational characteristics are quite attractive: inherently wideband configurations, self limiting blanking and sync levels, smooth clipping adjustments and precise amplitude control. These factors combine to form a step towards an optimized video control system.

Summary

This three-part series has endeavored to shed some illumination on the variety and versatility of IC differential and monolithic design techniques. In general, the use of these modules is attractive. In particular, they hold significant promise of powerful techniques to the video designer, and the examples presented here are intended to serve as stepping stones, as this study is by no means exhaustive. With the use of the cited references and a measure of ingenuity, the interested reader should be able to expand upon these starting points.

Acknowledgements:

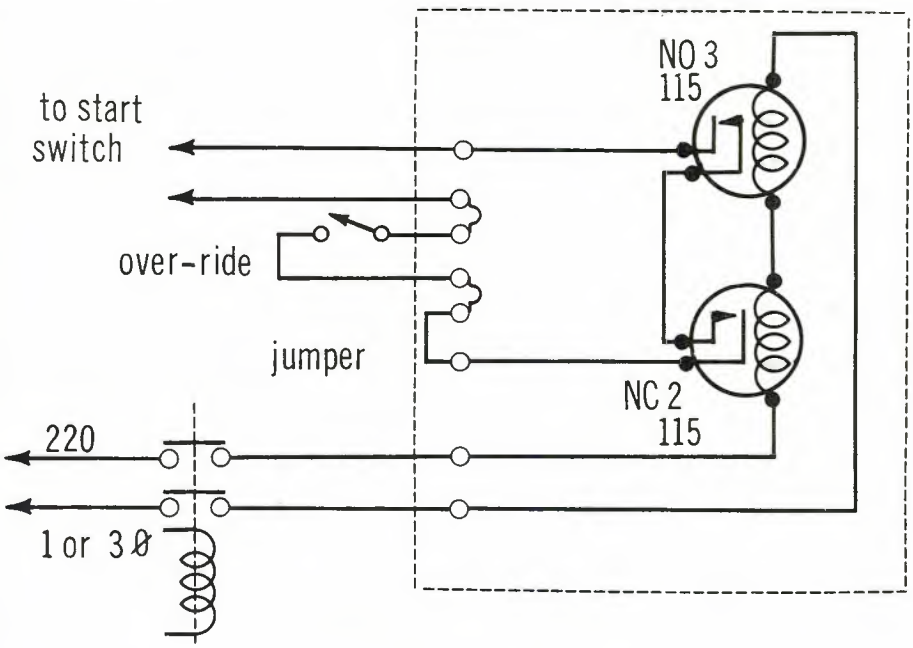
I would like to gratefully acknowledge the help of the LM171-LM371 designer, Robert Hirschfeld of National Semiconductor, who was instrumental in initiating interest in this study. Several fellow workers also—Richard Groom, Steve Miller and John Hanna contributed quite helpfully in various forms during the course of this work.

ENGINEER'S EXCHANGE

Gates Transmitter Tip

Here's a circuit that we installed in our BC-500GY Gates 500 watt AM transmitter. We had problems staying on the air during the lightning season and had to manually start the transmitter each time we kicked off. The series heater circuits of the time delays are attached to the drop side of the high-voltage contactor. When power is applied to the transmitter the delays warm up and becomes ready. If the transmitter kicks off from over-load the power is removed from the delay heaters and they begin to cool. The NC2 cools faster than the NO3 and closes the "start circuit" before the NO3 has a chance to open, thus restarting the transmitter. If there is another overload immediately the same thing happens, but if more than two or three successive overloads occur in quick succession the heaters don't have time to complete their time delay action and the "start" circuit will remain open, leaving the transmitter off. A jumper is shown here. . . this can be taken off to a remote control over-ride function. Time from fully energized to re-set is about four seconds . . . and it works in any 220 volt system.

John E. "Ted" Thayer
Chief Engineer
Station KIKX
Tucson, Arizona



Schematic Showing Jumper

Using Old 4-400A's In the Modulator

The following item is not new or sensational but may have been overlooked by some engineering staffs. We use the 4-400A and the later type numbers of this tube in our Bauer 707 transmitter final amplifier up to about 12 months before they have to be replaced to stay within the minus 10% power tolerance. While the tubes are no longer

satisfactory in the final amplifier, they may work quite well in the modulator.

There is one important restriction on their use in this manner. The static current, with the available bias voltage range, must be within limits. Fortunately, many of them will be.

We have several used tubes on our shelf. The procedure is to find two tubes for the modulator that have the same static current for a given bias setting. This is done by leaving one modulator tube out of its socket and inserting tubes in the other socket, noting the static current of each. When two tubes are found that have about the same static current, within 5 to 10 mills of each other, preferably exactly the same, the job is almost done.

The total static current can be corrected somewhat by adjusting the bias. Although new tubes usually are balanced, it is common procedure to make this check before buttoning up the modulator.

Most transmitter bias supplies will provide enough voltage to achieve the balance. However, tubes should not be used that will not meet the requirements of the next Proof. You many drop old 4-400A's into the modulator that provide adequate punch, but remember that sour (gassy), old tubes will have an effect on audio fidelity.

Once a used, balanced pair is found and the bias set within reasonable limits, you may find it necessary to raise the audio input to the transmitter slightly. At WEBJ we have had good success with this method of re-using these tubes.

There is no estimate as to how long used 4-400A's will perform in the modulator, but every month used is money saved.

Gene Vinson, Engr.
Station WEBJ
Brewton, Alabama

FCC Proposes Change Of Section 1.526

The FCC has proposed an amendmeent to Section 1.526 of the Rules which would make it mandatory for broadcast stations to hold "local inspection" files containing copies of applications and other material filed with the FCC for a period of seven years.

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1969 ANNUAL INDEX

TECHNICAL DATA

For further information, circle data identification number on reader service card.

100. **AXEL ELECTRONICS CORP.**—A new comprehensive catalog on Drimica High Voltage Capacitors is now available. The 16-page catalog covers complete and informative information on DC Capacitors, Mylar Wrap and Epoxy Case; Pulse Capacitors Mylar Wrap and Epoxy Case; Pulse Forming Network Design Data; Flat Disc, Low Industance Energy Discharge Capacitors; and Flat Line Low Industance Discharge Capacitors. The information is specifically important where the applications are required in the field of High Voltage-Low Inductance Energy Discharge-Pulse Forming Networks-AC Filtering-By-Pass-Coupling Blocking-Arc suppression and Power Factor Correction.

101. **COHU ELECTRONICS, INC.**—A two-page, two-color planning guide for broadcast television accessories is now available. Data sheet 6-469 uses photographs and a selection table to describe the various studio combinations available with the 2600 series video multiplexer, color bar encoder, colorlock, chroma detector, sync generator and color bar, black burst, dot bar, background and drive generators.

102. **COMPUTER PRODUCTS, INC.**—A six-page bulletin, effective September, 1969, covers Computer Products' complete line of low power octal mount, printed circuit mount and bench model regulated DC power supplies. Output voltages and currents range from 3.6 VDC @ 250 MA to 180 VDC @ 10 MA. Both dual and single output supplies are shown with complete specifications (electrical and mechanical), prices and delivery for all fifty-two models.

103. **CHRONO-LOG CORP.**—A two page Bulletin 4,000 describing the new low cost integrated circuit Time Code Generators is now available with a variety of options. The basic Series 4,000 Time Code Generator is priced at $870. Among available options are a selection of IRIG and NASA time codes; BCD or NIXIE display; various time bases ranging from line frequency to an internal oscillator with a stability of 1 part in 10^7 per week; and several supply voltages. Accompanying the bulletin is a price list which allows users to select the options which meet their needs, make up the proper model number and determine the price. In addition to low cost, the Series 4,000 Time Code Generators are small in size, requiring as little as 1¾″ of panel height in a standard 19″ rack.

104. **DATA DISC, INC.**—Three illustrated data sheets are now available. They describe and give typical applications for three new devices recently placed on the market by the Palo Alto, California, firm. The three equipment items covered by the new literature are: Wide-band Instrumentation Disc Recorders (4100 and 4250 Series) developed by the Video Division, Parallel Disc Memory (5200 Series) developed by the Display Division and the Disc Controller (1200 Series) for interfacing up to four Data Disc's 7200 Series Disc memories with a small computer developed by the Computer Products Division. All three units

were shown for the first time at this year's WESCON in San Francisco.

105. **ELCO CORP.**—The revised, 52-page 1969 edition of the P. C. Connector Guide describes and illustrates 25 Varicon (metal-to-metal) connector series that conform to MIL-C-5400, MIL-E-8189, and MIL-T-21200; 14- and 16-pin DIP receptacles; and test probe receptacles. An illustrated three-page foldout chart, which indexes all Elco p. c. connectors, immediately identifies the connector required by the application. Connector contact spacings include .050", .100", .156", and .200", while contact terminations include solder (wire hole and p. c. tab), taper tab, taper pin receptacle, crimp, and wire-wrap post. Connector sizes range from 2 to 152 contacts.

106. **ELECTRONIC INDUSTRIES ASSOC.**—Information on buying, installing and servicing a color television set is provided in a new booklet published by the National Better Business Bureau. The booklet contains hints on conditions that could affect the quality of picture reception, factors that determine charges for a service call, and what to expect from a service call.

107. **EQUIPTO**—The latest Steel Equipment Reference Manual No. 493 is now available. The new manual contains over 100 pages of standard steel storage, shop and office equipment, available for immediate shipment from stock. Over 17 pages are devoted to new products that have been added to a line of more than 3,000 products. New products shown in this catalog include handy tool trays, open safety grating, semi-portable work benches, cleaning benches, and are included with other storage, store, office, warehouse and shop equipment shown in the previous issue. The manual includes six instant action business reply cards to provide a means of quick communication for additional information or assistance.

108. **HANNAY**—A new 6-page bulletin on Reels is now available. The bulletin contains inmation on reels for cable storage, reels to handle live electric cable, and specifications and prices. Also includes information on explosion-proof switching, portable reel storage, and custom built reels for television and auxiliary power.

109. **JULIE RESEARCH LABORATORIES, INC.** — A new catalog covers the latest DC techniques for precision test and measurement in general production and engineering areas, as well as in standards and calibration laboratories; describing in detail Julie automated, computerized and manual systems and instruments and precision components. In its detailed descriptions and specifications of the wide range of Julie high accuracy instrument and systems lines, the 12-page cata-

log features a new medium-priced line including an AC/DC Differential Voltmeter, a Microvolt Potentiometer and Source; a new series of High Voltage and Ultra-High Voltage Dividers; a new Electronic Null Detector; a new series of Precision Decade Resistors; and a Portable Standard Reference Resistor.

110. **KALART** — Kalart/Victor Series 75MC3 projector bulletin illustrates and describes a new 16mm optical sound projector featuring the Marc 300 high intensity light source and power pack combination. Series 75MC3 provides four times more light output than 16mm projectors using standard incandescent lamps and is available in both 15-watt and 25-watt, RMS, full-power amplifiers. Other features include "snap-out" reel arms, exclusive safety film trips for film protection, top-mounted reels, and color-coded threading for simplified threading.

111. **KISTLER INSTRUMENT CORPORATION**—A new, four-page bulletin on the Company's Series 602 Universal Dynamic Pressure Probes, compact quartz sensors for measuring transient or cyclic pressures in environmental extremes. In addition to listing specifications common to the entire 602 series, bulletin No. 274-4/69, contains specific data on the various type 602 sensors available. Information includes descriptions of the thin 602 Probe and the 602 Probe mounted in precision-threaded adaptor. Models are classified according to specification performance data as well as special features such as "acceleration compensation," "ground isolation," and "hermetic sealing".

112. **KOPPERS**—A new technical bulletin describing properties, applications and standard stocked sizes of EXTREN fiber glass reinforced polyester (RP) structural shapes is now available. The bulletin discusses and gives data on mechanical, electrical, thermal, fire-retardant and other properties of sheet, rod, square bar and other shapes. A general corrosion resistance guide indicates recommendations for Extren RP use with 50 chemicals. Sizes and pounds per lineal foot are given for sheet and the following shapes: equal leg angles, channels, round and square tube, round and square bar, wide-flange beams and I-beams.

113. **LUXOR** — A new, 32-page catalog giving complete details of all Luxor products has been published by the Jack C. Coffey Co., Inc. More than 200 products for use in schools, churches, industry and government by audio visual departments, instructional materials centers, training departments, libraries and film departments are described in Catalog No. 3269. There are three series of library units for filing and storing AV and instructional materials: 10½" wide Landmark series, 19½" wide Leader series and the new 39" wide UnLimited series in bright, contemporary finishes. Other equipment shown in the catalog consists of mobile multi-height projector and TV receiver stands, mobile storage/projection centers, mobile video tape recorder console, the Luxor AV an instructional materials record system and various forms and materials for AV library use.

114. **LYNCH COMMUNICATION SYSTEMS** — A new eight-page brochure on "E" compatible signaling units is now available. Lynch B850 Inband Signaling Systems provide the means for transmitting E & M Dial, One-Way Loop Dial, or Foreign Exchange Signaling information over cable carrier, microwave multiplex, open-wire line carrier or a four-wire physical line facility using 2600 Hz for supervision and dial pulse information. Signaling units described include: "E4B" E & M Dial; "E3B plus Applique" E & M Signaling for use with

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2-wire line facilities; "E2L and E2S" Foreign Exchange Signaling, Loop Start; "E2L with E2LA, E2S with E2SA" Foreign Exchange Signaling, Ground Start or Loop Start; and "E2C and E2D" One-Way Loop Dial Signaling. All Lynch B850 transistorized signaling equipment is electrically equivalent to and will work on an end-to-end basis with the various types of Western Electric "E" type signaling systems.

115. **MAGNETICS INC.**—Twelve sizes of 550 Mu moly-permalloy flake cores, nine of them new, are described in a new illustrated bulletin. 550 Mu moly-permalloy cores, which are essentially "fixed gap" toroids, bridge the gap between 300 Mu power cores and nickel laminations for use in inductors, transformers, filters, chokes and coils. The bulletin describes how the 550 Mu cores reduce size, copper resistance and distributed capacity, improve temperature stability and reduce costs. A table lists the nine new and three existing sizes, for which prototype quantities are available from stock.

116. **MALLORY CAPACITOR COMPANY**—A new technical bulletin describing the division's line of TDC solid electrolyte tantalum capacitors is now available. The Mallory TDC (Tantalum Dipped Capacitor) is a space saving, low cost solid electroltype capacitor and the new 8½ by 11 inch bulletin gives complete details of the four case sizes and wide range of ratings available. The capacitors have a hard, dip coated epoxy coating and are supplied with tinned nickel radial leads for applications in industrial, commercial and entertainment electronics equipment.

117. **MERIMAC RESEARCH & DEVELOPMENT, INC.,**—A new 100-page catalog containing complete price and technical information on the company's line RF, IF and microwave components is now available. The catalog includes separate sections covering Merrimac's extensive line of quadrature (90) hybrids, hybrid junctions, power dividers, directional couplers, attenuators, phase shifters, mixers and phase comparators, filters, and special products, plus a listing of all Merrimac domestic and foreign sales representatives. Each product section includes an introductory section containing general technical information, and specifications on each of Merrimac's standard and miniature sized components.

118. **MOTOROLA INC.** — A new precision instruments catalogue is now available. Extracted from the Motorola Buyer's Guide, the 36-page catalogue contains both general purpose test equipment and special two-way radio test equipment and service aids.

119. **MTI**—An illustrated four-page catalog sheet (MTI Publication 0569-1) describes the

low light level capability of the Image Orithicon TV camera and its varied applications in industrial inspection, astronomical research, underwater CCTV and the medical and dental fields. The camera's many features are listed with emphasis on the extreme sensitivity of the "Orth" series (1,000 times more sensitive than Vidicon cameras). Also included are charts showing camera sensitivity comparison, imaging tube lag comparison, and comparison of photocathode spectral response in addition to detailed performance specifications.

120. **RCA ELECTRONIC COMPONENTS**—A new 12-page catalog describes mounting hardware supplied with RCA transistors, thyristors (triacs, SCR's, diacs) and silicon rectifiers. Included in this catalog are detailed exploded views to help illustrate the preferred procedures for mounting and connecting these solid-state devices into equipment. A quick reference chart is also included to permit quick access to the appropriate mounting information for a specific device.

121. **SAN FERNANDO ELECTRIC MANUFACTURING CO.** — Specifications of RFI filters designed to attenuate fluorescent lamp-generated noise in computer centers, instrumented test and research laboratories, clean rooms and other installations are highlighted in a new data sheet. Major features of the type F-20064 West-Cap ballast filter detailed in the data sheet include: unique light weight (only eight ounces) combined with noise attenuation that meets or exceeds that of any RFI filter presently available; current rating from 4.0 to 6.0 amperes; voltage rating of 115-280 volts AC/DC for 50/60 cys.; high temperature; leads of six inch minimum length, 18 AWG stranded wire; special eyelet design that prevents abrading or cutting of the leads.

122. **STODDART ELECTRO SYSTEMS**—A brochure describing the new Microwave Interference Analyzer/Receiver Model NM-65T is now available. As described in the brochure, the Model NM-65T is all solid state, completely self contained, compact, light weight, field portable, and integral battery or AC-operated. The new instrument offers laboratory precision and exceptional reliability. These features make the Model NM-65T ideal for determining the source and analyzing the characteristics of electromagnetic interference. The brochure covers typical application; military specs and standards met by the instrument; special features; and performance specifications. The publication also displays the functional block diagram, outline and mounting diagram, and illustrated list of accessories.

123. **TECHNICAL ACCESSORIES COMPANY** — The spring 1969 catalog containing specifications, dimensions and pricing on its line of several thousand electronic hardware components is now available. The reference and specification data catalog is designed for the specifying designer and engineer.

124. **TECHNICAL WIRE PRODUCTS, INC.** — A four-page data sheet covering technical information on Teckstrip is now available. Along with photos and engineering drawings, it describes Teckstrip as a resilient EMI/RFI shielding gasket combined with a solid extruded aluminum mounting strip. Supplied ready-to-mount, Teckstrip can be attached directly to an electronic enclosure by spot welding, screwing, riveting, or similar fastening techniques. In addition to adding stiffness and strength to a structure, the solid aluminum extrusion prevents gasket overcompression and provides a load-bearing element to meet most shock and vibration requirements.

125. **TELEMATION**—A six-page brochure describing TeleMation broadcast video switchers, audio and video distribution switchers and passive video switchers is now available. The brochure gives detailed specifications and describes features of the TPS-12X3 Vertical Interval Broadcast Switcher, the TPS-8X2 broadcast switcher with automatic preview; the Series TAS-12X/TVS-12X solid-state audio and video distribution switchers, and Series TVS-6X1 bridging or terminating switchers.

126. **TEXSCAN CORPORATION**—Catalog Sheet RC gives complete description and technical parameters of newly developed remote controlled attenuator line which has a life expectancy of 100,000 revolutions, minimum. Along with wide range these devices feature a broad frequency range, ruggedized construction, rapid switching time and a choice of BNC, TNC, N, or STM connectors.

NEW PRODUCTS

(Use circle number on reader service card for further information)

Gates Breaks The Ice

Color TV Xmtr

The first complete line of VHF transmitters designed specifically for color has been introduced to the broadcasting industry by **Gates Radio Company,** a division of Harris-Intertype Corporation.

Gates' transmitters are now available to broadcasters for service on the high-band channels 7 to 13 at power outputs of 1300 watts, 13 kW, 18kW, 25 kW, and 50 kW. The low-band transmitters for channels 2 to 6 have outputs of 1300 watts, 13 kW, 18 kW and 25kW.

The unusual feature of the new color line is video IF Modulation, which according to Gates, produces a color signal of greatly improved quality. This new line is the first FCC type-accepted transmitters with IF Modulation for VHF TV service.

Color fidelity in the new line stems from Intermediate Frequency (IF) Modulation of the visual carrier, and straight-forward circuitry in the power amplifier stages. No excessive compensating circuits or video phase matching burden the generation and transmission of the color carrier.

IF Modulation needs fewer circuits to produce a fully processed color picture signal. Gates' system takes less than 1.0 volt of video signal to modulate the RF carrier, where other recent designs need as much as 70 volts for carrier modulation.

IF Modulation results in nearly perfect signal linearity. Thus, predistortion circuitry which degrades color fidelity is significantly reduced. Use of the ring modulator allows modulation percentages to approximately 2 percent. With this linearity and depth of modulation, good color performance is obtained even such colors as high saturated as yellow.

Circle Number 60 on Reader Reply Card

General Coverage Receiver

Hallicrafters is now in full production of its latest general communications receiver, the SX-122A.

By employing dual conversion on all bands, its obtains optimum image rejection. Coverage of 1.75 KHz through 34 MHz is aided by selectivity made possible by the use of a 50 KHz second-IF system with four high-Q, permeability-tuned circuits. Receiver selectivity is variable in steps of 0.5, 2.5., and .5 KHz at 6 dB down.

Frequency stability is achieved by ceramic trimmers and coil forms in the first-conversion oscillator, extensive temperature compensation, voltage regulation of oscillators, and a crystal controlled, second conversion oscillator.

The tube complement includes: 6DC6 RF Amp; 6AU6 First Mixer; 6C4 Variable Osc.; 6DC6 IF Amp.; 6BL8 Second Mixer-Crystal Osc.; 6BA6 IF Amp.; 6BE6 Product Det.; 6BN8 AVC Amp., Rect., and AM Det.; 6GW8 Audio Amp. The noise limiter uses an IN456 diode.

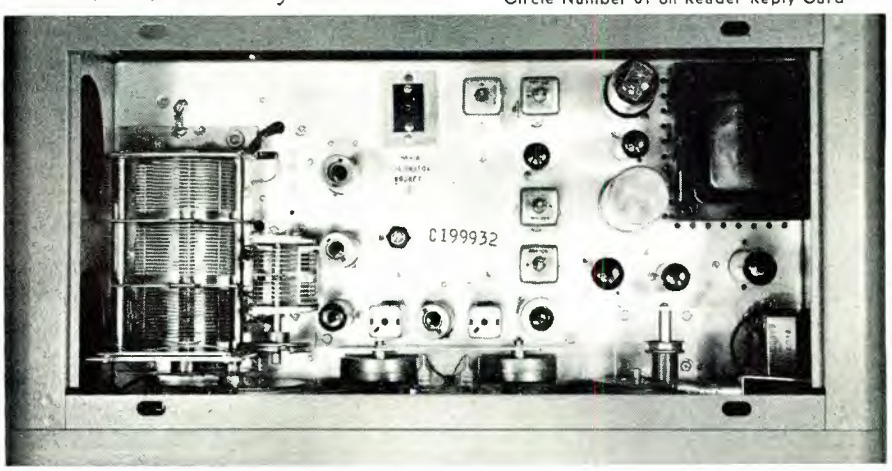
Also, for the sake of maintenance and alignment, the new receiver uses a quick entry top cover. This eliminates removal of chassis from cabinet.

And while the SX-122A has not completely gotten away from string drives, some real progress has been made in the tuning section. The main dial is gear-connected to the main tuning capacitor. The front main tuning knob is string driven, but slippage will not affect the dial reading. Also, the bandspread to dial mechanism relies on a wire drive from the capacitor to the dial. Here again, the only string involved is the front knob, which will not cause tuning errors.

Provisions have been incorporated to accept a 100 KHz crystal calibrator to provide marker signals for checking calibration accuracy.

On the test bench at BE we found the SX-122A to be more than adequate for monitoring time signals from WWV, AM and SSB signals, foreign broadcasts, EBS, and for general local communications (Amateur and CB) monitoring during emergencies.

Circle Number 61 on Reader Reply Card



Head Cleaning Cartridge

A new head cleaning cartridge which permits automatic, daily maintenance of tape cartridge equipment is available from **Marathon Broadcast Equipment Sales Corporation.** Designed for easy use by routine operating personnel, the Model 301 Head Cleaning Cartridge eliminates danger of upsetting azimuth adjustment and the need for manual cleaning with alcohol and swabs.

The new cartridge contains a continuous tape loop which provides 20 seconds of programmed cleaning and lubrication. Specific segments

provide 5 seconds of light abrasive action, 5 seconds of lubrication, 5 seconds of polishing, and a final 5 seconds of lubrication. The Marathon cleaning cartridge incorporates advances in silicon carbide and chromium oxide technology applied to tape materials and provides proper cleaning action without damage to the head surface in any way.

It is designed for use once at the beginning of each broadcasting day. A pre-recorded cue tone stops the tape after a single cleaning cycle and leaves it ready for next use.

Circle Number 62 on Reader Reply Card

Oscilloscopes

Tektronix, Inc. announces the new 54 Series of oscilloscopes designed and manufactured by its English subsidiary, Telequipment Ltd. This series includes the dual-trace model D54, single trace model S54A, and its companion, the S54U, which is capable of being operated from internal batteries or an external DC source, as well as from the AC line. This series features solid-state design, including FET inputs

which are not usually available in oscilloscopes in this price range.

The basic specifications of the three instruments are identical: Vertical bandwidth from DC to 10 MHz. Deflection factors from 10 mV/cm to 50 V/cm in 12 steps, bandwidth is 10 MHz at 10 mV/cm sensitivity. Sweep rates from 200 ns/cm to 2 s/cm in 22 steps. 6x10-cm CRT.

Versatile triggering including TV line and field.

The Type D54 Dual-Trace Oscilloscope has four operating modes: Channel 1 only, Channel 2 only, Alternate, Chopped.

Circle Number 63 on Reader Reply Card

Audio Mixer

Visual Electronics has a new solid state mixer console featuring push-button selection of high level inputs to either of two mixers; built-in plug-in 8 watt amplifier; two switchable microphone inputs on mixer four (plug-in modules allow for mi-

crophone preamps to be substituted on mixer four); and full cue facilities.

Designed with production operation and small studio use in mind, the unit includes a VU meter and a clock.

Circle Number 64 on Reader Reply Card

Gates has a new line-up of VHF-TV Transmitters see pages 18 - 19

VTF Titlefile

The new Model VTF Titlefile is a random-access magnetic tape loop information storage and retrieval device specifically designed for interface with **Visual Electronics Corporation's** display control units. The Titlefile consists of a rack mounted tape deck with associated controller and a table mounted Address Control Keyboard.

The Titlefile stores up to 800 rows of display (up to 30,000 USASCII characters) on a ½-inch magnetic tape housed in a removable tape cartridge and arranged in a 15-inch loop configuration. A 9-channel read/write head is used to record 9 tracks on the ½-inch tape. Eight tracks are used for recording information. The 9th (center) track serves as a master clocking track to facilitate location of information recorded on the 8 data tracks.

Messages or titles may be composed on the associated Visual Display Control Unit and transferred onto the Titlefile in specific address locations as selected by the Titlefile Address Control Keyboard. Up to 800 rows of display information (24 or 32 characters per row) may be stored on one tape loop. Access to any row is via electronic addressing from the Address Control Keyboard, where a one, two, or three digit address provides access to any of the 800 rows or addresses in an average of 350 milliseconds. Addresses are sequentially arranged from 000 through address 799.

The Visual Titlefile features straight-forward mechanical design. The only moving parts are the rotating tape guide rollers, and the drive motor. Tape cartridge removal and replacement is simple and fast. The cartridge provides complete protection for the tape and is easily stored.

Circle Number 65 on Reader Reply Card

FET Meter

Sencore now has available a new FET meter, the FE149 Senior. Featuring pushbutton design and a response greater than many scopes, the FE149 accuracy is 1.5% on DC and 3% on AC.

And for measuring those low transistor voltages, the meter includes a range that is zero centered, reading up to .25 V either side. This assures checking transistor bias to less than .1 V. Also, the FE149 mirrored scales help prevent parallax errors on these critical readings.

Set up in nine DC and nine AC current ranges, the meter also will reach eight resistance ranges and will read up to 50 KV with a 39A21 high voltage probe.

The unit is designed for absolute meter and circuit protection against circuit overload. Housed in a nonbreakable, scuff-proof steel case, the FE149 Senior operates on AC, on self-contained rechargeable batteries plugged in.

Circle Number 66 on Reader Reply Card

Carrier Generator

Vikoa has introduced its new C.W. Carrier Generator. The C.W. generator is engineered and designed for use in cable loss testing, dynamic amplifier testing, as a portable "Head End" to check out system sections when normal Head End signals are not available or are unreliable, for checking AGC performance composite or pilot type.

Also, in the use of several channels or a single channel for noise tests, cross-modulation test carriers, substitution carriers, etc. The C.W. generator helps locate "hidden" noise inputs from broken connectors, loose covers by providing stable, noise-free unmodulated carriers which may be inserted at any point in a system from head-end to subscriber tap. Field checking for device loss, tilts, program channel suck-outs replacing variable system signals with stable sources, crystal controlled on low band, and high "Q" compensated cavities on high band.

Circle Number 67 on Reader Reply Card

Delay Cartridge

A unique tape delay cartridge having time lags up to sixty seconds for live AM and FM radio broadcast is available from the Automatic Tape Control Division of **Gates Radio Company.**

Gates' newly introduced cartridge is designed to provide delays from six to sixty seconds from audio input to audio output when a time lag is needed by studio personnel for live shows. The unit is ideally suited to audience participation shows, panel discussions and interviews. A tape erase element is contained

within the cartridge causing an erasure of 50 dB or more.

No special changes or additions are required for the cartridge machine. When using a standard, direct drive record-playback unit, the studio technician simply inserts the delay cartridge into the machine to set up a delay system.

Delay time varies from six seconds to one minute depending on how the tape is wound on the cartridge. A delay period can be changed by readjusting the tape wind.

Over ten minutes of tape on each cartridge greatly reduces tape wear and also leaves splice "dip" unnoticeable. This makes the cartridge superior to other tape delays systems where one point on the tape passes the heads as often as once every six seconds.

Circle Number 68 on Reader Reply Card

FM Transmitter

Collins Radio Company now has available a new 20 kw FM transmitter. Called the 831G-1, this transmitter uses solid state on-off switching and is equipped with automatic power output control.

The 831G-1 also offers front panel tuning with complete metering and control facilities on its extended control panel. The direct FM all solid state exciter offers such options as stereo multiplex and an SCA generator. The manufacturer claims the transmitter will provide extended uninterrupted service.

Circle Number 69 on Reader Reply Card

Equalizer-Amplifier

Telemet is now offering an equalizer-amplifier designed to correct "soft" picture problems such as streaks and exponential undershoots and undershoots.

The color/monochrome equalizer-amplifier #3205 permits on-air adjustments of phase disturbances in the troublesome 15 KHz to 500 KHz range. This is accomplished at base band before switching into the program line.

This fully transistorized unit, with several in use at Cape Kennedy, boosts both color and monochrome signals to desired strengths. It weighs just 6½ pounds and will fit a 19-inch rack.

Circle Number 70 on Reader Reply Card

Videographic Kit

A Videographic Kit for instant production of visual aids has been developed by **Sony Corporation of America.**

The Videographic Kit contains six sheets of lettering, four sheets of illustrations, 12 reuseable visual boards, a lettering level, letter removal tape, a burnishing tool with crafting point, a felt tip pen, a desk top easel and an instruction book.

The kit is designed to replace time-consuming, make-shift efforts necessary to put together effective visuals for closed circuit productions.

Circle Number 71 on Reader Reply Card

Send Your News To

Broadcast Engineering
1014 Wyandotte
Kansas City, Mo.
64105

PEOPLE IN THE NEWS

NAB Appoints Engineering Conference Committee

Vincent T. Wasilewski, president of the National Association of Broadcasters, has announced the composition of its Engineering Conference Committee.

Chairman is Lee R. Wallenhaupt, vice president for engineering, The WSJS Stations, Winston-Salem, N.C.

Other committee members are Albin R. Hillstrom, director of engineering, KOOL, Phoenix, Ariz.; Eldon Kanago, chief engineer, KICD, Spencer, Iowa; Leslie S. Learned, vice president for engineering, Mutual Broadcasting System, New York, N.Y.; Richard T. Monroe, vice president for engineering, Westinghouse Broadcasting Co., New York, N.Y.; James D. Parker, staff consultant, telecommunications, CBS Television Network, New York.

Royce LaVerne Pointer, director of broadcast engineering, American Broadcasting Co., New York; Russel B. Pope, director of engineering, Golden Empire Broadcasting Co., Chico, Calif.; Roland R. Richardt, director of engineering, WSAU, Wausau, Wisc.; William H. Trevarthen, vice president, operations and engineering, National Broadcasting Co., New York, and Philip Whitney, general manager, WINC, Winchester, Va.

The Engineering Conference Committee will plan for next year's annual conference to be held in Chicago in conjunction with NAB's 48th annual convention April 5-8.

Technical Director Named

The appointment of Steve Nelson to the newly created position of Technical Director for Metromedia Radio News was announced by Alan Walden, Vice President for News, Metromedia Radio.

Nelson, who assumes his new role effective immediately, will be based at Metromedia News' National Bureau in Washington, D. C. Included in his responsibilities will be the management of all technical operations involved in the voice new agency's coverage of national and global events.

Nelson began his broadcasting career in New York in 1965 as Chief Engineer of WFUV, Fordham University's FM station. He subsequently worked WPAC Radio (Patchogue, N. Y.), and joined Metromedia Radio's WNEW (New York) in June, 1966. The following October he began working in the WNEW Newsroom. When Metromedia Radio developed a national news service, Nelson became actively involved in technical arrangements for covering such events as the Martin Luther King Funeral in Atlanta, the 1968 political primaries, conventions and elections.

Boulding Named National Program Director

Sonderling Broadcasting Corporation has appointed Jerrold M. Boulding to the posts of Vice President of the Radio Division and National Program Director, it was announced by Alan Henry, executive vice president. Both are newly formed positions within the diversified communications company.

Boulding's new duties include serving as advisor to the managers of Sonderling's ten AM and FM radio stations on programing and anchillary matters, assisting in devising policy and solving problems in programming, and making recommendations concerning broadcasting personnel. In addition, he will continue as operations manager of the group's New York Station, WWRL, a post he has held for the past year.

The new official began his broadcasting career as an announcer with Station WILY, Pittsburgh, in 1954 while still a college student. Subsequently, he was affiliated with several other broadcasting organizations, including WEBB, Baltimore,

as program director; WOL, Washington, D. C., as production director and announcer; KJCK, Kansas City; WAMO, Pittsburgh; and KSAN, San Francisco.

Stein To NAEB Staff

George Stein, formerly systems analyst for Pittsburgh Plate Glass Industries, Inc., has joined the NAEB staff as director of the newly formed information gathering, retrieval and dissemination system, and will be responsible for its development. The project has been funded by the Corporation for Public Broadcasting which will also utilize its services.

WCCO Technicians Promoted

Five technicians with a total of 75 years' service at WCCO Television, Minneapolis-St. Paul, have been promoted to assistant supervisors, according to an announcement by Sherman K. Headley, station general manager.

Those receiving the new classification are Jerry Bergstrom, Dave Erickson, John Sieberz, Jim Vaughn and Roy Westberg.

"These men have all been with WCCO Television for many years," said Engineering Director John Sherman in recommending the promotions, "and have exemplified themselves by their knowledge, devotion to duty and enthusiasm."

Arkansas Broadcasters Assoc. Elections

W. N. "Bill" Cate of Walnut Ridge was elected president of the Arkansas Broadcasters Association at a meeting of the board of directors during the annual summer convention in Hot Springs. Cate succeeds Preston Bridges of Benton.

The new president is part-owner and general manager of radio station KRLW, Walnut Ridge. He was elected to the ABA board of directors in 1967 and has served as secretary-treasurer and first vice president.

Other officers elected at the convention in Hot Springs are W. J. "Dub" Wheeler of KHOZ, Harrison, first vice president; Jack Freeze of KFPW, Fort Smith, second vice president and J. C. Willis of KVOM, Morrilton, secretary-treasurer.

New board members elected during a business session at the convention are B. G. Robertson of television station KTHV, Little Rock; Michael Horne of KARV, Russellville and W. H. "Hi" Mayor of KBRI, Brinkley.

Haas Presented Pioneer Award

Julian F. Haas of Crossett was presented the annual "Pioneer Award" plaque at the closing luncheon of the summer convention in Hot Springs.

Haas is a native of Shreveport, Louisiana but has spent most of his life in the broadcast industry in Arkansas. He joined KARK in Little Rock on January 1, 1941 as an account executive. When he left the

Little Rock station in 1952, he was commercial manager.

From 1952 until this summer, Haas owned and operated radio station KAGH in Crossett. He is still affiliated with the station and is a member of the current ABA board of directors.

Furman Promoted

John D. Furman, Jr., promotion manager for WSB-TV, has been promoted to coordinator of broadcast standards for the parent company, Cox Broadcasting Corporation, effective December 1, 1969.

In the newly created position, Furman will work with managers of all CBC stations. He will report to Michael S. Kievman, vice president in charge of programming for CBC. In addition to Atlanta's WSB AM-FM-TV, Cox owns stations WHC-TV, Pittsburgh; WHIO AM-FM-TV, Dayton; WSOC AM-FM-TV, Charlotte; WIOD AM-FM, Miami; and KTVU (TV), San Francisco-Oakland.

NAB Appoints Renne

The National Association of Broadcasters announced that Lynn W. Renne of Crystal Lake, Ill., has been appointed regional manager of the mountain states region.

Prior to joining NAB, Renne served as general manager and later president of WCLR, Crystal Lake, and was president and part owner of the Lake-Valley Broadcasters, Inc., before it sold the station October 1.

"Quick! Circle item 6A on the Reader Reply Card."

NAB Gives Cable Formula

The National Association Board Chairman, in a letter to Chairman John L. McClellan of the Senate Copyright Subcommittee, has proposed copyright legislation plus revisions to the Communications Act which would provide for the orderly development of both free broadcasting and cable television service. The letter outlined the proposed changes to the Communications Act and asked that these be simultaneously considered with copyright legislation because the "two are inexorably entertwined".

The major facts of the NAB proposals are:

A. A licensing system for CATV operations similar to that for a broadcasting station where CATV systems wish to originate programming other than purely automated services.

B. A requirement that all local stations be given carriage and nonduplication protection to enable them to compete and therefore continue to provide local service with the signals from distant television stations. NAB proposed a sliding formula for the importation of distant television signals by CATV systems.

C. A prohibition against CATV systems selling advertising which is the traditional support for broadcast programming. Instead, CATV systems "would have to continue to look only to its subscribers for income".

D. A prohibition against charging for CATV on a per program or per channel basis rather than a monthly rate basis for the whole service.

E. Confirmation of the Federal Communications Commission's authority to establish and enforce technical standards for CATV systems with special emphasis on prohibiting the degradation of TV signals they transmit.

F. Specific provisions to "grandfather-in" the existing transmissions of CATV systems in order not to reduce the volume of service which CATV subscribers have received in the past.

NAB said it based its legislative proposals on four major premises:

1. That there are millions of Americans who are unwilling, unable or would be seriously hardpressed to pay for television service, and that there are millions of Americans living in rural areas in which cable television is not economically feasible.

2. CATV systems should be allowed to develop new and truly innovative services, to improve reception of existing and future television broadcast stations, and to carry appropriate distant television broadcast stations where local television broadcast services are either nonexistent or few in number.

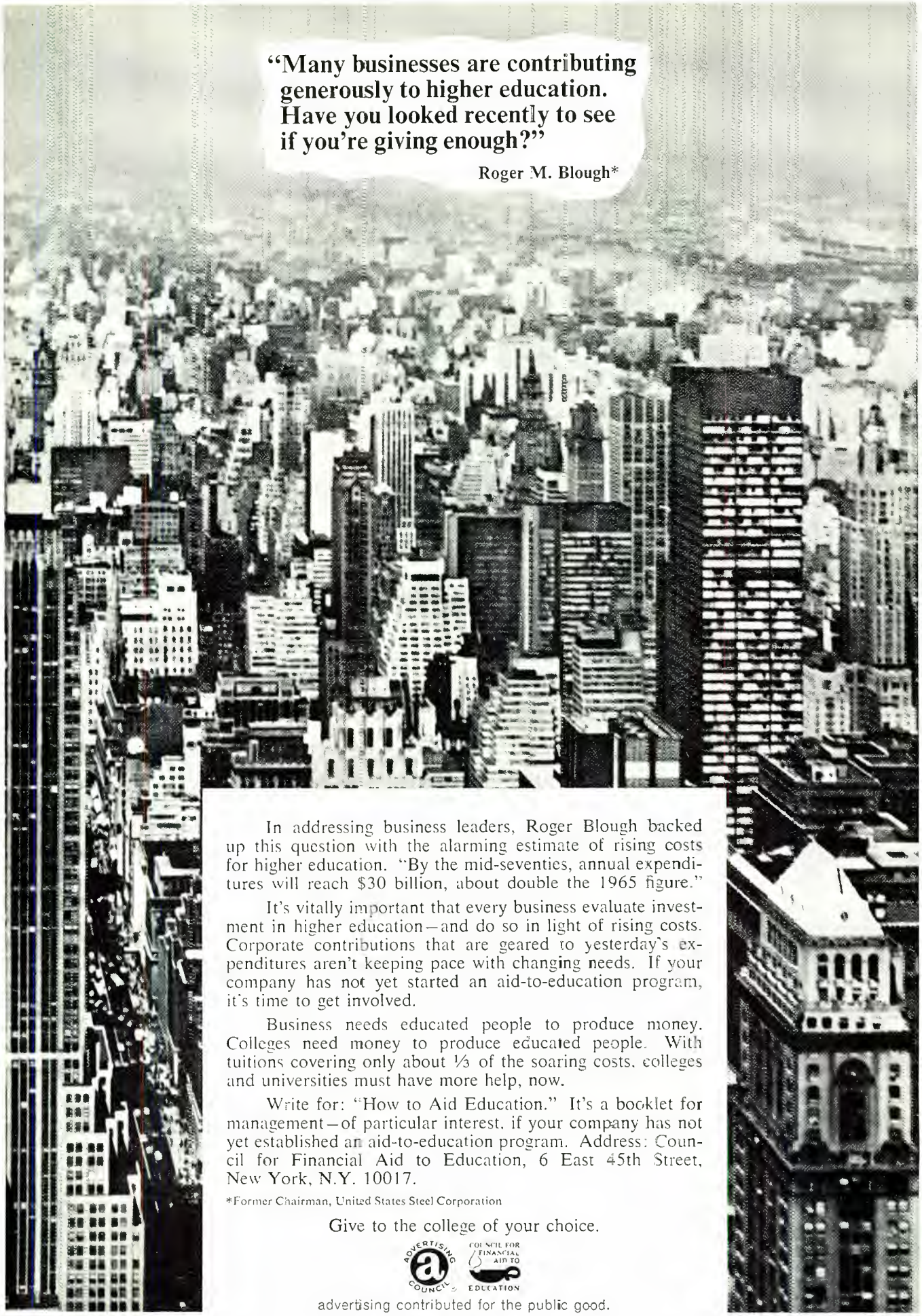
3. CATV systems ought to pay, like any other business operated for a profit, a reasonable and just compensation for the use of programs and broadcast signals of others.

4. To the maximum extent possible, smaller and remote CATV systems should be relieved from complying with regulatory measures which are really designed to deal with problems posed by CATV development in major markets.

IEEE Sets Date For Solid State Meet

The conference on Solid State in Industry—The New Generation of Industrial Control, sponsored by the IEEE Group on Industrial Electronics and Control Instrumentation will be held at the Statler-Hilton Hotel, Cleveland, Ohio, June 15-16, 1970. The purpose of the conference is to bring together those actively engaged in various areas of electrical engineering in order to disseminate information and generate ideas on the application of solid state devices and systems to industrial applications.

Contributed papers are being solicited on industrial semiconductor components, solid state devices having industrial applications, process control systems, computer systems for industrial control and data acquisition and the application of solid state devices and components to industrial heating.



In addressing business leaders, Roger Blough backed up this question with the alarming estimate of rising costs for higher education. "By the mid-seventies, annual expenditures will reach $30 billion, about double the 1965 figure."

It's vitally important that every business evaluate investment in higher education—and do so in light of rising costs. Corporate contributions that are geared to yesterday's expenditures aren't keeping pace with changing needs. If your company has not yet started an aid-to-education program, it's time to get involved.

Business needs educated people to produce money. Colleges need money to produce educated people. With tuitions covering only about ⅓ of the soaring costs, colleges and universities must have more help, now.

Write for: "How to Aid Education." It's a booklet for management—of particular interest, if your company has not yet established an aid-to-education program. Address: Council for Financial Aid to Education, 6 East 45th Street, New York, N.Y. 10017.

*Former Chairman, United States Steel Corporation

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CATV Channel Facilities Extended

New England Telephone and Telegraph Co. has been authorized by the Commission to continue operating and to extend CATV channel facilities in the vicinity of Hyannis, Yarmouth and Dennis, all Mass. (P-C-7108). The authorization is conditioned on compliance with FCC Rules by the CATV system leasing the facilities.

The telephone company applied for certification under Section 214(a) of the Communication Act (requiring the Commission to certify that extension of lines is in the public interest). The CATV channel service is leased to Cape Cod Cablevision Corp., which has operated a CATV system since August 1966. Existing facilities are in and around Hyannis, consisting of 21 miles of feeder cable and 70 miles of distribution cable costing $253,000. The CATV headend is to be moved from Hyannis to South Dennis, adding 8 miles of feeder and 45 miles of distribution cable at a cost of $123,900.

Norton Industries Inc. petitioned the Commission to deny the Section 214 application or hold a hearing on it. Norton said it is the only party authorized by the Town of Barnstable, Mass., to build and maintain CATV facilities. Robert A. Gilmore petitioned for denial and hearing, saying that he was licensed by the Town of Yarmouth, Mass., to operate CATV facilities and that Cape Cod Cablevision had no such authority.

Denying the opposition petitions, the Commission said, "It appears that the Town of Barnstable and Yarmouth have not issued exclusive permits to operate cables for the transmission of television signals along public ways to Petitioners. It further appears that such towns have no objection to grant of the subject application. They were served with a copy thereof and filed no objection or other response. . . ."

It took note of the pole and cable permits issued for the emergency request segment of the system and added, "In fact, the Board of Selectmen of the Towns of Yarmouth, Dennis, and Barnstable, in letters filed with the Commission on March 17 and March 20, 1969, specifically stated that they had no objection to grant of the request for emergency service authority contained in the application and urged prompt consideration of the matter. We find no support for Petitioners' allegations that Cape Cod Cablevision is operating in defiance of the laws of Massachusetts and in contravention of the intent of the Selectmen of the Towns of Barnstable and Yarmouth."

In authorizing the construction and operation, the Commission said, "Our action herein is not intended in any way to foreclose any right of the local governments involved to franchise CATV systems, or to enforce or enact such local regulations as may be appropriate concerning the entrance or operation of CATV systems in areas that we have not preempted."

Six Antennas Installed Atop 100-story Building

First TV broadcasts in October from massive antennas atop the 100-story John Hancock Center in Chicago marked the completion of a real engineering feat. Six antennas, designd by RCA, weighing nearly 150 tons, were installed on two 100-foot cylinders on the building roof. Four TV stations have already switched to the new site, while the two others plan to begin broadcasting there next year.

The antenna installation ranks with the multiple system designed by RCA for the Empire State Building and erected 16 years ago. Five TV antennas are mounted on the Empire State in a single stack, while the Hancock project employs twin towers, supporting three and two antennas respectively. In both locations, other antennas are mounted below the stacks.

TV transmitters are installed inside the Hancock Center, near the roof. Transmission lines connecting them to the antennas run up through the twin towers.

The towers and their bases add 349 feet to the 1,107-foot Hancock Center. The huge building complex contains 705 apartments, more than 800,000 square feet of office space, restaurants, stores, an observatory and indoor parking for 1,400 automobiles.

RCA engineers, working with new mathematical model techniques, used computers to design the special radiation patterns that the transmitting antennas emit, and to avoid any electrical interaction among them. The studies also took Chicago's windy weather into account, and the design provided enough rigidity to keep the sway of the topmost antenna on each tower to less than 0.5 degrees in a 50-mile per-hour wind.

The Chicago project also marked the first use of RCA's new antenna for UHF stations, the Polygon. The 10-ton Polygons top each of the 349 foot antenna towers and are used by WFLD-TV, Channel 32, and WSNS-TV, Channel 44.

The four stations that signed now on the air from the Hancock antenna site are WBBM-TV, Channel 2; WMAQ-TV, Channel 5; WGN-TV, Channel 9, and WFLD-TV. The other two are new UHF stations, WCFL-TV, Channel 38, and WSNS-TV, Channel 44, that plan "on air" dates in 1970.

NCTA President Ford Asks Free Time For Candidates

In a special "President's Letter" to the membership of the National Cable Television Association, Frederick W. Ford, chief executive of the association, urged CATV system operators to make their program origination channels available free of charge or at the lowest possible cost to officials and candidates for office at all levels.

Ford's letter pointed out that the high costs of political campaigning are of increased concern to many national leaders. Referring to the report issued by the Commission of Campaign Costs in the Electronic Era and the legislation introduced in the House and Senate a few weeks ago, Ford said:

". . . these plans have failed to emphasize the role that CATV could—and has—played in providing candidates with increased television exposure at little or no cost to them. The plans so far advanced appear to be discriminatory and unimaginative attempts at solving this most difficult problem. Generally they share one point in common: 'Since legislators make the laws then they should help themselves to broadcast property at no or reduced costs.' "

Ford added that voluntary contributions of time are another matter. He explained that during the 1968 primary and general elections, approximately 350 cable systems in all but five states carried filmed and taped messages of both the Republican and Democratic Presidential candidates to millions of viewers. Ford said the films and video tapes were given repeated showings on the cable systems' origination channels and "with few exceptions, the time was provided free of charge by the individual cable systems."

He added that many cable systems also make their program origination—or cablecasting—channels available to candidates during state and local campaigns. Still others, he said, encourage the use of their program origination channels by local, state and national officials to provide regular reports to constituents.

Declaring "There is no better public service that our industry can perform than aiding political leaders in developing an informed electorate," Ford reminded that his association has long "endorsed the right and responsibility of CATV systems to originate as many different types of programs on as many different channels as possible." He added that the association has especially encouraged CATV systems to devote as much time as possible to public service programming.

He strongly urged cable operators who already originate programs to redouble their efforts in making the availability of their facilities known to officials on all levels, and he also encouraged those CATV system operators who do not originate to give further consideration to begin program originations.

"HE BROADCASTS OUR TIME SIGNALS."

Bell Using Prism As Laser Guide

The prism, an old optical tool that has delighted generations of children, could become an important element of a technology now being explored at Bell Telephone Laboratories. Prisms have now been used to guide laser beams into thin crystal films that may be the forerunners of miniature laser circuits.

If laser systems are to be practical for future communication systems, they should become smaller, inexpensive, durable, and reliable. By using the prism to couple laser light into a thin film, the Bell Labs scientists believe that they have taken a promising step toward the integration of lasers and thin-film solid state circuits. They forsee the development of new laser amplifiers, light modulators, harmonic generators and parametric oscillators. All of these may be useful in thin film form for future laser communication systems.

In miniature laser circuits, light beams would flow in thin transparent crystal layers, just as electricity flows in the copper wires of conventional circutis. To work, however, this approach required efficient and practical means of putting laser beams into thin films.

P. K. Tien, R. Ulrich, and R. J. Martin of Bell Labs have now demonstrated that a prism can be used to feed a laster beam into a thin semiconducting film.

Previous attempts concentrated on directing the beam through the film's edge. However, the ragged edges of semi-conducting films tended to scatter the beam. In addition, such a film is generally much thinner than a laser beam, sometimes many thousand times thinner. Even if the beam could be focused down to the size of the film, the required precise alignment of the beam and the film makes this approach impractical.

In the Bell Labs setup, the base of the prism is placed parallel to the film, but at a precisely controlled distance away from it. The laser beam, entering the prism through its longest side, reflects from the base, as predicted by laws of conventional optics. However, contrary to conventional assumptions, the laser energy is not reflected totally.

A portion of the light waves "tunnels" through the gap between the prism base and the film, and generates electric and magnetic fields in the film. Initial experiments have shown that more than 50 percent of the incident laser energy can be transferred into the film. Theoretical calculations predict efficiency of 80 percent.

The light waves can travel in the thin film in a number of distinct patterns of electromagnetic vibration, or modes. There is a characteristic speed of propagation for the waves of each mode. It is one of the advantages of the novel prism coupling method that it can excite any selected one of the possible modes by simply directing the laser beam at a proper angle, relative to the film.

The prism-film coupler is expected to be useful in a number of applications. It might be used to split the light beams into different wavelengths to form the separate channels of a laser communication system. Within the film, the beams can be modulated or amplified. Then the beams would leave the thin film via another prism-film coupler and travel to the destination point, probably along an underground "pipe line." At the destination point these beams would again be coupled into thin film for signal processing.

One present problem of the thin film laser beam circuitry is the loss of light by scattering at microscopic imperfections of the thin crystal films.

High-Speed Photography Seminar To Be Held

The first intenational seminar in the western United States on high-speed photography will be held August 2, 1970 in Denver. An estimated one thousand scientists and engineers from twenty nations will attend the 9th International Congress on High-Speed Photography.

The program of 80 scientific lectures will feature an address by Harold E. Edgerton, Professor Emeritus of Electrical Engineering, Massachusetts Institute of Technology. Know widely as "the father of high-speed flash photography," Dr. Edgerton will review highlights of a rich and varied career that has made commonplace the "freezing of bullets in flight and new views of familiar sports events such as the punting of a football.

Much new American work in the field will be presented at Denver. A strong program of Russian papers is also expected, and Russian will be added as an official language for simultaneous interpretation for the first time.

The technical program will be rounded out by an extensive exhibit of high-speed cameras and lighting equipment manufactured by leading firms throughout the world, plus a full schedule of social events and excursions.

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Wanted: Telefunken U-47 condenser microphone, good condition. Joel Newman, WOMN, Decatur, Georgia 30030. 12-69-2t

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

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Call (collect) or write (resumé) Jim Barnes, Chief Engineer, to arrange a personal interview.

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KWWL-AM-FM-TV, Waterloo, Iowa, is expanding its engineering staff. Position is available at both studio and transmitter for 1st Class engineer having aptitude in the area of operations or maintenance. Contact E. M. Tink, Vice President of Engineering. 11-69-2t

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ATTENTION PROFESSIONAL ENGINEERS. Ready for a bigger challenge? We protect your confidence & represent your interests ethically. Sample list of new positions: Industrial Design EE's, video processing $12-$16,000, microwave $11-$15,000, audio applications $11-$14,000, Marketing & Sales $12-$20,000; Station, TV chief $12-$16,000, AM chief $12-$15,000. Contact us immediately. No fees, ever. ENGINEERS LOG, Box 252, Latham, New York 12110. 518 785-3840. 12-69-1t

Transmitter engineer with First Phone wanted for western part of Nebraska. Permanent state position. Experience desirable but on-the-job training possible. Salary commensurate with experience. Contact Director of Engineering, 1600 R Street, Lincoln or call collect 402-477-6974. 12-69-2t

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Television Technician to assist chief in all technical phases of development, operation, and maintenance of CCTV, 2500 MHz installation, and radio production unit in large university's new facility. Northeastern location. Second Class license and experience with quad and helical video recorders desirable. A junior position, beginning immediately. Contact Joseph Bailer Division of Instructional Communications, 6RB, Northeastern University, 360 Huntington Avenue, Boston, MA. 02115. 12-69-1t

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IMMEDIATE OPENING for TV transmitter operator with 1st class license at Raleigh, N. C. Reply to Chief Engineer WTVD, Durham, N. C. 919-477-2131. Equal oportunity employer. 12-69-2t

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

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Surplus audio and video patch panels and patch cords. 500 to 500 ohm repeat coils flat to 20,000 cycles. Send for list. Gulf Electro-Sales, Inc., 6325 Beverly Hill, Houston, Texas 77027. 4-69-12t

1000 watt FM transmitter. ITA FM-1000B. Also stereo generator. Box 2605, Corpus Christi, Tex. 78403. Other equipment available. 10-69-tf

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1000 watt FM transmitter. ITA FM-1000B. Also stereo generator. Box 2605, Corpus Christi, Tex. 78403. Other equipment available. 10-69-tf

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CARTRIDGE TAPE EQUIPMENT—Completely reconditioned Spotmaster and Tapecaster Record/Playbacks, $375.00. Playbacks $250.00. 30-day money-back guarantee on all equipment. BROADCAST PRODUCTS CO., INC. 12330 Wilkins Avenue, Rockville, Maryland 20852. Ph: 301-933-3400. 10-69-tf

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35 ft. semi mobile unit, 50 K W Generator, 4 electric cable drums, 10-ton air conditioner, electric elevator to roof level, GMC series 5500 tractor. Does not contain TV equipment. Broadcast Engineering, Dept. 236, 1014 Wyandotte St., Kansas City, Mo. 64105. 12-69-2t

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Tower Lite Control Panel Box containing alarm telo & auxiliary circuits, auto transformer and flasher units—115V 60 cycle unused. $125.00 each. Sierra-Western Electric Co., Oakland, Cal. 94623. Phone 415-832-3527. 16-69-tf

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SPARTA CONSOLE. Sparta A-10 four channel eight input solid-state console. Good condition. $250.00. Dan Tynus, 230 N. Michigan Ave., Suite 222, Chicago, Ill. 60601. 312-236-4814. 12-69-1t

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Brand new Chronetics Pulse Generator, latest model PG2, current cost $927. $385 cash takes it. Also HP524C counter, perfect $750. Ted Dames Company, 308 Hickory Street, Arlington, New Jersey 07032. 12-69-1t

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Ampex MR-70 3 Channel (½" tape). Purchased new 8/13/68. Has never been used. Transport and electronics modified from original 15/30 ips to 3¾/7½ ips. (Modification performed by Expert Electronics, Chicago) To be sold "as is." F.O.B. Morton Grove, Illinois. Write D. J. Gulliford, Radiant Educational Corporation, 8220 North Austin Avenue, Morton Grove, Illinois 60053 (Phone 312-966-4200). 12-69-2t

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FOR SALE—½" Shibaden, 2-head, B & W VTR with monitor. Takes 1-hr. reels. Ideal for CATV setups or educational institutions. Virtually new. Reasonable. MONOCO PRODUCTIONS, INC., RIDGEWOOD, N.J. 201-652-2852. 12-69-1t

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The now-famous TDA2 Distribution Amplifier, in use at most television stations and networks, has a recently added feature. The "D" stands for Differentiol 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. The compact TDA2D fits neatly into 1¾" of panel space and produces virtually no heat.

For complete information, write to:

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MODEL TPC2 TRANSISTORIZED BURST PHASE CORRECTOR

The TPC2 permits rotation of the color burst phase signal driving a TV transmitter, without the necessity for extensive transmitter investigation and possible modification. It permits advancement or retardation of the color burst by 20 degrees, without affecting the amplitude or other characteristics of transmission. This completely transistorized unit has its own internal regulated power supply, and is constructed on a 1¾" by 19" panel.
$575.00 F O B Nashville.

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TC1 CLAMPING AMPLIFIER

The TC1 Clamping Amplifier employs tip clamping to remove low frequency signal deficiencies without disturbing burst and other chrominance information in or about back porch levels. The clamped stage utilizes a field effect transistor driven by a balanced bridge circuit. This advanced design technique produces highly effective and stable clamping. The TC1 Clamping Amplifier sells for $325.00 F O B Nashville.

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TBG2 BLACK BURST GENERATOR

The brand new TBG2 Black Burst Generator allows you to go black and back with perfection. The TBG2 has two outputs available for added versatility, and each has burst phase and burst amplitude adjustments so the two feeds can be matched under any condition. The TBG2 has the industry's only continuously rotatable phase control, and is accurate to within one degree. All the controls are on the front panel and can be locked. The unit is small, compact and lightweight. So is the price . . . $475.00 F O B Nashville.

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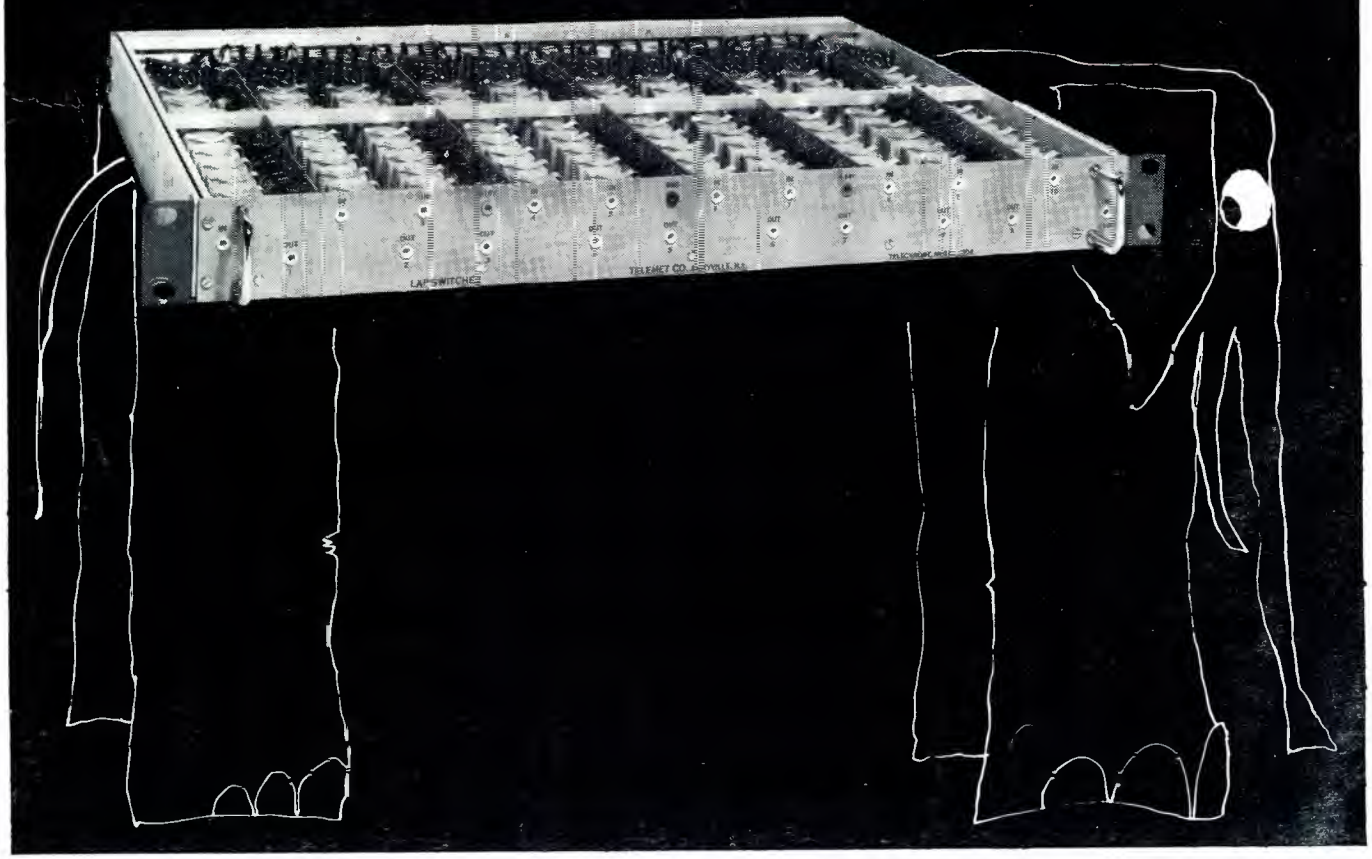

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