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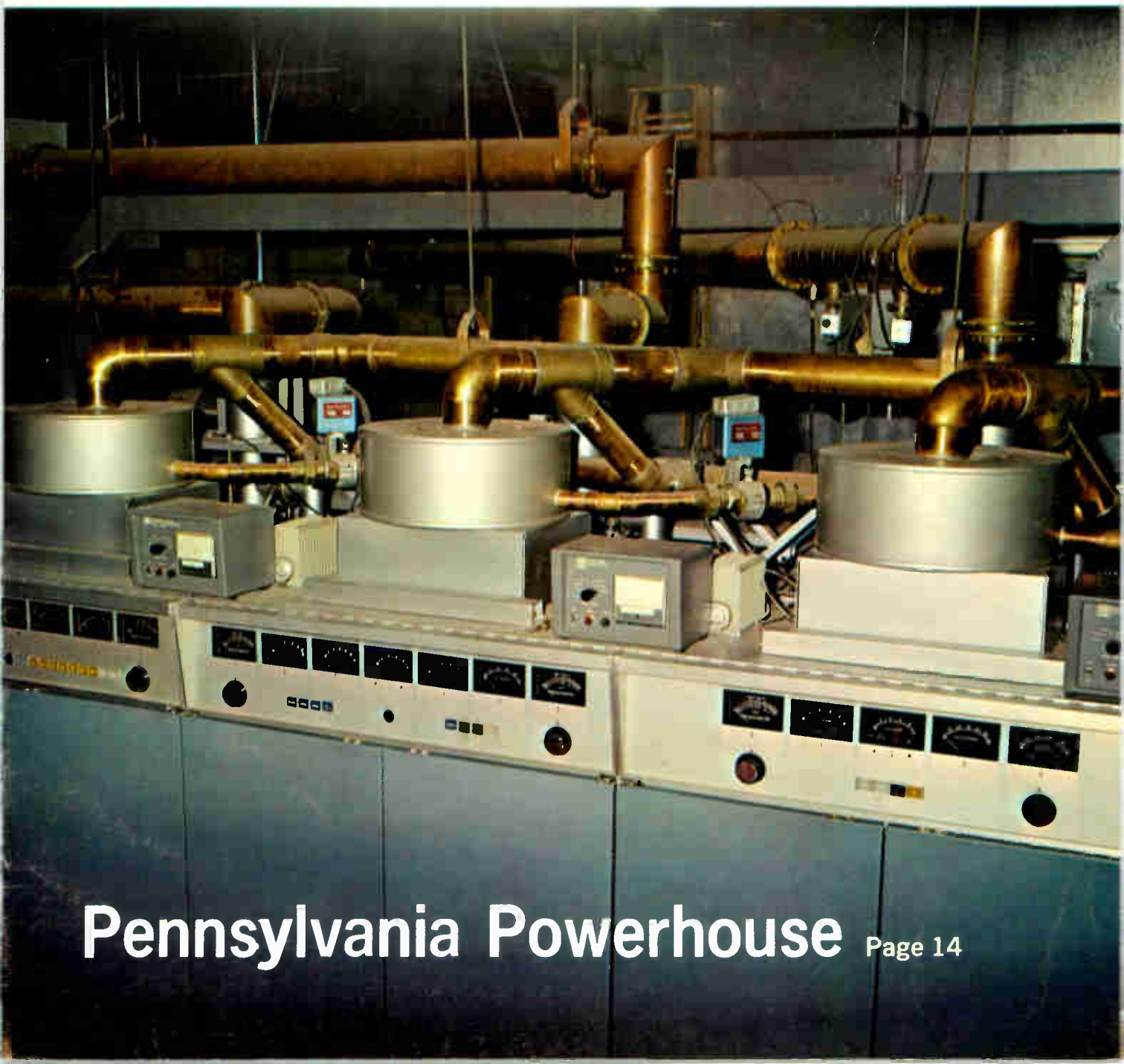
April, 1969/75 cents

Broadcast Engineering

the technical journal of the broadcast-communications industry



Pennsylvania Powerhouse Page 14

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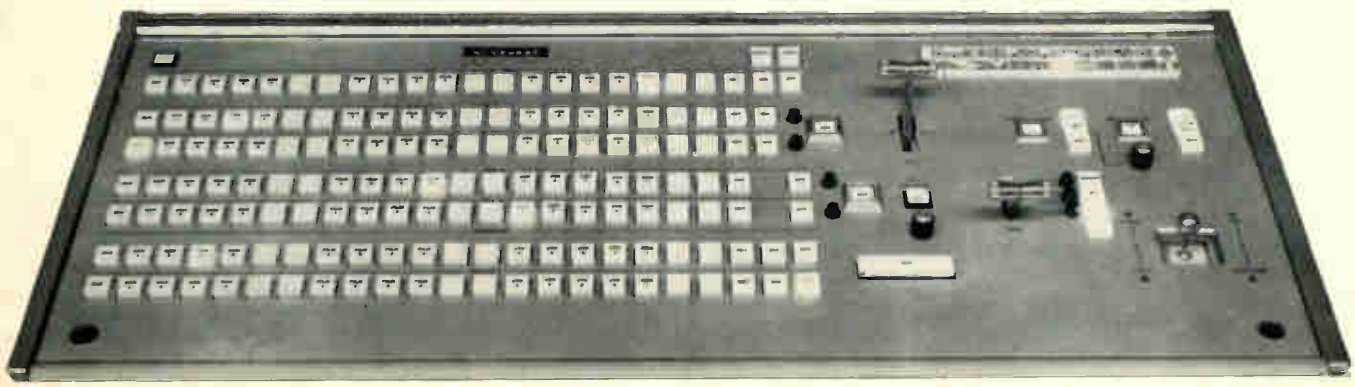

Circle Item 1 on Tech Data Card

April, 1969 • Volume 11, No. 4

Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

ABOUT THE COVER

This picture was taken at WPHL-TV in Philadelphia. The station is the first on UHF to hit 4.3 million watts ERP. For a look inside WPHL-TV, see story on page 14 in this issue.

DEPARTMENTS

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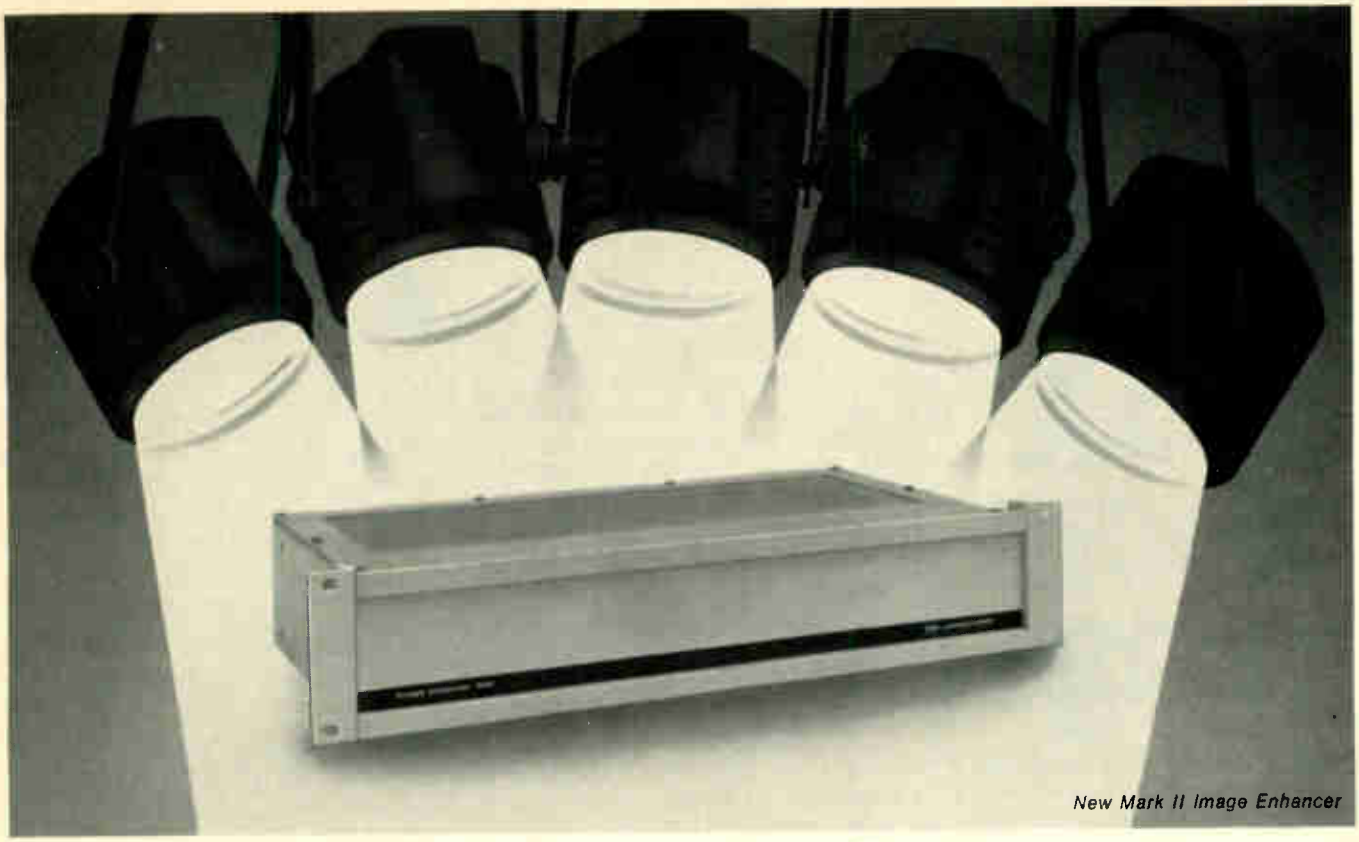

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LETTERS TO THE EDITOR

We enjoyed your review of human engineering factors in the December issue of **Broadcast Engineering.** ("Human Engineered Remote Audio," p. 38 by Bill Wokoun.) And it fits a problem we have here.

As a technician in the Instructional Communications Division of Northeastern University, I am faced with a problem: our remotes for radio and TV production are run by student operators. Equipment gets very rough usage in odd places . . . and funds limit the purchase of first line (commercially built) equipment. Yet we must produce broadcast grade tape shows for use in over 50 radio stations!

We would like very much to build one or two tough NEMO units such as you reviewed. However, your article did not give any internal electronic details. Would you forward an electrical schematic and perhaps a parts list? We will most likely have to make minor changes in output connectors for use with our gear, but the schematic will provide a good starting point.

Thank you very much for the help and some good reading! Keep up the ideas.

James Tighe
Malden, Mass.

Ed. Note: The main thrust of Wokoun's article was to aid in the mechanical design of remote equipment for use under good and poor field conditions. Rather than to just end up with a black box, he was putting considerable time into discussing the selection of a panel that could be seen in low light level conditions, and knobs that mean something to a groping operator.

Broadcast Engineering will run other articles on remote audio in upcoming issues. Meanwhile, Bill Wokoun can give you further details on construction and circuitry if you will write to him at Muzak, 229 Park Avenue South, N.Y., N.Y. 10003.

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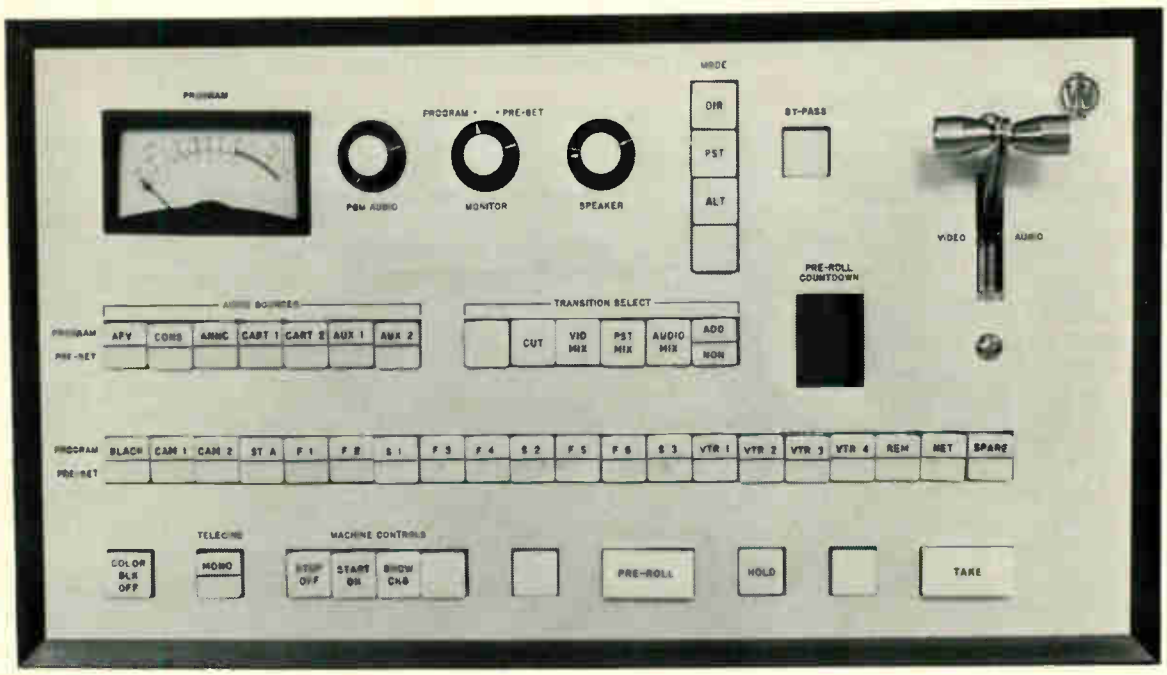

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INDUSTRY NEWS

Missing: Heartbeat For Station WELW

Cat burglars stole the voice of WELW, a 500 watt AM station serving east Cleveland and vicinity last February 9 by snatching $30,000 worth of equipment in the predawn hours.

The radio-wise, polka-loving burglars made off with five polka discs, WELW's transmitter, auxiliary transmitter, and broadcasting controls. What can you do with a commercial station and no license? Perhaps it could be shipped out of this country for some distant clandestine role. But a licensee without a transmitter is just plain embarrassing. In recent months there have been other such cases of thieves hauling off commercial gear.

Thus with turntables, microphones, over 100 tape cartridges and other assorted pieces and the transmitter, the thieves effectively silenced the "station with heart."

And typical of the field, local radio and TV stations were almost immediately in touch with the WELW station manager, Ken Otstot, offering equipment and spare parts to get the station back on the air.

It was during this same time that floods were hitting San Luis Obispo, California. KSLY was awash as a result. Once again, two local competitors, KATY and KVEC, came to the rescue.

After being contacted by WELW, Gates Radio called in crews to pack equipment ordered through them, and by Sunday night it was on the road.

We could have gone back on the air Tuesday, Otstot said, except that crystals had to be ground and didn't arrive until Thursday."

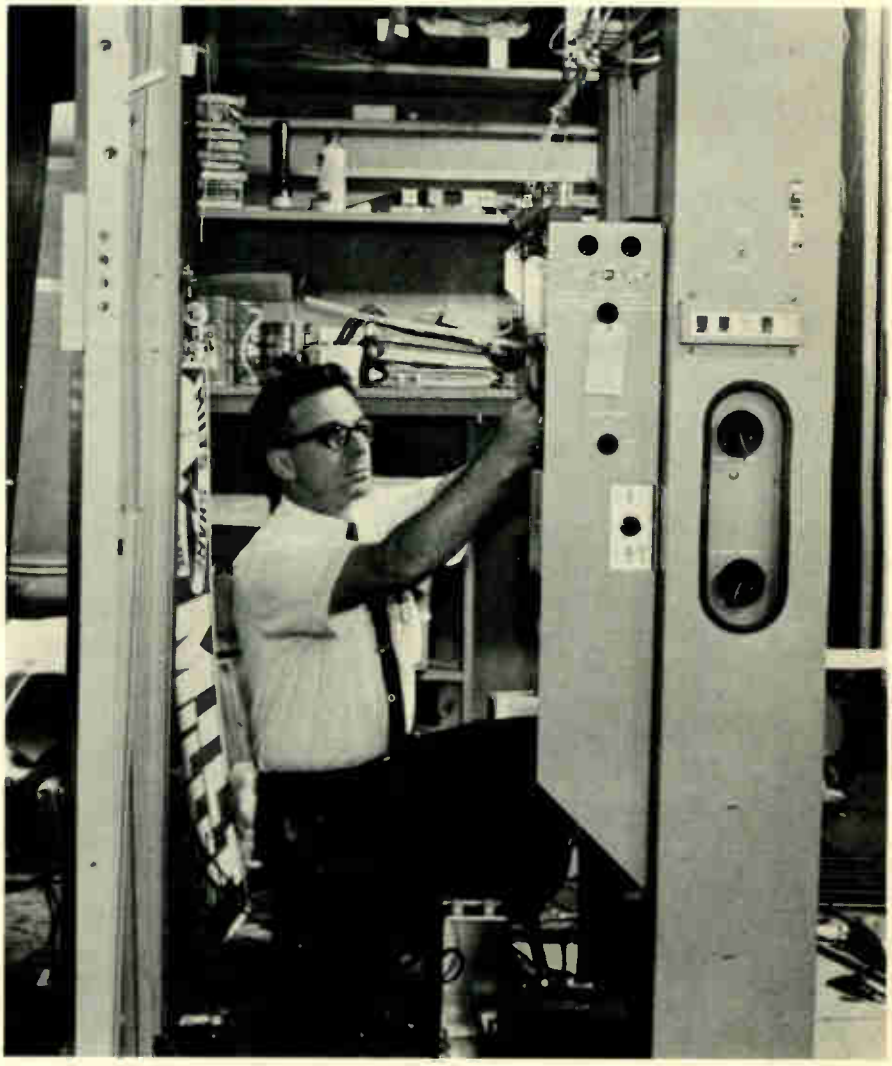
By Friday, six days after losing its voice, WELW was back on the air. A German Shepherd has joined the station staff to greet late night visitors.

FCC Equipment List Ready

The latest listing of Radio Equipment Acceptable for Licensing, dated January 12, 1969, has been issued by the Federal Communications Commission.

The 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.

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).



Walt Leamon, of the WELW engineering staff, installs the new Gates transmitter, which was delivered 24 hours after the theft was reported.

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EIA Lashes FCC Recent Land Mobile Proposal

The Consumer Products Division of the Electronic Industries Association has opposed the proposal in the Federal Communications Commission Docket 18261 and has filed comments with the FCC. The proposal calls for the reallocations of UHF television channels 14 through 20 to the land mobile services for use within the 25 largest urbanized areas of the United States.

"The proposal would be in conflict with the spirit and intent of the All-Channel Receiver Law which requires that all television receivers sold in the United States have the capability of receiving in addition to channels 2-13, channels 14-83. All-channel receivers are now almost 50 per cent of the 50 million television receivers now in U.S. homes, and will account for 75 per cent of the sets in use by the end of 1970.

"Thus, the entire television industry, including parts manufacturers, television set manufacturers, distributors and retailers, have a sizeable investment in the pioneering of the technological research, the development, the production and the marketing of a reliable and good quality television receiver. The FCC proposal would degenerate television receiver performance in seven of the most desirable UHF television channels.

"The FCC proposal would present Grade B contour level interference problems. The possibilities of interference problems to TV land mobile radio services is great.

"The proposal would produce undesirable interference ("beat") frequencies. With the highest density of allocated assignments existing in channels 14 through 20, land mobile radiating sources in this band will create a serious multiplicity of "beat" frequencies (i.e., interference) in the TV receiver, which it is believed will result in inter-modulation problems.

"The proposal would interfere with efforts toward VHF/UHF tuner parity. Major efforts now under development toward insuring parity (i.e., tuner equality) of UHF/VHF ease of tuning to the customer will be deterred in their implementation due to the presence of undesired land mobile carrier frequencies.

"The proposal would ignore the trend to higher-power UHF facilities. UHF-TV broadcast facilities radiating in excess of the recommended FCC power level of one megawatt are on the increase. Thus, the assumed Grade B contour specified would then be inadequate to protect many viewers within the actual Grade B contour of the desired channel.

"The proposal would render all-channel master antenna systems useless."

KIDO Relocates Through Window

Recently, when station KIDO in Boise, Idaho moved into the Owyhee Plaza—a remodeled section of the old Owyhee Hotel, its 7½ foot long control panel would not go through the doors. The problem was first attacked by attempting to put it through one of the windows on the 5th floor by means of a man-powered pulley rope arrangement. When this was unsuccessful, a 160 foot crane had to be hired to lift the panel from street level and through the 5th story window.

John Neff, president of Broadcast Electronics, explains Tape system to NAB president Vincent Wasilewski. Stations could call Washington during the recent convention and hear taped convention reports.

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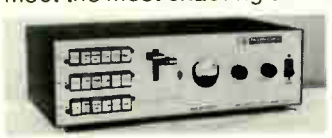

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FCC Extends EBS Deadline

In order to afford interested persons a final opportunity to submit proposals for EBS station notification and public alerting, the FCC has extended the deadline to May 1, 1969.

In response to a request by the assistant secretary of Defense (Civil Defense), the FCC appointed a Special National Industry Advisory Committee Working Group (NIAC) early in 1963. The Group was to assist in the development of improved signalling and alerting techniques for use in connection with the Emergency Broadcast System (EBS).

At the request of the Commission, the NIAC Special Working Group addressed itself to the dual problem of developing improved techniques for (1) station alerting (Emergency Action Notification of standard, FM and TV broadcast facilities), and (2) emergency alerting of the general public. The latter program has dominated the efforts of the NIAC Special Working Group, with specific emphasis on finding a reliable method of activating AM/FM/TV broadcast receivers to provide an emergency warning service to the public.

The deadline for submission of proposals for consideration by the NIAC Special Working Group was September 5, 1963. Of the 13 proposals submitted, four were selected for testing—Philco, General Electric, CBS "Homealert," and Zenith.

Court Nix On Paging

The United States Court of Appeals for the Second Circuit has denied a petition by Radio Relay Corporation for review of Commission action amending the Rules to allocate two new pairs of high frequency bands for use by wireline and non-wireline carriers for one-way paging services and denying Radio Relay's request for reconsideration and a hearing. The Commission adopted its Report and Order (Docket 16778) amending Part 21 of the Rules for the frequencies 152.85 Mc/s and 158.10 Mc/s on May 9, 1968. On June 14 the Commission granted a stay of the effective date of the Rules pending action on Radio Relay's petition for reconsideration. The petition was denied on August 21, 1968.

CATV Petition

The United States Court of Appeals for the Third Circuit has been petitioned by Bucks County Cable TV, Inc., of Fairless Hills, Pa. for review of the Commission's CATV proposed rule making, inquiry and interim procedures released December 13, 1968.

The CATV system also requested review of the automatic stay provisions of Section 74.1105(c) of the FCC Rules as applied to Bucks County's service after December 19, 1968, and Commission action of January 22, 1969 authorizing Bucks County to operate in Falls Township, Pa., with local Philadelphia and Wilmington, Del. TV signals, and setting up a hearing on requests for importation of distant signals from New York City.

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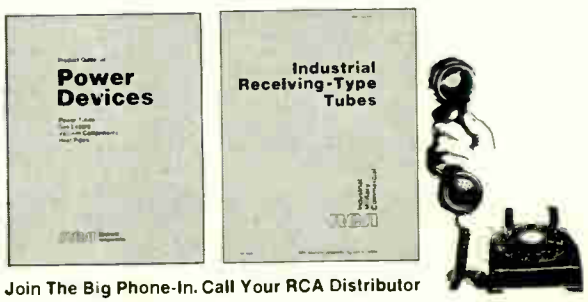

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SMPTE Program Set For Miami Meet

Following a coordinating meeting between members of local arrangements and national committees, the final program for the 105th Technical Conference of the Society of Motion Picture and Television Engineers has been set. The Conference will take place April 20-25, at the Fontainebleau Hotel, Miami Beach, Fla. According to SMPTE Conference vice-president E. B. McGreal, the program promises to be high caliber in its technical content and of far-reaching interest to those in the motion picture and television fields.

Conference program chairman V. D. Armstrong has lined up over 70 technical papers to be presented in nine topic sessions during the week. Areas in which papers will be presented are: Aerospace; Cinematography; Education and Medicine; Instrumentation and High-Speed Photography; Sound; Laboratory Practices; Oceanography; Photo-Science; Television; and Theater Presentation and Projection.

WFMB Spots Hole In Indiana Law

Proof of the first reported mishandling of Indiana's new Motor Vehicle Inspection Law was provided to authorities by The WFBM Stations recently.

The law which went into effect January 1st, has created much heated discussion throughout the state by both private citizens and officials, many of whom anticipated incidents of unlawful activities among some of the inspection stations.

Following up on a tip, a WFBM newsman drove to an Indianapolis inspection station and secured an official sticker for his car—sight unseen. The sticker cost him $10, as opposed to the regular $2.50 inspection fee. WFBM News then notified State Police, who checked into the station's operations and made the first arrest in the state's new inspection program.

The WFBM News Department was cited by the State of Indiana Department of Vehicle Inspection for the assistance and cooperation in exposing the abuses to the law.

11 ITFS's Connected

Eleven ITFS stations in the New York City area were recently interconnected to form the nation's largest ITFS network. The group includes seven stations owned by the Roman Catholic Archdiocese of New York and four stations owned by the Catholic Schools of Brooklyn.

The network, consisting entirely of ITFS and 12 KHz interconnections, is capable of originating three channels of programming to the two dioceses from the Yonkers (N.Y) studio of the Archdiocese. Plans are under way to include additional stations in the Diocese of Rockville Centre (Long Island) by the end of the year.

When complete, the system will allow origination from any of the three dioceses, and bring instructional programming to four million Roman Catholics in the 6000 square mile area. Previously, the three dioceses have cooperated in the production of an Adult Education series and have exchanged video-taped lessons by mail.

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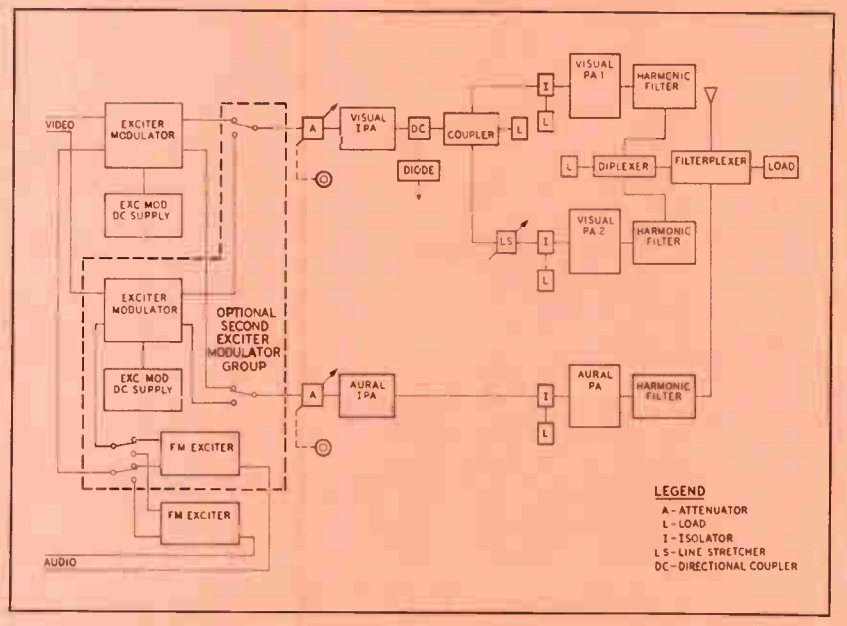

Fig. 1 110 kilowatt transmitter block diagram. The optional spare exciter and modulator is at left.

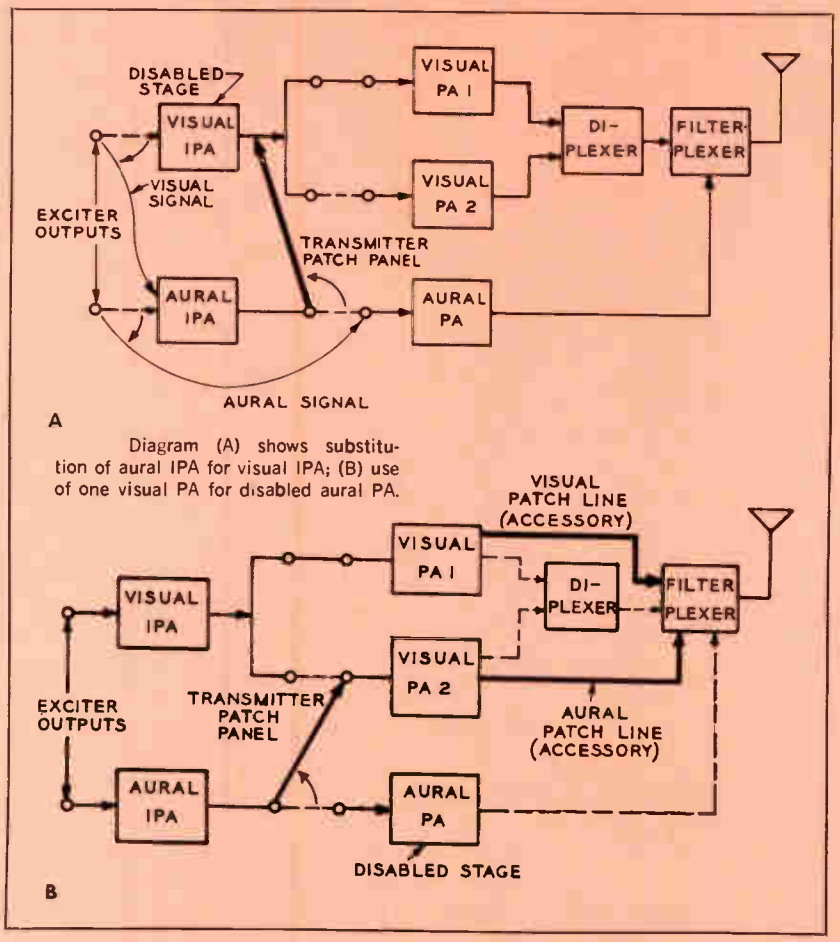

Fig. 2 Diagram showing substitutions of aural IPA and visual IPA and PA.

By Harry A. Etkin*

WPHL-TV, the U. S. Communications Corporation's Philadelphia, Pennsylvania, outlet, became the nation's first super power UHF station with initial operation of the first 110 kW transmitter. The system employs a 40 gain UHF pylon antenna to develop 4.3 million watts of effective radiated power.

WPHL-TV is the flagship station of the U. S. Communications Corporation. The history of WPHL-TV has been rather unique in certain respects, especially where transmitting equipment is concerned.

Since the purchase of the station the owners have had the unique distinction of using four transmitters and three different types of antennas in a period of only three years. At the start of operations the station used a one kilowatt transmitter and a 20 gain antenna fed with a 3⅛ inch transmission line. At that time the highest estimated UHF set penetration was no more than 10 per cent.

Expansion Program

On September 17, 1965 when WPHL-TV began commercial operation the UHF set penetration was little more than 1 per cent. The all-channel law had been in effect only a few months. However, prior to beginning construction of the new Channel 17 station, it was decided that if a noticeable increase in UHF viewer coverage and acceptance was to take place, a better quality and more powerful signal would need to be provided. In line with this philosophy, the construction permit was modified in early 1965 to specify a 30 kW transmitter and a 30 gain antenna, using a nominal null-filled pattern and a one degree beam tilt. The transmission line was increased to 6⅛ inches. This transmitter-antenna combination produced 626,000 watts ERP.

During this period, the transmitter manufacturer was conducting

*Consulting Engineer

WPHL-TV Delivers Super Power on UHF

tests with a 50 kW transmitter, using a single klystron tube. Although considerable design work and tests were being done, the station engineering personnel decided to use the 30 kW transmitter while they were still looking for more power provisions and coverage which would permit the station to become more competitive with the maximum-powered VHF TV stations. To achieve greater power and coverage, the concept of paralleling two 30 kW klystrons evolved. As a result, arrangements were made to convert the 30 kW transmitter in the field.

WPHL-TV, after this modification, went on the air in August, 1966 with a maximum radiated power increase from 626,000 watts to 1,050,000 watts. As the UHF penetration had skyrocketed to 50 per cent, it was the consensus that there was a need for more "brute force" power to penetrate some of the hard-to-receive areas. It also was decided to move the transmitter-antenna facility to the antenna farm in the Philadelphia Roxborough section in order to increase the maximum height of the antenna.

The 110 kW transmitter was displayed at the NAB convention in 1967. After checking the aural and visual performance specifications, it was determined that it would do the required job.

After planning and engineering considerations, a decision was made to purchase the 110 kW transmitter in combination with a 40 gain special antenna tailored for the specified requirements. A 9 3/16 inch transmission line was planned for the installation. This combination achieved a maximum ERP of 4,300,000 watts.

The "Brute"

The TTU-110 A transmitter employs diplexed power amplifiers and new five cavity, vapor-cooled klystrons with exceptionally high sensitivity. The one aural and two visual power amplifier klystrons are identical high power tubes, type VA-953 A. Since the cavities are never separated from the klystron, the tube is essentially a plug-in device. Other key features of the 110 kW transmitter are solid-state circuits and built in provision for remote control.

The major circuit elements of the 110 kW transmitter are shown in the block diagram of Figure 1.

One of the three klystrons is employed in the aural PA, and two in the visual PA. The two visual klystrons are diplexed; thus each tube contributes independently to the output. If either visual tube fails, the other continues to operate unaf-

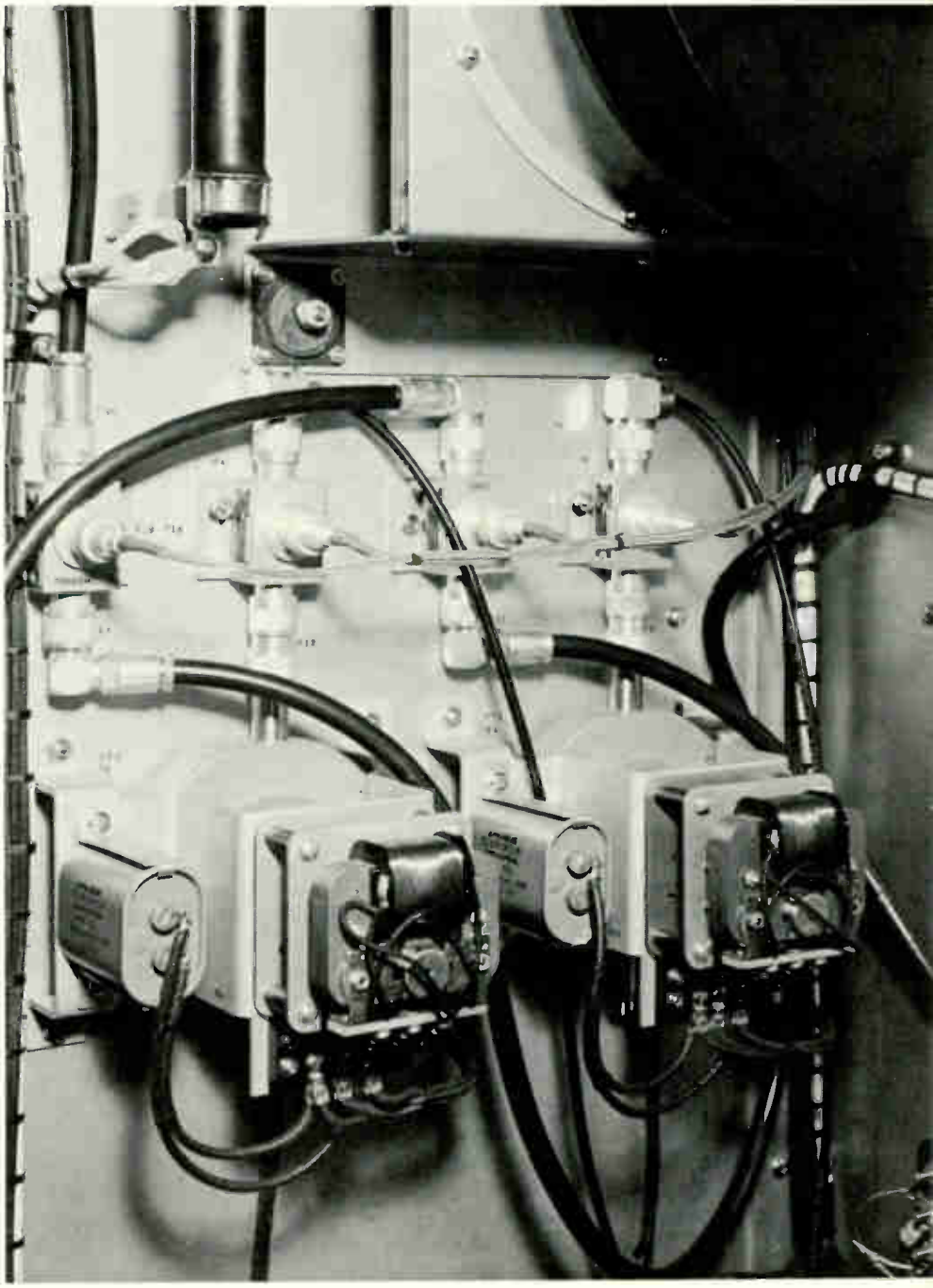

Fig. 3 Motor driven controls, relays and metering points are built in for remote transmitter control.

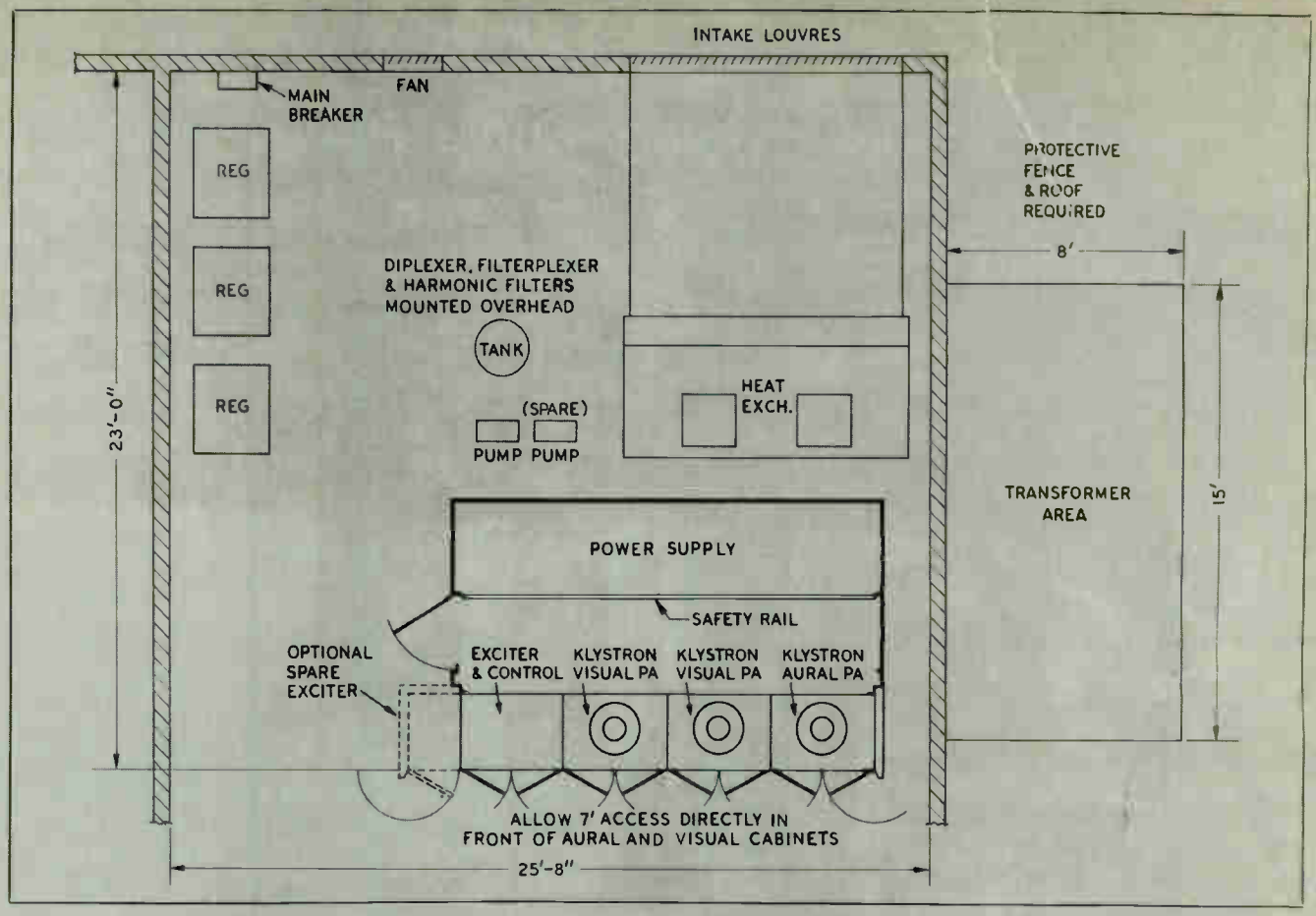

Fig. 4 Floor plan layout of the transmitter.

fected. Diplexing usually is more effective than simply paralleling tubes.

Video modulation takes place at a low RF level in the exciter and, due to the high gain of the five cavity klystrons, only small aural and visual IPA stages are required for the necessary PA drive. Both IPA stages employ a type 7289 triode and both are capable of operating as visual amplifiers.

As noted in Figure 1, the diplexed visual amplifiers and the optional spare hot exciter all offer a measure of backup that nearly equals a second transmitter. The station desired this type of operation since remote control is contemplated and no standby transmitter is planned.

Should the need arise, the transmitter has facilities for changing small coaxial connectors at the front of the transmitter to permit the visual signal to be fed through either IPA stage while the aural signal may be fed directly to the aural klystron. The identical aural and visual PA stages are equipped with front panel input patch facilities to provide a redundancy that permits up to 50 per cent normal transmitter power to be maintained, should any of the three klystrons fail. If necessary, one visual PA can be substituted for a disabled aural PA, or one of the visual PA amplifiers can supply up to 50 per cent visual power and thus stay on the air. Figure 2 displays this type operation.

The transmitter is housed in four 77-inch cabinets. The three cubicles at the right contain the aural and visual klystron power amplifiers. The left hand cubicle contains the aural and visual exciters, IPA's and control circuits. It incorporates solid-state high voltage rectifier modules that consist of matched unit assemblies. These modules simplify identification, reduce maintenance time, and improve rectifier cooling and efficiency. All other power supplies are also solid-state.

The transmitter is essentially self-operating, requiring little more than turning the transmitter "on" at the start of the on-the-air time and "off" at the end of the broadcast day. It is fully ready for operation by remote control, including metering points for remote monitoring. All wiring, relays, and motor driven controls are built in as shown in Figure 3.

Transmitter Systems

A number of decisions had to be made during the evolution of the transmitter in order to provide optimum compatibility with the new WPHL-TV transmitter building plant. Basic design objectives were established to allow ease of installation, operation and maintenance.

Of particular interest in a transmitter of this size are the external systems. Heat exchange, power distribution and rectifier systems become particularly important. The input power equipment was coordinated for a flexible plan of AC routing to provide logical access to power feeds under a variety of circumstances. Wall-mounted disconnects and free standing regulators

Fig. 5 View of aural and visual klystron power amplifier cabinets with attached wave guides.

Fig. 6 Coaxial patch panel.

were adapted. The heat exchanging equipment required an outside wall surface area in order to obtain adequate cooling air.

The various requirements of the TTU-110A transmitter layout are shown in the typical installation plan illustrated in Figure 4. The floor plan outlines the areas recommended for installation of the system and provides guidelines for the equipment layout. Normally, the more detailed recommendations are created after technical requirements of each system are known. A large portion of the transmitter building requirements center on the cooling air required for dissipation of the unused power in the amplifier tubes.

Cooling Process

The unused energy from the klystron amplifiers is dissipated in a copper mass at the upper end of the tube. This collector is grooved to increase the surface area in contact with water. The water is changed into steam and carries away its heat of vaporization through the steam system to the steam condenser. The increased efficiency of the change-of-state cooling system becomes apparent because the required 180 kW dissipation capability can be realized with only a 1.25 gallon-per-minute flow of water into the klystron.

In this transmitter, the cooling input water flows through the magnet into the collector. In cooling the magnet, the temperature of the water is elevated to approximately 80° C, which is the temperature at which it enters the klystron boiler. The temperature continues to rise until the water changes into steam at the rate of 0.7 gallon-per-minute for every 100 kW of power being dissipated. Additional temperature-controlled water enters the cavity cooling circuit to hold the body of the tube to a uniform temperature.

The integral cavities are cooled to maintain their mechanical and temperature stability. The overall result is to achieve a high degree of consistent klystron power gain and phase stability. Generally, two tubes in parallel yield no more than 100 watts variation of diplexer or combiner reject power from the cold to the warm condition over the various power levels encountered in the television signal.

The cooling system employs a controlled overflow scheme in which a small amount of 100° C water flows along the base of the steam line into a reservoir where it is collected and returned to the tank. This assures a positive height of boiling medium above the collector. When facing the design problem of assuring the presence of water in the boiler, a positive interlocked level control was provided.

A unique water level indicator is used in the steam separator located at the top of the klystron cabinet. It senses the presence of the boiling medium. If the emulsion is not present, the float within the indicator drops, causing the DC beam power supply to shut off. In addition to this operation, the flow into the magnet and collector is metered and interlocked for a specified minimum rate. The body cooling water is also interlocked in a flow meter system. To maintain a uniform input temperature of the water to the klystron cavity, a certain amount of water is pumped out from the reservoir and routed either directly to the tube or through the heat exchanger. The water is then recombined and fed to the tube. A probe in the piping detects the water temperature and, in conjunction with a motorized valve, regulates the water distribution. This system maintains the water temperature to within 2° C of a predetermined value. The vapor cooling facility allows the efficient transfer of a large amount of heat while requiring only a minimum of AC power for driving the heat exchanger system and pump. An important major advantage of the vapor cooling system is the inherent efficiency of the steam condenser. Less than 25,000 CFM of air under standard conditions is required for cooling compared with about 50,000 CFM for a comparable water-cooled transmitter.

High Voltage Supply

Another major factor placed upon the transmitter plant building design is that of supplying the AC power and the conversion of the AC to DC for operation of the final amplifiers.

The DC beam voltage supply for the TTU-110A transmitter consists of two solid-state high voltage rectifier modules that are matched unit assemblies. The beam voltage requirement for the klystrons is 23

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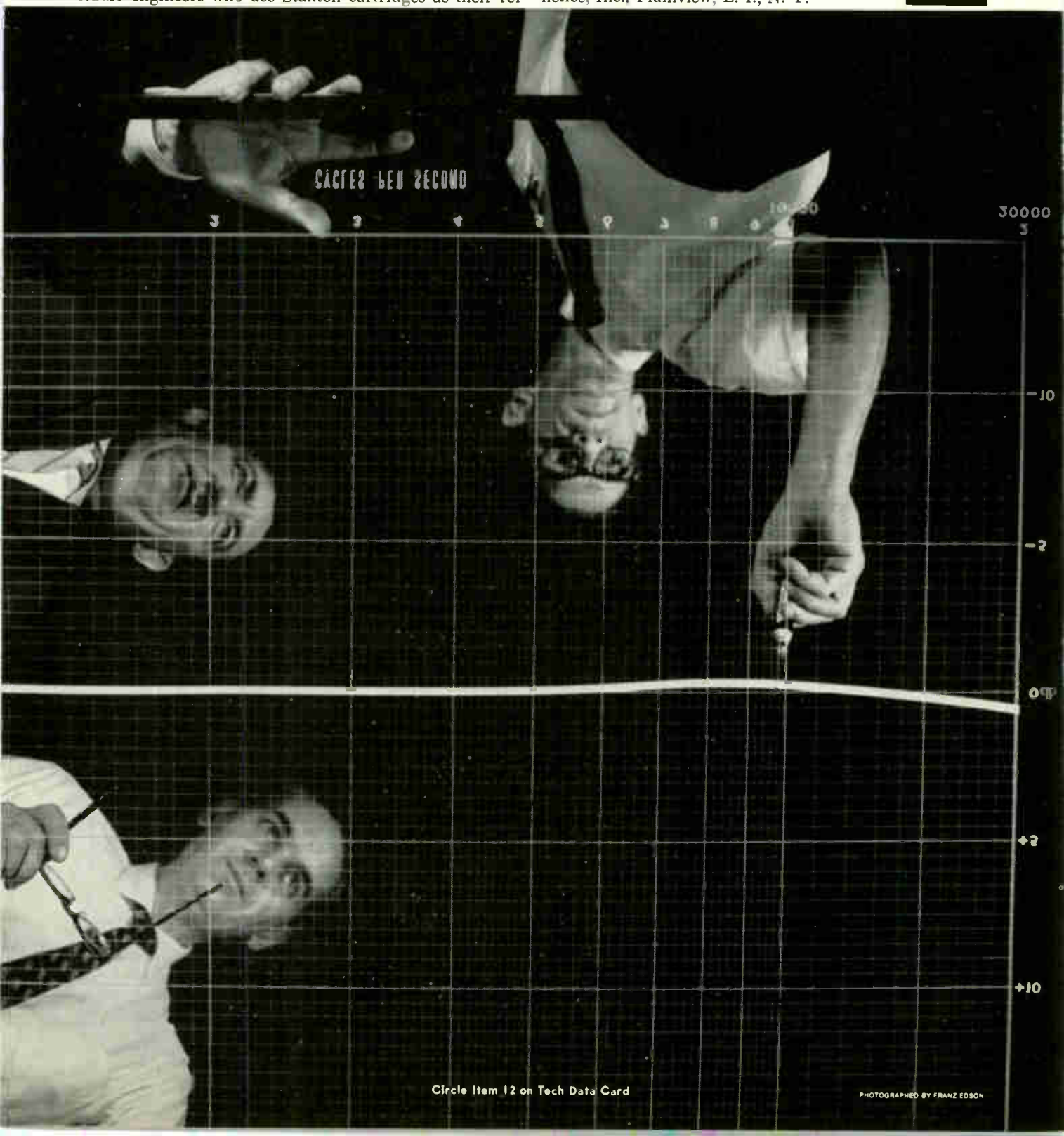

kV. The transformers contain the rectifier units, RC snubbing networks, and reactors which are all located within the oil tanks. Each transformer unit weighs 6,800 pounds, and the primary voltage requirement is 480 volts AC. One supply uses a wye and the other a delta-connected secondary. The two supplies are paralleled to form a 12 phase rectifier feeding a common filter capacitor. The primary ripple frequency is 720 Hz.

Careful control of the transformer windings and three single phase line regulators assure optimum phase-to-phase balance and minimize the low frequency, 120 Hz ripple. This type of configuration was selected to reduce the size of the filter capacitor which is necessary to smooth out the ripple. The use of the smaller filter capacitor reduces the stored energy available for sudden internal shorts of the tubes, thus lessening any possibility of damage due to an arc.

The design was chosen not only for the higher ripple frequency but also for the capability of providing emergency operation. When a fault occurs in one of the matched unit supply assemblies, operation can be continued with the unit not affected at one-half normal load by disconnecting the AC input and DC output of the defective unit. The inter-phase reactor normally required for balancing the output is shorted out in each supply to reduce the buildup of the induced 360 Hz voltages.

Overload

Two separate overload systems are employed in the transmitter. An electro-mechanical overload using relays to protect the transmitter against power supply overloads and an electronic antenna overload. The antenna overload system is a cycling type of protection that cuts off the visual and aural output within six microseconds should an overload occur in the antenna system, filterplexer or transmission line.

A unique quick-change system is provided for klystron replacement. This system is made possible because the tube body contains stainless steel rollers which engage tracks inside the electromagnet. The tube and magnet are tilted to the horizontal position, permitting the tube to be pulled out on its rollers to a waiting handling carriage. The klystron carriage built on wheels contains positions for two klystrons. The spare tube is unloaded from the crate and transferred, in a horizontal position, to the bottom of the carriage. The tube being removed from the transmitter is placed into the top carriage position. When the two tubes are in position, the carriage is indexed about the horizontal axis, thus revolving the defective tube to the bottom of the cradle and raising the spare new tube to the top loading position.

When the cradle is locked in the upper position, the new tube is loaded into the electromagnet. The lower pole piece of the klystron will mate with the lower pole piece of the lower surface of the magnet. When in a vertical position, the tube actually rests on the lower pole piece, providing the best field geometry in the gun region where it is most critical. Experience with the transmitter in daily operation has shown that a complete tube change can be accomplished in less than five minutes by one man working alone.

Figure 5 is a view of the aural and visual klystron power amplifier cabinets. The photograph shows the aural power amplifier wave guide

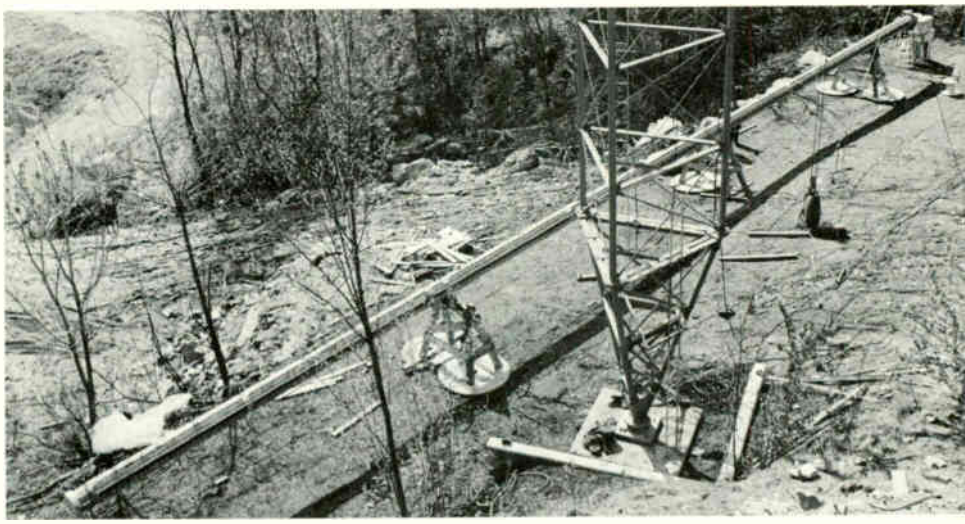

Fig. 7 The assembled UHF channel 17 antenna.

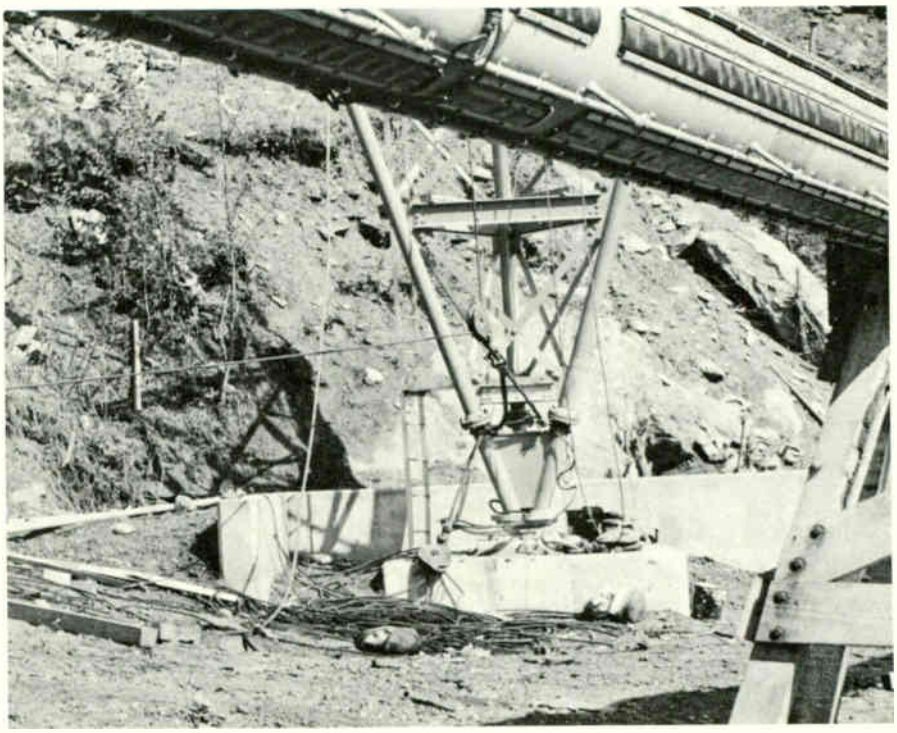

Fig. 8 View of WPHL-TV tower base.

plumbing feeding into a harmonic filter which is then coupled to the filterplexer. The two visual output stages are coupled to harmonic filters and are then combined in the visual diplexer. The combined visual output stages are fed into a waveguide section which is in turn coupled through a waveguide coupling section to the filterplexer.

Figure 6 shows the nine-inch coax patch panel at time of installation. The filterplexer output feeds to one of the patch panel inputs. The dummy load feeds into another input. The transmitter line feeding the antenna is coupled to the remaining input.

For operation of the transmitter, tower lighting, terminal equipment, and house lighting, a combination of three different voltages were required. The transmitter requires three-phase 480 volts. The tower lighting and remainder of the equipment and house lighting requires 110/208 volt single phase. A dual AC primary feed is supplied from two separate sources. There are two 1000 kVA oil-cooled transformers used in this setup. The incoming primary voltage is 13,200 AC, and the transformers reduce the primary voltage to 480 volts.

A unique feature of the AC power installation is an automatic transfer panel which automatically transfers the loads during service interruption. There are facilities provided to tie both services together. Since the transmitter is remote controlled, provisions are made on the AC power panel to permit changeover to either AC feed or tying of the two together from the remote control point. A 50 kVA dry type transformer provides 110/208 voltage used for other equipment in the transmitter plant building.

Fig. 9 Antenna tower bridge assembly.

Antenna and Tower

The antenna selected for WPHL-TV in combination with the 110 kW transmitter is a TFU-46K 40 gain custom-built UHF pylon with a one-half degree beam tilt and a first null-fill of 30 per cent. It has a field of not less than 10 per cent available to an angle of 10 degrees.

Figure 7 gives you some idea of the length of the antenna after it was bolted together on the ground. It is 127 feet long and weighs approximately 30,000 pounds (15 tons). The tower is 1,020 feet tall and is designed for the future addition of a candelabra platform. The base of the structure is "pinned" by a pivot configuration which assures even distribution of the 15 ton load and eliminates any redundant moment at the bottom of the tower. Figure 8 illustrates the pivot construction at the base of the tower.

Figure 9 is a photograph of the bridge which carries the transmission line and conduit from the tower into the transmitter plant building. The bridge is 55 feet long and comes off the tower at 50 feet above the base.

Conclusion

The WPHL-TV Channel 17 installation marked the first of three super power UHF TV stations planned by U. S. Communications. WPHL-TV has been in operation for eight months, achieving dependability, operating ease and everyday economy. As a result of these operational features and unusual achievements, two more super power transmitters have been scheduled for installation. One will go to their Pittsburgh station, which is planned to go on the air in December, and one to the Atlanta station.

The author is indebted to Robert E. Leach, Technical Director of U. S. Communications Corp., whose cooperation has made it possible to write this article. ▲

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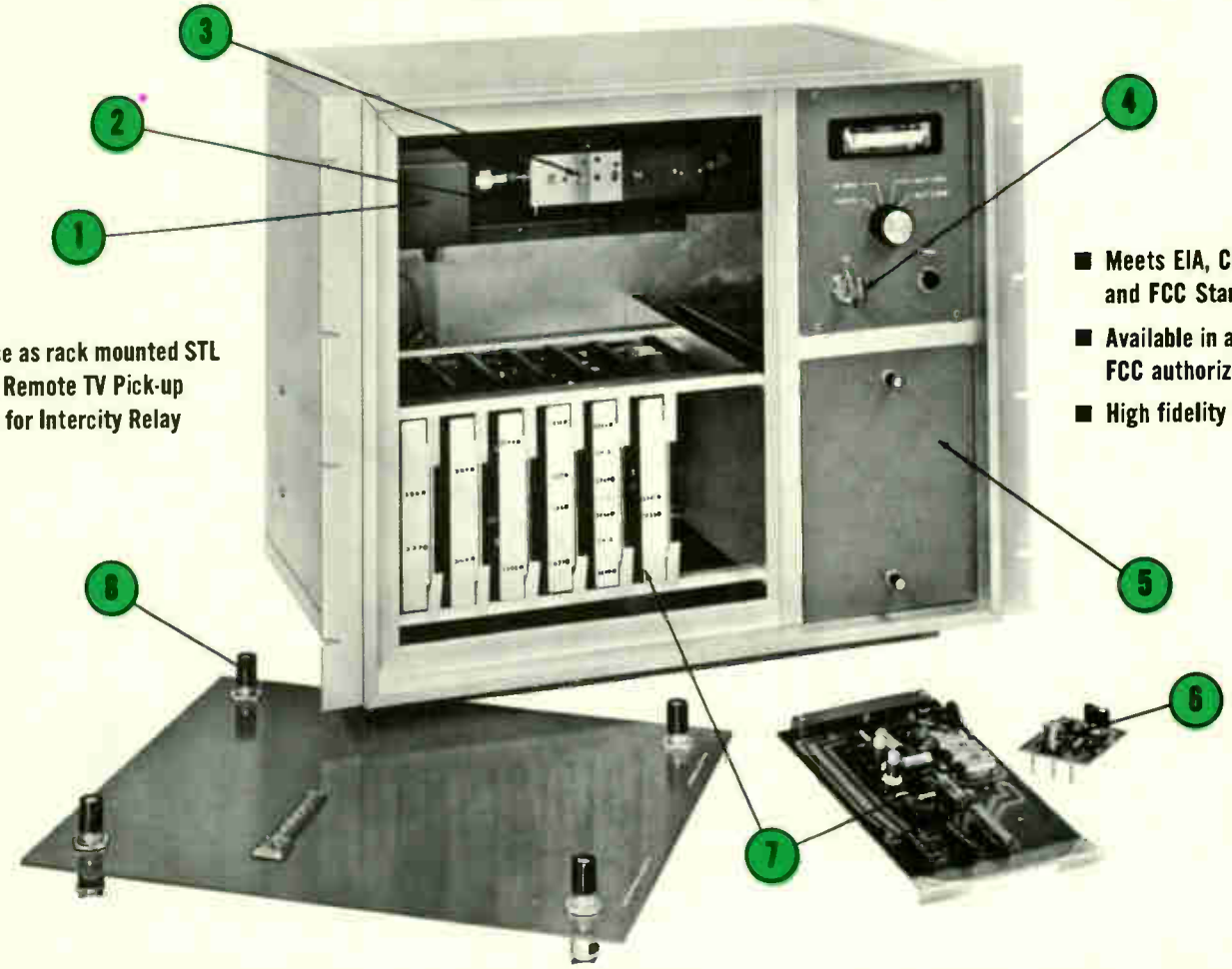

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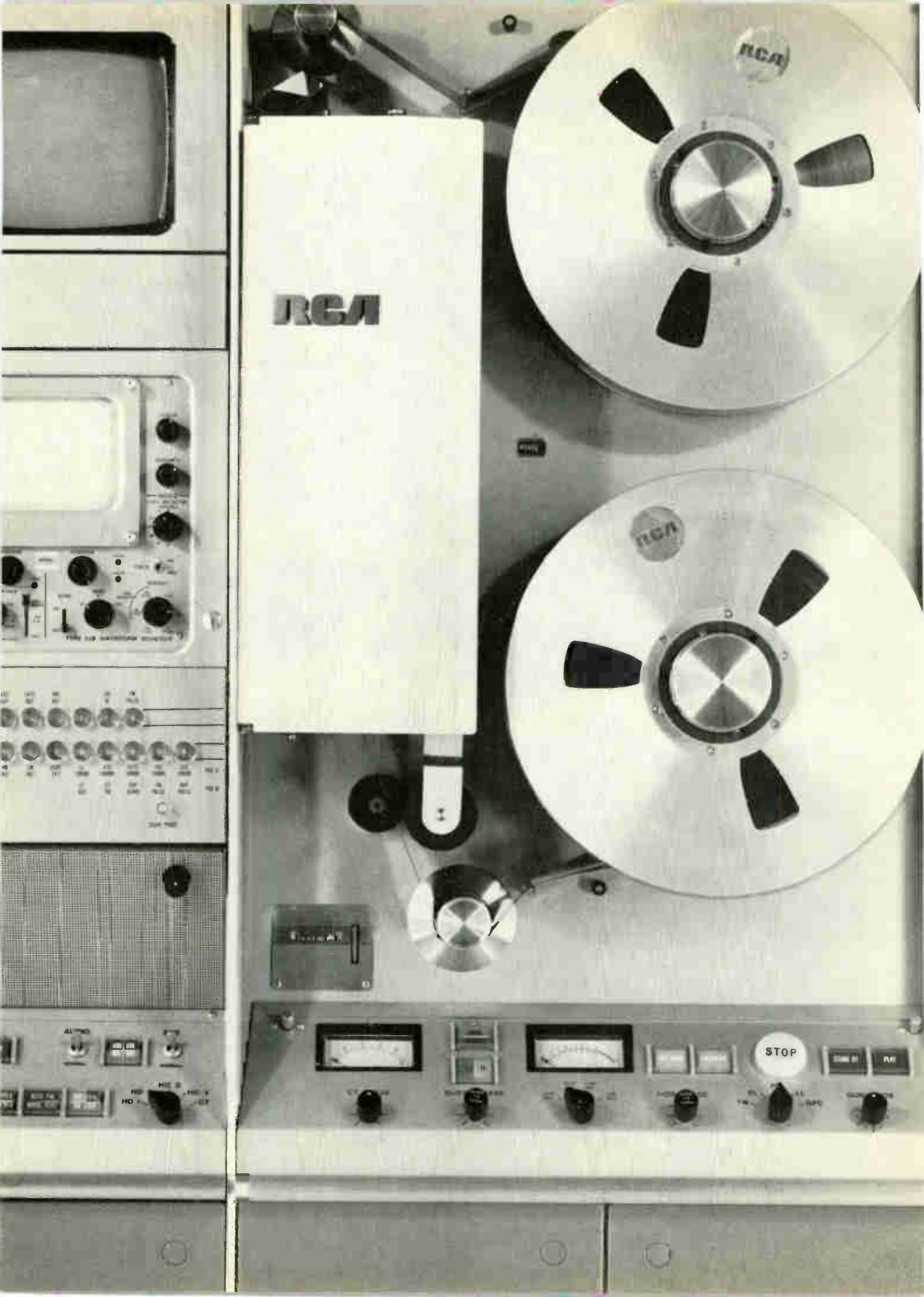
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Circle Item 14 on Tech Data Card

Replacing an FM Antenna

Many engineers are now facing or will soon face replacement of an FM antenna due to increase in power, change to circular polarization, expensive repairs, or SCA operation impaired by crosstalk. Whatever the reason, if certain guidelines are followed, the engineering task will be eased considerably.

This article is not intended to be a step-by-step guide. It is intended to assist in planning, construction and filing of the proper FCC documents for antenna replacement. The example used as a basis for this material is the replacement of a 4-bay Pylon mounted on top of a 350 foot AM tower. The 54 foot Pylon is electrically part of the AM tower, making the AM tower 404 feet high. The general procedures outlined will be the same for any FM antenna replacement.

Locating the Problem

WJBC-FM, now WBNQ, started SCA programming in 1965. Crosstalk levels were marginal between stereo and SCA channels. Tests showed the transmitter was not involved in the crosstalk problem.

Further tests revealed the antenna as the major contributor to crosstalk due to its narrow bandwidth and high SWR. Also, icing was raising the SWR beyond safe limits for the transmitter.

The Pylon is an unheated antenna reportedly unaffected by icing and foul weather conditions. However, icing on the slot covers was responsible for large increases in the SWR with corresponding increases in crosstalk.

The antenna was retuned under factory supervision, but results were still not acceptable. During the 18 years of service, the internal harness had developed several air leaks and was in need of other repairs. If both SCA and stereo programming were to continue, the crosstalk figures had to be lowered.

*Chief Engineer, WJBC - AM, WBNQ - FM, Bloomington, Ill.

The increasing trend to circular polarization leads to many antenna replacements with a simultaneous increase in power, so that maximum power may be transmitted in both horizontal and vertical plants. Circular polarization should certainly be considered where a large number of mobile and portable receivers are in use.

Cost Considerations

An estimate of total cost must be prepared. This is of prime importance to management. The preparation of an estimate is related to the questions that must be answered about your installation. Will the antenna be side mounted on the AM tower? Is there a support structure on top of the AM tower or will ad-

FCC Form 301 — Form Approved
Dec. 1966 — Budget Bureau No. 52-R014.19

Section I

UNITED STATES OF AMERICA
FEDERAL COMMUNICATIONS COMMISSION

APPLICATION FOR AUTHORITY TO CONSTRUCT A NEW BROADCAST STATION OR MAKE CHANGES IN AN EXISTING BROADCAST STATION

INSTRUCTIONS

A. This form is to be used in applying for authority to construct a new standard, commercial FM, or television broadcast station, or to make changes in existing broadcast stations. This form consists of this part, Section I, and the following sections:

Section II, Legal Qualifications of Broadcast Applicant
Section III, Financial Qualifications of Broadcast Applicant
Section IV-A, Statement of Program Service of Broadcast Applicant (AM-FM)
Section IV-B, Statement of Program Service of Broadcast Applicant (TV)
Section V-A, Standard Broadcast Engineering Data
Section V-B, FM Broadcast Engineering Data
Section V-C, Television Broadcast Engineering Data
Section V-G, Antenna and Site Information

B. Prepare three copies of this form and all exhibits. Sign one copy of Sections I, IV-A, and IV-B. Prepare one additional copy (a total of four) of Section V-G and associated exhibits. File all the above with Federal Communications Commission, Washington, D.C. 20554. A SEPARATE AND COMPLETE APPLICATION (IN TRIPLICATE) MUST BE FILED FOR EACH AM STATION, EACH FM STATION, AND EACH TV STATION.

C. Number exhibits serially in the space provided in the body of the form and list each exhibit in the space provided on page 2 of this Section. Show date of preparation of each exhibit, antenna pattern, and map, and show date when each photograph was taken.

D. The name of the applicant stated in Section I hereof shall be the exact corporate name, if a corporation; if a partnership, the names of all partners and the name under which the partnership does business; if an unincorporated association, the name of an executive officer, his office, and the name of the association. In other Sections of the form the name alone will be sufficient for identification of the applicant.

E. Information called for by this application which is already on file with the Commission *(except that called for in Section V-G)* need not be refiled in this application provided (1) the information is now on file in another application or FCC Form filed by or on behalf of this applicant; (2) the information is identified FULLY by reference to the file number (if any) the FCC form number, and the filing date of the application or other form containing the information and the page or paragraph referred to, and (3) after making the reference, the applicant states: "No change since date of filing." Any such reference will be considered to incorporate into this application all information, confidential or otherwise, contained in the application or other form referred to. The incorporated application or other form will thereafter, in its entirety, be open to the public. (See Section 1.526 of the Commission's Rules and Regulations, "Records to be maintained locally for public inspection by applicants, permittees, and licensees."

F. This application shall be personally signed by the applicant, if the applicant is an individual; by one of the partners, if the applicant is a partnership; by an officer, if the applicant is a corporation; by a member who is an officer, if the applicant is an unincorporated association; by such duly elected or appointed officials as may be competent to do so under the laws of the applicable jurisdiction, if the applicant is an eligible government entity; or by the applicant's attorney in case of the applicant's physical disability or of his absence from the United States. The attorney shall, in the event he signs for the applicant, separately set forth the reason why the application is not signed by the applicant. In addition, if any matter is stated on the basis of the attorney's belief only (rather than his knowledge), he shall separately set forth his reasons for believing that such statements are true.

G. Before filling out this application, the applicant should familiarize himself with the Communications Act of 1934, as amended, Parts 1, 2, 73 and 17 of the Commission's Rules and Regulations and the Standards of Good Engineering Practice.

H. BE SURE ALL NECESSARY INFORMATION IS FURNISHED AND ALL PARAGRAPHS ARE FULLY ANSWERED. IF ANY PORTIONS OF THE APPLICATION ARE NOT APPLICABLE, SPECIFICALLY SO STATE. DEFECTIVE OR INCOMPLETE APPLICATIONS MAY BE RETURNED WITHOUT CONSIDERATION.

File No.

1. Name of applicant (See Instruction D)

Street Address

City | State | ZIP CODE

2 Name and address of person to whom communications should be sent, if different from item 1

Name

Street Address

City | State | ZIP CODE

3. Purpose of application (check one)

☐ New Station ☒ Change existing station facilities

4. (a) Requested facilities

Type of station (as Standard, FM, Television)

Existing FM Broadcast

Frequency	Call	Channel No.	Power in kilowatts		Minimum hours operation daily
			Night	Day	
101.5	WJBC FM	268	50	50	17

Hours of operation

Unlimited X	Sharing with (Specify Stations)	Other (Specify)
Daytime only	None	None
Limited		

Station location

City	State
Bloomington	Illinois

(b) If this application is for changes in an existing authorization, complete Section I and any other sections necessary to show all substantial changes in information filed with the Commission in prior applications or reports. In the spaces below check Sections submitted herewith and as to Sections not submitted herewith refer to the prior application or report containing the requested information in accordance with Instruction E. If contemplated expenditures are less than $5,000, complete paragraph 1 of Section III only. Section IV is not required for applications for minor changes not involving change in power, change in frequency, change in hours of operation, or moving from city to city.)

	Section No.	Para. No.	Reference (File or Form No. and Date)
☐	Section II		On File
☐	Section III		Attached
☐	Section IV		Does not apply (on file)
☐	Section V		Attached

Have there been any substantial changes in the information incorporated in this application by reference in this paragraph? Yes ☐ No ☒

FOR COMMISSION USE ONLY

Fig. 1 Application for authority to make changes in the broadcast station.

Part 1 of 2 Part Series / by Marvin Beasley*

ditional tower sections be needed? How much space is available for mounting the antenna? What power gain is needed? Is antenna icing a problem? Can the old antenna be used as a support structure? Will the transmission line have to be changed? Will special adapters be needed for connecting the transmission line to the antenna? Will FM programming continue with reduced power on a temporary antenna? Will power circuits have to be installed for de-icers? Will horizontal or circular polarization be used? Are any changes in the pressurization system necessary?

Labor estimates to reharness the Pylon indicated a new antenna could be installed for approximately the same cost. Even if the Pylon were reharnessed, proper operation still could not be assured. The only solution was to replace the antenna.

An analysis of the problem revealed I had 54 feet of mounting space and that the Pylon could be strapped and detuned, then used as a support for the new antenna. A minimum power gain of 6 was required to reach the licensed 50 kw ERP. A power gain in excess of 6 would be desirable. This would lower the transmitter input.

Icing would continue to be a problem. Adapters would be needed to join any antenna selected to the transmission line since the replacement would be offset from the previous feedpoint. Wiring and an isolation choke would need to be installed for the de-icer circuits. A variac should be installed to control the voltage to the de-icers. FM programming would continue from a temporary antenna, and reduced power would be necessary. Since circular polarization was not available when it became necessary to change antennas, horizontal polarization was selected with the possibility of adding vertical elements at a later date.

The next step was to consult various catalogs and sales representatives to determine what antennas were available. Don't let sales representatives confuse you. I have found in actual practice that most reasonably priced antennas are affected by icing. When the selections have been narrowed to one or two, call someone who has a similar installation. Other engineers will quickly let you know what problems they have encountered. After deciding which antenna to use, contact several contractors for an installation estimate. If possible, find a contractor who has made a similar installation.

A properly prepared estimate should include the antenna, shipping, de-icers, de-icer wiring, isolation choke, conduit, special antenna fittings, adapters for connections to

Broadcast Application — FEDERAL COMMUNICATIONS COMMISSION — Section III

FINANCIAL QUALIFICATIONS OF BROADCAST APPLICANT

Name of Applicant: BLOOMINGTON BROADCASTING CORPORATION

The Commission is seeking in the questions that follow information as to contracts and arrangements now in existence, as well as any arrangements or negotiations, written or oral, which relate to the present or future financing of the station; the questions must be answered in the light of this instruction.

1. a. Give estimated initial costs of making installation for which application is made. If performed under a contract for the completed work, the facts as to such contract must be stated in lieu of estimates as to the several items. In any event, the cost shown must be the costs in place and ready for service, including the amounts for labor, supervision, materials, supplies and freight. Cost items such as professional fees, mobile equipment, non-technical studio furnishings, etc. should be included under "Other Items" below.

Transmitter proper including tubes	Antenna system, including antenna-ground system, coupling equipment, transmission line	Frequency and modulation monitors	Studio technical equipment, microphones, transcription equipment, etc.
$ does not apply	$ 5900.00	does not apply $	does not apply $

Acquiring land	Acquiring, remodeling, or constructing buildings	Other items Itemize	Total	Give estimated cost of operation for first year	Give estimated revenues for first year
does not apply $	does not apply $	Attorney & Engineering Fees $ 300.00	$ 6200.00	does not apply $	does not apply $

b. State the basis of the estimates in (a) above.

1. Antenna cost from Gates radio, Quincy, Illinois.
2. Labor estimate from United Tower Service , Monticello, Ill.

c. The proposed construction is to be financed and paid for in the following manner (including specified statements as to the approximate amount to be met and paid for from each source.) The financial plan should provide for any additional construction costs should the actual cost exceed the original estimated cost, and also for the early operation of the station in the event operating expenses should exceed operating revenues:

Existing Capital	New Capital	Loans from banks or others	Profits from existing operations	Donations	Credit, deferred payments, etc.	Other sources (specify)
$ 6200.00	$ ----	$ -----	$ ---	$ -----	$ ----	$ ------

2. a. Attach as Exhibit No. 1 a detailed balance sheet of applicant as at the close of a month within 90 days of the date of the application showing applicant's financial position. If the status and composition of any assets and liabilities on the balance sheet are not clearly defined by their respective titles, attach as Exhibit No. schedules which give a complete analysis of such items.

b. Attach as Exhibit No. a statement showing the yearly net income, after federal income tax, for each of the past 2 years, received by applicant from the various types of activity in which he was engaged or from any other source.

3. Furnish the following information with respect to the applicant only. If the answer is "None" to any or all items, specifically so state:

a. Amount of funds on deposit in bank or other depository

b. Name and address of the bank in which deposited

c. Name and address of the party in whose name the money is deposited

d. Conditions of deposit (in trust, savings, subject to check, on time deposit, who may draw on account and for what purpose, or other condition)

e. Whether the funds were deposited for the specific purpose of constructing and operating the station

Fig. 2 Station Financial Qualifications form.

Broadcast Application | FEDERAL COMMUNICATIONS COMMISSION | Section V-B

FM BROADCAST ENGINEERING DATA

Name of applicant: **Bloomington Broadcasting Corporation**

1. Purpose of authorization applied for: (Indicate by check mark)

(If application is for a new station or for any of the changes numbered B through D, complete all paragraphs of this form: if change E is of a character which will change coverage or increase the overall height of the antenna structure more than 20 feet, answer all paragraphs, otherwise complete only paragraphs 2 and 10 and the appropriate other paragraphs; for changes F through H, complete only paragraph 2 and the appropriate other paragraphs; for change I, complete only paragraphs 2 and 5.)

A. ☐ Construct a new station
B. ☐ Change effective radiated power or antenna height above average terrain
C. ☐ Change transmitter location
D. ☐ Change frequency
E. ☒ Change antenna system
F. ☐ Change transmitter
G. ☐ Install auxiliary or alternate main transmitter
H. ☐ Other changes (specify)
I. ☐ Change studio location

If this is not for a new station, summarize briefly the nature of the changes proposed. **The present antenna is an RCA Pylon. It will be strapped and used for mounting the new antenna. There will be no change in the height of the tower.**

2. Facilities requested

Frequency	Effective radiated power in kilowatts	Antenna height above average terrain
101.5Mhz	50	461 ft.

3. Station location

State	City or town
Illinois	Bloomington

4. Transmitter location

State	County
Illinois	McLean
City or town: Bloomington	Street Address (or other identification): Rte. 66, .5 mile S. of city

5. Main studio location

State	County
Illinois	McLean
City or town: Bloomington	Street address: 209 E.Washington

6. Remote control point location

State	City or town
Illinois	Bloomington

Street Address (or other identification): 209 E. Washington St. (AM-FM Studio)

7. Transmitter

Make	Type No.	Rated Power
RCA	BTF 10D	10 kw

(If the above transmitter has not been accepted for licensing by the F.C.C., attach as Exhibit No. a complete showing of transmitter details. Showing should include schematic diagram and full details of frequency control. If changes are to be made in licensed transmitter include schematic diagram and give full details of change.) Does not apply

8. Modulation monitor

Make	Type No.
Belar	FMM 1 FMS 1

9. Frequency monitor

Make	Type No.
Belar	FMM 1 FMS 1

10. (a) Antenna structure:

Is the proposed construction in the immediate vicinity or does it serve to modify the construction of any standard broadcast station, FM broadcast station, television broadcast station, or other class of radio station? If "Yes", attach as Exhibit No. complete engineering data thereon. Yes ☐ No ☒

Submit as Exhibit No. a vertical plan sketch for the proposed total structure (including supporting building if any) giving heights above ground in feet for all significant features.

Overall height in feet above ground. (Without obstruction lighting)	Overall height in feet above mean sea level. (Without obstruction lighting)
404 ft.	1,358 ft.
Overall height in feet above ground. (With obstruction lighting)	Overall height in feet above mean sea level. (With obstruction lighting)
406 ft.	1,360 ft.

Height of antenna radiation center in feet above mean sea level. 1331 ft.

Geographical coordinates of antenna (to nearest second)
North latitude 40 ° 27 ' 32 " West Longitude 89 ° 00 ' 38 "

(b) Antenna data

Make	Type No. or description	No. of sections
Gates Radio Co.	FMA 6B	6

Effective free space field intensity at one mile in mv/m for one kilowatt antenna input power	Antenna field gain	Antenna power gain
Horiz. 342.6	2.51	6.3

Is horizontal polarization proposed? Yes ☒ No ☐
If "No", attach as Exhibit No. complete engineering data on the antenna and the effective radiated power proposed.

Is directional antenna proposed? Yes ☐ No ☒
If "Yes", attach as Exhibit No. complete engineering data thereon.

Fig. 3 FM Broadcast Engineering Data form V-B, page 1.

Broadcast Application | FM BROADCAST ENGINEERING DATA | Section V-B, Page 2

11. Transmission line proposed to supply power to the antenna from the transmitter

Make	Type No.	Description
Andrew	452	Coaxial

Size (nominal transverse dimension) in inches	Length in feet	Rated efficiency in percent for this length
3-1/8	450	85

12. Proposed operation

Transmitter power output in kilowatts	Power dissipation within transmission line in kilowatts
9.34 kw	1.4 kw
Antenna input power in kilowatts	Effective radiated power in kilowatts (Must be same as shown in Para. 2)
7.94 kw	50 kw

13. Will the studios, microphones, and other equipment proposed for transmission of programs be designed for compliance with the FM Technical Standards? [X] Yes [ ] No

14. If this application is for modification of construction permit state briefly as Exhibit No. the present status of construction and indicate when it is expected that construction will be completed.

Does not apply

15. Attach as Exhibit No. map(s) (Sectional Aeronautical Charts where obtainable) of the area proposed to be served and show drawn thereon:

(a) Proposed transmitter location and the radials along which the profile graphs have been prepared;
(b) The 1 mv/m and the 50 uv/m contours predicted;
(c) Scale of miles. Does not apply

Areas and population: (1950 or later census.)
(All towns and cities having population in excess of 10,000 and receiving signal intensity of less than 1 mv/m shall not be included in the tabulation of areas and populations within the service contours.) Does not apply

Area (sq. mi.) within 1 mv/m contour	Population within 1 mv/m contour
Does not apply	Does not apply
Area (sq. mi.) within 50 uv/m contour	Population within 50 uv/m contour
Does Not apply	Does not apply
Area (sq. mi.) within interference free contour (if station would be limited inside the 50 uv/m contour by any other station or stations).	Population within interference free contour (if station would be limited inside the 50 uv/m contour by any other station or stations).
Does Not apply	Does not apply

Number of persons residing within 0.5 mile of proposed transmitter location Does not apply

Number of persons residing within 0.25 mile of proposed transmitter location Does not apply

Specify the source of population data as used in this paragraph Does not apply

16. (a) Attach as Exhibit No. a map(s) (topographic where obtainable, such as U. S. Geological Survey quadrangles) for the area within 15 miles of the proposed transmitter location and show drawn thereon the following data: Does not apply

1. Proposed transmitter location--accurately plotted;
2. Transmitter location and call letters of all radio stations (except amateur) and the location of established commercial and government receiving stations within 2 miles of the proposed transmitter location;
3. Proposed location of main studio;
4. Character of the area within 2 miles of proposed transmitter location, suitably designated as to residential, business, industrial, and rural nature;
5. At least eight radials each extending to a distance of ten or more miles from the proposed transmitter location, one or more of which must extend through the principal city or cities to be served.

(b) Attach as Exhibit No. profile graphs for the radials in (a) (5) above. Each graph shall show the elevation of the antenna radiation center. Identify each graph by its bearing from the proposed transmitter location. Direction true north shall be zero azimuth and angles measured clockwise. Show source of topographical data on each. Does not apply

17. From the profile graphs in 16(b), for the eight mile distance between two and ten miles from the proposed transmitter location, and in accordance with the procedure prescribed in the FM Technical Standards, supply the following tabulation of data: (If proposed location is adjacent to the sea coast or the Great Lakes omit from this tabulation all radials which lie over water substantially the entire distance between two miles from the proposed transmitter location and the predicted 50 microvolt per meter contour.)

Radial bearing (degrees true)	Average elevation of radial (2-10 mi.) in feet above mean sea level	Height in feet of antenna radiation center above average elevation of radial (2-10 mi.)	Free space field intensity in millivolts per meter at one mile	Predicted distance in miles to the 1 mv/m contour	Predicted distance in miles to the 50 uv/m contour
Does not apply					
0	feet	feet	mv/m	mi.	mi.

Average

Antenna height above average terrain feet
(Average of above listed heights -- must be identical with Paragraph 2)

I certify that I represent the applicant in the capacity indicated below and that I have examined the foregoing statement of technical information and that it is true to the best of my knowledge and belief.

(date) Signature

(check appropriate box below)

[ ] Technical Director [ ] Chief Operator [ ] Registered Professional Engineer [ ] Consulting Engineer

Fig. 4 FM Broadcast Engineering Data form V-B, page 2.

the temporary antenna, attorney's fees, and engineering fees. When all costs have been estimated, add 10 per cent to cover hidden costs. The antenna and accessories should be ordered well in advance of the planned change, because usual delivery will range from 45 to 90 days.

After considering all possibilities, a Cycloid was ordered. The specifications read; power gain 6.3, and mounting space 50 ft. at 101.5MHz. I placed the order and immediately turned to the stack of FCC paperwork required.

FCC Applications

All FCC applications should be checked by your attorney. I can hear some engineers saying, "Who needs an attorney? I can do it myself." It's not worth the chance of waiting several weeks only to have the application returned for correction of a technicality or a typographical error. I had an emergency situation when our application was filed. Our attorney checked the application and practically handcarried the papers through the FCC.

Sections 1, III and V-B of form 301, Application for Authority to Construct a New Broadcast Station or Make Changes in an Existing Broadcast Station, should be promptly filed. Section 1 is self-explanatory. Section III, page 1, Financial Qualifications, should be similar to the example shown. Section III, page 2 is self-explanatory. Section V-B, FM Broadcast Engineering Data, is the section of prime importance to the engineer. Some parts of the example need explaining.

The antenna manufacturer will supply information for Paragraph 10 (b). The information for paragraph 11 can be obtained from the previous license application. Paragraph 12 can be figured as follows:

ERP 50 kw, Power gain 6.3

$$\text{Ant. input} \quad \frac{50}{6.3} = 7.94 \text{ kw input}$$

$$\text{Transmitter power output} = \frac{\text{Ant. input (kw)}}{\text{Transmission Line Efficiency}}$$

or

$$\frac{7.94 \text{ kw}}{.85} = 9.34 \text{ kw output}$$

The transmission line power dissipation is the difference between the transmitter power output and the antenna input.

Your construction permit will probably have a condition as follows: "Subject to WJBC receiving permission from the commission to determine power of WJBC by the indirect method during installation of the FM antenna and checking resistance of the tower after the installation has been completed; prior to authorization of program tests, resistance measurements and Forms 302 must be submitted for WJBC."

The request for permission to determine AM power by the indirect method should be handled as an informal application. Simply write a letter such as: "This letter is a request for authority to determine operating power of WJBC-AM by the indirect method pending installation of a new FM antenna as authorized by the commission, Reference File BPH-5635. Request permission for 30 days beginning February 25, 1967." The request should be made about two weeks before construction starts.

If you intend to operate at low power on a temporary antenna during construction, another informal application is necessary. The general form of the letter can be: "This letter is a request for permission to operate with temporary antenna facilities for WJBC-FM during erection of a new FM antenna as authorized by CP BPH-5635. The temporary antenna will be 40 feet above ground level and mounted on a self-supporting tower. The antenna will be of the turnstile type with a power gain of less than unity. The 250 watt driver of WJBC's RCA BTF-10D will supply power. See exhibit Number 1 for sketch of the proposed temporary antenna. The erection of the new antenna will begin on February 27, 1967."

Tentative arrangements should be made at this time to have the antenna resistance measurements made as soon as construction is complete. Program authorization is tied to this requirement and should be submitted as promptly as possible.

Part 1 of this series has covered the necessary items to get your construction permit and get a work schedule organized for the actual transition. Construction, post construction, and other essential paperwork will be covered in part 2.

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Circle Item 16 on Tech Data Card

CO-CHANNEL INTERFERENCE:

Avoiding a CATV Headache

By Phil Dean*

Co-channel interference is completely described by the phrase "Co-Channel" and means exactly that—two stations being received on the same antenna.

The two stations referred to are on the same frequency, and while the FCC is the controlling factor in assigning frequencies to broadcaster, the Grade B contours are often very near each other. When a CATV system is located midway or near the middle point between two stations, the phenomenon of Co-channel appears.

When a CATV system is planned, a physical, signal strength survey will determine the feasibility of receiving and using the signals available in the area under proposal. Thorough map surveys will reveal the possibility of interference from undesired station signals or from stations that the operator cannot carry on the proposed system.

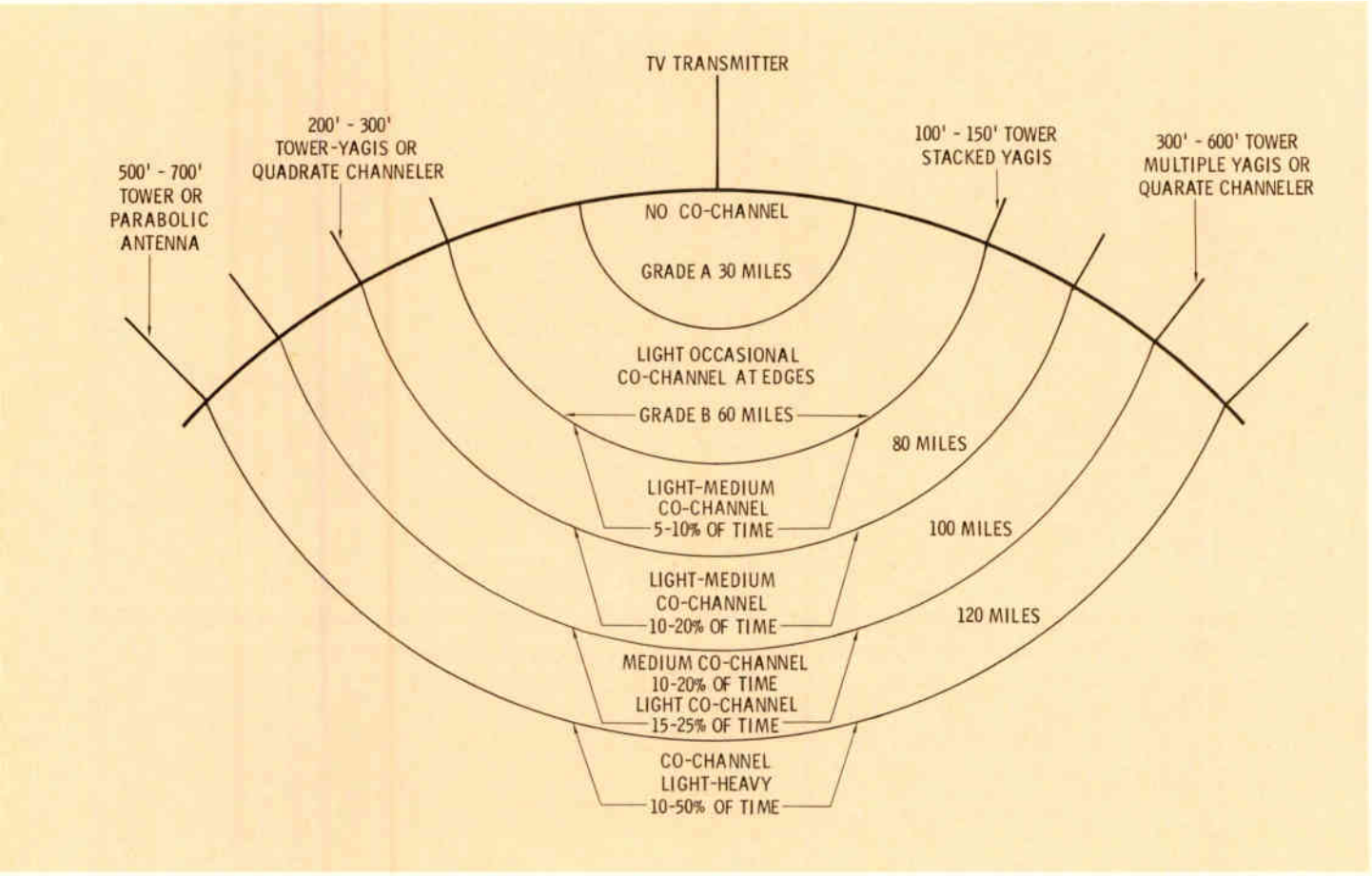
Frequently, it is impossible to accurately predetermine whether or not a location will be plagued with co-channel until the tower has been erected and the antennas have been placed. The problem usually appears when phasing of antennas has commenced and the actual setting of levels is under way.

If the undesired signal is constant and direct, horizontal stacking of Yagis will develop a narrow horizontal beamwidth, and the undesired signal can be phased out of the pickup. If the undesired signal is varying due to weather or other local atmospheric conditions, such as reflections from the discharge of chemical plants, the problem becomes seemingly insoluble.

Regardless of the conditions causing the delivery of the undesired signal, careful plots of the source and thorough design for stacking and orientation of antennas can result in the creation of nulls that will cancel or reduce the undesired signal to a level that does not produce noticeable interference to the viewer.

All manufacturers of antennas supply data and specifications that remove all guesswork from the application of their products. It is ludicrous to attempt an in-depth presentation of the solution of a hypothetical problem, as this has been done many times in every trade journal in the industry. From many past experiences, however, the positive statement that the majority of co-channel problems can be solved and satisfactory pictures can be obtained seems appropriate. The determining factor in all cases is a careful determination of signal sources and the analysis of all available information, then the application of this knowledge to the available antennas and towers.

*Phil Dean & Associates



April, 1969

Late Bulletin from Washington

by Howard T. Head

Commission Proposes To Relax Requirements for Directional Antenna Remote Control Inspection

In response to a petition by the National Association of Broadcasters (NAB), the Commission has proposed to relax the inspection requirements for standard broadcast directional antenna systems operated by remote control. At present, an inspection at the transmitter must be made within two hours after switching to any mode of directional operation. In the case of stations employing different patterns day and night, this may require as many as three transmitter inspections each day.

The Commission now proposes to require only a single daily inspection (seven days a week) provided that directional antenna phase angle indications are logged at the remote control point. Daily inspections will be required to be scheduled so that no more than 48 hours would elapse between successive inspections for a given mode of directional operation.

In making the proposal, the Commission notes that there is no present requirement for type approval of phase monitors, or any requirements in the Technical Standards governing the maximum permissible phase angle deviation from the license value. Consequently, the Commission also proposes to require all stations employing directional antennas (not just the ones operated by remote control) to install type-approved monitors and to maintain indicated phases within ± 2 degrees. No change is proposed in the present ± 5 degree tolerance on current ratios. Phase angle indications would be logged regularly along with the other transmitter operating parameters. In a few special cases of critical directional antennas, more stringent tolerances on the phase angle and current ratio are specified by the station's license.

Filings Heavy in UHF Land Mobile Channel Proposals

Both the broadcasting and the land mobile industries have filed extensive and detailed comments in connection with the Commission's twin proposals which would (a) permit land mobile services to share UHF television Channels 14-20 with television broadcast services and (b) reallocate Channels 70-83 to land mobile and common carrier operation. Land mobile licensees are registering increasingly frequent complaints of congestion in the frequency bands presently assigned to them.

Broadcasting and land mobile interests were critical of the Commission's proposal for sharing Channels 14-20. The broadcasters pointed out that even if restrictions as to height and power were imposed on land mobile

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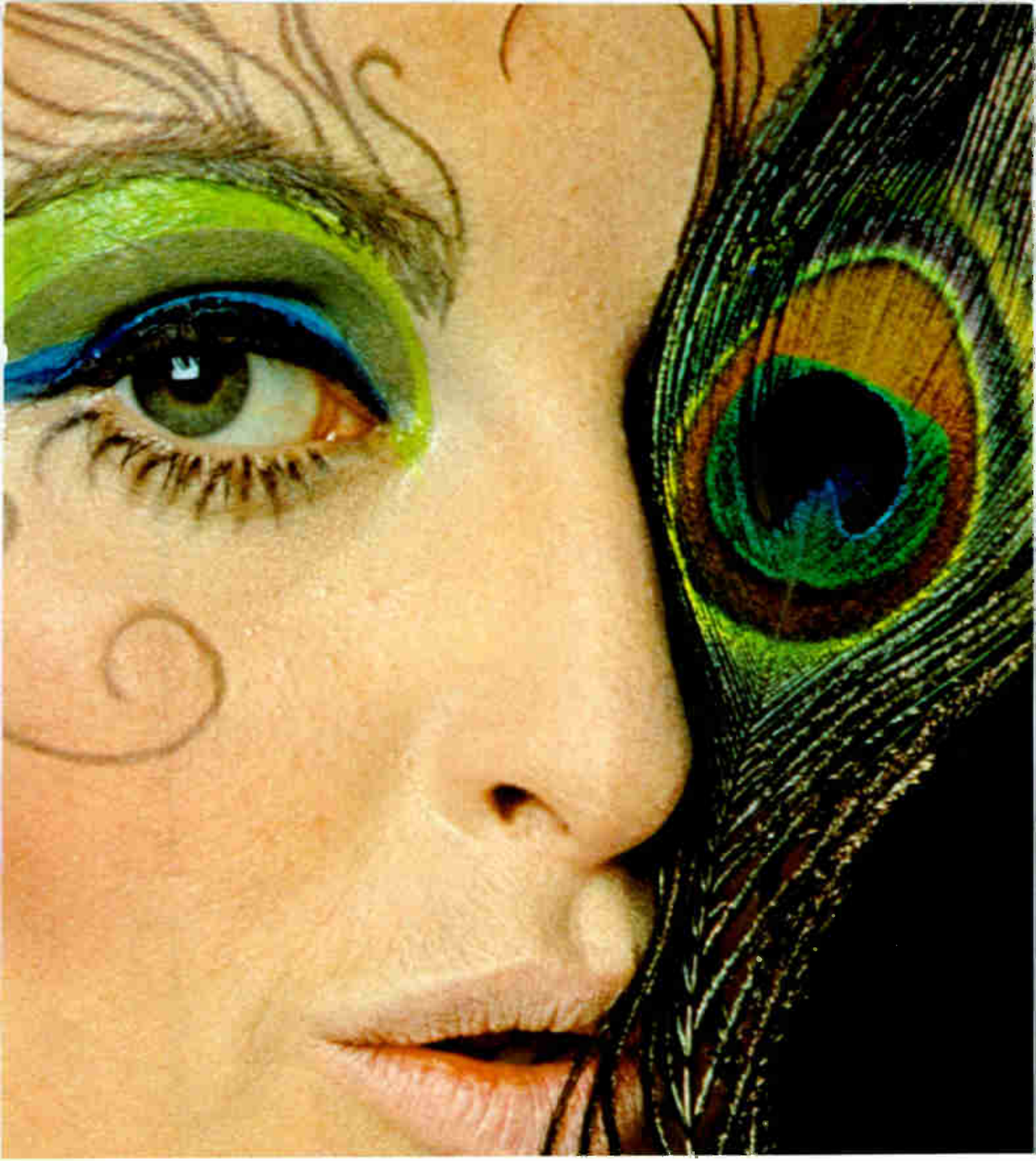

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operation, there would still remain a threat of potential interference to television reception. The land mobile interests insisted that the restrictions which the Commission proposed to minimize television interference were unrealistic and would not permit full exploitation of the band for land mobile purposes.

Various land mobile organizations have asked that instead of sharing Channels 14-20, this entire band (470-512 MHz) be withdrawn from television broadcast service and reassigned to the land mobile services on an exclusive basis. This would involve the ultimate reassignment to higher channels of 115 UHF stations now either licensed or authorized on Channels 14-20.

The broadcaster's filings emphasized findings showing that present land mobile usage is often very haphazard, with discipline being laxly enforced, and large amounts of the presently assigned spectrum going largely unused. Similar conclusions are being reached by the Stanford Research Institute, which is expected to report to the Commission this summer on findings of a $500,000 research contract which was let to explore land mobile usage in detail.

Short-Haul Microwave Systems Proposed by CATV

The Commission has invited comments on a proposal that use of the Community Antenna Relay System (CARS) band from 12.7-12.9 GHz be authorized for local signal distribution. Modulation would correspond to standard television modulation, including the aural channel. The Commission has asked for comments on such matters as the need for more than a single microwave system to serve a particular CATV area.

In a companion operation, the Commission has authorized experimental tests by the Teleprompter Corporation of a system operating near 18 GHz for short and medium range CATV relaying. Tests are authorized in New York City, Farmington, New Mexico and Eugene, Oregon.

Short Circuits

An increasing number of television broadcast stations are installing precise carrier frequency control as a means for co-channel interference reduction. Improvement up to several db is claimed . . . Rules requiring calibration of television transmitter output meters at 80 per cent, 100 per cent and 110 per cent have been made final. Where the transmitter can't make 110 per cent, calibration may be made at the highest available power . . . The Commission continues to levy an increasing number of heavy fines for technical violations . . . The NAB has moved into a new 2.5 million dollar headquarters building at 1771 N Street, N.W., Washington, D.C. The new phone number is now 202-293-3500.

Howard T. Head
Washington, D.C.

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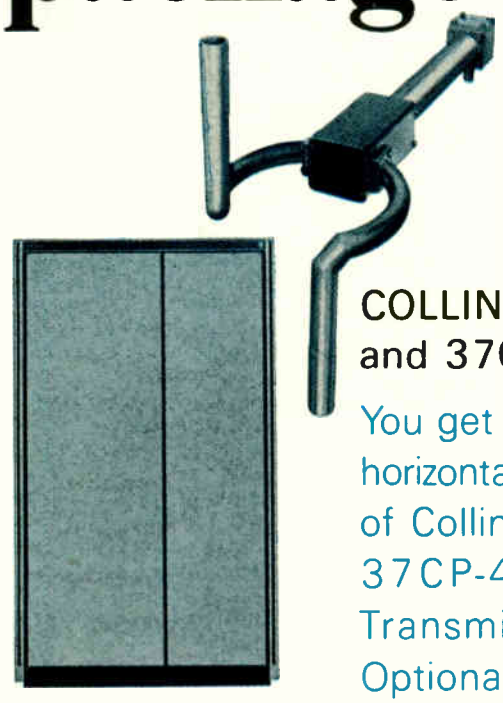

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COMMUNICATION/COMPUTATION/CONTROL

Circle Item 17 on Tech Data Card

Patching in the studio

By James Ranney*

At radio stations where a separately manned transmitter is operated, the transmitter engineer often represents a virtually untapped source of manpower which might be used to good advantage in studio operations.

This is particularly true if the transmitter equipment includes a tape recorder or two which could help relieve the pressure during peak periods of studio recording.

The problem, in many cases, is that the transmitter engineer does not have ready access to studio program sources. If a studio "patch job" is required whenever the transmitter is to do any recording, most of the advantages of the extra man and equipment are lost. An alternative would be to have equalized telephone lines between all studio program sources and the transmitter, but in most cases this is prohibitively expensive.

One solution to the dilemma is a system that we at WCKY have dubbed the "Patch-O-Matic." Despite the fancy name, this is a simple system using readily available components, which allows the transmitter engineer to do his own patching at the studio.

Whatever source he selects is fed to him over a single program line. The emergency program line found at most stations can serve admirably for this purpose. Control circuits for

*Chief transmitter engineer, WCKY

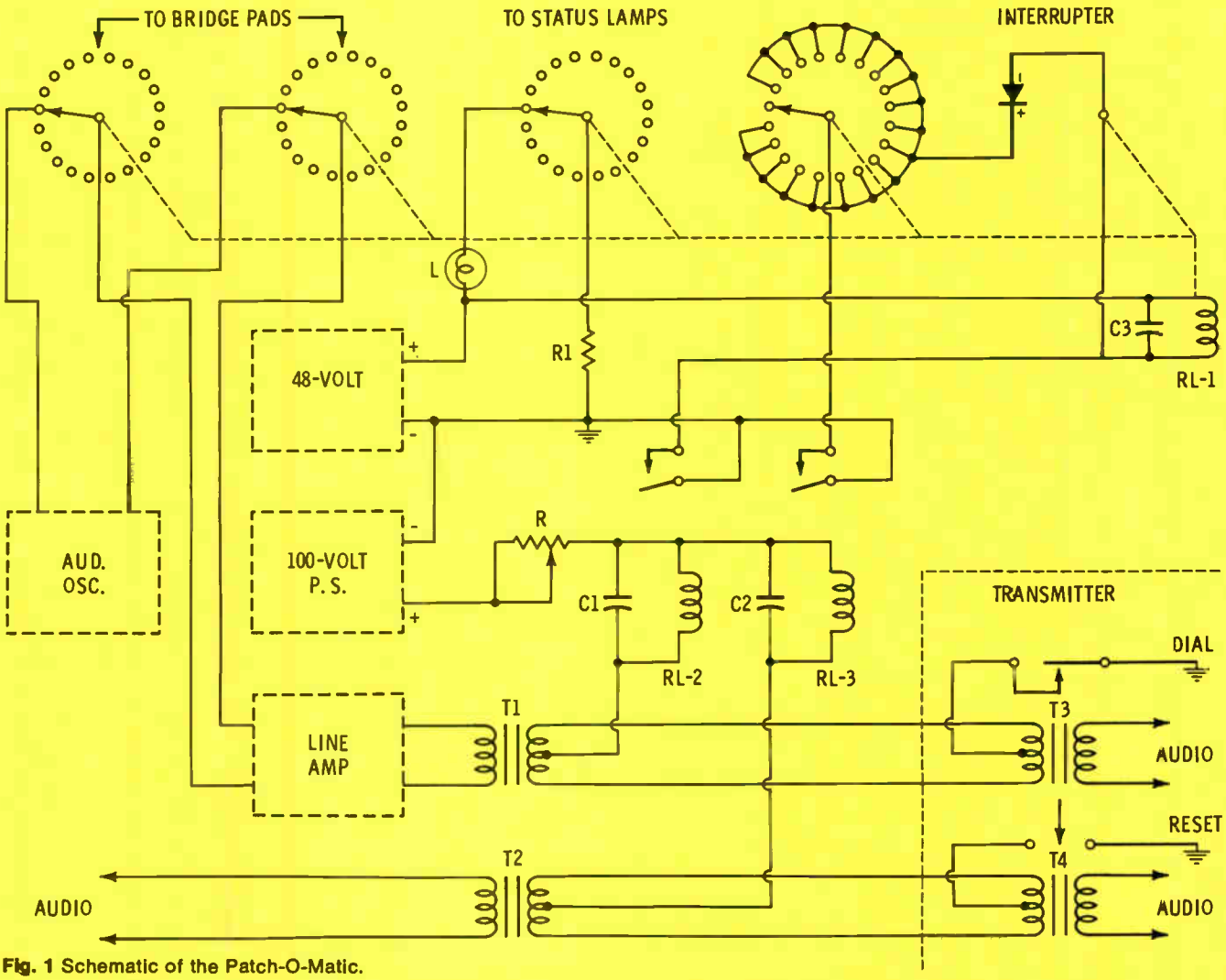


Fig. 1 Schematic of the Patch-O-Matic.

with the Patch-O-Matic

the system can be "phantomed" over existing lines so that, in many cases, no additional line charges are incurred.

The simplicity of the Patch-O-Matic can be seen in Figure 1. Two decks of a four-deck "stepper" relay (RL-1) are used to switch the input of a program amplified across desired sources. Homemade plug-in bridging pads are used in the input of the amplifier.

They raise the amplifier input impedance to approximately 10,000 ohms to avoid loading the program source, and they also attenuate the level of the source to the proper value. In this way, the output of the amplifier into the program line is constant, regardless of the source level. By making these pads plug-in, they may be interchanged or replaced when program sources are changed or switched to different stepper positions.

Attenuation values of these pads are determined by the program amplifier gain and the level of the source to be bridged. The source level in dbm, minus the pad attenuation in db, plus the amplifier gain in db should result in standard telephone line level, +8 dbm. Construction of these pads is shown in Figure 2, along with the formulas necessary for calculating resistance values. Values for the power ratio N used in the formulas are shown in Table 1. Any value of N not appearing in Table 1 can be calculated by using the formula:

$$N = \frac{\text{antilog db attenuation}}{10}$$

The stepper relay shown in Fig-

PARTS LIST

RL-1 Four deck stepper relay, 48 VDC coil.

RL-2, RL-3 SPDT relay, 5000-ohm coil, P&B type LM-5 or equivalent.

R Adjustable resistor, 20,000 ohm, 5 watt.

R-1 Resistor, 120-ohm, 10 watt

L 28-volt pilot lamp, No. 313.

C1, C2, C3 0.1 mfd., 400-volt tubular. Use if necessary to suppress clicks.

T1 through T4 Telephone company line coils, Type 111C or similar.

Dial, normally open type; see text.

Reset spring return pushbutton, normally open.

48-volt power supply—Any DC supply capable of handling current drawn by stepper relay. Voltage and current requirements will be determined by type of stepper used.

100-volt power supply—Any small DC supply with 50 MA or more capability.

Line Amplifier—Program quality amplifier, 600 ohm input and output, 40-50 db gain.

Audio Oscillator—Any tone source; see text.

TABLE 1

Decibel	Power Ratio (N)
2	1.5849
4	2.5119
6	3.9811
8	6.3096
10	10.0000
12	15.849
14	25.119
16	39.811
18	63.096
20	100.00
22	158.49
24	251.19
26	398.11
28	630.96
30	1000
40	10,000
50	100,000
60	1,000,000

Values of N to be used in determining bridging pad resistances.

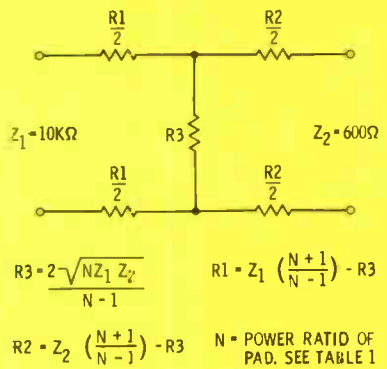


Fig. 2 Calculating resistance values for pads.

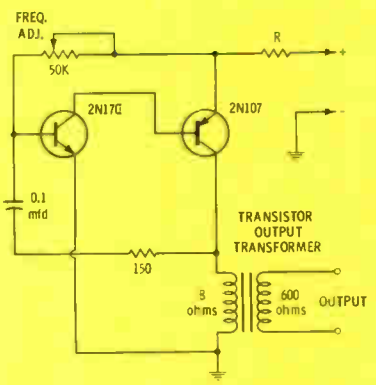


Fig. 3 Transistor oscillator to be connected to the home position indicator lamp.

ure 1, and visible in the photographs, is a 20-position, 4-deck type with a 48 VDC actuator coil. Allowing one step for a "home" position, up to 19 different program sources can be handled by such a relay. Two decks are used for program bridging, as explained. A third deck is used to switch indicator lamps which reveal the stepper position at all times. While this feature could be dispensed with, it is recommended that it be included. Without the lamps, it is a tedious procedure to locate the position of the stepper relay by inspection during tests, or when setting up new positions.

The fourth deck is used to return the stepper relay to home position when the reset button is depressed. This is accomplished by feeding the reset interrupter voltage through the fourth deck contacts, leaving the home position contact unconnected. Figure 1 reveals how this reset system works. At home position, the program amplifier is bridged across the output of an audio oscillator so that the operator at the receiving end knows when this position is reached.

A schematic of a simple transistor oscillator is shown in Figure 3. If desired, an existing oscillator can be employed for this function. If the transistor oscillator is used, its operating voltage can be taken from the 48 volt DC supply by using a suitable dropping resistor. It can be connected to the home position indicator lamp so that a tone is present only when the stepper is in this position.

As mentioned previously, the stepper relay in the system being described was a 4-deck affair with a 48-volt DC coil and an interrupter contact used for resetting. There is another common type of stepper which uses a different reset system. It has two coils—one for stepping, and another for reset. The stepping contact assembly rotates against a tension spring. Applying voltage to the reset coil releases the step ratchet, and the contact assembly is returned to home position by the spring. This type of relay may not be as positive in advancing and resetting as the other type, but will give good service if properly adjusted and maintained. Since it does not require use of a set of contacts to return to home position, and since the indicator lamps can be eliminated in the interest of simplicity, a 2-deck relay of this type could be used.

In Figure 1, the step and reset functions can be done over phantom circuits on studio transmitter lines, providing these lines employ no amplifiers. The stepper relay coil current is too heavy to be passed directly over the phantom circuit, so two auxiliary relays, RL-2 and RL-3, are used. Since these relays require only 10 to 15 Ma for proper operation, a 100-volt power supply will allow use of lines where the total resistance, including ground return, is as much as 6000 ohms.

The resistance per mile of telephone lines and ground returns varies considerably. It is recommended that this resistance be measured with a conventional ohmmeter before contemplating the use of phantom circuits. This can be done by grounding the line side center tap of the 111-C coil at one end of the line and measuring the resistance to ground at the line side center tap of the 111-C coil at the other end of the line. Resistor R in Figure 1 is adjusted to secure proper relay coil current..

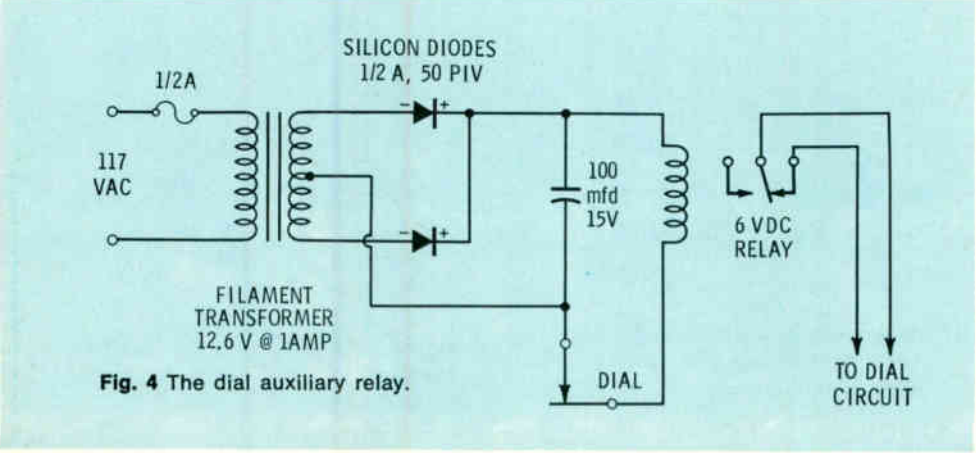


Fig. 4 The dial auxiliary relay.

Temporarily insert a 0-100 Ma meter in series with the coil of the reset auxiliary RL-3. Depress the reset button, and adjust R for a value of current which results in positive operation of the relay. This will usually be between 10 and 15 Ma, but will vary with the relay used, spring tension, etc. If the stepper auxiliary RL-2 is an identical type, this setting will be satisfactory for it also. Do not use more than 100 volts for this control function, as this is the maximum allowed by most telephone companies. Check with your local company if in doubt about their regulations in this matter.

If use of phantoms is not desired, or if impossible due to amplifiers in the program lines, most telephone companies can furnish an unloaded "metallic pair" for control functions. If such a pair is used, the dial-step function is carried by one wire of the pair and ground return; the reset over the other wire and ground return. In ordering such a circuit, be sure to specify that the line include no loading coils or other shunt elements.

Any dial used with the circuit shown in Figure 1 must be of the type which is normally open and makes contact when operated. Many, if not most telephone systems, employ a dial with normally-closed contacts which open as the dial revolves. The dial used in our system was removed from Stromberg-Carlson equipment, which employs the normally-open type. If you cannot find this type of dial, one of the normally-closed variety can be used by modifying the contact assembly, or by installing a dial auxiliary relay as shown in Figure 4.

Finally, since standard dials will advance the stepper a maximum of 10 steps in one operation, two numbers must be dialed to reach step 11 and beyond. This can be done without confusion by designating step 11 as 92, step 12 as 93, etc.

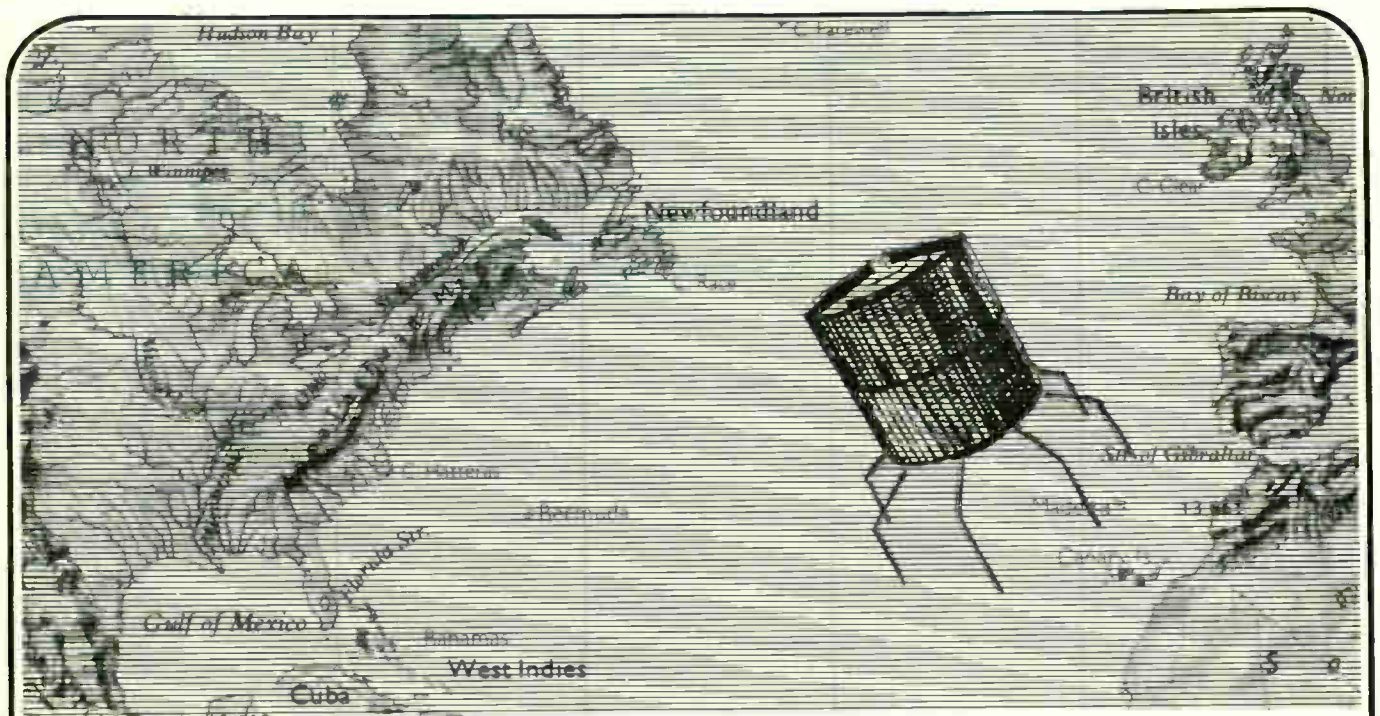
The Patch-O-Matic system was designed primarily to work between studio and transmitter. It could, however, prove valuable in large studio operations by furnishing the production man a means of picking up program sources at any desired point in the studio complex, without multiple lines or complicated switching arrangements.

CINTEL

FIELD STORE TELEVISION STANDARDS CONVERTER

The colour and monochrome pictures received throughout Europe of the Mexico Olympic Games and, more recently, of the Apollo 8 launch, were trans-coded electronically by an advanced field-store converter, designed by the British Broadcasting Corporation. The Mexico programme was networked to thirty-one television services in twenty-eight countries, the received picture having remarkable quality, full picture size and minimal loss of definition.

Rank Cintel are now manufacturing, under license, the British Broadcasting Corporation 525/60 NTSC to 625/50 PAL converter and also an equipment providing the reverse process. In addition to its basic function, switchable facilities give PAL/PAL (alternatively NTSC/NTSC) field synchronisation and rapid check-out. With replacement of the conventional decoding and encoding units, the equipment operates on other 625 line colour systems.



BASIC OPERATION OF CINTEL FIELD STORE CONVERTER

Incoming Colour Signal (i.e. 525/60 NTSC) → Input Transcoder → Interpolator → Main Store → Timing Corrector → Output Transcoder → Outgoing Colour Signal (i.e. 625/50 PAL)

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Circle Item 18 on Tech Data Card

Understanding Audio Transistor Circuits

Part 6 of a 6-Part Series

By Norman H. Crowhurst

As a good exercise in various aspects of audio design with transistors, let's close this series by designing a 20-dB voltage-gain unit. It will include a bridging input and a low impedance output, maximum handling capacity for the supply voltage used, and high stability.

The basic circuit for a 20-dB gain, which is 10:1 voltage gain, can use a single transistor, with a collector circuit resistance 10 times its emitter circuit resistance (Figure 6-1). However, its gain is heavily susceptible to associated circuit impedances. In fact, a matching output load would immediately halve the gain.

The next step is to provide this basic gain stage with emitter-follower input and output. It can use direct coupling (as shown in Figure 6-2) or separately biased stages with AC coupling, (Figure 6-3).

When using direct coupling, the operating point of the middle and output stage is determined principally by the current gain of the first transistor. The third will follow the second, DC as well as AC, virtually independent of its own precise value of current gain.

With the AC coupling, bias arrangements can hold operating points quite closely. But the circuit will have four low-frequency roll-off elements, instead of the two in the direct-coupled case. For inclusion in circuits employing feedback, reducing the series coupling elements from four to two may be an important advantage.

First, take another look at the circuit of Figure 6-3. The first stage is not critical, so long as its emitter and base voltage is high enough to accept adequate input to drive the remaining stages. The second, or gain stage, can be controlled by adjusting base voltage with a bias circuit that swamps base current (the values shown give an average of 9 times the base current in the base-to-ground resistor) and thus can hold a close voltage tolerance. The third stage, we'll assume, uses a resistor 150 times the emitter resistor. With a gain of 150, this would hold emitter voltage at 6 V. With a gain of 100, it would drop to 4.8 V. With a gain of 225, it would rise to 7.2 V.

Now use the other approach. We design for the resistances and voltages shown in Figure 6-2.

The output stage reflects an emitter impedance of from 100 to 225 times 560 ohms (working open-circuit at the output) or from 56K to 126K. With a 500 ohm output load, this will change to a load for the emitter follower of 500 ohms in parallel with 560 ohms. The reflected impedance will now vary between 26K and 58K, according to the current gain of the stage.

First, by selection and adding suitable parallel resistors, adjust the 180 ohm value so that the value

Fig. 6-2 Putting an emitter follower before and after the stage of Fig. 1 protects it from interference by the external impedances connected to it.

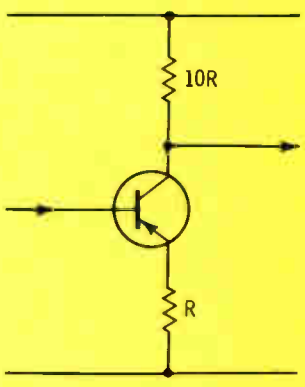
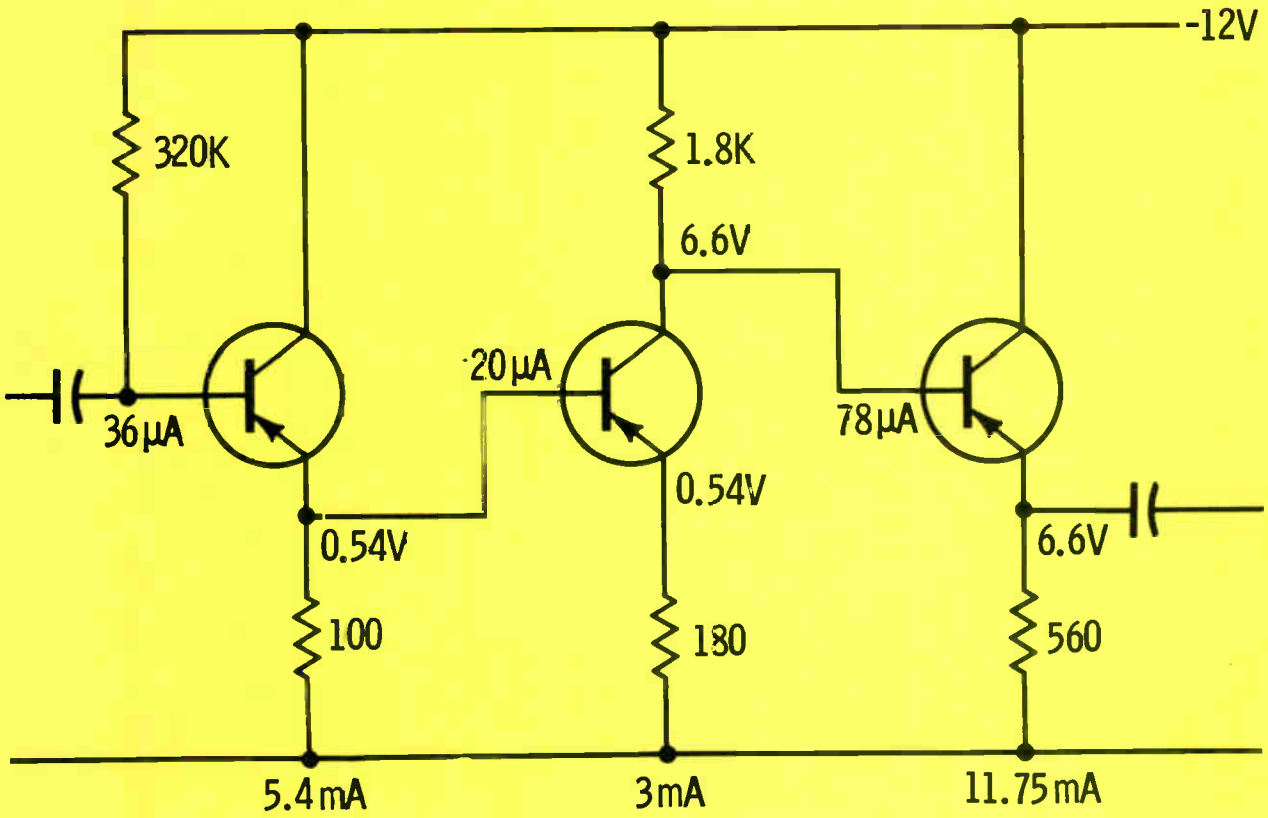


Fig. 6-1 The basic simplified circuit for achieving a voltage gain of 10:1, or 20 dB.



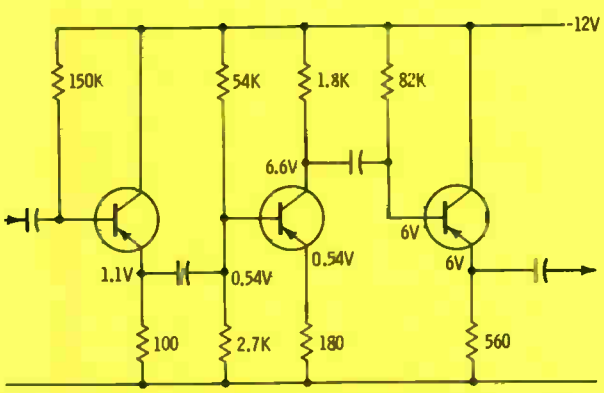


Fig. 6-3 An alternative form, using AC coupling between stages.

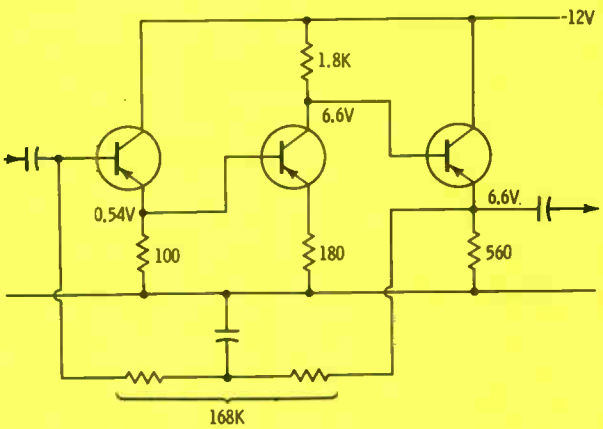


Fig. 6-4 A first try at DC feedback to minimize fluctuation of operating conditions, due to changes in current gain, in the circuit of Fig. 6-2.

of the collector, shunted by 56K (a mean value of all possibilities) is 10 times the emitter resistance value. Then gain will be 10:1 ±3.5%, or within 0.3 dB, with all likely variations of transistor gain and output loading.

Operating Conditions

Change in current gain of the first stage will cause the emitter voltage coupled to the next stage base to change from the design-voltage value of 0.54, down to 0.36 V and up to 0.81 V.

With 0.54 V on the second stage emitter, its collector will have 6.6 V. Changing the input DC voltage to this stage will change the voltage drop in the collector resistor to 3.6 V or 8.1 V, making the collector voltage vary between 8.4 V and 3.9 V respectively.

This deviation could seriously limit maximum signal capacity. With 0.54 V on the emitter and 6.6 V on the collector, the middle and output stage can handle a 5.4 V peak signal. As the input can handle 0.54 V peak, and the gain is 10, the cut-off limits coincide. At peak current, the emitter voltage will be 1.08 and the collector 1.2 V, leaving only 0.12 V across the transistor, which is probably near saturation voltage.

If input transistor current gain is 225, second stage emitter voltage will rise to 0.81 V, and its collector voltage will drop to 3.9 V. Saturation (assuming zero voltage) will be reached with a peak signal of (3.9-0.81) divided by 11, which figures to 0.28 V input, with 2.8 V output.

On the other hand, if input transistor current gain drops to 100, second stage emitter drops to 0.36 V and its collector voltage rises to 8.4 V. Peak signal, when cut-off is reached, is 0.36 V in and 3.6 V out. Either of these changes in operation point seriously reduces signal handling capacity.

Overall Feedback

One way to offset this would be to use overall feedback. For this to be effective, we need to know the input impedance. The gain will then depend critically on the external impedance connected unless a decoupling capacitor is used to render this feedback effective only to DC (Figure 6-4).

Calculate this arrangement based on stage current gain of 150 for an assumed output stage DC voltage of 6.6 V. The emitter resistor of the first stage is 100 ohms (which will reflect into the base circuit as 15K, with limits from 10K to 22.5K so 0.54 V will make the first stage collector—more importantly emitter—current 5.4 mA. With a gain of 150, the base current needs to be 36 microamps.

The voltage difference, from output emitter to input base, is 6.6-0.54 =6.06 V. So the total feedback resistance needs to drop 6.06 V at 36 microamps, requiring a value of 168K. Without bothering to figure the two parts and the decoupling value, let's see how much variation can occur due to change in current gain.

Assume 36 microamps input current and the first stage gain is only 100. Its emitter voltage will be 0.36 V, and the following stage collector and the output emitter will rise to 12—3.6=8.4 V.

As the output voltage provides exactly the input current bias, the DC feedback is very close to 6 dB, so the output voltage rise will be halved. Instead of rising from 6.6 to 8.4, it will rise from 6.6 to 7.5. The input will be about 0.45 V DC instead of 0.36 V DC, which it would be with 36 microamps and a gain of 100.

Now assume the first stage gain is 225. With 36 microamps input current, emitter current is 8.1 mA and voltage 0.81 V. Collector voltage and output emitter voltage will be 12—8.1=3.9 V. Again, the drop in bias current will reduce the input current below 36 microamps, half correcting this error. But even so, the circuit still produces considerable variation in available output swing.

Amplified Feedback

One way to overcome this is to use amplified feedback on the bias. The direct method virtually limits the DC feedback to about 6 dB. If more feedback is used, the operating point is unbalanced, which is the very thing we're most interested in correcting.

The middle stage has enough feedback between collector and emitter because it has a current gain always in excess of 100—to ensure that the collector signal voltage reproduces the base signal voltage with very low distortion. Distortion as a voltage amplifier is well cared for without the need for overall feedback.

The way to amplify DC feedback is to use a delay like the old delayed AGC. Suppose we decide to delay the bias control so that only the last 0.6 V (average) exerts any control. Figure 6-5 shows how.

The base of the fourth transistor is held at 6 V. With average current gain, the emitter is coupled to the output DC voltage through a resistor such as 6.6 V which, on the output, produces the right emitter and collector current in this transistor to correctly bias the input stage requiring 36 microamps. This makes the resistor about 15K.

With another 15K resistor in the collector feeding the input stage base, a like current with another 0.6 V drop will bias that stage. The rest of the 6 V drop, from base and emitter of the 4th transistor, occurs in the collector of that transistor, which also "takes up the slack" to correct for current gain variations.

Thus, if the input stage current gain is only 100, so that 54 microamps are needed to secure the correct operating condition, the output

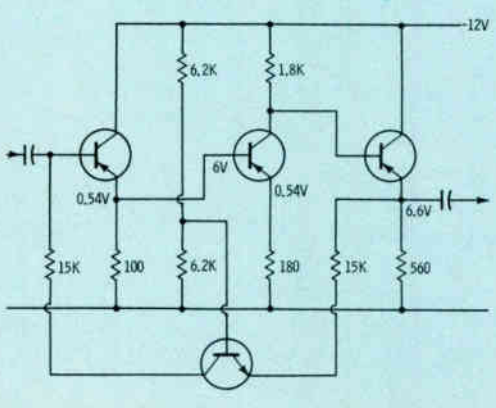
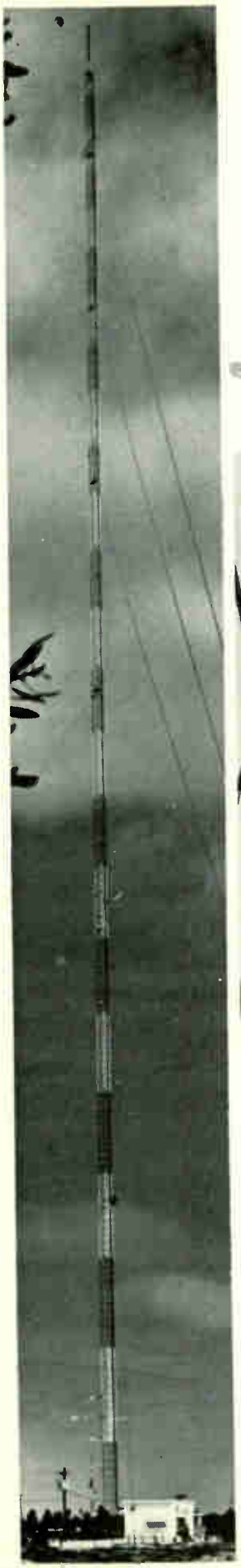


Fig. 6-5. A way of applying delayed feedback to get more precise control of operating points.



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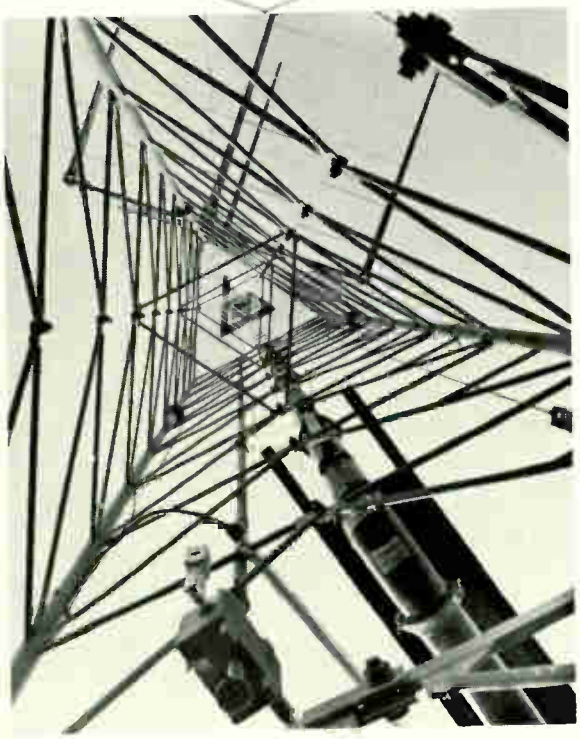

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voltage rises from 6.6 V to 6.9 V, and the 4th transistor collector from 1.08 V to 1.38 V. And if the input stage current gain rises to 225, requiring the use of 24 microamps, the output voltage drops to 6.4 V, and the 4th transistor collector to 0.88 V. This provides much closer control. Incidentally, using this delay will also help recovery from overload signals that send the amplifier into cut-off.

Now we can consider other effects. All the while the basic amplifier of Figure 6-2 is operated within its maximum signal level, it is stable, because the bias current averages the same with signal as without it. But immediately the signal runs into the cut-off region, the input base-emitter junction starts to rectify the signal, using the input capacitor as a reservoir. Consequently, it quickly biases to cut-off.

The usual remedy is a base-to-ground resistor, which could be used here. But the delayed bias circuit also helps. When cut-off occurs, second-stage collector rises to supply voltage, causing the 4th transistor to saturate. When the 15K resistance in the emitter has 6 V across it, so will the collector circuit resistance. This action expedites recovery by about a 10:1 factor.

Decoupling

If no decoupling is provided for this control circuit, let's figure its effect on signal gain. Assume the first stage has a current gain of 150. Then its transfer resistance, with 100 ohms emitter load, is 15K. With the voltage gain of 10, the transfer resistance from input to output is 150K. And the DC feedback resistor, from the output's viewpoint, is 15K (because the emitter of the 4th transistor presents a very low impedance termination for the 15K).

So the AB factor is 10, and the feedback factor 11, making about 21 dB feedback. Without decoupling, 21 dB feedback on a 20 dB amplifier won't leave much useful gain. It virtually becomes a rather elaborate phase inverter!

So we need signal decoupling. The question is, where? An obvious place is at the collector of the 4th transistor (Figure 6-6). This then allows the average output (DC) voltage to control the current through the 4th transistor, working in grounded base mode, which makes its gain 1:1 (or 100:99 perhaps), while the capacitor gets rid of the AC component.

With the 15K bias resistor, from the 4th transistor collector to input base, and the collector impedance higher than this, an electrolytic capacitor can yield quite a long time constant, providing good stability. But there is a flaw.

If the emitter is not decoupled, current will only flow in the 4th transistor during the negative-going excursions of output signal. During positive excursions, or at least the part that goes nearer to ground potential than 6V negative, the 4th transistor will not conduct. Thus, during a full amplitude, steady signal, the output DC voltage will rise from its average value of 6.6 V to an average of 7.2 V, to maintain the same stable operating point 'found' without signal. Or with minimum current gain (in the input stage), the rise would be from 6.9 V to 7.8 V.

At any rate, that operating point should fluctuate with signal is undesirable. To overcome this, decoupling should be provided on the emitter side to reduce voltage and current fluctuation during signal, at the lowest signal frequency, preventing the 4th transistor from running into cut-off. Fig. 6-7 shows this.

Undoubtedly, this will provide sufficient signal decoupling, but now a new difficulty can arise. If we didn't spot it when figuring things out, based upon experience, trying out a mock-up would soon find it. The base of the 4th transistor is 'hot' and is fed from a potentiometer across the supply voltage. So any supply ripple will be amplified and fed to the input transistor as part of its bias current. Collector decoupling eliminates this.

This suggests that as a possible solution we need decoupling in both places. But when we put decoupling both places, we may find a bounce condition any time the circuit is disturbed—both when the amplifier is first energized, and at anytime a maximum signal pushes the circuit so it momentarily reaches cut-off.

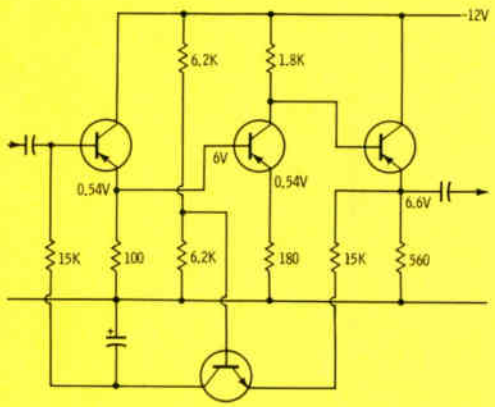


Fig. 6-6 First way to provide decoupling to the circuit of Fig. 6-5, so it operates at the signal gain determined by the middle stage.

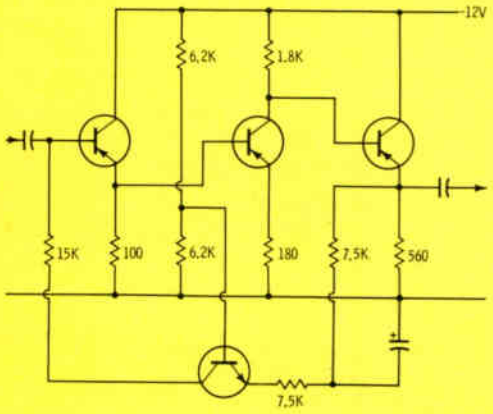
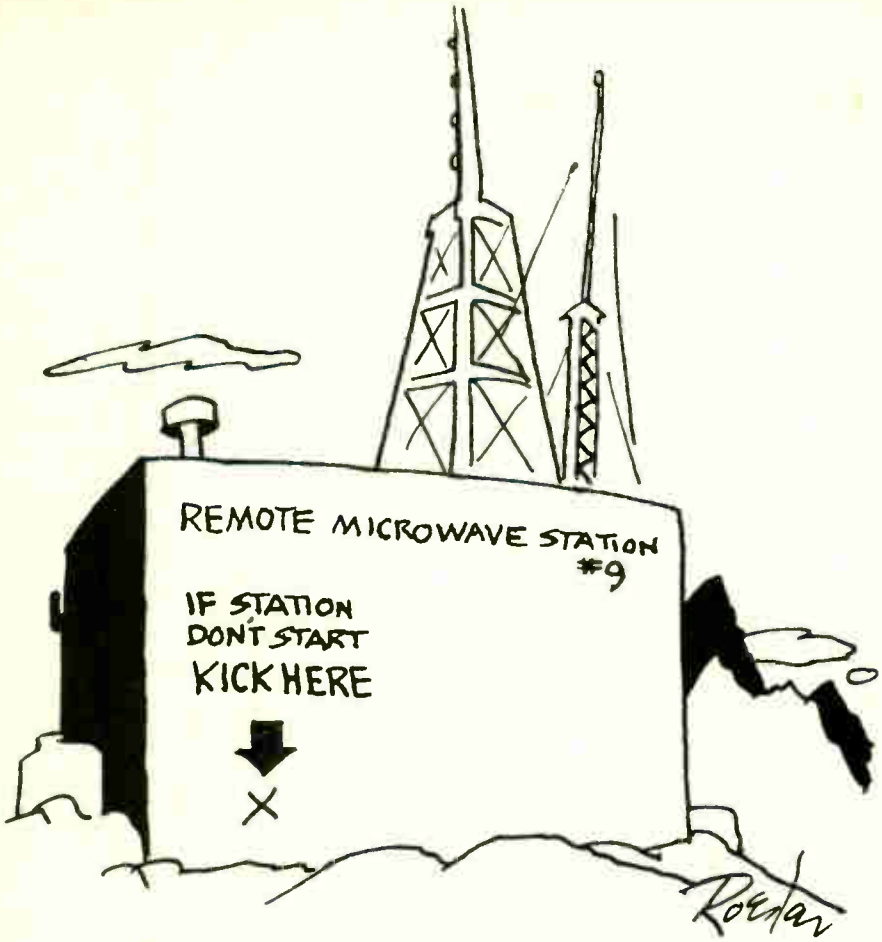


Fig. 6-7 Another way to provide decoupling. Each method overcomes some problems and leaves others. Should both be combined?



For this, the two decoupling circuits must be treated as very low-frequency, low-pass elements.

With 21 dB feedback (which still operates down near DC) the ratio of decoupling time constants to positively avoid any bounce, needs to be about 20:1. If one of them is 1 second, the other should be no greater than 50 milliseconds.

Emitter Decoupling

Suppose we make the emitter decoupling 1 second, because we need all the attenuation to signals we can get this point. If each resistor is 7.5K, the effective parallel value is 3.75K, requiring 250 mfd (12 V working) to yield a time constant of about 0.94 second.

At 20 Hz, a 250 mfd capacitor has a reactance of about 40 ohms. In conjunction with the first 7.5K from the output, this would adequately attenuate the output signal, so that at this junction it would never go positive of the 4th transistor's emitter.

If the collector decoupling is made 1 second and this one no more than 50 milliseconds, using about 12 mfd, the reactance at 20 Hz is 800 ohms, which could allow the 4th transistor emitter to run into cut-off on a full amplitude low-frequency signal.

So the emitter decoupling must use the longer time constant, and the collector decoupling time constant should be about 40 milliseconds (allowing a margin, because the other is less than 1 second), which, with 15K, requires about 2.5 mfd. This will produce a reactance of about 1,000 ohms at 60 Hz, and thus will not provide too much attenuation for any ripple signal that may be amplified by the 4th transistor.

This problem leads to a third possibility. Instead of decoupling the emitter circuit to either ground or supply negative (either of which might produce more problems, augmenting or offsetting the ones mentioned), decouple the emitter to base, which is nominally grounded (Fig. 6-8).

Now, in the signal range—also over the ripple range—emitter and base are coupled. This means the whole transistor 'floats' as an entity, to signal and whatever ripple appears at its base, and merely does its controlling virtually at DC. Now a collector bypass with 40 or 50 millisecond time constant might be adequate.

At this point another factor helps. In the signal range, ignoring the collector decoupling (which does not reflect materially), the emitter bypass now couples the 7.5K resistor from the output to the junction of the two 6.2K resistors, yielding an AC impedance at this point of 3.1K.

Decoupling Action

So the emitter decoupling has a double action: as well as reducing emitter swing, it applies an offsetting swing to the base, allowing the whole transistor to swing at signal voltage—to be precise, at 3.1/10.6, or about 3/10 of the output signal.

This means the action of the decoupling will be like a step, or shelf equalizer circuit. The beginning of the roll-off will occur where the time constant of the capacitor with its total series resistance of about 10.6K puts it. This means 100 mfd will now give slightly more than 1 second.

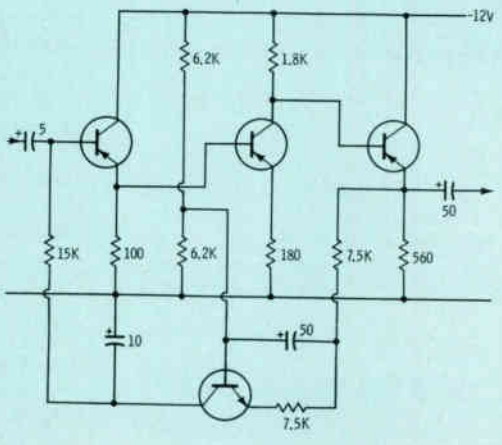


Fig. 6-8 The improvement eventually arrived at, with all values finally calculated.

And because this acts like a step circuit, the overall effect, with the collector decoupling added, is like 2 roll-offs and a roll-up. With 100 mfd, making the roll-off at 1 second, the roll-up would be 300 milliseconds. So, provided the collector decoupling time constant is less than 300 milliseconds (rather than 40 or 50, as before), there can be no peak or bounce, because the roll-up will offset its roll-off, before it starts to act. With 15K, 20 mfd will give 300 milliseconds.

This is moving toward more comfortable values, but with this arrangement, even these time constants may be unnecessarily long. Probably 50 mfd, to give 500 milliseconds on the emitter-base decoupling, and 10 mfd, to give 150 milliseconds on the collector, will be quite adequate. The important thing is to watch that you stay out of the bounce region. Unless you sit down and carefully figure it out, this can be a very frustrating thing to try to do, by cut and try. You always seem to move any value you try changing in the wrong direction—or I do!

Capacitors Needed

Finally, to complete the design, we need values for input and output capacitors. The input feeds into minimum total impedance of 10K reflected by the base, in parallel with 15K bias resistor, which makes 6K. If we want to stay within 0.5 dB down to 20 Hz, the 3 dB point of each coupling capacitor should be at 5 Hz. A reactance of 6K at 5 Hz requires a capacitor of 5 mfd.

For the output, we assume the minimum external impedance is 500 ohms. The internal impedance is negligible (at maximum it's about 1.8K divided by 100, or 18 ohms). So the output capacitor should have a reactance of 500 ohms at 5 Hz, requiring 60 mfd. Probably 50 mfd is adequate. If the external impedance is higher than 500 ohms, the performance will be that much improved.

This example was deliberately chosen to illustrate some aspects of feedback that are not always understood: the kind of feedback that doesn't involve what we usually regard as signal. The circuit could have been designed some other way, no doubt, but as we said at the beginning it proved a useful exercise.

Denver Announces Novel TV Plan

A novel plan to televise major disaster scenes and disturbances from a helicopter and a mobile van for simultaneous viewing by Denver, Colorado, fire, police and other officials at 37 separate locations was announced today.

An initial step toward creating the microwave-frequency broadcast system was the signing by Denver Mayor William H. McNichols, Jr., and county authorities of a contract for RCA television cameras and other studio items, a TV transmitter and receivers.

The system will permit Gov. John A. Love, along with Mayor McNichols and other city-county government and public safety officials, to monitor TV pictures of emergency situations and to take immediate action, using two-way radio for on-the-scene communications. Because they are transmitted at high frequencies, the broadcasts will not be viewable on home receivers.

As conceived by Denver authorities, the long-range plan calls for equipping a helicopter with a small TV camera, fitted with a zoom-type lens, for making closeups of trouble spots. On the ground, the TV van would carry a camera capable of use in a fire-fighting "cherry picker" bucket.

In its first stage, the Denver system will operate from a professionally-equipped studio to be established in a Fire Department facility. Two TV cameras, a TV tape recorder and an audio-video switching system are among the items scheduled for installation there.

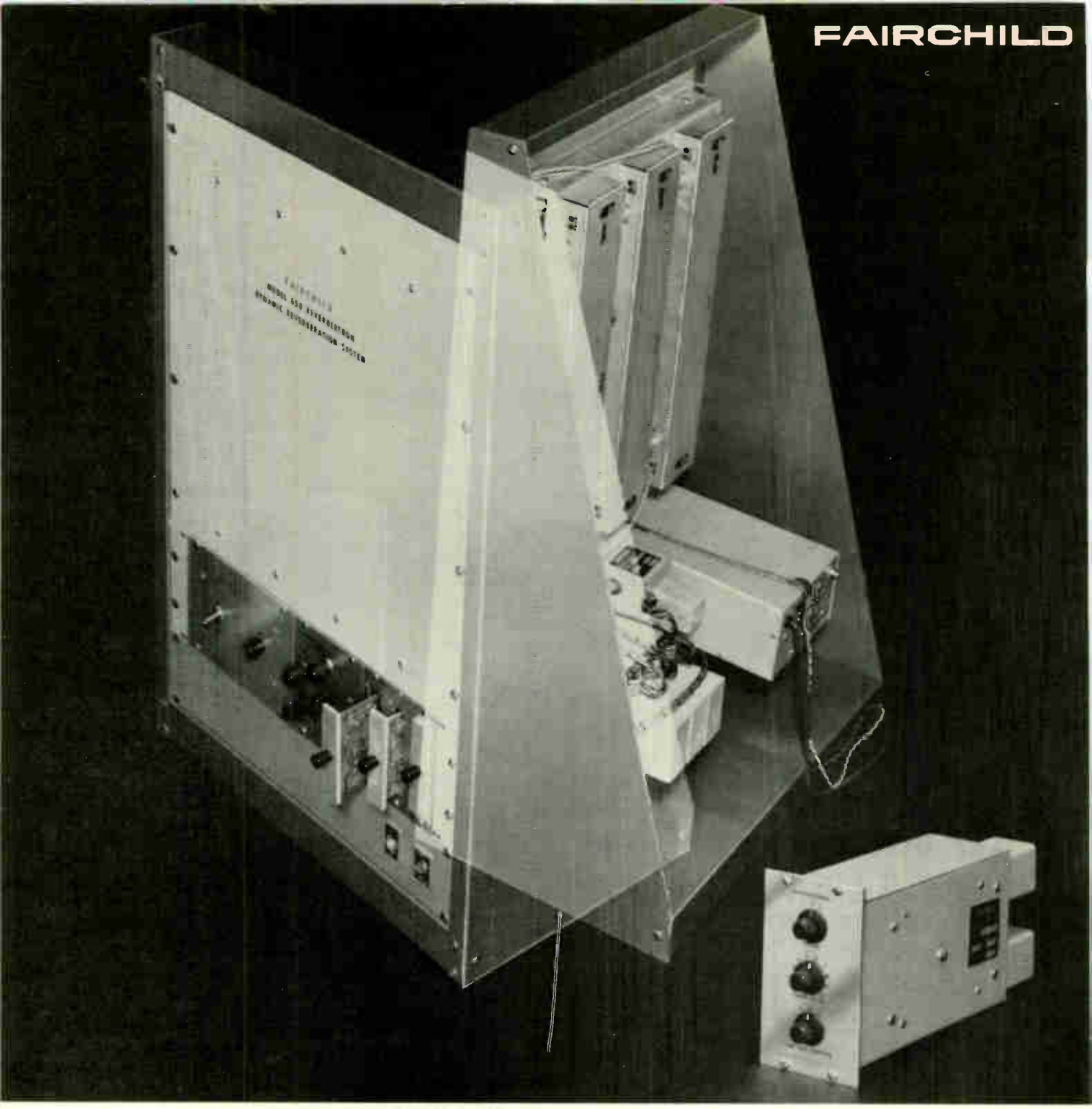
The studio will be used for originating training courses, special events and other programs for relay to the viewing locations. Broadcasts will be made over a 2500-megahertz frequency which, in effect, makes the system "closed circuit" since TV signals at those frequencies cannot be picked up by a standard receiver. A "down converter" at each receiving point will change the incoming signal so it can be viewed on a standard TV receiver.

Denver officials said that the system is being funded by interested foundations and businesses. The Federal Government has allocated $42,000 to Colorado, under the omnibus safe streets act, which amount Governor Love assigned to the new TV system.

Court Reverses FCC Grant to CATV

The United States Court of Appeals for the District of Columbia Circuit has reversed Commission orders granting Laramie Plains Antenna TV Association, Inc. permission to rebroadcast, via translator stations, signals of three Denver, Colorado, network affiliated stations, without providing non-duplication protection for KFBC-TV, Cheyenne, Wyoming, and denying a request for reconsideration of the grant.

The appeal was brought by Frontier Broadcasting Company, licensee of KFBC-TV. The Commission granted the translator application on July 3, 1967. It denied a Frontier request for a show cause order on December 22, 1967. The Court ordered this action vacated. The Court stayed its order for ten days to permit filing for remand.



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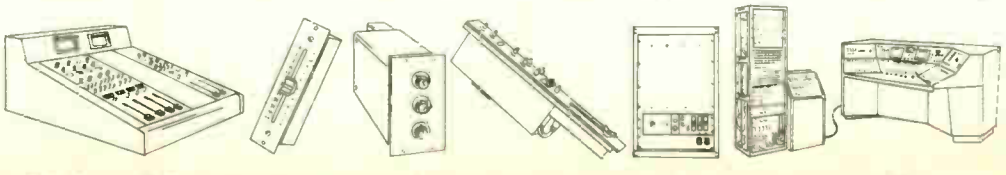


DESKTOP MODULE CONSOLE / LUMITEN / REVERBERTRON 658B / INTEGRATED CONTROL MODULE / REVERBERTRON 658A / REMOTE AUDIO CONSOLE

Marshall University Gets New Station On UHF Channel 33

WMUL-TV, a new educational TV station is being established on the Marshall University campus in Huntington, W. Va.

According to Richard Settle, general manager, the new UHF station will carry both instructional and public TV programming when broadcasts begin early next summer on Channel 33.

He said that some programs will be originated in color through the use of a complete color film system and three of the newly-announced type TR-60 high-band color TV tape recorders. The studio equipment complement also includes "live" and film cameras for monochrome programming.

The campus studios will be linked by microwave to the transmitting site, approximately twelve miles from Huntington, where a 30-kilowatt transmitter and a pylon-type broadcast antenna will be installed.

Some of the technical equipment will be used in an auxiliary studio at Nitro, W. Va., near Charleston, where program production will start next April in preparation for the on-air date, Settle said.

The station will be operated by Marshall University and Associates Broadcasting, an organization created by the West Virginia Educational Broadcasting Authority through appointment of members from the University and from the boards of education of Cabell, Wayne and Kanawha counties. A new telecommunications center will be built on the University campus as the station's permanent home.

NAEB Elects Eight To Board of Directors

Eight individual members of the National Association of Educational Broadcasters have been elected to the board of directors of the NAEB's Instructional and Professional Systems Division, Robert Maull, IPS executive director, announced today.

Elected to three-year terms are: Kenneth L. Warren, Instructional Materials and Equipment Services, Oregon State System of Higher Education, Corvallis; Rev. John M. Culkin, S.J., director, Center for Communications, Fordham University, New York City; James S. Miles, director, TV Unit, Purdue University, West Lafayette, Indiana, and Erling S. Jorgensen, associate director, Instructional Media Center, and director, Closed-Circuit Television, Michigan State University, East Lansing, Michigan.

Elected to two-year terms on the IPS board are: Wanda B. Mitchell, Evanston Township High School, Evanston, Illinois; Dr. Lark O. Daniel, executive director, Southern Educational Communications Association, Columbia, South Carolina; Harold Hill, associate director, Bureau of Audiovisual Instruction, University of Colorado, Boulder, and Brother Raymond Fleck, president, St. Edward's University, Austin, Texas.

INDUSTRY CALENDAR

APRIL

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

28-30 Annual meeting, Canadian Association of Broadcasters at MacDonald and Lacombe hotels, Edmonton, Alberta.

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

MAY

1 Deadline for submission of working title for those planning to present papers at the 1969 Joint MCAD Conference, Address SIAM, 33 South 17th St., Philadelphia, Pa. 19103.

5- 7 Kentucky Broadcasters Association spring convention, held at Sheraton Seelbach hotel, Louisville.

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

7- 8 Annual spring meeting of the Pennsylvania Community Antenna Television Association will be held at Allentown, Pa.

7- 9 Regional conference co-sponsored by National Association of Educational Broadcasters and Southern Educational Communications Association. Dedication ceremonies of Kentucky ETV Network at Phoenix Hotel, Lexington.

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

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

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

12-15 National Community Antenna Television Association of Canada to be held at Le Chateau Frontenac, Quebec.

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

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

23-25 Date for spring meeting of Illinois News Broadcasters Association to be held at Wagon Wheel Lodge, Rockton, Ill.

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

NAEB Meets May 7-9

A Region II conference sponsored jointly by the National Association of Educational Broadcasters and The Southern Educational Communication Association will be held May 7-9 in Lexington, Kentucky, at the Phoenix Hotel.

Highlights of the conference will be a Governor's Reception hosted by Governor and Mrs. Louis B. Nunn, May 9, and an Invitational Dedication Dinner. O. Leonard Press, host chairman for the meeting and executive director of the Kentucky ETV Network said that the dinner will serve as the formal dedication of the network which began its air time in September, 1968.

Activities for the three-day conference include general meetings; professional interest section meetings; a tour of the network production center; luncheons and dinners at race tracks in the Lexington area, and a tour of the Calumet horse farm. Registration will take place in the afternoon of May 7 at the Phoenix Hotel.

Ceremonies will be broadcast live and in color throughout the state via the 12 transmitter facility. This is the first time that exhibits will be included at an NAEB regional meeting. Broadcast hardware and instructional materials will be on display in an exhibit area at the Phoenix.

NAEB president, William G. Harley, announced recently that a grant of $65,000 has been made by the Corporation for Public Broadcasting, to expand the activities of the National Association of Educational Broadcasters' National Educational Radio Network.

Frank Pace, Jr., CPB chairman, described the grant as a "modest beginning" which will lead to increased activity based upon what the CPB learns from a study of public radio nearing completion.

Two significant improvements, among others, that the grant will make possible are an increase in the program offerings on NERN, which is now limited to five hours per week, and opening the way for NERN to make grants to affiliated stations for the production of programs for national distribution.

"We are especially pleased that the first educational radio grant made by the Corporation for Public Broadcasting is to the nation's oldest established tape network program service," Harley said. "The CPB's indication of confidence in the long-range future of the NERN is equally as important as the dollars themselves."

NERN executive director, Robert Mott, stated that "The money will be spent to bring maximum benefit to educational radio stations and their audiences with the bulk of the funds earmarked for program acquisition and development." He stressed that the programs developed will "identify and suggest solutions for regional and national social problems. We know that educational radio can inform and alert the public to these problems and that an informed public will respond."

According to Mott, other plans in the offing for NERN include the purchasing of audio tape stock as well as packaging and shipping materials for program distribution.

Contract Announced To Purchase Stations

Lloyd S. Smith, executive vice-president of the Rau Radio Stations, has announced that a contract has been signed for the purchase of Radio Stations WFMI and WFMI-FM, Montgomery, Alabama, from Fine Music, Inc., the stations' present operators. Purchase is subject to the approval of the Federal Communications Commission.

WFMI and WFMI-FM will become one of the Rau Radio Stations which is headed by Henry Rau, president. Other stations in the Rau Radio organization are WARK-AM, FM, Hagerstown, Maryland, WATO-AM & FM, Oak Ridge, Tennessee, WDOV-AM, FM, Dover, Delaware and WNAV-AM, FM, Annapolis, Maryland. The organization also operates Delaware Teleservice Company, a cable TV operation serving the Delaware towns of Dover, Camden, Wyoming and Smyrna.

Investigation Of TV News Coverage Continues

The FCC has written television networks that it finds no substantial basis to conclude that they failed to give reasonable opportunity for presentation of contrasting viewpoints in their coverage of the Democratic National Convention. However, it is continuing to investigate reports of "distorting or staging the news."

The letter was an evaluation following submission of network comments on a Commission letter to them last September 13 about hundreds of complaints to the FCC on TV coverage of the convention. It was addressed to American Broadcasting Co., Columbia Broadcasting System Inc. and National Broadcasting Co. Inc.

The Commission reviewed the working of its Fairness Doctrine in coverage of controversial issues of public importance by broadcast licensees. The Fairness Doctrine, prescribed in Section 315(a) of the Communications Act, requires a licensee covering an issue of public importance to afford a reasonable opportunity for presentation of contrasting viewpoints. "The sole function of the Fairness Doctrine is to maintain broadcasting as a medium of free speech not just for a relatively few licensees, but for all the American people," the Commission wrote.

The Commission pointed out that it does not sit as a review body to examine broadcast news for the purpose of determining whether it is "the truth," because this would take it into the area of censorship.

On the question of the opportunity given to presentation of contrasting viewpoints, the Commission mentioned issues at the convention such as the Vietnam war and civil disorders in Chicago. It cited coverage of podium debate on the war and interviews with spokesmen for both sides.

On civil disorders, it said the NBC response, for example, showed "significant and reasonable" presentation of provocation by demonstrators "and that the leading spokesman for one side, Mayor Daley, was afforded opportunity to appear." The Commission found no further action to be warranted on this aspect of the inquiry.

FCC Proposes Amendment Of Rules Governing CARS

Amendment of the rules governing Community Antenna Relay Stations (CARS), proposing to accommodate a local distribution service for CATV systems in the 12-7-12-95 gigaHertz band, has been advanced by the Commission in a Notice of Proposed Rule Making. In a related matter, the Commission has told Hughes Aircraft Company that its proposal for such a local distribution service would not be permissible under present CARS rules.

The proposed rule making would be by amendment to Part 74, Subpart J of the Rules. The Commission said it appeared that amendment of Section 74.1061 "and perhaps other sections of the rules governing the CARS service" might be appropriate if a local distribution service is to be authorized in this band.

The Commission, in an order released May 20, 1968, denied a petition by Teleprompter Corporation, New York, New York, for rule making to allocate frequencies in the 18 GHz band for a high capacity, local distribution communications service to be used with CATV systems. In this order, the Commission invited Teleprompter to explore the practicability of including such a service in the 12.7-12.95 GHz band shared by CARS.

Hughes Aircraft, which developed the equipment Teleprompter proposed to use at 18 GHz, is now considering developing and manufacturing equipment for a local distribution service in the 12.7-12.95 GHz band. It proposes single side-band, amplitude modulation, video transmission equipment with accompanying FM sound-utilizing channels 6 MHz wide—to transmit TV signals and related audio signals by CATV stations.

The Commission stated that rule making is appropriate to allow comments by community antenna relay and broadcast auxiliary interests. Interested persons were asked to consider if more than one transmitter site is needed to serve a single area; if, in a single system serving a single area from a single transmitter site, the transmitters should be operated on an adjacent or alternate channel basis; whether, if the use of an adjacent channel basis is practicable, it should be required; and whether it is practical in some areas to obtain local signals at the receiving sites. Deadline for comments was March 14, 1969, and for reply comments, April 14, 1969.

Want More Coverage?

Send your news to:

The Editor
Broadcast Engineering
1014 Wyandotte
Kansas City, Mo. 64105

NEW PRODUCTS

The National Association of Broadcasters late March convention was the showplace for a host of new products. As reported in the March issue, some manufacturers preferred to introduce their latest lines at the show, rather than being published before the convention. In the May issue of **Broadcast Engineering** some of the new pieces of equipment introduced at the convention will be covered.

(82)

Sony Corporation of America demonstrated their new compact color TV camera during February at the American Association of School Administrators annual convention in Atlantic City.

The new camera, to be called the model EDC 1000, weighs 29 pounds. Its three controls make the camera easy to operate. Using a single light-color level control, the solid-state camera has a built-in encoder to obtain a direct NTSC signal.

Despite the compactness and simplicity, Sony spokesmen say the EDC 1000 offers versatility and picture quality usually associated with larger cameras. It is equipped with a four-inch viewfinder, an f.2 lens capable of zooming from 16.5mm to 94mm, and two vidicons that produce good color resolution even at light levels as low as 150-foot candles. It also has a built-in and intercom system.

The system consists of two units —the camera and a color sync unit. The sync unit automatically controls at distances from the camera up to 165 feet.

(83)

Gotham Audio Corporation is now offering a new pulse-duration-modulation unit. It provides a technical solution to the problem of controlling the compressor characteristics. The EMT 156 can work as a compressor, limiter or a combination of the two. The recovery time can be made varied for the function of the program material.

Another feature of the EMT 156 is that it avoids the usual rise in background noise (hiss) during signal pauses. The limiting threshold, threshold of compression, compression ratio, compression, compression threshold for low levels, and expansion for low levels are all individually and continuously controlled.

In the automatic mode, an analog computer built into the EMT 156 controls the recovery time so that it is a function of the program material.

(84)

Collins Radio Company has introduced their 900F-1 SCA monitor that is capable of displaying the characteristics and frequency error of a 67 KHz SCA subcarrier.

Frequency error from the desired frequency or peak frequency deviation (modulation level) is displayed

by a meter. Two additional monitoring outputs are provided; a 600-ohm audio output for monitoring applications or distortion measurements, and an output to indicate carrier presence.

Requiring 5¼ inches of space in a standard 19-inch rack, the 900F-1 has removable top and bottom panels. The unit is FCC approved for use with Collins 900C-2, 900C-3 and 900C-3A FM modulation monitors.

(85)

Visual Electronics Corporation showed their new three-tube color camera at the NAB March meeting. The three-tube Plumbicon color camera can be used for either studio or field work. It weighs only 90 pounds (head only, plus 20 pounds for the removable 10.1 zoom lens).

The camera features simplicity, high color quality, maximum sensitivity and improved performance through the use of parallel yokes and EMI printed circuit yokes. Other features include temperature-compensated gamma circuits and extensive use of integrated circuits.

(86)

International Video Corporation has recently introduced their IVC-600 series of portable videotape recorders. The low cost recorders should be compatible with closed-circuit television operations.

Designed specifically for color operation, the IVC-600 videotape recorders achieve their recorded picture through a 4.2 MHz bandwidth. Fixed entry and exit tape guides permit ease of threading and insure compatibility with all other recorders using the IVC Format.

All IVC videotape recorders feature ferrite recording heads. Pulse interval modulation provides a high signal-to-noise ratio and good frequency response. Fast forward and rewind time for the new recorders is less than four minutes. A sensor switch in the tape path cuts power and disengages the capstan when the tape runs out, eliminating capstan and pinch roller damage.

(87)

CCA Electronics Corporation now has available a 10-channel stereo console and a 10 fader, dual channel monaural console. Both of these units utilize Altec components in all of their major sections.

The March NAB CCA display was really a "mini-Nab." The company represents Sparta, Spotmaster, CBS, Magnecord, Scully, Ampex and their recently acquired QRK Electronics. QRK will operate as a wholly owned subsidiary of CCA Electronics.

(88)

An automatic device for displaying messages and pictures on the TV screen has been developed by **Tele-Mation, Inc.,** Salt Lake City manufacturer of specialized television equipment.

The Message Channel, Model TMM-300, handles 24 different message units. Used as a TV "bulletin board," the Message Channel displays public service announcements, advertising messages and photographs on 3″ by 5″ cards. The data can be carried on a separate channel or integrated into other programming.

Message Channel may be set to run consecutively throughout the entire range of cards; to remain stationary in any one position, or to repeat-scan a given number of card slots. Manual operation is also possible, either from the control panel or by remote control.

(89)

Central Dynamics Ltd. of Montreal, Canada, has recently completed the design and development of fully automatic videotape editing equipment for use in the production of television programs. The machine was developed entirely in the company's laboratories in Montreal.

It employs the latest electronic circuit techniques and enables one operator to edit television recordings with precision and speed. Tape editing equipment is used for electronically joining together all the individual shots that go to make a TV production such as Rowan & Martin's 'Laugh-in'.

(90)

The new **Cohu Electronics** 2600 Series Background Generator provides a composite and/or non-composite video signal which is adjustable from mono-black or color-black through all shades of gray to white and all of the colors of the NTSC color spectrum. The remote control panel provides finger-tip selection of output mode (monochrome or color) and adjustment of hue, saturation and luminance.

Cohu's Background Generator consists of a remote control and a

plug-in circuit module. The remote control is 3.6 inches high by 3.6 inches wide and is designed to be mounted in a console. The circuit module plugs into a frame that occupies 1-¾ inches of vertical space in a standard 19 inch rack. Up to three circuit modules (Background Generators, Black Burst Generators, or any combination of each) can be used in one frame, which is a modular plug-in power supply.

(91)

Microwave Associates has introduced a completely solid-state CARS band CATV microwave TV relay system for the 12.7 to 12.95 GHz band.

Automatic video-presence detection circuitry turns the microwave transmitter on and off with the broadcast signal to provide the control required by FCC CARS Band regulations.

The MA-13 BX system is crystal controlled to eliminate drift. Transmitter power output exceeds 100 MW; typical output is 150 MW. Receiver noise figure is 12 dB with optional low noise preamplifier.

The system features wide band circuit design, providing color television in single or multiple hop repeater use with performance exceeding 60 dB video signal to noise and differential gain of 0.5 dB and differential phase of ±0.5°.

(92)

Anderson Laboratories has developed a chrominance delay equalizer that will eliminate cable trimming. This is a unity gain variable delay channel designed to delay-equalize video signals over a full 5 MHz bandwidth.

The unit permits continuous adjustment of delay over an interval exceeding 280 nanoseconds, which corresponds to greater than 360 degrees of color subcarrier phase.

The continuous delay adjustment and unit flexibility in routing signals eliminates the need to operate within the constraint of fixed signal paths for every show.

(93)

Nortronics Company, Inc., is now showing a new line of tape heads called the 9000 series. These heads are designed for longer life and offer a smooth low end response down to 20 Hz, and a good high end response.

The ¼-inch heads have the same case size as the original 8000 series and feature an all metal hyperbolic face for reduced oxide loading and intimate tape contact.

(94)

AKG microphones have just announced the introduction of a new microphone, the D-190E to their growing mike line.

This most recent addition, a cardioid dynamic type, incorporates a finely tuned microphone system capable of objective, effortless sound transmission over the entire audible range. And its directionality, eliminating pick-up of sound from the rear, and response over a wide range without peaks, offers good feed-back cancellation.

The AKG D-190E is equipped with a sintered bronze cap which eliminates the disturbing effects of wind and breath air turbulence and also prevents moisture from reaching the microphone system. The microphone system is shock mounted and isolated from the microphone housing, thereby reducing handling noise and minimizing possible impact damage.

Engineers' Exchange

Modulation Monitor Calibration

I have missed the Engineer's Exchange department in your magazine lately. I would like to submit this item in that category.

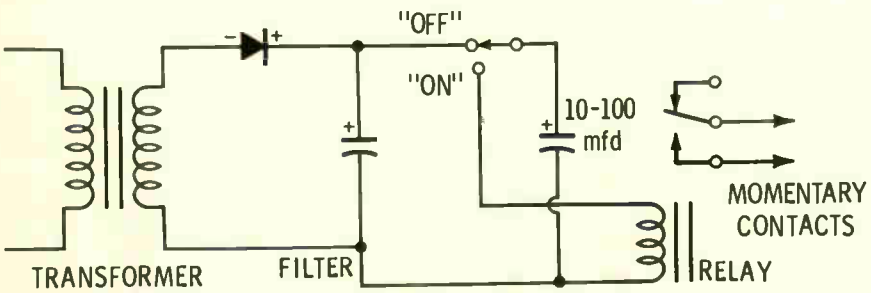
Older modulation monitors often lose their calibration as tubes, transistors and other components change their values with age. Before conducting a proof, the engineer should check his monitor calibration, especially when old tubes or components are replaced. Just follow this procedure:

1. Adjust the unmodulated wave on the scope to a band precisely 4 cm wide.
2. Modulate the transmitter with a 400 Hz tone until the peaks are 6 cm and the valleys are 2 cm apart.
3. Calibrate the percent modulation meter.

It is assumed that before this procedure is used, the mechanical and electrical zero sets will have already been adjusted. Some transmitters will not modulate up to 100 per cent. With others it often is difficult on the scope when 100 per cent is reached, because positive peaks sometimes flatten at around 95 per cent.

Paul Schuet
Station Engineer, KWG
Stockton, Calif.

Remote Cartridge Starting



Many stations remote the turntable power switches to the board channel switches. A slave relay, controlled by the remote switch, makes this easy. Remoting cartridge starting to the board presents a problem, as most cartridge machines (and solenoid operated tape machines) require a momentary closure.

The circuit shows how to add a momentary closure to any switch which has unused S.P.D.T. contacts available. When the switch is off, the electrolytic capacitor charges. Closing the switch discharges the capacitor through the relay coil, closing the relay momentarily. The relay cannot close again until the switch is turned to its off position, allowing the capacitor to recharge.

A 2500 ohm plate circuit relay works well with a 25 volt transformer and suitable rectifier. Choose an electrolytic with enough capacitance for solid closure of the relay. I used capacitors ranging in value from 10 to 100 mfd., so the exact value is not critical. Avoid grounding the relay, capacitor and power supply to audio ground, to avoid inductive clicks.

Alternately, a 10,000 ohm plate circuit relay will operate directly from rectified 117 volts AC without any transformer. Use a 200 volt electrolytic.

The filter capacitor shown is not essential, but keeps pulsating DC out of the board's interior by smoothing the DC when the board's channel switch is turned on. This capacitor, too, is not critical: 10 to 100 mfd. at a voltage rating above the peak DC voltage.

Ronald Pesha
Chief Engineer, KLWN
Lawrence, Kansas

PEOPLE IN THE NEWS

WDKC of Albany has announced its new slate of personnel. Effective on December 1, 1968, **Ed McKee** was made Operations Manager of the station. McKee is also the air personality of the 11 a.m. to 3 p.m. spot.

On that date also, **John McCulloch** became the air personality of the 3 p.m. to 8 p.m. spot.

A late January addition was **George Boyce** who takes over the 6 a.m. to 11 a.m. time. Boyce also has the responsibility of WDKC Music Director.

Also as of late January, **Dick Bennett** became the air personality of the WDKC 8 p.m. to 2 a.m. time slot.

Lowell H. Harris of WSBT AM-FM-TV, South Tribune Stations, retired in late January from 32 years of service with the stations. For the past several years Harris has been station transmitter engineer.

Vincent T. Wasilewski, president of the National Association of Broadcasters, has announced the appointment of **David H. Polinger,** president and general manager of WTFM, New York City, as chairman of NAB's FM Radio Committee.

Polinger, who has been a member of the FM Radio Committee since 1966, began his broadcasting career in 1947 in Durham, North Carolina. After graduating from Duke University, he became program director of WDUK in Durham.

In 1950, Polinger was appointed assistant station manager of WPAM, Pottsville, Pa.

John Alexander, station manager, WFLA, Tampa, Fla., recently was named Chairman of the Radio Code Board of the National Association of Broadcasters.

Alexander, already a member of the Board, was appointed Chairman by NAB president **Vincent T. Wasilewski,** and his appointment was ratified by the Radio Board of Directors in session here.

He succeeds **Richard M. Brown,** president of KPOJ, Portland, Ore., who is completing his maximum service of four years on the Code Board. The appointment is effective at the close of the NAB's Convention in Washington, D.C., on March 26.

..Wasilewski appointed and the Board ratified three new members: George A. Foulkes, president, WAAC, Terre Haute, Ind., succeeding Brown; Tom Harrell, president, WSTP (AM-FM), Salisbury, N.C., succeeding Morton H. Henkin, president, KSOO, Sioux Falls, S.D.; Robert Wells, president KIUL, Garden City, Kans., succeeding James H. Quello, station manager, WJR, Detroit, Mich; and Mrs. Jason T. Pate, president of WASA, Havre de Grace, Md., reappointed for a second two-year term.

Dick Doty and **Jere Pierce,** two familiar newscasters to south Florida televsion viewers, have teamed up to "anchor" the 6:00 p.m. Gold Coast News each evening on WSMS-TV, Channel 51. The Fort Lauderdale station went on the air in late November.

Pierce, who has been named Channel 51 news director, was Broward bureau chief for Miami's Channel 7 for several years. Before that, he was a reporter for Channel 4.

Doty is president of a Fort Lauderdale public relations agency and assumed the TV-51 assignment as an extracurricular activity. Like Pierce, he also headed news operations in Broward for a Miami station, serving from 1962 until mid-1967 as Channel 4's chief of operations in Broward and Palm Beach counties. Prior to that, he was owner, general manager and program executive with several Florida and New York state radio stations.

Doty's broadcast news experience goes back to just after World War II and included a four-year stint in the 1950's as a commentator with the National Broadcasting Company. He was "anchor man" on NBC's World News Roundup.

Election of **Edward R. Wallace** as a corporate vice-president has been announced by **Edward J. Gerrity, Jr.,** senior vice-president and director of Corporation Relations and Advertising of the International Telephone and Telegraph Corporation.

Prior to joining ITT, Wallace was director of news and special events and program manager for the National Broadcasting Company in Philadelphia. Previously, he had been director of news and special events for NBC in Cleveland, Ohio.

Wallace joined ITT in January 1958, as manager of Special Events. Subsequently, he became manager of News Services, later director of Public Relations for North America and in 1965 was appointed worldwide director of Public Relations for the Corporation.

PEOPLE IN THE NEWS

New chairmen and members of Educational Television committees have been named for 1969.

Jack G. McBride, KUON-TV, Lincoln, Nebraska, ETS Board Chairman, announced the following newly-named committee chairmen:

James L. Loper, KCET-TV, Los Angeles, Labor; **William J. Lamb,** WNDT-TV, New York, Copyright, and **William J. Ballard,** WUCM-TV, Delta College, Michigan, CATV.

Officers elected to the Council of State Educational Telecommunications Authorities are:

Frederick Breitenfeld, Jr., Maryland Educational Cultural Broadcasting Commission, Baltimore, chairman; **Luke F. Lamb,** University of Wisconsin, Madison, vice-chairman; **C. H. Logan,** North Dakota State University, Fargo, Secretary, **Harry Brawley,** West Virginia Educational Broadcasting Authority, Charleston, Treasurer.

Phillip Allen, staff announcer at WTTN, Trenton, joins Kaiser Broadcasting's WKBS TV, Philadelphia in a similar capacity. Previously Allen was an announcer at WDVR, Philadelphia; WBUD, Trenton, and WPIX and WPAT, New York.

Clyde Shinazy has been named manager of the far western region by the construction department of the CATV Systems Division, Jerrold Electronics Corporation.

He is responsible for building cable television systems in the ten far western states on the continent, plus Hawaii and Alaska.

According to **Charlie Hodges,** Jerrold's superintendent of construction, the appointment of Shinazy rounds out a new nationwide regional construction organization. **Lemon Pace,** Wichita, heads the midwestern region; **Karl Daus,** Philadelphia, the northeastern region; and **Walt Donehew,** Atlanta, the southeastern region.

Frederic W. Constant, station accounting manager WKBF TV, Cleveland, is promoted to station controller at WKBD TV, Detroit while retaining supervisory responsibilities at WKBF TV. Both are Kaiser stations.

Constant joined Kaiser/Cleveland a year ago from WMHT-TV, Albany-Schenectady-Troy where he was business manager. Before that time he was on the staff of Westinghouse Broadcasting Company and National Broadcasting Company, both of New York.

Western Broadcasting Co. and its seven operating divisions have announced the election of **Dale G. Moore,** formerly president of the company, as Chairman of the Board. Replacing Moore as president will be **Earl E. Morgenroth,** present vice-president of Western Broadcasting and general manager of KCOY-TV of Santa Maria, California.

Morgenroth will take over his new position as president on or before June 1, 1969. Morgenroth graduated from the School of Business Administration, University of Montana, in 1961. He began work for KGVO Radio, a division of Western Broadcasting in 1959 as a part-time employee while attending the University. He was vice-presiden of the Montana Broadcasters Association when he moved to California.

Gene Peterson was named manager of KGVO Radio in Missoula. **Lee Wahl,** general manager of Radio Station KCAP, Helena, Montana, will continue in that capacity as well as that of vice-president of radio for Western Broadcasting. **W. C. Blanchette** of Missoula will continue to serve as vice-president of television.

Commissioner Nicholas Johnson recently announced the appointment of **Tracy A. Weston** as legal assistant.

Weston is from Santa Barbara, and is a Phi Beta Kappa graduate of Pomona College, a graduate with First Class Honors from University College, University of Oxford, England, and an honors graduate of the University of California School of Law at Berkeley.

Stuart Casper, president of Nardcom Corp., newly formed communication subsystems subsidiary of Narda Microwave Corp. announced the election of **Fred Kornberg** as vice-president and general manager by the Board of Directors.

Kornberg's new post will give him responsibility for the overall operations of the subsidiary which will specialize in the design and production of microwave communications subsystem equipment for television, telephone, computer data transmission, and other forms of voice and business data transmission. The company's products will be used in microwave communications systems including satellite earth stations and conventional land-based microwave networks.

Kornberg, most recently, was director of research at Radio Engineering Laboratories. He also directed research and development for the first all solid-state wideband multichannel, quadruple diversity, FM microwave tropospheric scatter communications system. As a member of the Research Division of New York University, he participated in a Government-sponsored research on Information Theory, and also in the development of a coded binary communication decision-feedback system.

A native of Lemberg, Poland, Kornberg received his BEE and MEE degrees from the College of Engineering, New York University. He is a member of the IEEE and of the Armed Forces Communications and Electronics Association.

Richard Estell, WKAR-AM-FM, East Lansing, Michigan, and **Karl Schmidt,** WHA-AM-FM, Madison, Wisconsin, have been recently elected to the executive Board of Directors of the National Association of Educational Broadcasters, representing the NAEB's National Educational Radio Division.

According to Robert Mott, NER executive director, each will serve a three-year term. They replace **Jack Summerfield,** assistant director, Urban Reporting Project, News School for Social Research, New York City; and **John Witherspoon,** general manager, KEBX-TV-FM, San Diego.

Mott also announced that **Marjorie Newman,** WFSU-FM, Tallahasee, Florida, has been elected to the NER board, having served a previous board term from 1964 to 1967. **Ken Kager,** KUOW-FM, Seattle, has also been re-elected to the NER board.

Will Lewis, WBUR-FM, Boston, and **Myron M. Curry,** KFJM, Grand Forks, North Dakota, will continue on the NAEB and NER boards. Curry is vice-chairman of the NAEB executive Board of Directors.

John O. Bigelow, news producer-editor, WBZ-TV, Boston, joins Kaiser-Globe Broadcasting as news producer for WKBG-TV, Boston. Bigelow, formerly, was news director at WTVL, Waterville, Maine. He is a 1964 communications graduate of Boston University.

Johnny Michaels, who joined WTRY, Troy, New York, on December 30, 1968, has become the permanent personality of the 6 a.m. to 10 a.m. spot.

PEOPLE IN THE NEWS

Doug Cole has been appointed to position of Operation Manager, WTRY, as of January 6, as announced by **Arthur H. Simmers,** vice-president and general manager of WTRY.

Pamela Freihofer accepted the position of Continuity Director, WTRY, as of January. Also effective as of January 6, Rod Carr moved from the position of WTRY news director to WTRY-WDKC managing editor. Filling the spot of news director for the station is **George Lezotte,** "Capital Country's No. 1 newsman."

Ronn Owens has joined WCAU Radio, Philadelphia, the second largest CBS owned and operated radio station, as one of the youngest broadcasting personalities of any radio or television station in the country. He is the new host of the "Ronn Owens Show," broadcast from 2 a.m. to 5 a.m., Tuesday through Sunday.

Owens' program is consistent with the "two-way" radio format of WCAU, and places the station on a 24-hour broadcast schedule. On the two-way format, listeners are permitted to call and discuss their opinions regarding any topic of interest. WCAU has used the format since April, 1968.

Owens has had broadcasting experience on other stations in the metropolitan area, but this is the first time he has hosted his own show. A cum-laude graduate from Temple University, he is at present working on his masters degree from the University's School of Communications and Theatre.

Kenneth D. Wells, president of Freedoms Foundation at Valley Forge, has announced the selection of WABC Radio to receive The George Washington Honor Award for the station's "Servicemen Appreciation Campaign." The distinguished National and School Awards Jury selected WABC for the honor in recognition of the station's efforts in 1968 to collect transistor radios for servicemen in Viet Nam.

During the campaign, WABC received over 5,000 transistor radios from its listeners. The 101st Airborne Division Association participated by shipping the radios to the west coast and then directly to combat centers in Viet Nam. WABC has also received numerous citations and awards from the 101st Association and the Veterans of Foreign Wars for its campaign. Subsequently, the project has been repeated in major-market radio stations across the nation.

In announcing the award to WABC vice-president and general manager **Don B. Curran,** Wells described the station's effort as "an outstanding accomplishment in helping to achieve a better understanding of the American Way of Life."

Loebe Julie, president of Julie Research Laboratories, Inc. was awarded a medal "for outstanding achievement in industry and commerce" at a dinner commemorating the 50th anniversary of the City College of New York School of Engineering. The dinner, held on Friday, March 28 at the Hotel Roosevelt in New York, was sponsored by the City College Engineering and Architecture Alumni Association.

Julie, who was one of 17 honored at the dinner for significant achievement and contribution to special areas within the technical community, was a Cum Laude graduate from CCNY in 1941. Today, he is one of the leading innovators and educators in the field of precision electronic and electrical test and measurement. Since the world entry into the aerospace and computer age, Julie's contributions have been significant in that they have helped to popularize the new art of parts-per-million accuracies.

He has been awarded 20 patents and has written many articles for professional journals on the subject

of modern techniques for DC measurement.

Loebe Julie's contributions to the electronics field span more than 30 years. Since 1936, he has been active in design and development work in electronics. His first efforts were in the radio and communications field. During the past, he designed and put into extensive use the first two-tube, single-ended and differential input high-gain, high-bandwidth operational amplifiers.

For more than a decade, Julie's efforts have been devoted to the design and manufacture of new types of ultra-precise electronic components and instruments needed by the computer and aerospace industries. His successful development of a number of low-cost, easy-to-use one-part-per-million devices have made possible the widespread application of greatly improved instrumentation in areas of the electronics industry outside of the typical laboratory environment.

Several on-air personnel shifts have been announced at WSMS-TV-51, Fort Lauderdale's new television station.

Sales manager **Jimmy Harper** has stepped down as host of "Talk About Town," adult show—3:30 to 4:30 p.m., Monday through Friday—to devote his full time to concentrating on the station's sales efforts.

Barney Kobres, general manager, said Harper had done a "terrific job" in getting the show off the ground.

Harper has been replaced on "Talk About Town" by singer **Mark Sims,** who is also TV-51's "Capt'n Zero."

WSMS account executive **Bob Humphrey,** who doubled as a 6:20 p.m. sportscaster, has left the air in favor of selling fulltime and has been replaced by **Joe Whitcomb.** Whitcomb also does the 11:20 p.m. sports show on TV-51.

TECHNICAL DATA

137. **AMERICAN GELOSO ELECTRONICS**—An 8-page microphone and microphone accessory brochure has been recently released by the company. It includes the complete line of Geloso professional and entertainer series of microphones, stands, bases, mixers, and accessories.

138. **AMPEX CORP.**—A brochure containing a description and specifications of the new Ampex CC-330 television camera for use with a Plumbicon pickup tube in educational, government and industrial applications, is available.

139. **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM)**—The following new ASTM standards are now available in single and quantity lots:

ASTM Specification for High Temperature Glass Cloth Pressure Sensitive Electrical Tapes (D 2754-68) — This standard covers requirements for high temperature electrical insulating tape consisting of glass cloth coated on one side with a pressure sensitive adhesive.

ASTM Specification for Impervious Steatite Ceramics for Electrical and Electronic Applications (D 2757-68 T) — This specification contains the requirements for impervious steatite ceramics having low electrical loss characteristics for use in electrical and electronic applications.

ASTM Method of Test for Weight Loss of Electrical Insulating Varnishes (D 2756-68)—The method describes the procedure for measuring the loss in weight of cured electrical insulating varnishes on exposure to elevated temperatures in air.

ASTM Method of Sampling and Testing Untreated Paper Used for Electrical Insulation (D 202-68)—(Revision) A strain test for fine pores for kraft papers has been added.

ASTM Method of Testing Lacing Twines and Tapes Used as Harnesses in Electrical Equipment (D 2443-68a)—(Revision) A method for Braid Pick of lacing tapes has been added.

ASTM Method for Sampling Gas from a Transformer Under Positive Pressure (D 2759-68T)—This method covers the sampling of gas above the insulating liquid of a transformer by use of a sampling bottle. Representative samples of gas are taken for analysis to determine the components, such as oxygen and moisture content.

140. **BIRD ELECTRONIC CORP.**—A discussion of pitfalls in the accurate measurement of Peak Envelope Power (PEP) of video, pulse, AM and other envelope modifying modulations is the subject of a new 3-page application note from Bird entitled "PEP TALK." The essay traces the potentially cumulative errors involved in present methods of applying a correction factor to average power measurement to get PEP, and introduces a servo amplifier concept to gage maximum modulation excursion directly.

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

by Cohu. Eight photographs and a complete story on "Live CCTV Flight Test Coverage" describe the airborne-land-based television system in operation at the Air Force Flight Test Center, Edwards Air Force Base, California.

142. **DIALIGHT CORP.**—A new catalog describes "Momentary and Alternate Action Illuminated Push Button Switches and Matching Indicators." Catalog L-169D provides complete data, drawings and ordering information for 513 Series Push Button Switches. Data is also given for 183 Series Matching Indicator Lights.

143. **ENGLER INSTRUMENT CO.**—A new free 4-page brochure describes complete details on Engler's line of Hour Meters. Covering the basic AC and DC meters, the brochure contains descriptions, uses, specifications, operation details, features and how-to-specify information. Another section covers mounts and accessories in detail and describes the new S.O.S. (Service-On-Signal) meter plus the tamper-proof vibration-powered model.

144. **FAIRCHILD**—A complete listing of Fairchild Semi-conductor discrete devices is now offered in a 64-page Transistor and Diode Condensed Catalog, 1969 edition. The catalog presents key parameters and package outline dimensions, along with a numerical index that quickly locates the device of interest. Listings are grouped by applications for the reader's convenience.

145. **GUDEBROD BROS. SILK CO., INC.**—An 8-page bulletin has just been issued, illustrating and describing two lacing systems for electronic gear. System "S" covers spot tying, utilizing cut lengths of lacing tapes, the hand-held snips, and the new swivel-tilt harness board mount. System "C" describes continuous lacing with a cable-lacer, longer pins and the swivel-tilt harness board mount.

146. **HICKOK ELECTRICAL INSTRUMENT CO.**—Additional plug-ins for the DMS 3200 Digital Measuring System are described in a brochure recently published.

147. **KRECO ANTENNAS**—Kreco Antenna Catalog 6970 is available. It describes high and low band co-plane antennas, stacked co-axial antennas, folded ground plane antennas, high and low band ground plane antennas, high and low band duo ground plane antennas, and discone antennas. Accessory specifications are also included.

148. **MELCOR ELECTRONICS CORP.**—A new 16-page catalog (C1008), describing their new complete line of DC solid-state operational amplifiers is ready. The amplifier lines includes operational amplifiers, servo and computer amplifiers and professional audio components. Detailed electrical and mechanical specifications are given. Measurement techniques, small quantity pricing and ordering information is included.

149. **SAN FERNANDO ELECTRIC MFG. CO.**—A 32-page brochure details the company's complete line of molded inductors. Included are the microminiature series (1A 1000M) and a miniature size shielded inductor (DKM Series). Many other series of inductors for numerous applications, as well as a custom design capabilities section of Variable Inductors, RF and IF transformers and other types of wound components, are also included. A cross reference inductor table is given.

150. **SENCORE**—A new 12-page catalog describes the complete line of advanced electronic

test equipment for service and industry. The catalog, Form No. 458, features five new test instruments, including a sweep and marker generator, combination oscilloscope-vectorscope, color generator, and two transistor/FET testers. A new compact portable color generator CG18 Color Cadet is also described, as are the TF151 and TF17, two new in-or-out-of-circuit transistor and field effect transistor testers.

151. **SOLA BASIC INDUSTRIES**—The Acuvolt® line voltage regulator is fully described in a new catalog now available from Hevi-Duty Electric Division of Sola Basic. The regulator provides response times on the order of 10 cycles and is of a static magnetic design, according to the bulletin.

152. **TEXAS INSTRUMENTS**—A new 24-page bulletin gives specifications, data and price listings for integrated circuits, diodes, rectifiers, SCRs and triacs, resistors, light sensors, transistors, tetrodes, and unijunctions.

153. **TEXWIPE**—Information and prices for tape-head cleaning kit and its individual components are offered.

154. **THOR**—Their new "1969 Wholesale Electronic Tube Purchasing Guide" is off the press, ready for distribution. It lists over 7,000 tubes, along with their prices.

155. **UNIMAX SWITCH DIV., MAXSON ELECTRONICS CORP.**—The Unimax LPB Series 9 Illuminated Push Button Controls is described in a catalog.

156. **U. S. ELECTRONIC SERVICES CORP.**—Low-cost Plastipak microcircuit packages (patent pending), encapsulating cups and shells, and precision custom molding services are fully described in a new comprehensive 4-page, 2-color capabilities brochure.

157. **VIKING INDUSTRIES, INC.**—A catalog sheet on a new "J" series P-C connectors is ready from Viking. The connectors are of the dual-readout type for double-sided circuit boards, and are available with 6 to 50 contact positions.

158. **WESTINGHOUSE**—A quick reference guide to industrial and military cathode ray tubes is available. A solid-state television camera Model STV-602 for closed-circuit TV applications is described in a new 4-page bulletin. Also, application information and specifications for light-and-medium-duty pan and tilt mountings for remote CCTV cameras are included in a new data sheet.

159. **WOLLENSAK**—Data sheets give specifications for a lens kit, zoom lens, and TV raptar lenses for Vidicon cameras.

WFBM Stations Receive RTNDA National Awards For Editorials

The WFBM Stations in Indianapolis have received their fifth national award for excellence in editorializing.

WFBM-TV was recognized by the Radio Television News Directors Association "for its extensive series of editorials on civil rights which placed emphasis on the issues in terms of the need for better human understanding."

The RTNDA television awards competition is judged by the Medill School of Journalism at Northwestern University and selected RTNDA members.

The WFBM-TV entry consisted of 21 editorials. Among its editorial conclusions the station advocated: a federal open-housing law; implementation of recommendations in the President's Commission on Civil Disorders and the New Jersey Racial Disorders Commission; an end to panic selling that followed integration of an Indianapolis neighborhood; a change in local teacher-placement policies to achieve racial balance in faculties; and better communication among public and private sectors as the basic means of achieving racial understanding.

The award-winning editorials were researched and written by editorial editor Jim Hetherington and editorial assistant Evie Birge.

The latest award was the fifth received by the WFBM Stations in the past six years. RTNDA honored WFBM Radio in 1963, and WFBM-TV in 1964, 1966 and 1968. WFBM-TV received a 1967 national award for editorializing from Sigma Delta Chi, a professional journalistic society.

The 1968 RTNDA award for excellence in radio editorials went to KOGO, San Diego, another station owned by Time-Life Broadcast.

Lloyd S. Smith, executive vice-president of the Rau Radio Stations, has announced that a contract has been signed for the purchase of Radio Stations WFMI and WFMI-FM, Montgomery, Alabama, from Fine Music, Inc., the stations' present operators. Purchase is subject to the approval of the Federal Communications Commission.

WFMI and WFMI-FM will become one of the Rau Radio Stations which is headed by Henry Rau, President. Other stations in the Rau Radio organization are WARK-AM, FM, Hagerstown, Maryland, WATO-AM & FM, Oak Ridge,

Send your station news on achievements, staff changes and items of interest about engineers and technicians to: Editor, Broadcast Engineering, 1014 Wyandotte, Kansas City, Mo. 64105.

Tennessee, WDOV-AM, FM, Dover, Delaware and WNAV-AM, FM, Annapolis, Maryland. The organization also operates Delaware Teleservice Company, a cable TV operation serving the Delaware towns of Dover, Camden, Wyoming and Smyrna.

FCC Announces Station Ownership Study of Conglomerates

The FCC has announced a study of ownership patterns in the broadcasting industry, with "special emphasis" to be placed on ownership of stations by licensees with "substantial" non-broadcast interests.

In a Notice of Inquiry, (Docket 18449), announcing the study, the Commission stated that today there is a greater interest generally in problems regarding conglomerate merger trends, and that it feels it is appropriate to concentrate on those problems presented in the broadcast field by conglomerates, and also by ownership of broadcast stations by any other person or entity with large-scale business interests.

The Inquiry, intended to "determine the full facts" on broadcast ownership by conglomerates or persons or organizations with large-scale business interests, will cover the following points:

The nature and interest of such owners, particularly multi-media owners;

The number and location of broadcast stations licensed to particular types of conglomerates or other large-scale business interests;

Population and revenue figures and trends;

Benefits or detriments to the public interest as the result of such ownership;

Contributions to technical innovation, stability, programming and formation of additional networks;

Possible hazards to free and fair presentation of materials by conglomerate-owned stations;

Reciprocity arrangements in advertising;

Lack of licensee responsibility due to inadequate supervision by top officials;

Siphoning of broadcast profits for other operations or acquisitions; increased leverage in either the broadcast or non-broadcast fields; and the "possible impediments" to technological developments.

The FCC's study will not be limited only to the largest conglomerate corporations, nor will it be directed to smaller station owners with additional small business interests. It is to be coordinated with any other studies, such as that of the Federal Trade Commission into conglomerate trends and effects.

The Commission stressed that the inquiry is broad-ranging and will cover all possible social, economic and political aspects of conglomerate activity in the field of broadcasting. It stated that it had formed no conclusions and was only seeking "factual information" to determine what, if any, action would be required.

In the past, the FCC has examined certain aspects of broadcast station ownership, including joint control of newspapers and broadcast stations, multiple ownership of stations, and diversity of control of mass media.

Advertisers' Index

Professional Services

Classified

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

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

Minimum classified charge, $2.00.

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

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

Business Opportunity

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

Help Wanted

COMMUNICATION PRODUCT DIRECTOR

Are you the experienced administrator we are seeking to guide our company's well-established communication product line; to plan and direct future expansion into related fields of your selection? Our outstanding engineering staff is standing by to accept your direction for product design and development. This completely autonomous key executive will report to our vice-president—marketing. We invite your reply, which will be held in complete confidence. Please contact: C. D. Haverty, (402) 342-2753.

McMartin Industries, Inc.
3104 Farnam Street
Omaha, Nebraska 68131

ALMA
ENGINEERING

Our fast-growing business - manufacturing video and audio switching and distribution equipment - needs two key men. Ground floor opportunities. Extremely attractive salary, bonus and other incentives.

NATIONAL SALES MANAGER

Direct sales to Broadcasters, assist distributor/rep organization in CCTV/CATV marketing.

MANAGER OF SYSTEMS ENGINEERING

Prepare system proposals, system design. Call (collect) or write (resume) R. G. Frick, President, Alma Engineering, 7990 Dagget Street, San Diego, California 92111 (714) 278-9330.

VIDEO TAPE ENGINEERS

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

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

VISUAL ELECTRONICS LABORATORIES
725 San Aleso Avenue
Sunnyvale, California 94086

Engineer to aid chief engineer in maintenance and operation of full-color production studio nearing completion and existing monochrome studios. New studio will feature Ampex high-band video-tape and General Electric color cameras. Color experience desirable. Salary commensurate with experience. Position open July 1. Send full resume to: Mr. Charles Anderson, Operations Manager, Western Kentucky University, Educational Television Dept. Bowling Green, Kentucky 42101. 4-69-2t

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

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

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Technical man with first phone capable of working with Chief Engineer and in production. Send full resume to: Dr. Fred Haas Coordinator of ETV, Western Kentucky University, Bowling Green, Kentucky, 42101. 4-69-2t

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

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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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Chief Engineer—large ITFS multi-channel, operation in Catholic school system in N.Y. Area. First phone. Studio and transmission operations. Considerable opportunity for innovation, and some designing. Requires skill imagination and drive. Salary dependent on qualifications. Resume to Broadcast Engineering, Dept. 230 1014 Wyandotte St., Kansas City, Mo. 64105. 4-69-1t

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Training

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

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

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Equipment for Sale

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

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

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

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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

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PRESTO 6N, 1-D cutter head, 176 & 112 screws, vacuum system 88A amplifier. Complete system $495.00. United Radio Supply Inc., 22 N.W. 9th Ave., Portland, Oregon 97209. 4-69-1t

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Remote Control Your Station—New Tape-Athon Automatic Broadcasting System. A complete audio control complex that may be customized to any radio format. KWUN, Box 1480, Concord, Calif. 94522.

Roelan

"TWO SECONDS AFTER YOU HEAR THIS, STATION WILL SELF-DESTRUCT."

TCA3 TRANSISTORIZED CAMERA AMPLIFIER

The dependable TCA3 has almost become standard equipment in all image orthicon cameras. It replaces the vacuum tube pre-amplifier and is designed so it may be quickly mounted within available space in the camera without permanently disabling the vacuum tube amplifier. This cool little amplifier, about the size of a package of cigarettes, can add years to the life of cameras. The TCA3 sells for $295.00 F.O.B. Nashville, Tennessee.

For complete information, write to:

INTERNATIONAL NUCLEAR CORPORATION

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

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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TDA2D VIDEO/PULSE DISTRIBUTION AMPLIFIER

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

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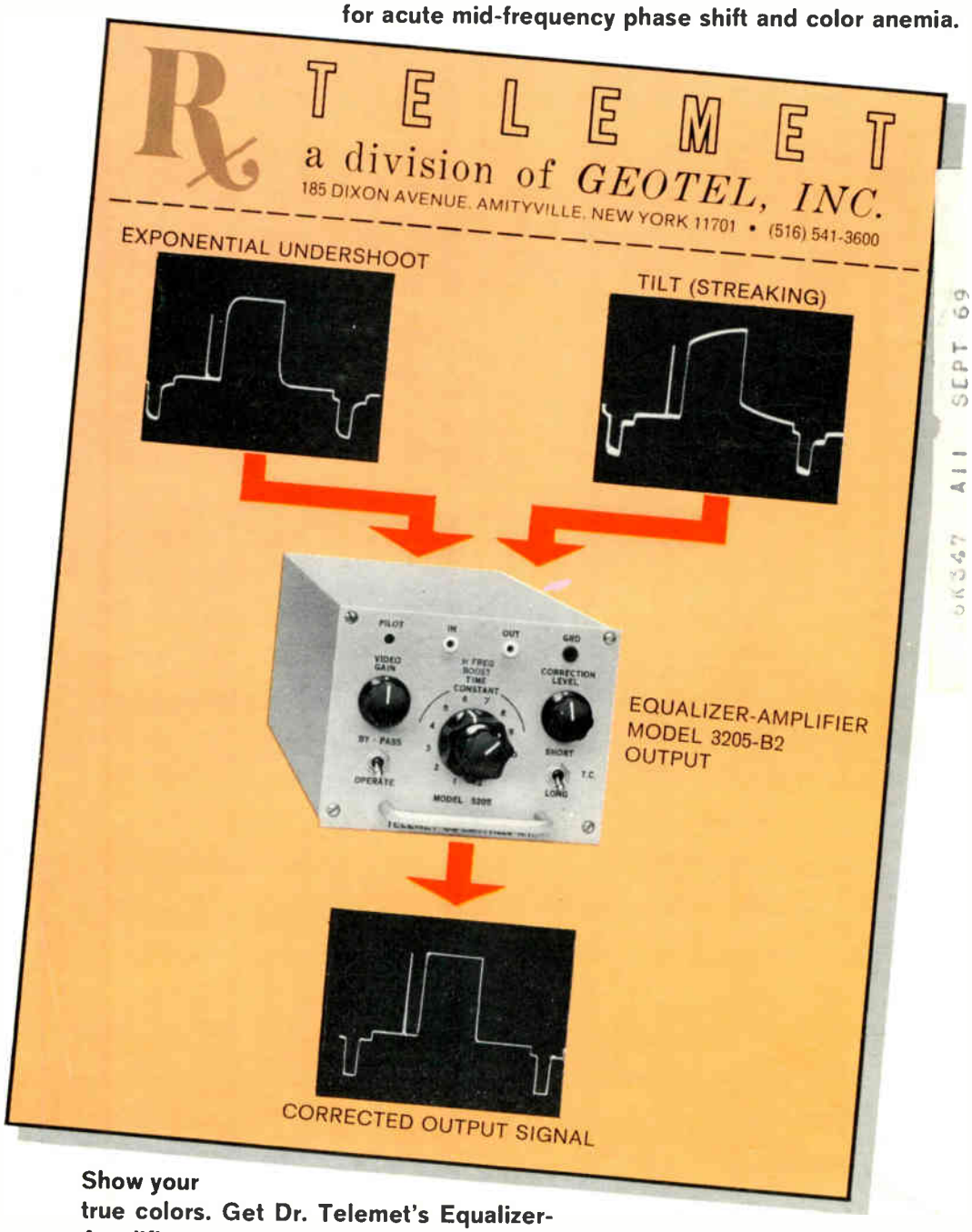
Then you need Doctor Telemet's Equalizer-Amplifier—the best prescription for acute mid-frequency phase shift and color anemia.



Show your true colors. Get Dr. Telemet's Equalizer-Amplifier soon... and be the picture of health.

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