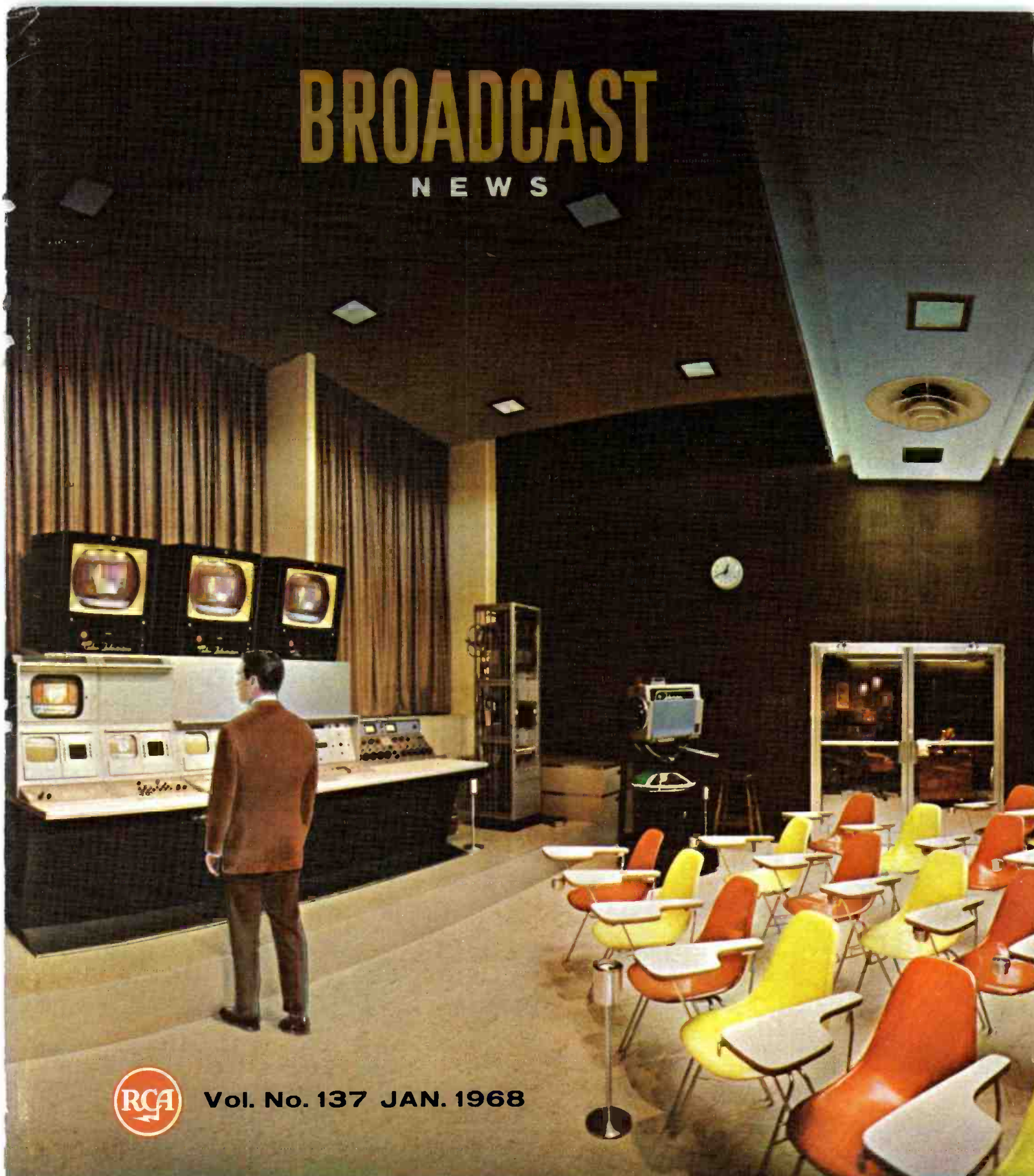
BROADCAST NEWS



Vol. No. 137 JAN. 1968

NEW RCA COLOR TV TRAINING CENTER HELPS

Needle-like Sharpness

No Noisy Pictures

Exciting Color

Automatic Quality Control

and indoor subjects, close-ups and macro-shots, all reflect the higher resolving power.

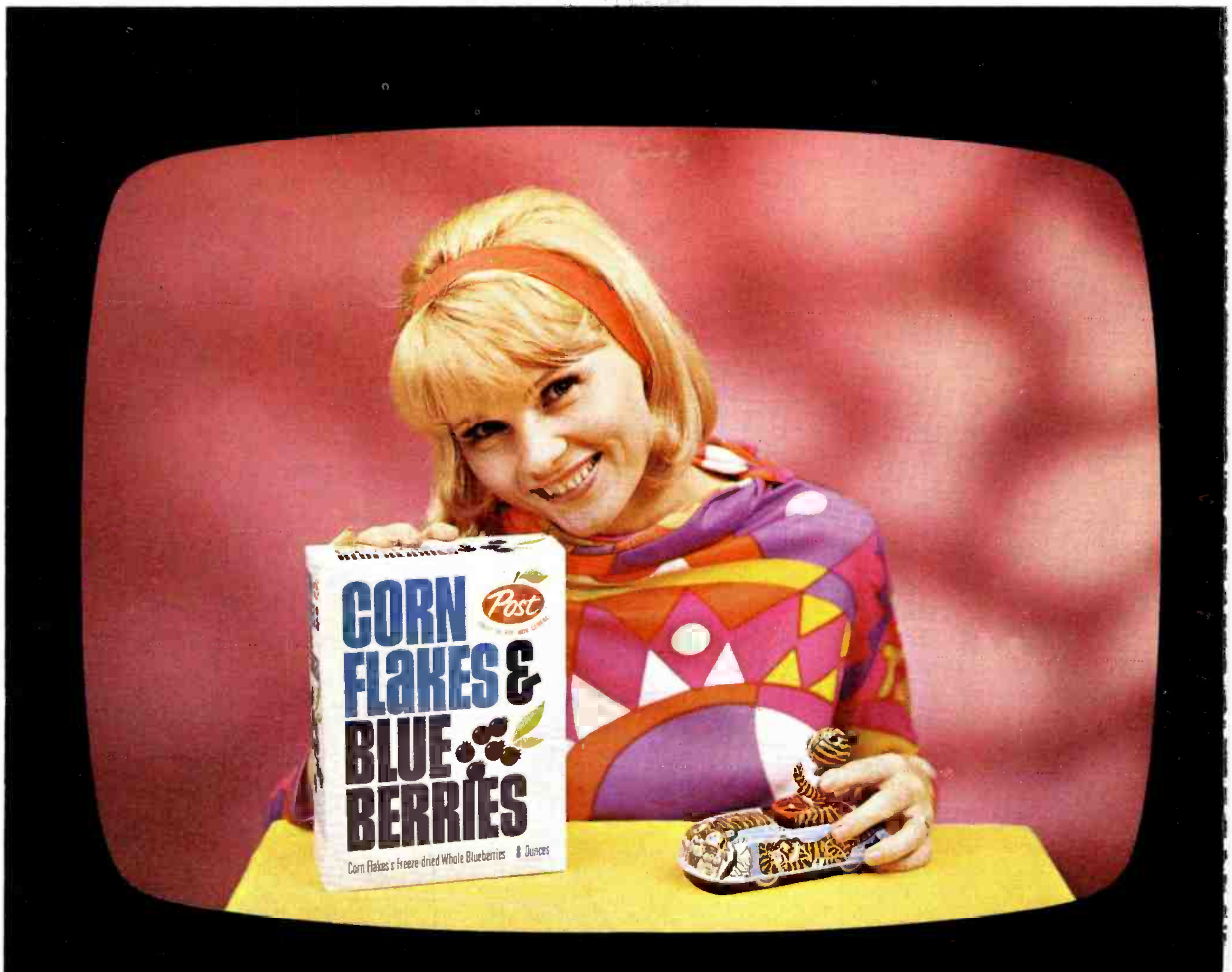
EXCITING COLOR. Sponsors like the way their products are easily and accurately identified. You get this kind of color fidelity because picture quality is automatically controlled. Levels are held constant to give the best contrast range. Result: your station can handle the widest range of color subjects—presenting a beautiful color picture at all times.

NO NOISY PICTURES. The Big Tube delivers a signal that's twice as strong. This means you get pictures without undesirable disturbances. It's important when projecting commercials made by modern techniques—like shooting into light, or using a large background area, or changing rapidly from a light to a dark subject. Just as a big photo negative produces a picture without grain, so the big tube produces a clear, noise-free picture.

AUTOMATIC QUALITY CONTROL. When a film (or slides) change rapidly from one contrast range to another, unique circuits automatically compensate for the difference in density. They match the contrast range of the film to the contrast range of the system. Smoothly, this circuitry responds to present a natural looking color picture everytime.

Film commercials and programs in *consistently brilliant color* create a fine image for your station. For further information call your RCA Broadcast Representative. Or write RCA Broadcast and Television Equipment, Building 15-5, Camden, N. J. 08102.

RCA® THE MOST TRUSTED NAME IN ELECTRONICS



Color Films Come Alive

. . . in their Original Brilliance with the RCA "Big Tube" Color Film System

The "Big Tube" concept in color film cameras assures reproduction of programs and commercials in all their original beauty. Film and slide subjects have the natural look of colors that are faithfully reproduced. Pictures are brilliant, films have snap and sparkle—to entertain, to educate, and to sell.

NEEDLE-LIKE SHARPNESS. By using a Big Tube—50% larger than others use—RCA gives you greater resolution. It's like using a big negative in photography. The picture is sharper, the focus is uniform—all over the screen. Outdoor

BROADCASTERS TO GET BEST PICTURES

Vol. No. 137 | January, 1968

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IN THE VIEWFINDER

COLOR STUDIO DEMONSTRATIONS, NEW EQUIPMENT ATTRACT CROWDS TO RCA'S BIG NAEB EXHIBIT

A pre-Thanksgiving harvest of ETV and related equipment was spread out for educational broadcasters and military trainers who converged on Denver in early November for the 43rd annual National Association of Educational Broadcasters convention.

The meeting coincided with President Johnson's signing of the first Public Television legislation, an event that seemed to help whet buying appetites for the shiny items on display.

Both NAEB members and equipment suppliers were on hand in greater numbers than ever before, prompted no doubt by non-commercial broadcasting's steady progress during the year and its bright prospects for the future.

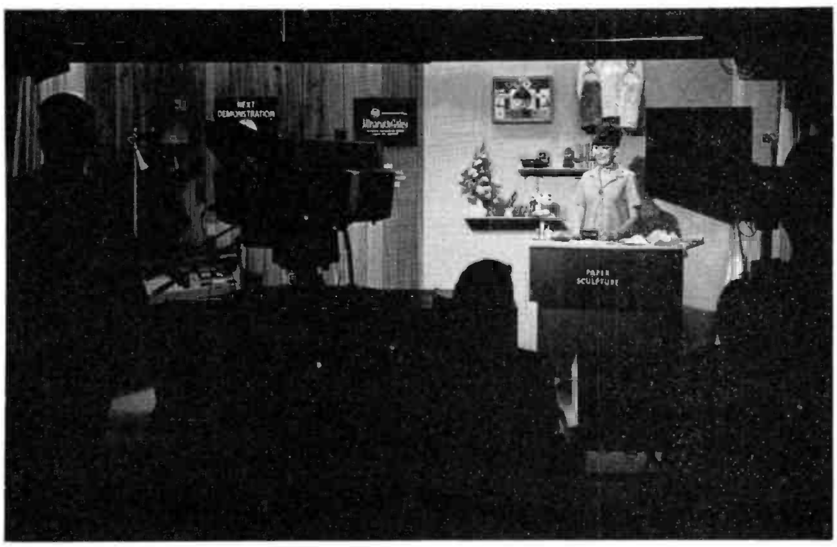
The RCA exhibit emphasized color apparatus in response to rising interest among ETV operators and military personnel in the medium. Stars of the color demonstrations were the TK-42 color studio camera —one of more than 400 now in use—and two high-band color TV tape systems, the TR-70 and the newer TR-50. The latter machine, described in a page 4 article, made its debut at the NAEB.

Demonstrations of the TK-42 and of the PK-330 and PK-315 monochrome cameras were controlled from a new RCA Professional Television console especially designed for educational systems. Since the console handles color, the black-and-white broadcaster acquiring it now already has taken a step into the Color Age.

Another feature was a new "suitcase switcher," a portable unit light enough to be carried to remote program pickup points for handling switching among multiple cameras. The unit features 9-inch preview and on-air monitors, eight video inputs and provides dissolves, fades and other effects.

Monochrome film pictures for the RCA exhibit were produced by the PFS-16 television film system, another new item shown for the first time at the Denver meeting. The low cost system ($5,490) brings together a PK-310 film camera, an RCA 1600 16mm educational projector adapted for TV use, and a compact optical multiplexer. A slide projector can be added.

'Teleroamer' is a rolling TV production unit.



TK-42 color camera demonstrations at NAEB included paper sculpture by Helen Carkin, West Coast TV personality and Chico State (California) College professor.

"Suitcase switcher" for remotes was among new products.

New TV console served as demonstration area nerve center.

RCA OPENS NEW EUROPEAN PARTS DEPOT IN AMSTERDAM

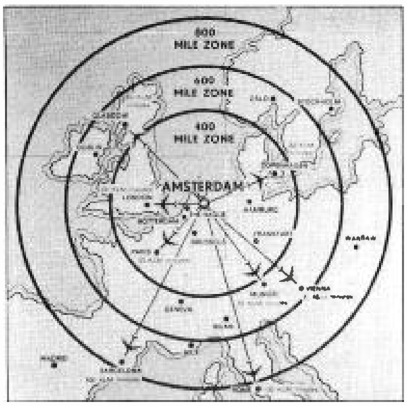
In a move to provide its European customers with faster service on parts, RCA has established a replacement parts depot in Amsterdam, the Netherlands. It will warehouse approximately 4,200 stock items for three major RCA product lines: television tape recorders, electron microscopes and 16mm sound motion picture projectors.

The new facility is located in the Atoom Building at Amsterdam's Schiphol Airport and is manned around the clock to assure immediate response to RCA customers' normal or emergency needs for replacement parts.

Company officials said Amsterdam was chosen as the depot site because the city has gained a reputation as "The Hub of Europe" since a market of some 180 million people exists within on hour's air travel time. From this strategic location, RCA will serve customers in Europe, Africa and the Middle East.

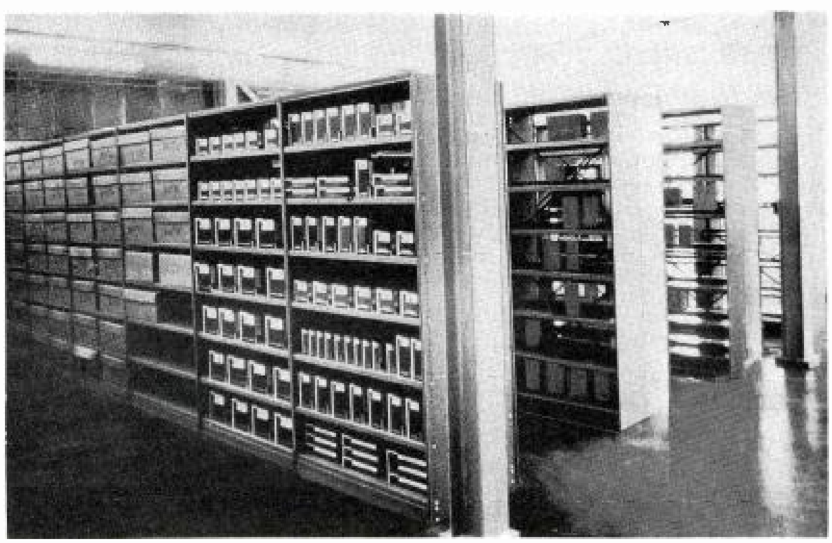
Another factor in site selection was the location of a Dutch customs office within the Atoom Building. This is expected to provide streamlined customs clearance and help to expedite parts shipments, particularly in emergency situations.

While the depot has been opened for only a short time, RCA already is planning for future expansion. By mid-1968 the facility will be relocated nearby in a new building now under construction at the airport. The additional space will permit extension of parts carried in stock to other RCA product lines.



Map shows how warehouse is positioned at Europe's "hub" to serve its major markets and those in Africa and the Middle East.


Tower at Schiphol Airport, pride of Amsterdam


Interior view showing shelving arrangement used in stocking 4,200 replacement items.

FIRST 'WORKING STANDBY' SYSTEM IS ANNOUNCED BY RCA FOR FM INDUSTRY

The FM broadcast industry's first system for parallel-operated transmitters to assure an uninterrupted broadcast signal has been introduced by RCA's Radio Station Equipment Merchandising group. The "working standby" FM transmitter system, which has been proven out in extensive field tests, is available for 10 kilowatt output (two 5 kW transmitters), 20 kW output (two 10 kW transmitters), and 40 kW output (two 20 kW transmitters).

The technique is being used by several television broadcasters but except for an RCA custom-built system combining two 20-kW units it has not been used previously in FM. With parallel operation, the station automatically switches to reduced power in the event one of the two transmitters fails. This allows the broadcaster to remain on air while repairs are made.

The arrangement is particularly useful for FM broadcasters operating transmitter plants by remote control or where quick access to the transmitter site is difficult.

Outputs of the parallel transmitters are fed into a single transmission line through a combiner and output switcher. The two transmitters are driven by one exciter, and provide automatic switching to a spare in the event of an exciter failure. With the RCA system the FM broadcaster enjoys the complete reliability of transmitter redundancy. Any RCA "E line" FM transmitter now in use can be adapted for parallel operation.

COLOR CAMERA FOR SPACE PRODUCES NTSC SIGNALS

This fall RCA's Astro-Electronics Division demonstrated a broadcast-quality color TV camera small enough to be carried by an astronaut on manned lunar missions. Completely portable, the camera system transmits video and audio signals to a base station. Its overall weight, 56 pounds, includes camera, power supply and transceiver.

Video pickup is handled by three one-inch hybrid vidicons, producing a standard NTSC color signal. Audio communications are two-way. The camera uses an F1.8 power zoom lens and provides a cable connection to the base station if desired.

When carried on the Moon's surface, the camera could provide scientist and home TV watcher alike "live" views in color of the lunar environment as it appears to the astronaut. RCA designers said the camera's compact size and light weight resulted from the use of integrated circuits and spacecraft packaging.

NEW TR-50 TV TAPE MACHINE: ADVANTAGES OF HIGH-BAND OPERATION AT ONE-THIRD LESS

RCA's new TR-50 high-band color TV tape recorder is designed to give broadcasters the advantages of high-band operation at a smaller investment than ever before. The TR-50 is priced at $54,500 which is some one-third less than RCA's deluxe high-band color recorder, the TR-70, at $87,500.

Broadcasters agree that the high-band standards provide state of the art performance in video recording. The viewer watching color programming from high-band tapes sees color pictures that are brilliant and faithful in their natural hues.

Fully transistorized, the TR-50 is a mere 33 inches wide, 66 inches high and 24 inches deep, which makes it the most compact high-band color TV tape system currently available. It makes use of expanded signal-monitoring facilities so that the operator, upon checking picture and waveform monitors, can make a continuing analysis of the pictures being recorded and keep performance at a high level.

While assembled and factory-tested as a complete record/playback color system, the TR-50 will accommodate various accessories to suit individual needs of the broadcast user. Space is provided for adding the accessories within its cabinetry.

Accessories include CAVEC (for Chroma Amplitude and Velocity Error Corrector), a unique item developed by RCA. It compensates for variations in the chroma content of the TV signal occurring between recording and playback and, in addition, corrects picture disturbances that may result from changes in head speed.

First TR-50, shown here by Lulu Johnson, was sold at convention with TR-70 to KBTV, Denver.

Other accessories which the TR-50 will accept are the guide servo, used to position the vacuum guide to eliminate picture skewing; the dropout compensator and the electronic splicer.

KAISER BROADCASTING ORDERS $2,260,000 IN EQUIPMENT FOR 2 NEW ALL-COLOR STATIONS

RCA contracts to supply approximately $2,260,000 in studio and transmitting equipment for Kaiser Broadcasting's new all-color UHF stations in Cleveland and San Francisco were announced recently.

The new stations—WKBF-TV, Channel 61 in Cleveland and KBHK-TV, Channel 44 in San Francisco—are scheduled to go on the air early in 1968. The Cleveland facility will be built and operated by a new organization formed by Kaiser and the Superior Broadcasting Corporation.

Each station has ordered three "live" color cameras, two complete color TV film systems, two TR-70 high-band color TV tape recorders, a master control switching system, audio equipment and a solid-state microwave system to link studio and transmitter sites.

Transmitting plants ordered for each station include the TTU-50C UHF transmitter and pylon-type broadcast antennas. Remote control equipment will permit transmitter operation from station studios.

Kaiser Broadcasting is a wholly-owned subsidiary of Kaiser Industries Corporation. Other Kaiser stations are WKBD-TV, Detroit; WKBS-TV, Burlington-Philadelphia; and KMTW-TV, Corona (Los Angeles). In addition, Kaiser owns and operates WKBG-TV, Boston, jointly with the publishers of the Boston Globe.

TAFT BUYS 10 MORE TR-70s FOR GROUP TOTAL OF 18

Taft Broadcasting Company, Cincinnati, has ordered ten TR-70 high-band color TV tape systems to augment the eight TR-70s already in use at the group's six television stations.

The contract signing was recorded in Camden, N. J. by an RCA photographer as William H. Hansher (seated), Taft Vice President in charge of engineering, wielded the pen. Standing (left) are Carl Raasch, RCA broadcast sales representative, and Edwin C. Tracy, Division Vice President, Broadcast Sales Department, Broadcast and Communications Products Division.

The Taft group includes WKRC-TV, Cincinnati; WTVN-TV, Columbus, Ohio; WBRC-TV, Birmingham, Ala.; WGR-TV, Buffalo; WDAF-TV, Kansas City, Mo., and WNEP-TV, Wilkes-Barre, Pa.

NEW RT-27 FOR AUDIO REACHES PRETTY EARS

Good listening can be good looking too as Linda Boyce illustrates here in debut of RT-27, newest cartridge tape recorder in RCA's expanding equipment line for radio stations.

FIRE-STILLED WEJL VOICE HEARD AGAIN IN 4 HOURS

Radio Station WEJL, Scranton, Pa., was forced off the air at 8:30 a.m. on October 25 by a transmitter fire, but made a swift recovery and was broadcasting again just over four hours later.

After the blaze was doused, Chief Engineer Guy Rauer determined that his transmitter was virtually intact except for a power transformer. He alerted RCA to his plight and a replacement unit was pulled out of stock at the RCA Parts and Accessories warehouse in Deptford, N. J.

Meanwhile Chief Rauer had engaged a private pilot to make the 120-mile flight to the Philadelphia Airport. Upon arrival there, the pilot found the transformer waiting for him; an RCA employee had brought it directly to the terminal building.

The return flight began immediately. Upon reaching home base, the pilot rushed the replacement transformer to the WEJL studios in the Scranton Times building. The waiting chief engineer began the installation, completing it in five minutes. At 12:42 p.m. the voice of WEJL was heard again.

The Deptford facility is the world's largest commercial distribution center for electronic parts. Its 200,000-square foot building was dedicated in 1964.

PLANNING AM/FM RADIO STATIONS

PART THREE: EQUIPMENT SELECTION, INSTALLATION AND MAINTENANCE

Editor's Note: This concluding article in our three-part radio planning series deserves, we believe, the special attention of all planners who now are or soon will be faced with decision-making in regards to AM and FM broadcast equipment. It explains many of the important differences between equipments and what to look for when making a choice. Also included are tips on the installation and routine care of broadcast station equipment for long term operating reliability.

Part 1 of the series, "Three Basic Floor Plans," was published in Broadcast News, Vol. No. 132, February, 1967 Part 2, "The Transmitting Plant," appeared in Broadcast News, Vol. No. 134, June, 1967. All three articles of the series are available in reprint form from any RCA Broadcast Representative.

While the technical equipment required for an AM or FM radio facility is determined basically by station size, layout and programming as outlined in Part One of this series, it should be remembered that the operating flexibility of the station depends to a great extent on the equipment selected.

An extra measure of versatility in the studio equipment may greatly promote program speed, accuracy and creativity, enhancing the station's audience and advertiser interest. Certainly, the transmitter plant with the highest efficiency and reliability will place the strongest and most consistent signal where the people are. More than just economy, therefore, each piece of equipment should offer all the added benefits of value and performance that modern technology allows.

Too many times the costly assumption is made that all broadcast equipments, if FCC type-approved, are basically the same "under the hood." So, all you have to do is to find the supplier with the lowest price. Several mismatched units and thousands of dollars later, however, price is very often found to be closely related to the quality and reliability of components, as well as the attention and service that can be expected from the manufacturer after the sale.

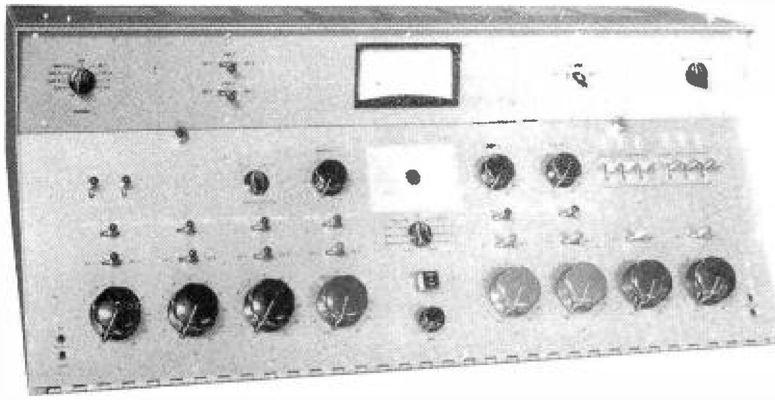
Audio Equipment

Since no two broadcast stations have the same operating requirements, the selection and arrangement of microphones, audio tape systems, turntables, consolettes, amplifiers and other equipment will differ for each installation. Many stations choose to have their control equipment tailored-made to the station's requirements.

Control Consoles

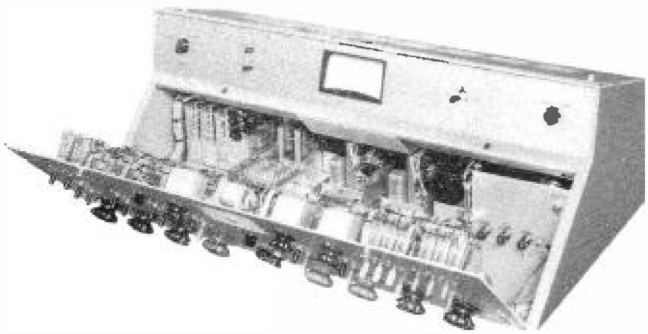
Usually the most important reason for the addition or replacement of a control console or consolette is the need for more input channels. This can be brought about by the addition of a new studio (and thus additional microphones) or by adding FM stereo facilities. It is convenient to be able to leave telephone lines connected to the "board", and thus as the number of remote programs increase, the telephone input requirements will increase. A consolette may also be added to a station in order to increase the flexibility of recording facilities. Many stations use a small board in a "production" control room where they make commercials and station promotion recordings. Another requirement for the addition of a small audio consolette is for the remote pickup of programs such as at sporting events, auditoriums, churches and nightclubs. In general, as a station increases its program variety and flexibility, its requirement for audio input facilities also increase.

Consolettes of the highest quality employ computer grade components throughout. In these equipments, components are selected for their long life and dependability. For example, the best consolettes use telephone type switches for their superiority over wafer types, and step attenuators rather than carbon pots. They are fully transistorized using the most advanced state of the art circuitry. Plug in modular design provides complete accessibility with interchangeability of subassemblies and quick, convenient servicing. Reliability of equipment is a priceless ingredient in the design of today's successful broadcast system in view of the increasing shortage of competent technical maintenance personnel.



Studio Consolette, BC-8

Completely self contained, high fidelity audio system for three channel mixing, switching, and monitoring. Dependable solid state plug-in amplifiers. Low impedance mixing circuits, built in cue/intercom amplifier.

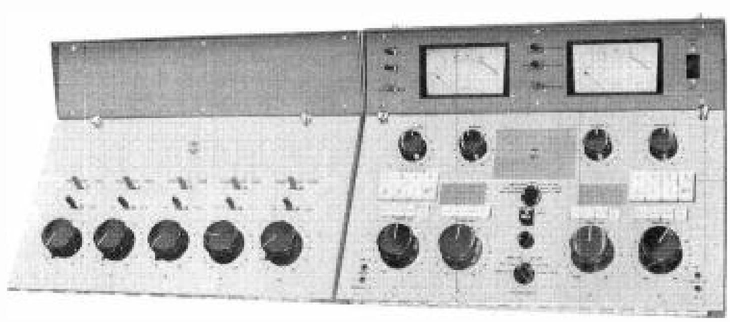


Compact, Modular Design

View of internal plug-in modules common to all RCA consolettes, including high level isolation units, amplifiers and power supply. All have built-in provisions for expansion.

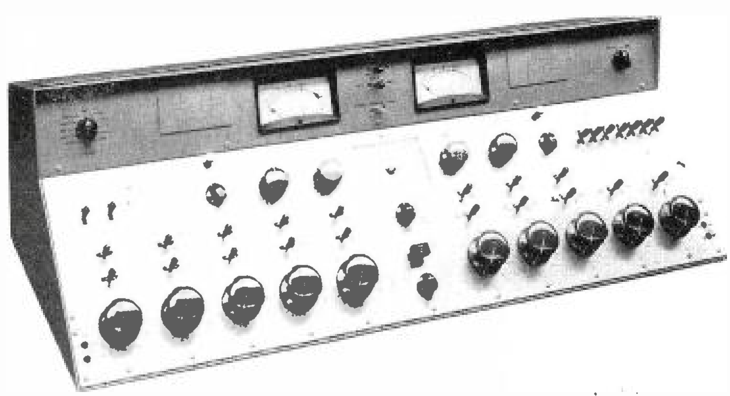
Studio Consolette, BC-9

Compact solid state mixing and switching, featuring pushbutton selection of high level sources, relay switching, and built-in intercom. Operation can be remoted. Plug-in modules interchangeable with other consolettes. Stereo version is the Type BC-19.



Audio Mixer Consolette, BC-19/BCM-2

Solid state BC-19 stereo consolette with matching BCM-2 Auxiliary which provides five additional mixing channels and 15 additional input sources. BCM-2 features plug-in modules, may be adapted for low level or high level inputs. Provides same expansion for BC-7, BC-8, BC-9 Consolettes.

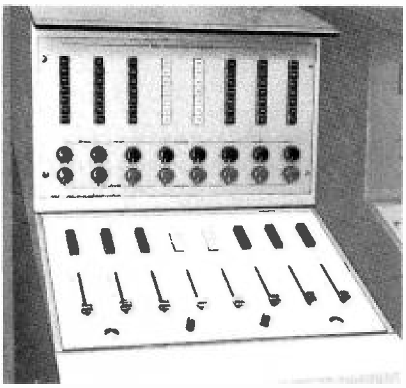


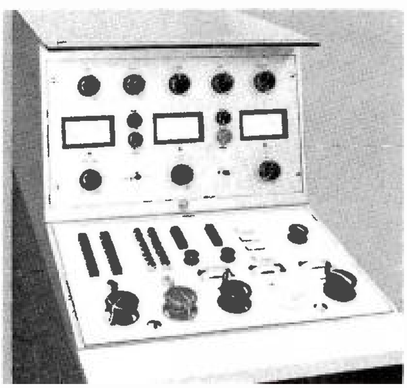
Studio Consolette, BC-7

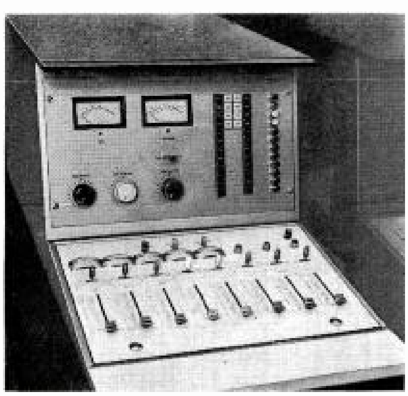
Versatile, completely self contained for both stereo and monaural mixing, switching and monitoring. Ten mixer positions: five low level, three high level, two line level. Dual mixer control in all stereo positions. Reliable solid state plug-in amplifiers. Built in cue/intercom.

Custom Consoles

Below are three custom consoles designed for side-by-side installation. At the top is an eight channel microphone mixer with three sub-mixing channels. Vertical type faders, with bus selectors. Reverberation and equalizer controls. Center section is an eight channel master mixer featuring remote meters for new automatic gain control amplifiers. At bottom is record mixer and monitor section for control of cartridge and reel tape, turntables. Solid state circuits and voice operated relays are part of the equipment.

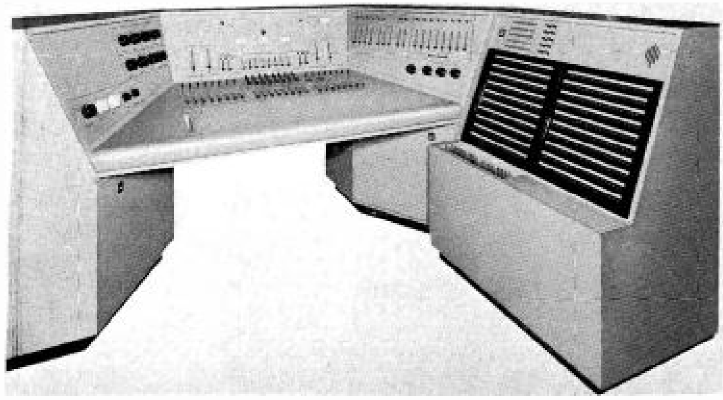






Custom Master Control

One of five master control consoles for a large radio network features sound effects controls, sub-mixers, equalizers, echo effects, unitized construction for complete accessibility.



Custom Operating Center

Modern control position designed for operating ease features built in turntables, dual channel stereo consolette and cartridge tape equipment.

Custom Audio Equipment

In addition to offering a comprehensive line of standard audio control equipment, leading equipment manufacturers specialize in custom designing and building complete speech input systems to meet individual needs of stations and networks. Their engineers have worked closely with the nation's leading broadcast engineers in the design, production and installation of many custom equipments. Studio control systems such as these are tailor-made, combining just the right facilities for the control of program operations and the reproduction of high-fidelity sound. This custom service is not limited to large stations and networks, it is available to everyone. Broadcast station engineers, in some cases, may wish to lay out and design the system themselves. In these instances, specifically built units or modified standard items can be supplied to meet these specifications. Or, as some stations may desire, a study of station requirements can be made with detailed layouts and specifications drawn up for the equipment needed.

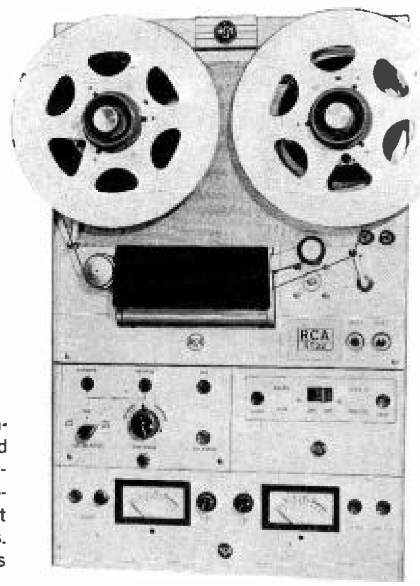
Tape Recorders

Program material on magnetic tape provides extra flexibility in scheduling, simplifies program operations and reduces the cost of program production. Modern stations utilize every possibility offered by the medium—mono or stereo, cartridge and reel to reel, two track and 4-track stereo, manual and automatic equipment. Cartridge tape systems permit the immediate playback of recordings without cueing and threading. They provide precision timing of program segments, and the program material will be exactly the same every-time a passage is repeated. They offer the most convenient storage medium and the quickest and easiest access to selected segments of material. The system of cue tones makes the equipment readily adaptable to automatic or semi-automatic systems. Multi-cartridge tape systems, designed essentially for the heavy traffic station, reduce the load on operating personnel by automatically handling a series of short (or long) program segments through start/stop and audio switching sequences in rapid errorless succession. Two hours of material can be programmed with one multi-cartridge unit, which can be teamed with as many other units as needed. Tape systems may be remotely controlled.

Reel-to-reel tape machines, on the other hand, take full advantage of the editing ease and speed that tape offers. Reel-to-reel machines can operate at various speeds so that the material can be tailored to program needs. Super thin tapes can be used to permit hours of programming on a single reel, and the equipment features portability for interviews and news stories. Manually operated and self cueing versions are available.

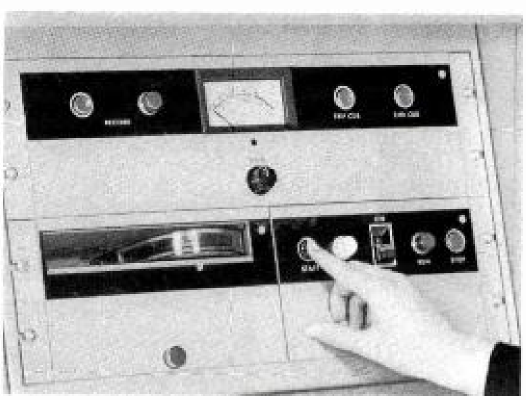
Audio Tape Recorder, RT-21

Professional, solid state recorder for monaural or stereo operations. Wide range of record input levels, high playback output levels. Either 7½/15 or 3¾/7½ ips tape speed. Full-track or dual half track. Plug in record equalizer, variable tape speed cueing. Console or portable carrying case available.



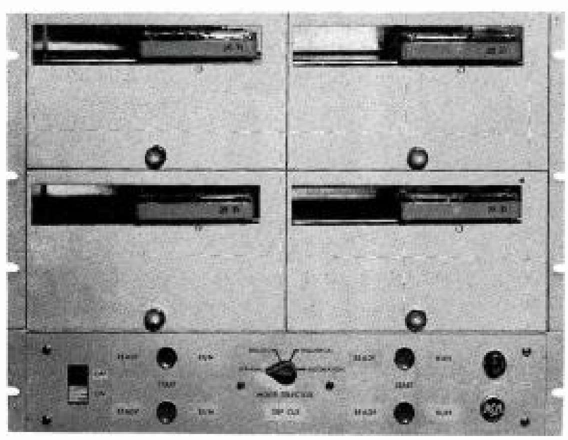
Automatic Tape Recorder, RT-22

Record/playback in stereo or monaural models. Variable tape speed cueing. NAB cue tones (reel or cartridge) recorded on tape for automatic operation. Plug in circuit modules. Remote control provisions. May be used in automatic systems with cartridge tape.



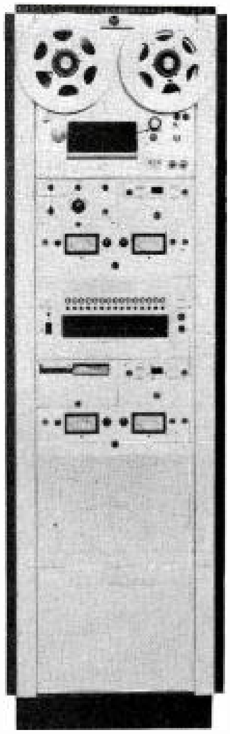
Cartridge Tape System, RT-27

Deluxe, solid state system for monaural or stereo cartridge record and playback. Separate record and playback heads, three cue frequencies, plug in circuit boards, pull out tape transport.

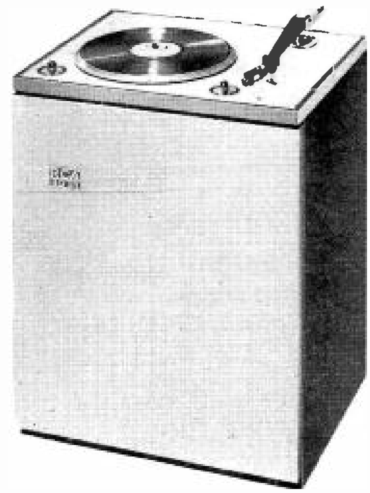


Multicartridge Tape System, RT-8

Compact monaural or stereo unit plays all NAB size cartridges. Units may be connected in multiples to give system of 8, 12, 16 or more automatic tape playback cartridges.



Automated Audio System
Completely automatic tape system consisting of RT-22 stereo reel recorder, top, BCA-15 automatic tape programmer, center, and cartridge tape system, bottom.



Dual Speed
Turntable, BQ-51
Compact, precision unit for 33⅓ and 45 rpm. Smooth, low rumble, rapid starts. Provision for two tone-arms. Cabinet accepts preamplifier.

Tape Automation Systems

An audio tape programmer combining solid state and relay switching is available to automatically program multi-event sequences from several different tape systems with an absolute minimum of attention from station personnel.

For use with both monaural and stereo systems, the device is designed to select from several audio sources and sequence them in any preset pattern as consecutive events. It is particularly advantageous to stations requiring separate programming for AM and FM. The operator who may be handling both programs can preset the system to sequence the FM events during times when live broadcasts or program changes must be made on AM.

Microphones

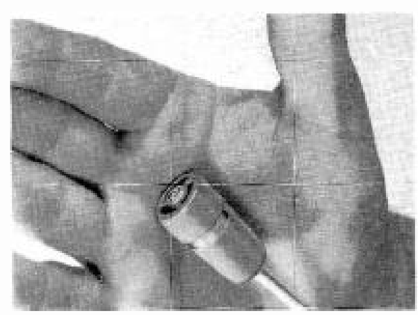
Careful thought should go into the selection of type and quality of microphones for AM and FM facilities. Too often the microphones selected do not complement the quality of other equipment. This can seriously impair overall performance.

There is considerable overlap in the uses of available broadcast microphones, of the many types, but each has attributes for specific applications. High quality broadcast-type microphones have performance features that make them ideal for AM and FM use, such as smooth frequency response over the audio range, low distortion, high output levels, and well shielded (and sometimes shockmounted) output transformers to prevent hum and noise pickup. Certain types have selectable directional patterns useful in high noise areas. Public address microphones, on the other hand.

Polydirectional
Microphone, 77DX
High fidelity, ribbon type, easily adjusted to obtain a variety of directional patterns. Ideal for AM and FM. Frequency range 30 to 20,000 Hz. Three-position voice-switch for selection of best operating characteristics. Efficient shock-mounting. The accepted standard of the broadcast industry.

Pressure Microphone, BK-1
Ideal for interviews. Insensitive to mechanical vibration. Smooth response over a range of 50 to 15,000 Hz. Removable from base for hand use or floor stand mounting.

Uniaxial Microphone, BK-5
A high quality ribbon instrument with a unidirectional pattern. Especially suited to use in high noise areas and for general studio applications. Wide frequency response of 30 to 20,000 Hz.



Subminiature
Microphone, BK-12
Lightweight, easily concealed lavalier dynamic microphone with excellent speech balance for studio and public address. Inconspicuous worn around the neck, clipped to the clothing, or hand held. Wide frequency response of 60 to 18,000 Hz.

Portable
Mixer-Amplifier, BN-26
Solid state, battery or AC powered unit providing four selectable inputs, cueing, monitoring and mixer bus paralleling. Completely self contained. Built-in 1,000 Hz setup oscillator. Cover serves also as tilt rest for unit.

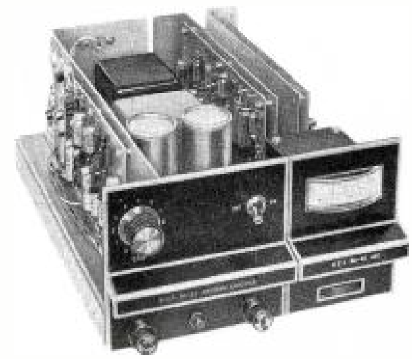
are designed to offer additional economy. Frequency range and sensitivity are sacrificed to some extent for ruggedness and lower cost. Response limitations should always be considered when these microphones are used for broadcast applications.

Signal Processing Equipment

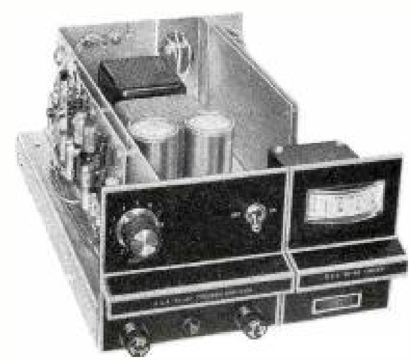
Audio signal processing equipment is available to automatically control audio peak and average levels into the transmitter, as required, to prevent overmodulation with consequent adjacent channel interference or even possible damage to the transmitter.

Automatic gain control (AGC) amplifiers, with their slower attack and recovery times, are used in control rooms and studios to maintain a constant average audio level. Peak limiters, with their faster attack times are normally used at the input of the transmitter because of their ability to limit the amplitude of high speed transient peaks.

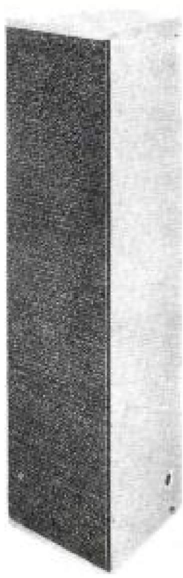
In FM, however, a 75 microsecond pre-emphasis network normally installed at the transmitter input produces a high frequency boost which tends to cause overmodulation. This overmodulation can be



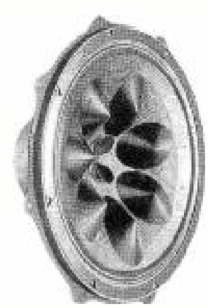
AGC Program
Amplifier, BA-43/45
Low distortion, solid state automatic gain control amplifier. Provides both expansion and compression. Wide adjustable AGC action. Step type attenuator. Plug-in chassis. Provision for remote meter.



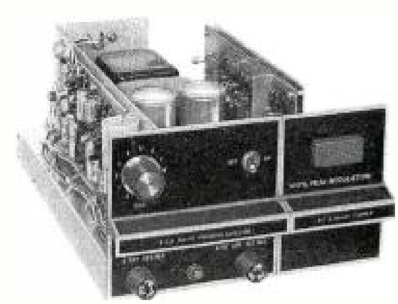
Limiting Amplifier, BA-43/46
Solid state, low distortion unit for extremely fast, abrupt limiting action. Plug-in shelf mounting. Separate input and output controls. Remote metering.



Studio Speaker, MI-38351-A
Excellent frequency response provided by five in-line speakers. Twenty-five Watt rating.



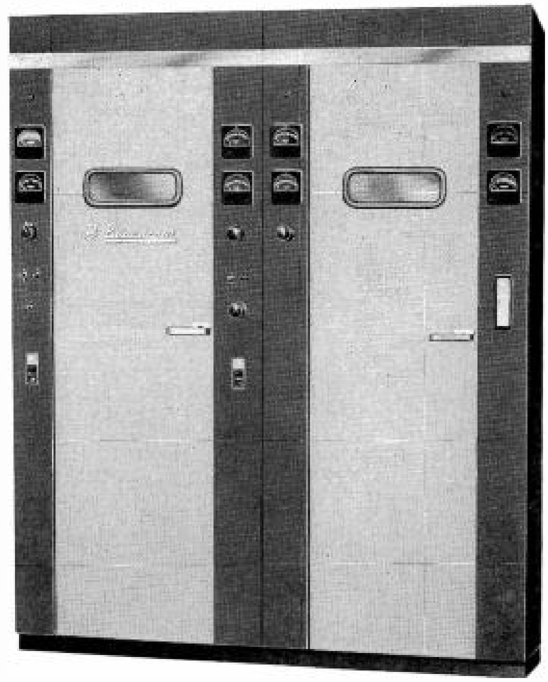
Duo-Cone Speaker, LC-1
Ideal for control room monitoring and other broadcast applications. Wide frequency response (25-16,000 Hz), wide angle distribution and low distortion.



Peak Clipper, BA-47
Solid state unit for use with BA-43 Program Amplifier. Performs both pre-emphasis and peak clipping. When fed from a BA-43/46 Limiter Amplifier, only the signal peaks in the pre-emphasis range and above 100 percent modulation will be clipped. Assures absolute protection against overmodulation.

1 kW AM Transmitter, BTA-1R2

Selection of 500 or 250 watt power levels from front panel or remote location. Highly perfected audio circuits with large, high quality transformer and reactor for outstanding modulation and unusually high fidelity sound. Simple circuitry, solid state power supplies. Complete accessibility, designed for automatic operation.



5 kW AM Transmitter, BTA-5T1

New high efficiency Class C power amplifier featuring big power savings and long tube life. PA efficiency of 85 to 90 percent saves up to 15,000 kilowatt hours per year. Only two tuning controls. Silicon rectifiers, vertical chassis construction and automatic operation.

prevented by high frequency roll-off, or by peak *clipping* after pre-emphasis, or by a combination of both. Peak *limiting* after pre-emphasis is not usually desirable because the high frequency peaks will cause a serious reduction in gain and consequent lowering of the average modulation level. High-frequency roll-off, too, is obviously undesirable because of the degradation of the received signal. Peak clipping is the recommended method since it provides absolute protection against overmodulation without reducing signal gain and with no audible degradation of the signal. Signal processing units are used in tandem for stereo.

Notes on Transmitters

The ability of a transmitter to handle high levels of modulation and a wide frequency range with low distortion gives the transmitter a signal which stands out in any market. Some transmitters are available today that are designed to sound better and louder than others. Transmitters of this type employ highest quality components, proven design, and they operate at conservative levels. Transmitters in this class not only sound better but components last longer. Tube life is lengthened by using types best suited to the application, and by operating the tubes well within their ratings. Attention is given to all details affecting their proper cooling. The importance of having conservatively designed and operated components in a broadcast transmitter cannot be overemphasized, particularly for a station that wishes to maintain the highest reliability with minimum lost air time.

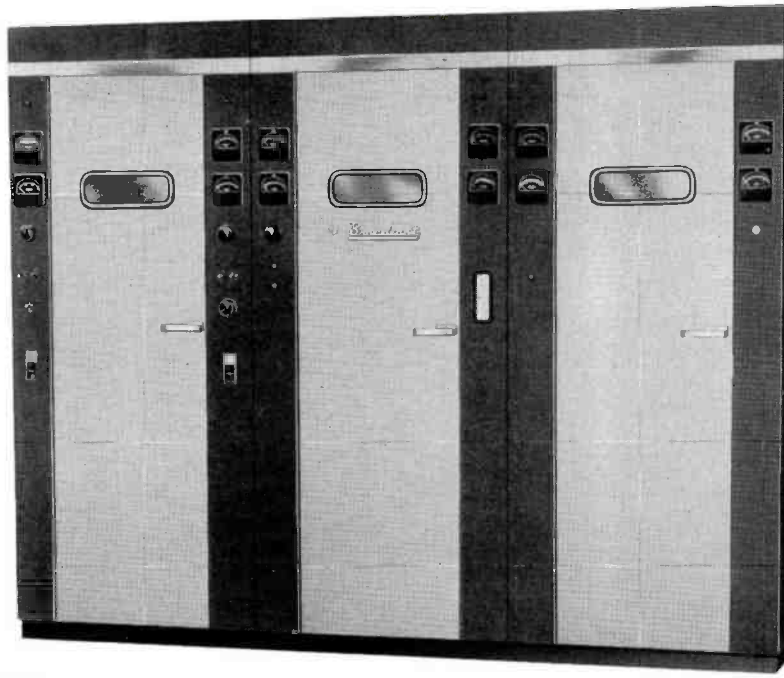
Weight Reduction

Some AM transmitter manufacturers are placing great emphasis on compact, lightweight units. One of these lightweight kilowatt transmitters weighs only 1,000 pounds or little more than half that of another design. Low weight, often associated with low cost, may not be economical for transmitters.

Reduction of weight is fine if it can be achieved without sacrificing reliability. But in AM radio transmitters, weight is usually concentrated in transformers and reactors to obtain high fidelity audio response and high transformer reliability. Unfortunately, this is where the most weight reduction is effected in so-called lightweight designs. It is advisable, therefore, to study and compare weights and transformer sizes between designs. Failure of one transformer could wipe out the savings in a lightweight design.

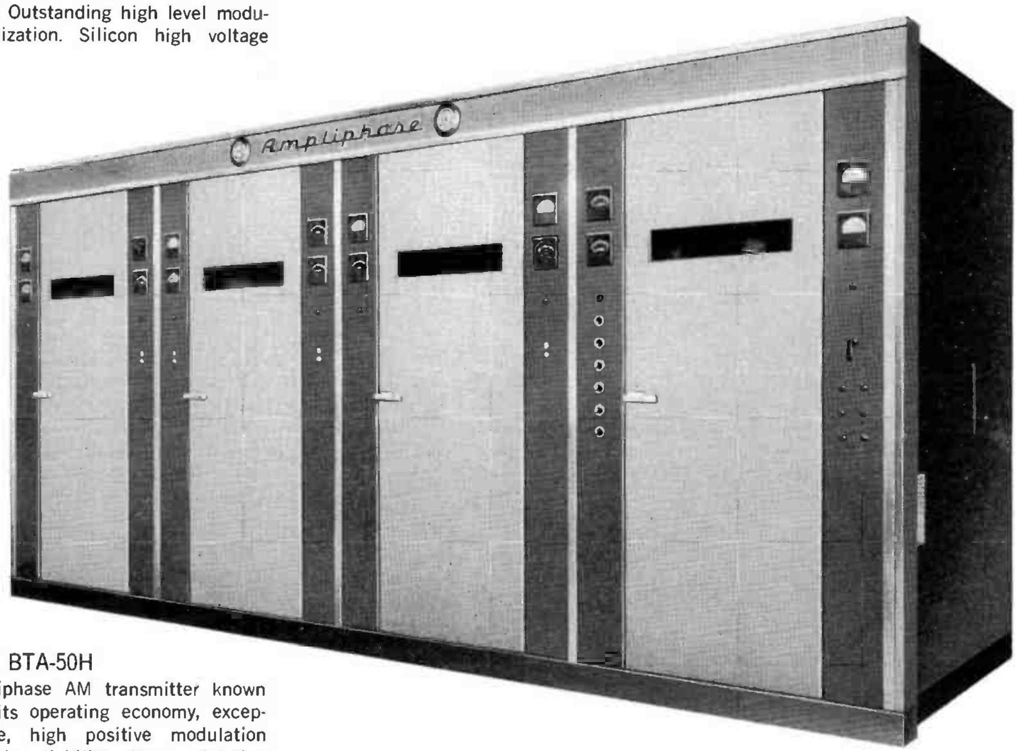
Tubes vs Transistors

The advantages of transistors are well known, particularly for handling small signals such as in low power, high frequency exciters and low level audio circuits. Good design employs transistors wherever adequate engineering and packaging considerations indicate their use will be beneficial. However, transistors and tubes are being mixed in some broadcast transmitters in a way that has certain disadvantages for the owner. Transistors do not work well in high RF fields. Often, very expensive tubes are required to overcome the low power of the transistors. The cost of one such tube may exceed that of several common types in another transmitter. In one highly transistorized transmitter the special tube and transistor complement required actually costs more than *twice* the complete set of tubes in a conventional tube transmitter of the same power. Moreover, due to the low drive power obtained from the transistor driver, the PA in this



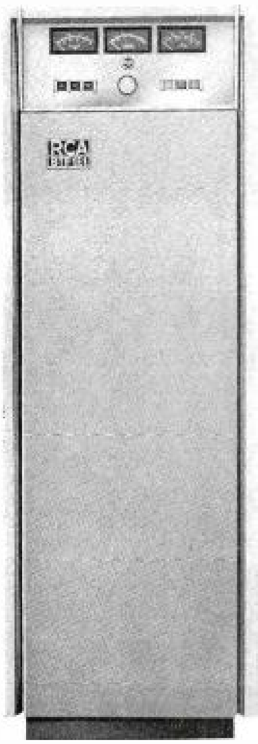
5-10 kW AM Transmitter, BTA-5U1/10U1

High efficiency, air-cooled 5-kilowatt transmitter with provisions for power increase to 10 kilowatts. Essentially identical to popular BTA-5T1. Same high efficiency PA, power economy and long life tubes. Simplified power cutback to 1 kW or 500 watts. Outstanding high level modulation. Broadband neutralization. Silicon high voltage rectifiers.

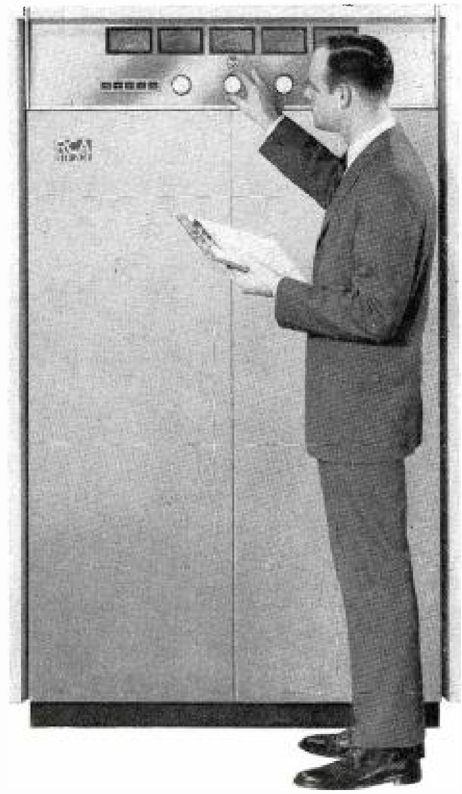


50 kW AM Transmitter, BTA-50H

A true high fidelity Ampliphase AM transmitter known throughout the world for its operating economy, exceptional frequency response, high positive modulation capability and exceptional reliability. No modulation transformer or reactor is used. Power amplifiers are hign efficiency, easily tuned Class C types. Silicon rectifiers. Automatic operation. 100-kW model available for international use.



POWER INCREASE TABLE	
BTF-5E 5KW	
Move Up From	**Outputs and Power**
5E to 10E	One 10kW
5E to 20E	One 20kW
5E to 40E	One 40kW
5E to 5/5E	Two 5kW
5E to 5 PLUS 5E	One 10kW
5E to 10/10E	Two 10kW
5E to 10 PLUS 10E	One 20kW
5E to 20/20E	Two 20kW
5/5E to 5 PLUS 5E	One 10kW
5/5E to 10/10E	Two 10kW
5/5E to 10 PLUS 10E	One 20kW
5/5E to 20/20E	Two 20kW
5/5E to 40E	One 40kW
5 PLUS 5E to 5/5E	Two 5kW
5 PLUS 5E to 10/10E	Two 10kW
5 PLUS 5E to 10 PLUS 10E	One 20kW
5 PLUS 5E to 20/20E	Two 20kW
5 PLUS 5E to 40E	One 40kW
BTF-10E 10KW	
10E to 20E	One 20kW
10E to 40E	One 40kW
10E to 10/10E	Two 10kW
10E to 10 PLUS 10E	One 20kW
10E to 20/20E	Two 20kW
10/10E to 10 PLUS 10E	One 20kW
10/10E to 20/20E	Two 20kW
10/10E to 40E	One 40kW
10 PLUS 10E to 10/10E	Two 10kW
10 PLUS 10E to 20/20E	Two 20kW
10 PLUS 10E to 40E	One 40kW
BTF-20E 20KW	
20E to 40E	One 40kW
20E to 20/20E	Two 20kW
20/20E to 40E	One 40kW



1 kW FM Transmitter, BTF-1E

This compact kilowatt employs a time proven, ten-watt direct FM exciter featured in all RCA FM transmitters. Completely self-contained in a single, attractively styled cabinet. Silicon power supplies, only one power amplifier tube. Single-tuned circuits and M-derived harmonic filter. Designed for automatic operation.

5/10/20 kW FM Transmitters, BTF-5E, 10E, 20E

One attractive cabinet taking less than 12 square feet of floor space houses each of these three air cooled FM transmitters. Design features make it easy to increase power from 5 kW to 10 kW, 20 kW or 40 kW (See Power Increase Table). The separate unitized power supply for each transmitter can be remotely located.

same transmitter is a Class AB-1 linear. which almost doubles (45 percent greater) the *average* power consumption of the transmitter. RF Feedback is usually required in transmitters of this design which causes problems with antenna load changes. Since such circuits are more complex they require a high level of technical competence in the engineering staff; straightforward circuitry does not require a more expensive level of engineering ability. Tube complements and circuitry of competitive transmitters should always be compared for their cost, complexity and reliability.

Reliability and Economy

The economics of transmitter reliability are difficult to assess without previous experience with a given design. Loss of broadcast time because of equipment failure, if substantial, could be very expensive. The question arises, how much money will be lost in advertising time? How much will be spent on replacement parts? Will equipment problems cause the transmitter to be operated at reduced power for long periods of time? What about overtime payments to engineers? In short, what will this cost in terms of listening audience? Prestige? Income? Profit?

Operating costs may be difficult to measure but they can spell the difference between an economical and costly transmitter design. One method is to compare the costs of a full tube complement for each transmitter being considered. Then compare the expected tube life from "experience curves" on the types employed.

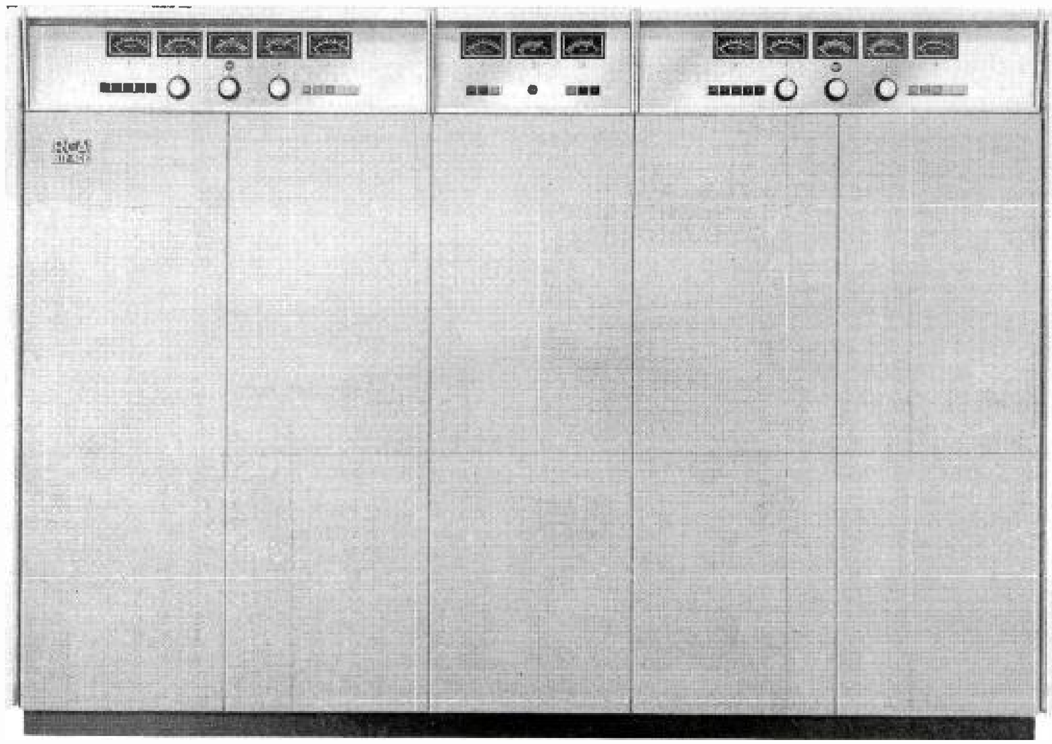
Automatic Operation

Will it be possible at a later date to automate operation of the transmitter being considered? Automatic operation, including remote control, logging and other functions, are becoming more widespread and many existing automatically operated installations have reported months of unattended transmitter operation without the need for a single adjustment at the transmitter site. If the transmitter when purchased is not designed for automatic control, and later, such is desired, the required modifications may be time consuming and expensive.

Many available transmitters include these provisions as standard equipment. This means that components such as relays, motor driven controls, wiring, meter shunts and multipliers used in automatic operation, are already a part of the transmitter and need not be added. Remote control signals may be DC voltages sent over telephone lines, or tone signals which permit operation on a single voice-grade telephone line or microwave link.

Transmitter Power

An important factor in transmitter design, particularly for FM, is the power expandability of the transmitter. This is related to the transmitter's susceptibility to obsolescence. For example, savings result if a 5 kW transmitter is expandable



40 kW FM Transmitter, BTF-40E

Efficient, fully air-cooled high power FM transmitter consisting of two 20 kW units driven by a single direct FM exciter. Offers added reliability of diplexed outputs over paralleled output stages. Features include single-tuned RF circuits, silicon rectifiers, provisions for remote control and unitized high voltage power supplies that can be remotely located from transmitter.

to 10 or 20 kW, and a 20 kW transmitter is expandable to 40 kW, etc., rather than replacing the original transmitter. In some designs, power can be doubled simply by substituting higher power electrical components with no increase in floor space.

Transmitter Redundancy

Some station owners will want to consider an FM transmitting plant with the complete redundancy of parallel operated transmitters. These installations start out with a transmitter that later can be diplexed with another identical transmitter to provide a power increase, plus the added reliability of two operating transmitters. Diplexed transmitters use a common exciter and a "hot" spare exciter which can be switched in at any time.

FM Exciters

By virtue of its design, the modern FM exciter adequately attenuates harmonics and other spurious signals, and produces a clean drive signal for trouble-free operation of subsequent stages of the transmitter.

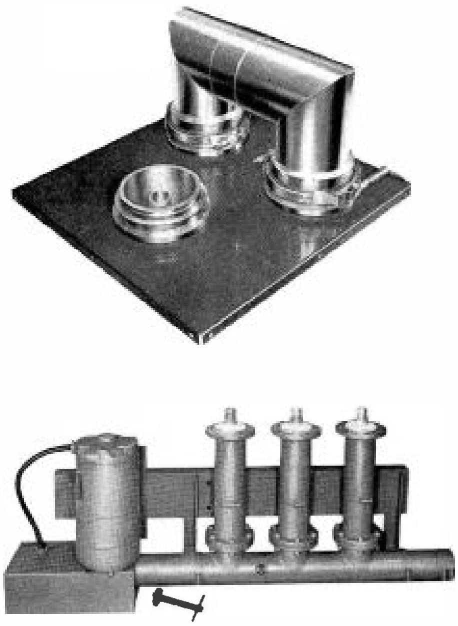
Some available exciters are deficient in instrumentation. The tendency today is to package the FM exciter in a very small space with a minimum of visual monitoring facilities. As a result, the operator must expend unnecessary time and effort to determine the operating status of some units. The best designs incorporate basic instrumentation such as metering and visual indicators, making it easy to see at a glance an inoperative unit.

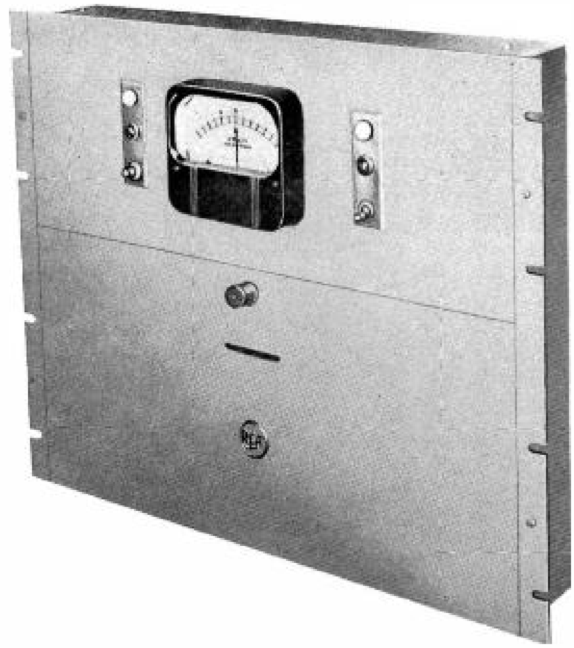
Detachable Power Supplies

A trend in design that makes transmitters easier and less expensive to install, is the two-unit construction concept in which the high voltage transformer and its rectifier are housed in a separate enclosure. This enclosure is designed for out-of-the-way installation in a basement or other unused space in the transmitter plant. Locating the power supply near the commercial power entrance does much to reduce wiring expense during installation. It also simplifies power increases.

AM Phasors

The ideal phasor of course provides the kind of radiation pattern wanted, assures a reliable, fade free signal in the coverage area, and is easy to maintain. It is possible to meet these conditions with either of the two general types of phasors that are available, the "jeep" or "ohms law" types, depending upon the installation. The jeep phasor, a simpler, less expensive type, should not be used in big arrays with four or five towers because of interaction of controls. Although more expensive, the ohms law phasor has less interaction, takes less time to set up and therefore may offer savings. It also makes it easier to achieve the proper power distribution throughout the phasor resulting in higher efficiency and less chance for failure. The engineer-



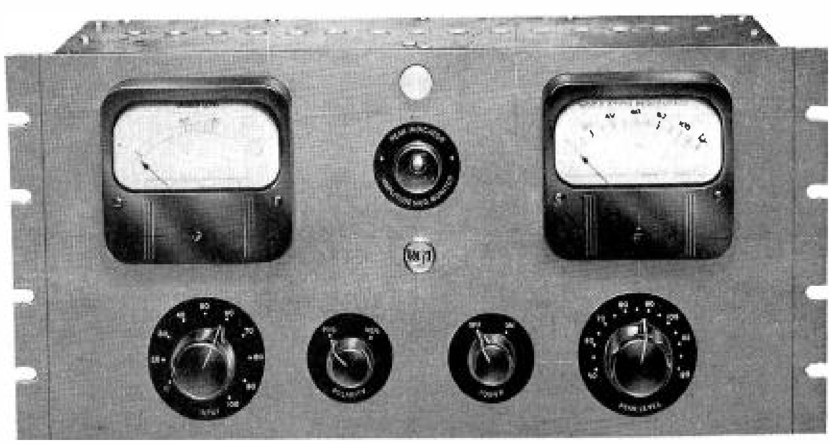


Coaxial Transmission Line Switches

Manual and motor driven switches available in a variety of styles. Manual panels in 3-pole version with U-type connector, 7-pole panel with three U-type connectors, plus custom arrangements. Motor driven are single pole, two-position switches. Maximum VSWR 1.04 to 1.0 or better.

AM Frequency Monitor, BW-11A

Continuous indication in magnitude and direction of any departure of carrier from its proper frequency. Wide input range of 10 mV to 25 Volts. Minimum accuracy of ±5 Hz for one year. Provisions for remote meter or recorder.

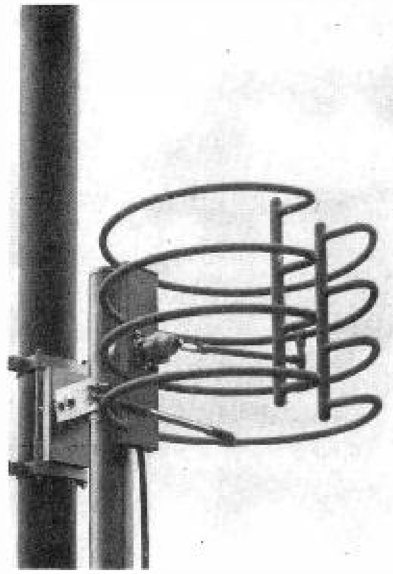


AM Modulation Monitor, BW-66F

Direct reading indications of percentage modulation. Operates at input power as low as 0.35 watt. Indicates either positive or negative peaks in percentage and in dB. No input circuit to tune. Remote meters can be used.

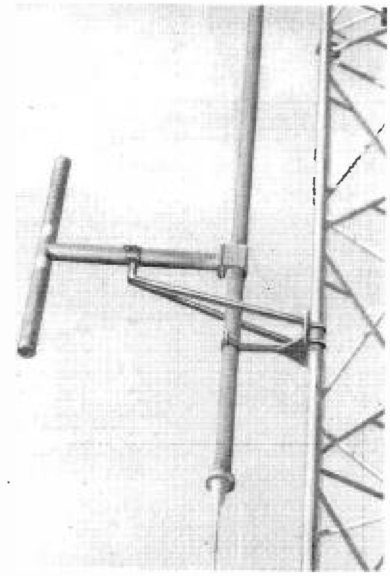
Circularly Polarized
FM Antenna, BFC

Omnidirectional radiator for all FM services, and specifically any application which requires both horizontally and vertically polarized signals of equal power. Lower windload and weight than combined antennas. Lower installation and maintenance. Excellent bandwidth and high power capabilities.



Horizontally Polarized
FM Antenna, BFA

Ideal for all FM broadcast services. Highest gain at low weight and windloading. Low VSWR over entire 200 kHz band. Can be top mounted or side mounted on existing towers. Provisions for de-icing. Easy to install, minimum maintenance.



Vertically Polarized
FM Antenna, 300 V

Designed for use in all FM broadcast services, particularly where vertical polarization is required. May be used with existing horizontally polarized antennas to provide dual polarization. High gain, low VSWR. Essentially omnidirectional when top mounted.

ing consultant should be given the opportunity to specify the phasor required.

In planning transmitting facilities, the customer should take into consideration future needs for a standby transmitter, if not being installed initially, so that the necessary transfer switches and relays between transmitters and antenna system may be built in, instead of added-on later.

Dummy Loads

The dummy load is an essential component in all transmitting installations, and one should be purchased with the AM or FM transmitter. The dummy load offers the opportunity for better adjustment and maintenance of the transmitter, particularly if a standby transmitter is used. Loads are offered in a range of impedances and power ratings. Loads for FM at 5 kW and below are air-cooled, and for 7.5 kW and above are water cooled. The AM dummy load should be selected with a power rating to handle the modulated peak power.

AM dummy loads are usually wirewound types, and although they are carefully designed to be non-inductive, they do have some inductance. This becomes apparent at the higher frequencies. The customer purchasing a wirewound dummy load should also procure an adjustable compensating network to cancel out the inductance. This is best obtained before the engineering consultant arrives to work on the array at which time he can use his bridge to find the proper adjustment.

Transmission Line Switches

Manual and motor driven transfer panels are available in a variety of styles to provide a convenient and rapid means of switching coaxial transmission line circuits between the transmitter and antenna for power cutback, dummy load switching, emergency antenna or spare transmitter switching and other functions. Microswitches are built into the motor driven types to operate indicators and power interlock circuits since RF power removal is necessary during operation of the switch.

Input & Monitoring Equipment

The input and monitoring equipment for the AM or FM station consists of FCC type-approved frequency and modulation monitors—and phase monitor if an AM directional antenna is used—plus limiter amplifier, VU meter panel, jack panel, fuse panel and possibly utility amplifiers for house monitoring. An unattended, remotely controlled transmitter would require, in addition, a remote control and automatic logging system which would provide control and measurement facilities for transmitter functions.

FM Antennas

Considerations in the design and planning of FM antenna systems are detailed in Part Two of this series of articles, where some discussion is devoted to means for achieving either horizontally polarized signals, vertically polarized signals or a combination of the two. As stated, antennas are available to produce either type signal, and both can be radiated simultaneously by interlacing the two types of antennas or more simply, by use of a circularly polarized antenna, which provides the equivalent of combined horizontally and vertically polarized radiators.[1] FM antennas should be supplied with a matching transformer. This provides a precise match between transmission line and antenna after the antenna has been mounted on the supporting structure.

It should be emphasized that the elements of some circular polarized antennas

[1] See "Dual Polarization FM Broadcasting With A Single Antenna," BROADCAST NEWS, Vol. No. 134, June, 1967.

have radomes available which is a feature worth considering in choosing an antenna. While radomes add wind loading in the order of 100 psf per section, this figure is still below the wind load of combined vertically and horizontally polarized antennas. Also antennas with radomes require no deicing, so there is a significant saving in power consumption, temperature control equipment and wiring. Radomes also provide not only a measure of protection for the antenna against the effects of rain, snow and ice but against atmospheric deterioration as well.

Prepare A System Diagram

After equipment for the new station has been evaluated and decided upon, the planner should next prepare a simple line diagram covering the units of his broadcast system from microphone to antenna. This will provide a functional checklist to assure that the system is complete and the design meets FCC approval. This planning diagram will also be helpful in installing the equipment and finally testing the system for proper operation.

Equipment Installation

It is well to establish a systematic procedure for checking equipment as soon as it is received at the station building. Equipment should be unpacked carefully and all parts identified with those on the packing sheets to avoid accidental loss of parts in discarded packing material. One good method is to prepare a list of the items received, giving dates and notations about any missing or damaged items.

Several of the heavy components will have been removed from transmitters and packed separately for shipment, along with large tubes, frequency determining parts and certain power determining components.

Careful study of the instruction book supplied with each equipment is necessary for proper installation and operation. This includes observation of any addendas that may be supplied with the book. Addendas are very important because they usually reflect beneficial changes that result from field experience.

Beyond that, sound wiring practices must be observed. A good station ground must be established and equipment connected to it by copper strap. Leads carrying AC should be well separated from audio wiring, and high level audio wiring should not be cabled with low level audio wiring such as microphone cables. Microphone shield should be grounded at one point only, and that is as near to the input of the associated preamplifier as possible.

Preventive Maintenance

Much improvement has been made in the reliability of broadcast equipment. However, there are still areas of equipment care for which a preventative maintenance schedule should be established and adhered to in order to sustain the value of the broadcast investment. The instruction book should be referred to for detailed maintenance procedure, but each station owner should take the time to analyze his equipment and prepare a check list to be sure maintenance chores are performed regularly.[2]

Dust is the number one enemy, by preventing proper heat dissipation, by changing electrical values of components, causing arcing, and by preventing proper electrical contact in relays and switches. Dust filters on equipment, though effective, do not prevent all dust from reaching components. Wherever possible, air brought into the building should be filtered. Any improvement in dust elimination will contribute to improved reliability of the equipment. Of course, air filters should be inspected and cleaned or changed at regular intervals.

Routine visual inspections should be made. Tighten screw type connections that may have loosened with vibration. Periodically test high voltage contactors. Check all moving and rotating items for proper functions. Keep switches and relays contacts clean. Low-current circuits sometimes use small fuses. It is good practice to change them once a year.

The antenna system usually requires maintenance. Tower spark gaps should be kept clean, and weeds kept cut around the towers. Guy wire tensions, insulators, and ground straps should also be inspected. Tower lighting equipment must be maintained in proper working order, and the tower kept painted in accordance with FAA requirements. Pressurized lines should be inspected regularly for leaks. Approximately five pounds pressure should be maintained on gas lines. Electrical junction boxes, or "pull boxes", should be checked. If moisture is present, check gaskets. Be sure breather hole is open and in down position. The antenna meter must be checked and calibrated against the base current meter at regular intervals.

It is necessary to check the modulation monitor with an oscilloscope at regular intervals to insure its accuracy. The same applies to the frequency monitor, which must be checked with an outside frequency measuring service. At the same time the modulation monitor is checked, operation of the limiter amplifier should be observed. The calibrations of the various functions of remote control systems should be checked.

Frequency response, noise, and distortion measurements should be made more frequently than the once-a-year overall proof of performance tests required by the FCC. It is good practice to check all station equipment at least four times a year in addition to proof of performance measurements.

Tools and Test Equipment

Even the smallest well equipped AM or FM radio station will have access to an adequate set of hand tools for use in making repairs and maintaining the equipment. Stations should acquire and make frequent use of good test equipment. Test equipment that will prove helpful when performing routine maintenance and making proof of performance checks will include an audio oscillator, noise and distortion meter, transmission set or set of calibrated attenuation pads, volt-ohm meter or VTVM, oscilloscope, tube tester and field intensity meter.

Supplier Qualifications

The qualifications of the equipment supplier very often are a key to equipment performance and customer satisfaction. The purchaser should give careful consideration to the various companies who will be called upon to supply the equipment, their experience, their record in the industry, their ability and desire to solve field problems. Many purchasers express a preference for doing business with one company, for the greater ease and convenience of a single source of contact and responsibility, and for an ideally matched system. This also may assure an orderly future expansion with units electrically and mechanically designed to work together.

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[2]The National Association of Broadcasters Handbook, available from NAB Headquarters in Washington, D. C., contains valuable information to guide the broadcaster in the operation and care of his station.

HOW TO IMPROVE VIDEO HEAD AND TAPE LIFE

by RICHARD H. WOOD
Television Tape Merchandising

EDITOR'S NOTE: This article should be of special interest to all users of quadruplex TV tape recorders regardless of make. It reports findings and recommendations by RCA and others within the industry who have been conducting extensive tests to determine the factors contributing to a recent, industry-wide decline in normal VTR head life.

During the five year period from 1960 through 1965, the broadcast industry as a whole experienced a continuing increase in video head life. The average was well over 300 hours, with isolated reports of as high as 1,000 and even 1,500 hours, particularly where tapes were not "bicycled" and were continuously used in house, on the same machine.

But, by the summer of 1966, average head life throughout the industry had dropped substantially. This occurred at about the same time a new generation of high band color recorders and high performance tapes were introduced.

As a result, recorder manufacturers and tape suppliers began an intensive testing program using different machines and various tapes that revealed several factors influencing video head and tape wear.

In summary, these are listed below, though not necessarily in the order of their importance:

1. Relative hardness of pole tip material.
2. Tip penetration used.
3. Type and condition of tape.
4. Tape environment.
5. Machine transport adjustment.
6. Class of service and machine operating techniques.

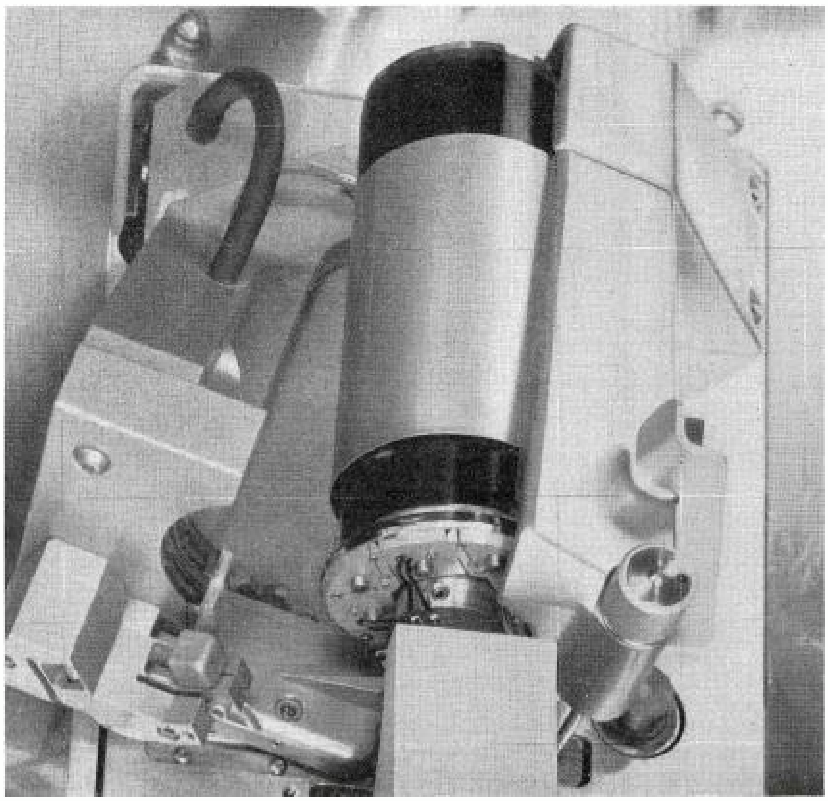

FIG. 1. Vacuum guide released to show video headwheel.

Relative Hardness of Pole Tips

The pole tip material used in present day professional recorders consists of an alloy of aluminum, iron and silicon. This alloy has a hardness of 48 on the Rockwell C scale, a reading which for this material normally does not vary more than an inconsequential 2 or 3 points.

Indications are that variation in the hardness of the metal pole tip is not very often a factor in today's problem of head life. It should be noted here that at no time in RCA's experience with manufacturing or warranty inspections for head composition, structure and hardness has there been evidence of soft metal pole tips. During the manufacturing process, the video headwheel is run in conjunction with a special "lapping" tape in order to contour the heads, a process that would quickly reveal soft pole tips if they were present. Also, any variation in the hardness of the metal would result in widely different wear rates between the four heads on the wheel, and this has not occurred. Occasionally, small variations in tip protrusion between individual heads may appear in the field. This is usually due to an unbalanced condition of the headwheel and shaft, and is not related to variation in pole tip hardness.

Pole Tip Penetration

A reduction in head life and damage to the tape can be expected if recordings are made with an excessive tip penetration. It is also true that an increase in head life can be expected by recording with a lower than normal tip penetration, although this increase in head life will be offset by the degradation in signal when the pole tips tend to lose contact with the tape as they approach the 1.0 mil protrusion point. The important thing to remember is that recordings made to a non-standard penetration will have to be replayed with a non-standard penetration, a condition that if allowed to grow could destroy the interchangeability of tapes throughout the industry.

Therefore, all tapes should be recorded at standard tip penetration (standard recording radius) as specified in the SMPTE Recommended Practice RP-11. This requires the use of a standard alignment tape which has been accurately recorded to the SMPTE standard. The RCA MI-40793 alignment tape conforms to this standard. Care should be taken in the use of the standard alignment tape to avoid

IMMEDIATE STEPS FOR REDUCING ABNORMAL HEAD WEAR

1. Clean heads and tape path after each tape pass.
2. Eliminate use of mechanically damaged tapes.
3. Eliminate tapes found to exhibit high abrasivity.
4. Store tapes on edge in dustproof enclosures. Ship only in recommended shipping cartons.
5. Keep tape machine environment as clean and dry as possible.
6. Check tape transport adjustments, especially the vacuum at the tape guide.
7. Check tape guide positioning for conformance to RP-11 standards.
8. Do not use excessively worn or damaged video heads.

FIG. 2. SMPTE Recommended Practice RP-11.

SMPTE Recommended Practice RP 11

Tape Vacuum Guide Radius and Position for Recording Standard Video Records on 2-inch Magnetic Tape

1. Scope

This recommended practice specifies the tape vacuum guide radius and position for recording standard video records on 2-in. magnetic tape.

2. Mechanical Dimensions

2.1 The radius of the tape vacuum guide shall be 1.0334, +0.0000, −0.0005 in. (26.248, +0.000, −0.013mm).

2.2 The position of the vacuum guide shall be set so that the eccentricity of its center of curvature with respect to the axis of rotation of the video heads is as indicated in the table. The eccentricity shall be such that the extension of a line joining the center of curvature of the vacuum guide and the axis of rotation of the heads intersects the tape at the midpoint of its width. The center of curvature of the vacuum guide shall lie between the axis of rotation of the heads and the vacuum guide.

Vacuum Guide Radius		Eccentricity	
Inches	Millimeters	Inches	Millimeters
1.0334	26.248	0.0000	0.000
1.0333	26.246	0.0001	0.003
1.0332	26.243	0.0002	0.005
1.0331	26.241	0.0003	0.008
1.0330	26.238	0.0004	0.010
1.0329	26.236	0.0005	0.013

Note: These dimensions are based on a nominal tape thickness of 0.0014 inch (0.0356mm) and a radius of rotation of the magnetic head pole tips of 1.0329 inch min. to 1.0356 inch max.

APPENDIX

The achievement of tape playback interchangeability requires, among other things, that means be provided to accommodate variations of (a) the radius of rotation of the magnetic head pole tips, (b) the radius of the vacuum guide and (c) tape thickness. These effects are compensated by the stretching of the tape into a slot cavity in the vacuum guide by virtue of the radius of rotation of the magnetic head pole tips projecting beyond the unstretched oxide surface of the tape as held in the vacuum guide. Over the limits normally encountered, the stretching provides automatic compensation if the vacuum guide is positioned to give the minimum geometric distortion in the reproduced picture.

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the possibility of the tape becoming damaged or stretched, thereby changing its effective penetration. Excessive stopping and starting of the machine and high speed winding when using the alignment tape should also be avoided wherever possible.

Normal Head Wear

Figure 3 depicts the typical head wear curve obtained by the industry with low band tape. It can be seen that the initial rate of wear at the 3.0 mil protrusion point is high (due to greater head-to-tape pressure) and then tapers off following an exponential curve to slightly below 1.0 mil protrusion which is the effective end of head life taking into account the SMPTE recommended practice RP-11. It can be seen by referring to RP-11 (Fig. 2) that the effective radius (or position) of the vacuum guide does not change during the 3.5 to 0.8 mil protrusion limits of the pole tips. This is because variations in timing between heads as the pole tips wear down are automatically compensated for by the varying tape stretch. This is illustrated in Fig. 4, where the line between points A and B represents a portion of the stretched tape. As the pole tip wears, tape stretching lessens, compensating for the shorter distance between points such as C and D. From this it is apparent that the actual head to tape pressure is greater at the 3.0 mil protrusion point, and this results in the higher wear rate for a new head depicted in Fig. 3.

Type and Condition of Tape

Extensive testing and evaluation of the various tapes available indicates that the type and condition of the tape are closely related to head life. The large variations in head life throughout the broadcast industry can be attributed in most cases to a mixture of different types of tape used at a given location. And while indications are that an average head life of over 300 hours may be obtained using the standard low band tape in monochrome service, some high performance tapes which are now coming into more universal usage with high band color operation have been found to cause a reduction in overall head life.

Testing for Tape Abrasivity

The tape itself can cause a reduction in head life by being abrasive or by becoming abrasive due to use or damage. It is important that tapes exhibiting highly abrasive qualities be removed from service as soon as possible after detection.

An abrasive tape can be detected by viewing the video head pole tips under a 100 to 150 power microscope with an attached light source, and observing the condition of the tips after the tape in question has been run against the head for 30 minutes. The three pole tips illustrated in this article were photographed after being magnified 150 times. Figure 5 shows a pole tip which has been operated with relatively non-abrasive tape. Figure 7 shows a pole tip which has assumed a mottled bluish appearance due to operation with a high performance tape which

FIG. 3. Typical video head wear curve obtained with low band tape.

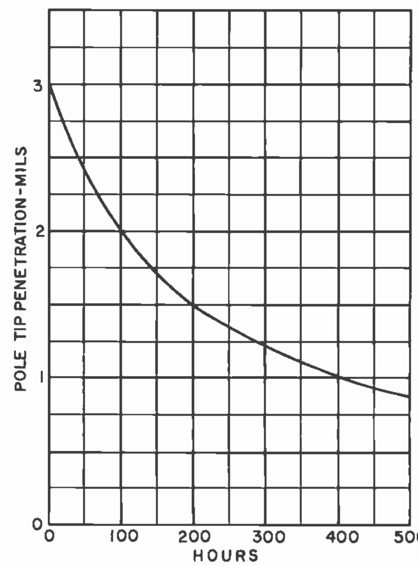
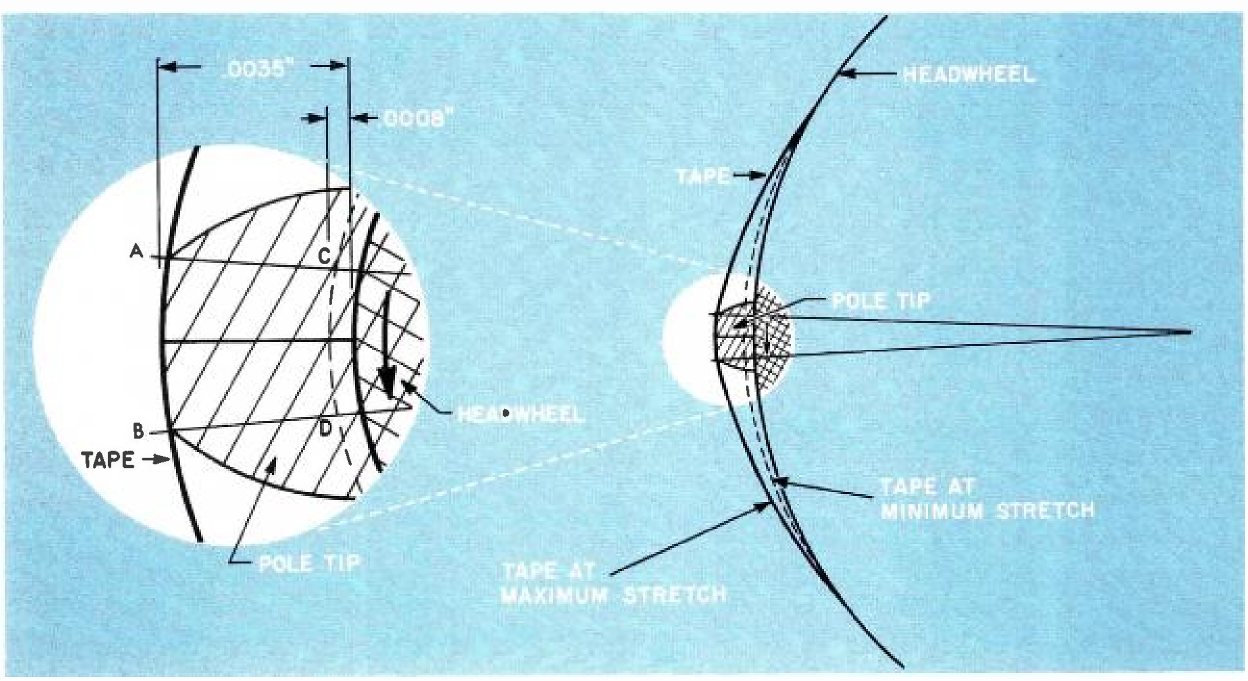


FIG. 4. Sketch showing how tape stretch compensates for variations in timing caused by pole tip wear.



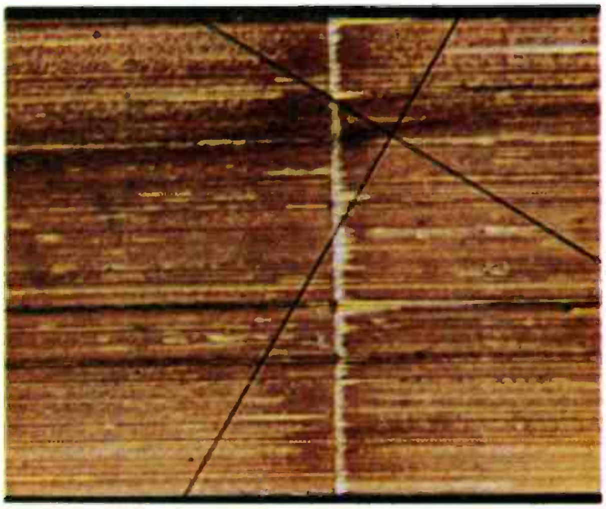


FIG. 5. View of pole tip surface depicting excellent life as it appears after running with relatively non-abrasive tape.

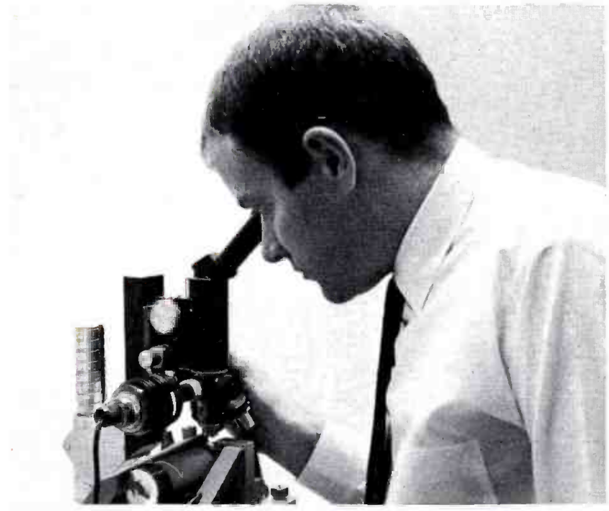


FIG. 6. Video head wear conditions can be evaluated by viewing the pole tips under a 150-power microscope with light attachment.

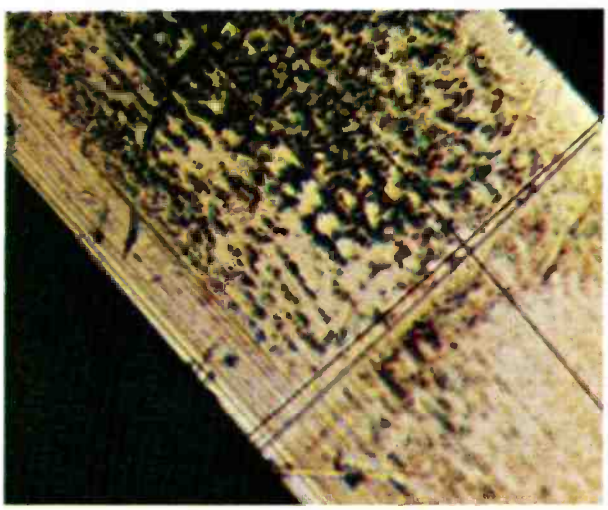


FIG. 7. Pole tip surface exhibiting mottled appearance with traces of blue, characteristic of use of head with high performance tape.

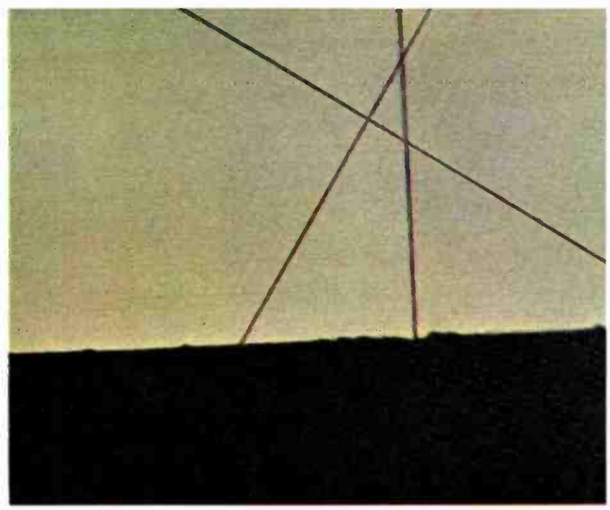


FIG. 8. View of pole tip surface operated against highly abrasive tape. Shiny, polished surface indicates very low head life.

has resulted in a higher rate of head wear than that of Fig. 5. Finally, Fig. 8 shows a pole tip which has been operated with an extremely abrasive tape and in this case it can be seen that the tape produced a shiny polished surface, an indication of perhaps 20 to 50 hours of head life. The video head gaps appearing in these photos run perpendicular to the edge of the heads and are not to be confused with the microscope crosshairs.

Worn Heads Damage Tape

Damage to an otherwise acceptable tape is possible by operating it with a damaged or excessively worn video head.

Normally a head should be rejected when the pole tips have reached 0.8 mil minimum protrusion. This will ensure that recordings are not made with a head having less than 0.8 mil protrusion as these recordings may not comply with the SMPTE standard. It is possible to continue using an 0.8 mil head for *playback* service, however, the danger here is that some operators, in order to eliminate head clogging, increase tip penetration by moving the vacuum guide toward the headwheel, relying on automatic timing correctors to remove skewing errors that are introduced. Operating in this manner will cause the tape to press heavily against the headwheel, resulting in three headwheel conditions that can damage the tape: (1) wear of chrome plating from the headwheel rim; (2) possible chipping and damage to the video heads; and (3) scratched surface of headwheel.

Care of Tape and Machine

Special precautions in the handling of tape and the care of the tape machine are necessary to extend the usable life of the tape. Particular attention should be paid to the following:

(a) All parts of the recorder which come into contact with the tape surface should be thoroughly cleaned with Freon TF or an equivalent inert liquid prior to threading the tape on the machine. This includes tape guides, tension arms, rotating headwheel assembly, vacuum guide, control track head and audio heads. *Note: Agents such as alcohol, benzine or lighter fluid should not be used. They can damage the capstan rubber pinch roller and if allowed to come in contact with the tape can soften and loosen the oxide binder.* The rotating headwheel assembly should be cleaned with Freon TF using soft applicators such as Kim Wipes. Toothbrushes, cotton tipped sticks or other stiff applicators should not be used, as damage to the head windings can result.

(b) The take-up and supply reels should be in good condition. Bent or damaged reels should be repaired or replaced. A bent reel can cause folding or creasing of the edges of the tape.

(c) The tape must be properly threaded to insure that it is correctly positioned over all guides, heads, etc. Particular attention should be given to correct seating of the tape in the vacuum guide assembly. Any slackness of the tape in the tape path may result in longitudinal creasing by the capstan and pinch roller assembly if this is not removed by turning the take-up reel by hand prior to starting the machine.

(d) Damaged sections of tape or curled ends should be removed. Failure to remove these damaged sections of tape can result in damage to the heads because of increased abrasion. Bad splices, or even an excessive number of splices should be avoided for the same reasons.

(e) After recording, editing or previewing a tape it is advisable to completely rewind the entire reel in order to remove stresses that might otherwise be set up during stopping and starting of the machine. Failure to remove these stresses can cause the tape layers to bunch up and fold over on themselves.

Tape Environment

Extremes of temperature and humidity for video tape will have an indirect, adverse effect on video head life and therefore should be avoided.

Tape manufacturers recommend that video tape should be used and stored under normal temperature and humidity conditions of 65-75F. degrees temperature and 40-60 percent relative humidity. Tests conducted at RCA indicated a sharp increase in head wear with humidities above 75 percent, and a similar increase in head wear was noticed when the relative humidity dropped to below 20 percent. These results agree with data obtained from the various tape manufacturers.

Tape which has been subjected to abnormal temperature and humidity conditions should be stabilized for at least 16 hours within the normal temperature and humidity limits stated above. Playback of a video tape at temperatures significantly different from that employed during recording will temporarily result in degradation of signal-to-noise and accentuate servo tracking problems due to tape slippage, or sticking to tape guides, audio heads and capstan. This is especially noticeable on color material. The tape machine operational area and videotape storage area should be therefore, air conditioned within the limits of 65-70°F. and 40-60 percent relative humidity.

A means should also be provided to prevent dust and dirt from entering these areas. Dust and dirt are well known for causing dropouts. But operating a tape machine in a dusty or dirty environment also causes excessive head wear and tape damage as the dust particles will be ground into the surface of the tape by the rotating headwheel and on subsequent replays further abrasion can occur to both tape and heads. Tape manufacturers have reported a 2 to 1 improvement in head life merely by cleaning a tape which has been operated in a dusty atmosphere.

Machine Transport Adjustments

The tape machine transport adjustments should be regularly checked to ensure that the tape tension, guide vacuum, air guide pressure, supply and take-up motor torques, brakes and capstan pinch roller adjustment—all conform to the values recommended in the instruction book. Excessive guide vacuum and tape tension have been found to increase head wear by a factor of 2 to 1.

Class of Service

The type of service for which the video recorder is used will have a bearing on the head life obtained. For example:

(a) If the machine is used for recording rather than playback the subsequent heating of the head windings and pole tips by the record drive current may cause a reduction in head life by as much as 20 percent.

(b) Use of the machine with virgin tape or tape which has only had one or two passes can also cause a reduction in head life. It has been found that up to four times the wear rate has been experienced with virgin tape.

(c) If the machine is primarily used for program delay purposes or is used for recording and previewing long programs the head life will be greater than the life obtained on a machine primarily used for recording, editing, previewing and replaying spot commercials.

(d) The actual techniques used by the various tape operators at a given location will also influence head life. The TV tape recorder is a precision instrument with close operational tolerances in the tape transport and headwheel area. Generally speaking, the extra care and cleanliness which is exercised when operating a tape recorder will pay off in terms of increased head life.

Conclusion

VTR installations can be sure of obtaining maximum head life by adopting rules and procedures relative to tape cleanliness, operation, storage, shipping and environment. This should minimize damaged tape and improve operating practices. Particular attention must also be given to cleanliness of the machine and heads. All tape transport operating parameters should be periodically checked as described in the instruction book. Replace heads that have reached the end of their useful life to avoid tape damage. Likewise, damaged tapes should be removed from service. Finally, it may be necessary to conduct abrasivity tests on all incoming tape if high head wear is experienced.

The recommendations outlined in this article are based on the results of tests and field experience, and if followed, should give a considerable improvement in video head and tape life.

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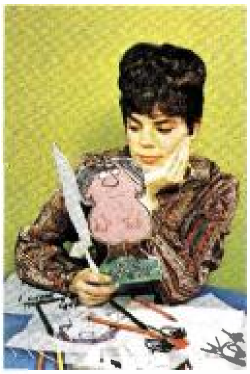
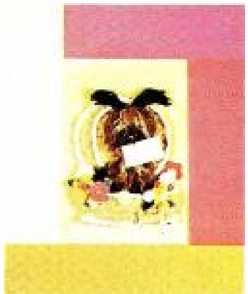
RCA TK-42 "Big Tube" Cameras and TR-70 Highband Tape Recorders

In the Rust Craft business, finest color reproduction is most important whether in greeting cards or broadcasting. RCA TR-70 highband recorders are a perfect match for RCA TK-42 studio cameras, giving Rust Craft stations an unbeatable combination in producing highest quality color programs and commercials.

Medium market stations, like those in the major markets, demand the best in color. The fact that many group-owned stations are ordering this RCA color combination is an indication of the emphasis on quality.



Some of the many Rust Craft artists at work, illustrating various stages in design of cards, party goods and gift wrap. In all these, the creative use of color combinations is basic to the appeal and sales of Rust Craft products.



Creative color combination: TK-42 color camera and TR-70 highband tape recorder in operation at WROC-TV, Rochester, one of the Rust Craft stations.

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NEW TYPE KLYSTRONS. Unique, integral-cavity vapor-cooled klystrons are a high power development of those used in the proven RCA TTU-30A and TTU-50C Transmitters. Reliability and long life are major advantages, with faster warm-up time, less weight and pretuning among other points of superiority.

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WALK-IN DESIGN. New design techniques and walk-in cabinetry result in smaller size and easy maintenance. This means direct savings in installation and operation and will minimize building construction costs.

ANTENNA CHOICES. RCA offers you a choice of Pylon and Panel Antennas for use with this new Transmitter. You get the kind of Antenna that suits your needs—directional or non-directional—as well as your power requirements.

COMPLETE LINE OF UHF TRANSMITTERS. There are three high-power integral-cavity vapor-cooled klystron transmitters: 30KW, 55KW and 110KW. Also two lower-power air-cooled transmitters: 2KW and 10KW (the 2KW is easily expanded to a 10KW).

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AUTOMATIC AUDIO PROGRAM LEVEL CONTROL

by R. CLIFFORD ROGERS
Audio Broadcast Merchandising

New Solid State Units Provide Excellent AGC Operation, Maintain Desired Peak and Average Signal Outputs

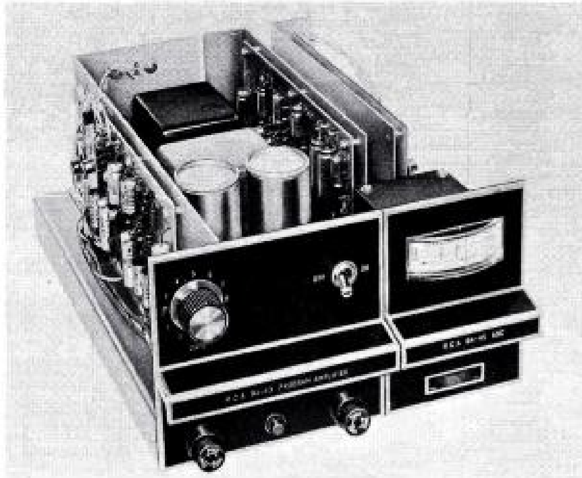


FIG. 1. BA-43/45 AGC Program Amplifier.

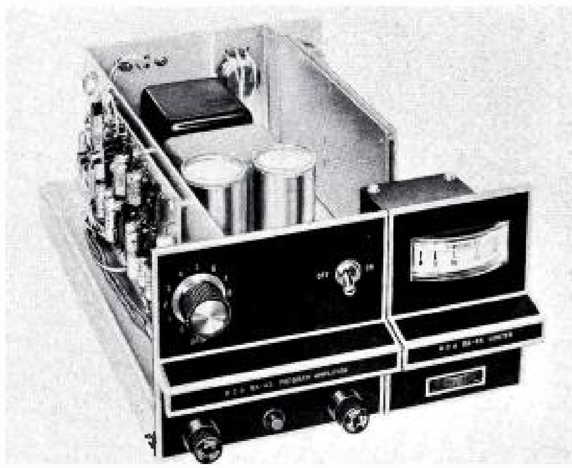


FIG. 2. BA-43/46 Limiter Amplifier.

Now, more than ever, there is a demand for audio signal processing equipment that will effectively and automatically control audio gain and thus provide substantially constant peak and average output levels.

This is brought about partly by the greater number and variety of program sources such as film projectors, tape recorders, turntables, microphones and program lines, and by the requirement for more stringent signal uniformity resulting from increased use of automatic equipment and pre-programmed selection techniques. Moreover, modern recording and broadcasting equipment maintains the high-frequency content of the program material which is most likely to cause transmitter overloading; so there is the normal requirement to maintain tighter controls against the possibility of overmodulation.

To meet these needs, a new series of automatic audio level control amplifiers has been designed: A Type BA-43/45 AGC Program Amplifier; Type BA-43/46 Limiter Amplifier; and a Type BA-43/47 Clipper Amplifier. See Figs. 1, 2, 3 and 4.

These units have wide applications in broadcast and recording studios. They are readily adaptable for use as a studio amplifier when feeding the control room or transmitter, or they may be used in combination with various audio sources to equalize signal amplitudes and maintain a high quality signal without degradation. They may be used advantageously in any recording application to permit higher recording level without overloading. They are completely automatic, requiring no operational adjustments or manual gain-riding whatsoever.

Present Audio Level Controls

The traditional program amplifier in the broadcast audio chain is gradually being supplemented by two basic units to provide the automatic level-controlling feature required in modern station operation. These two units are the AGC amplifier and the peak level controller.

The AGC amplifier is necessary in studios and control rooms to maintain a constant high average level and reduce the manual gain riding of the operator. The attack and recovery time of an AGC amplifier is slower than that of a peak limiter since it is intended to control the *average* levels over longer time periods. In maintaining uniform average levels, AGC amplifiers are operated within their compression characteristic. However, to widen the range of input signals that can be

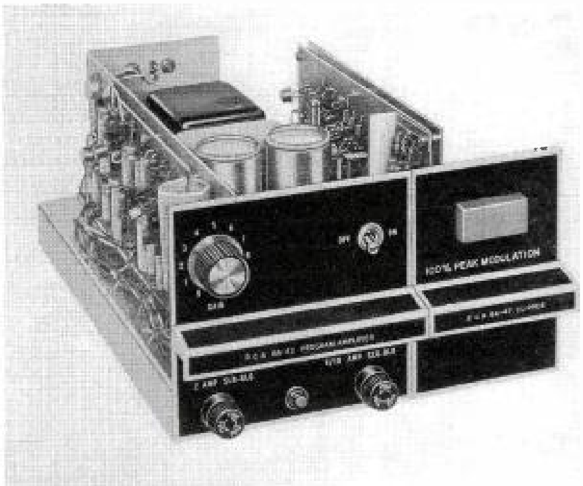


FIG. 3. BA-43/47 Clipper Amplifier.

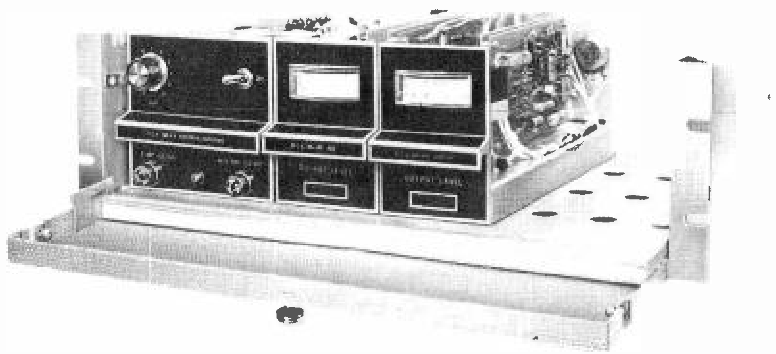


FIG. 4. Program Amplifier shown with AGC and Limiter units in rack mounting shelf.

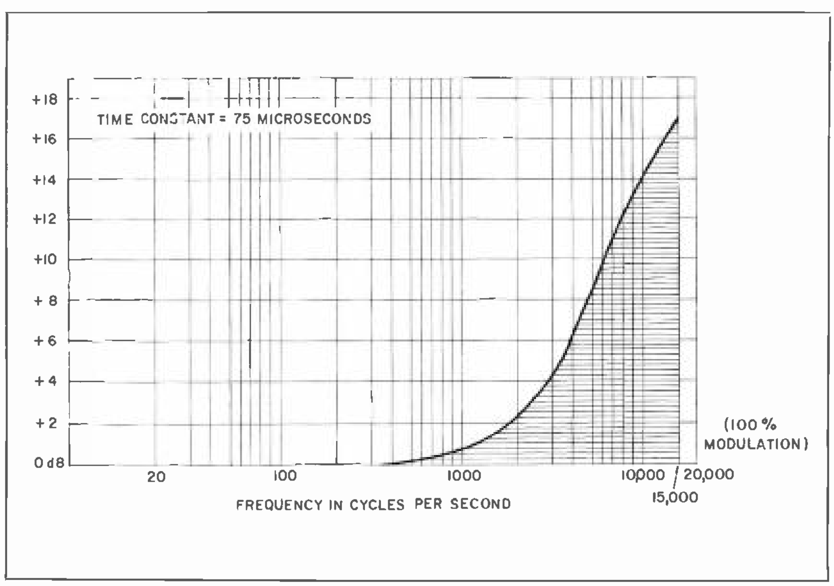
compressed without raising the background noise level, AGC amplifiers also provide a gain expansion on low amplitude signals to bring them up to average level. Important input/output characteristics of a good AGC amplifier are the flatness of its compression curve, and minimal distortion contributed to the audio signal.

Peak controllers, which may take the form of limiters or clippers, or both, are normally used at the transmitter site because of their ability to act fast enough to reduce to an acceptable level, any transient peaks which might cause overmodulation or damage to the transmitter. The speed of attack and recovery time and the flatness of the limiting curve are measures of the peak control unit's ability.

Handling FM Overmodulation

Audio signal processing equipment of the proper design maintains high and uniform signal levels with minimum degradation of any of the signal frequencies. This is particularly true for FM, where high fidelity is the stock and trade. How-

FIG. 5. Standard FM Pre-Emphasis curve.



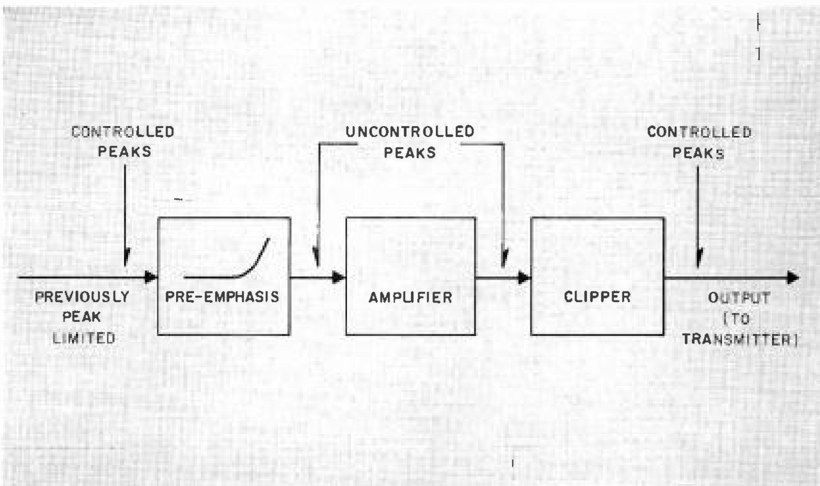


FIG. 6. Block diagram showing typical method of peak clipping prior to the advent of the BA-43/47.

ever, in attempting to achieve a high level of modulation, extreme care must be taken by the FM broadcaster to prevent overmodulation, since the FCC regulations provide that no peaks, even of short duration, exceed 100 percent modulation.

A large majority of the incidents of FM overmodulation are caused technically by the 75 microsecond audio pre-emphasis which is normally inserted at the transmitter input. Even though the peak limiter in the system limits audio peaks to a certain pre-determined level, the pre-emphasis network that follows produces a high frequency boost which amplifies the high frequency peaks more than the low frequencies (See Fig. 5). These higher peaks may cause overmodulation if allowed to go, uncontrolled, directly to the transmitter.

The Need for Peak Clipping

The placing of a peak *limiter* after pre-emphasis to correct the problem is usually not desirable because the pre-emphasized high frequency peaks will cause a predominant amount of limiting, resulting in signal gain reduction and a consequent lowering of the average modulation level. There are actually only two ways to reduce the peaks without affecting average level: By rolling-off the high frequency response, or by peak *clipping* after pre-emphasis.

Disadvantages of Frequency Roll-Off

Several types of equipment have been designed in an attempt to cope with the FM overmodulation problem. One type resorts to rolling-off the high frequency response by some amount that depends on the signal level. Operation is such that, as the signal level gets higher, the more high frequencies are lost in the rolling-off process. For signal levels whose peaks reach 100 percent, the entire program during these times will have a high frequency roll-off starting at 2,000 Hz (—2.8 dB), and going to 15,000 Hz (—17 dB). Since the pre-emphasis in the transmitter is complementary to the de-emphasis in the listeners' receivers to produce flat response, the net result is that the listeners will hear a severely degraded signal. This happens whenever the peaks reach 100 percent. The amount of degradation is dependent upon the frequency and level of the signal. Thus, at the highest input level, reduction of high frequencies will result, with obvious loss of fidelity.

Peak Clipping is Absolute

Peak clipping provides positive protection against overmodulation with the added advantage of no audible degradation of the signal. Figure 6 shows a functional diagram of how peak clipping is accomplished. The program material, having been previously peak limited, undergoes the standard 75 microsecond pre-emphasis and is amplified to obtain a level suitable for the transmitter. At this point, high frequency peaks which were controlled by the limiter to some 100 percent peak value may now exceed 100 percent by the amount of the applied pre-emphasis (as much as 17 dB). Now, however, the signal passes through clipping diodes that clip any peak in excess of 100 percent modulation by the amount of pre-emphasis it received (Fig. 5). The 100 percent modulation level is set by an arbitrary level from the peak limiter at some low frequency unaffected by pre-emphasis, say 400 Hz. Clipping may be accomplished either by Zener diodes having a breakdown at the determined 100 percent modulation level, or by plain diodes back-biased to conduct and clip at 100 percent. Either method provides positive control with an attack time in the one-microsecond range.

While it is true that peak clipping generates intermodulation and harmonic distortion, only the short duration signal peaks in the pre-emphasis range and above 100 percent modulation will be clipped. Most of this distortion is removed by the 75 microsecond de-emphasis network in the listeners' receivers, and the fidelity is preserved without resorting to frequency degradation.

New Generation Equipment

Extensive performance tests conducted during the development of the BA-43 Program Amplifier, BA-45 AGC Amplifier, BA-46 Limiter and BA-47 Clipper provided the basis for the design of this new generation of automatic gain-control equipment. The tests, which are described later in this article, demonstrated the ability of each unit to achieve its intended purpose and thus maintain a high average signal level while effectively controlling the peaks to prevent overmodulation. The AGC, Limiter and Clipper units are used with the Program Amplifier from which they derive their power and signals.

BA-43 Program Amplifier

The BA-43 Program Amplifier is a wide band, solid state plug-in unit featuring new circuitry, reduced power consumption and long life expectancy. High gain and low distortion make it ideal for use as a program or line amplifier, bridging amplifier or as an isolation unit. The improved amplifier circuit consists of an unloaded input transformer and three-stage negative feedback pre-amplifier, followed by a continuously variable gain control that is adjustable from the front panel. The amplifier drives a multi-impedance output transformer. Output as high as +30 dBm (one watt) is provided. Power supply is regulated and self-contained.

BA-45 AGC Amplifier

The BA-45 AGC Amplifier is a completely solid state plug-in unit designed for use with the BA-43 Program Amplifier to form a BA-43/45 AGC Program Amplifier. This combination is capable of providing a nearly constant average output level with wide variations in input level, since it provides expansion of low level signals as well as compression of high level signals. The BA-45 uses the light-dependent resistor (LDR) as the gain controlling

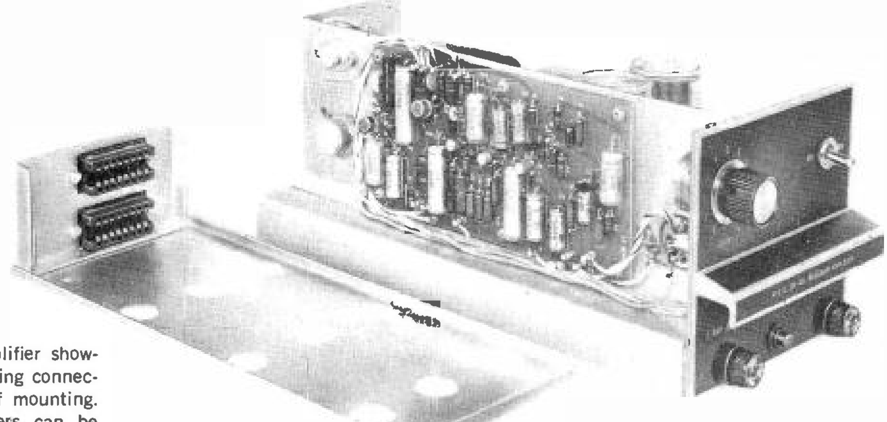


FIG. 7. BA-43 Program Amplifier showing guide assembly and mating connectors for plug-in BR-22 shelf mounting. Up to three BA-43 amplifiers can be accommodated on the mounting shelf.

element. BA-43/45 equipments are ideal for use in program or pre-amplifier channels. Special provisions allow for control of stereo signals. Other uses include microwave input audio control, and automatic fader control. The amplifier may be used with an external bias source for remote gain control or automatic fading. Input/output characteristics are shown in Fig. 8.

BA-46 Limiter

The BA-46 Limiter is a solid state plug-in device designed for use with the BA-43, from which it receives power and audio signals, to form a BA-43/46 Limiting Amplifier. This equipment provides economical and extremely fast and abrupt limiting action to prevent overmodulation of transmitters or overloading of audio recording facilities. The gain controlling element is an MOS field effect transistor.

BA-47 Clipper

The BA-47 Clipper is a solid state unit that operates in conjunction with the BA-43 Program Amplifier to perform both the functions of pre-emphasis and peak clipping. When this combination is fed from a BA-43/46 Limiter Amplifier, only the signal peaks in the pre-emphasis range and above 100 percent modulation will be clipped. This equipment provides absolute protection against overmodulation with no audible signal degradation.

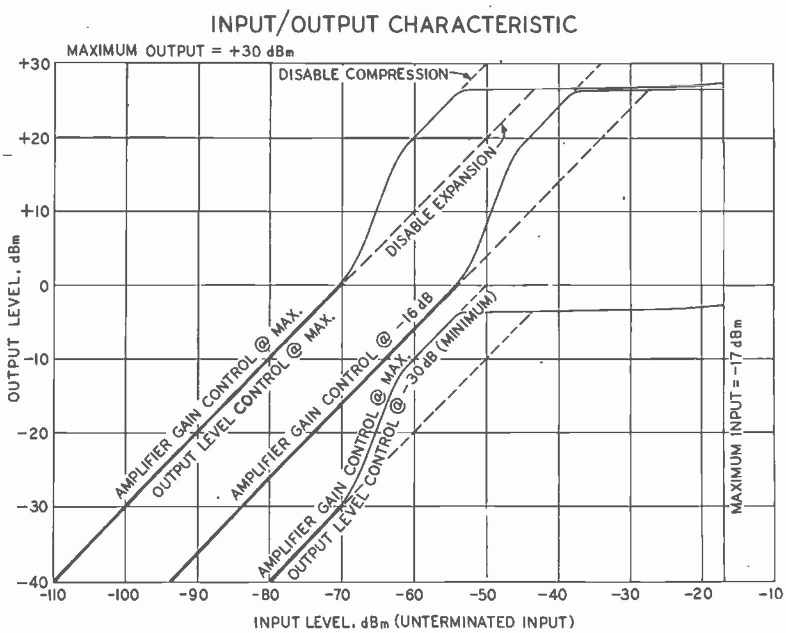


FIG. 8. Curves showing characteristics of the BA-43/45 AGC Amplifier.

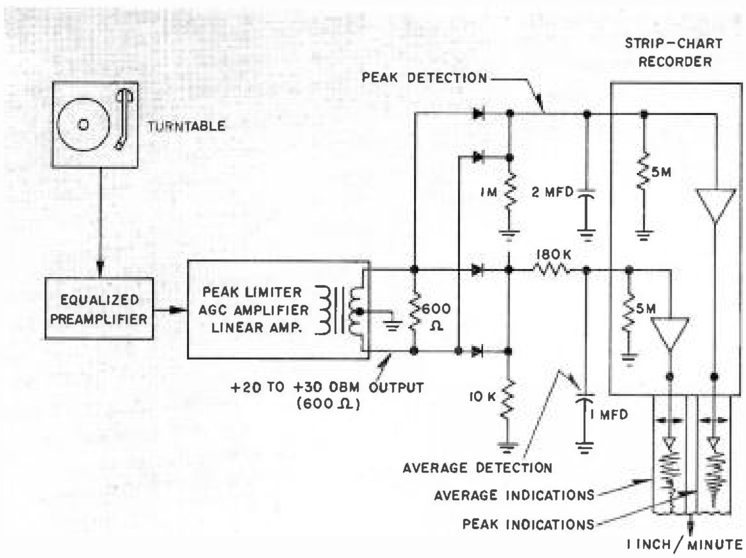


FIG. 9. Performance test setup.

Performance Tests

During the engineering development of the BA-43, BA-45, BA-46 and BA-47 series of audio signal processing and controlling equipments, listening tests were conducted using a variety of program sources such as microphones, phonograph records, audio tapes and sound effects. These tests were made in several locations in diverse acoustic conditions. To provide an objective correlation, measurements were made to indicate the quality of performance of each unit. The test set-up is shown in Fig. 9.

The program source, chosen for its diverse musical content, was a phonograph recording "Showcase in Sound". Although there was some compression used in the recording, this record contained a large dynamic range and a variety of program material ideally suited to such a test.

The equipment was mounted in a rack with a "normalling" jack strip as the interconnection arrangement, and an output selector switch was connected to the test equipment consisting of VU meter, long-persistence scope, strip-chart recorder, and monitor speakers. Fixed pads between each unit allowed the same standard level to be used at each input or output, so that the entire system was calibrated with one standard signal level. With this set-up, the program source is plugged into the input jack of any unit, and the output selector switch is turned to that unit to measure the output level. Since each unit was calibrated with the same output signal, and with the same amount of limiting or compression, any signal-level differences between the units is a direct comparison of each unit's ability to handle complex program waveforms.

The chart recorder provided a record of the test results. It has two independent channels, permitting the simultaneous recording of program peak levels on one channel and program average levels on the other. Therefore, the recorder acts as a recording peak-modulation monitor and a recording VU meter. The sine-wave signal was set at the indicated 100 percent peak modulation on one channel, and the VU meter channel read +7 VU. During complex program signals, the peak channel indicated the level of the peaks, and the average-reading channel hovered around 0 VU. Each chart in the test results contains the same program signal.

Test Results

The strip recordings are reproduced in Figs. 10, 11, 12 and 13. Figure 10 shows graphically the performance of the BA-43/45 AGC Amplifier. By raising the low level signals with expansion, and reducing the high levels with compression, the AGC chart exhibits an extremely uniform average level, as would be read on a VU meter. In the BA-43/45 AGC Amplifier, signal expansion is used to reduce the effect of "swishing." Thus, a loud signal with 10 dB of compression also produces 10 dB of expansion. When the program signal stops, the compression channel brings the gain up, and the expansion channel tends to lower. The result of this combined action is that no gain change or swishing of background noise can occur.

The essential action of the BA-43/46 peak limiter is illustrated in Fig. 11. Levels were initially adjusted to occasionally exceed 100 percent modulation and 0 VU. With the addition of a peak limiter, the program level can be increased without fear of overmodulation. In the test, the signal level was raised 10 dB, so that the peaks were being limited by 10 dB on the loud passages. With the use of a peak limiter, three points are noteworthy: (1) Signal peaks do not exceed 100 percent modulation; (2) The low average levels are raised 10 dB, and the high average levels are less affected; (3) Faster gain-recovery time results in a higher average level. As shown in the charts, the limiter maintained a uniform average level in addition to its precise peak limiting at 100 percent modulation. The unit does not clip to accomplish its limiting function.

Figure 12 illustrates the operation of the BA-43/46 Limiter and the BA-43/47 Clipper Amplifiers. Note the better controlled peaks and higher average signal levels achieved by the addition of the clipper unit. Figure 13 shows the advantage of using the complete new line of signal-processing equipment, where the BA-43/45 AGC signal output was cascaded into the BA-43/46 Limiter and BA-43/47 Clipper.

Conclusion

For broadcast stations or recording studios which must maintain a uniform program level from various sources including control consoles, the desirability of automatic gain control equipment is apparent. Yet, wide variations in program level are frequently experienced. This is particularly true when the distance between the performer and the microphone is subject to considerable fluctuation. Variations in program level are also encountered frequently when switching from one program source to another. The ear easily detects these variations, as well as differences in audio brilliance brought about by improper limiting or gain control action. And there remains the desire to lessen the need for manual adjustment.

The new RCA automatic gain controlling equipment features signal expansion, compression limiting and clipping to specifically overcome these deficiencies in broadcast and studio recording applications, prevent transmitter overmodulation, and maintain a higher and more uniform audio level with the least distortion.

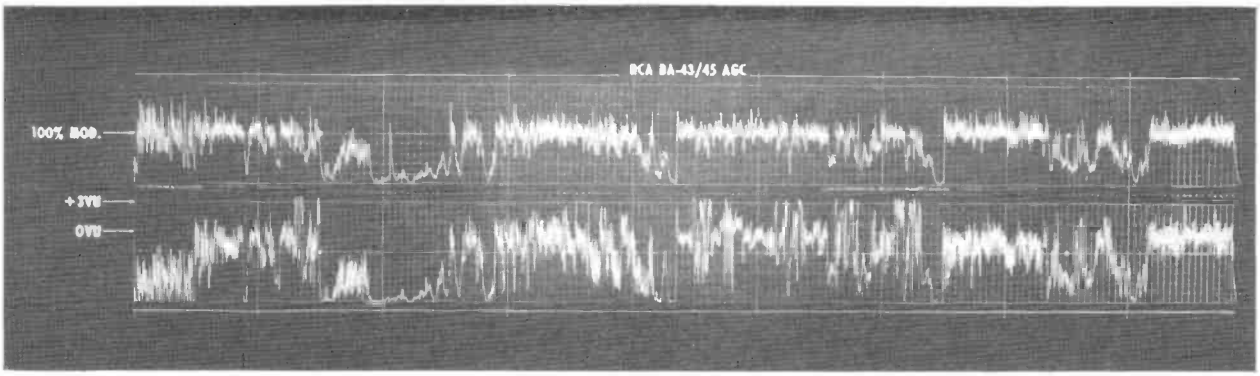


FIG 10. BA-43/45 AGC Amplifier output over input.

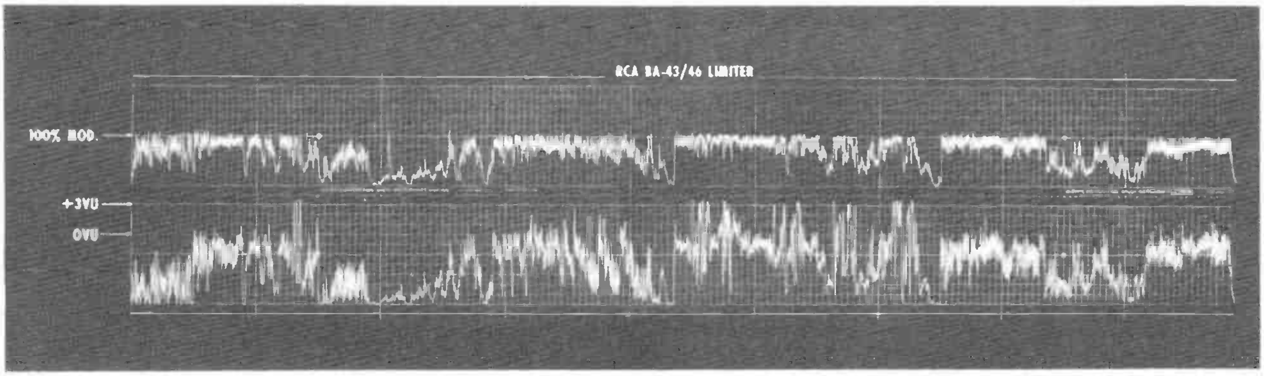


FIG. 11. BA-43/46 Limiter output over input.

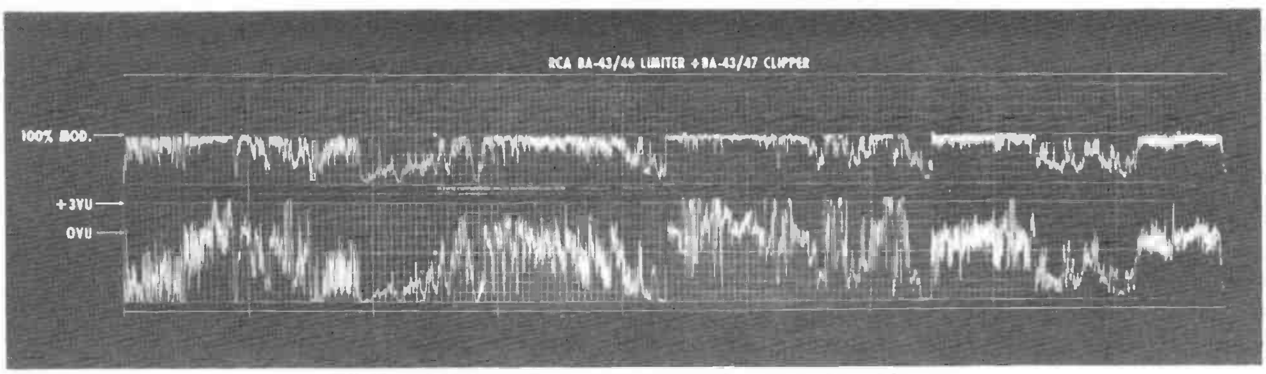


FIG. 12. BA-43/46 Limiter with BA-43/47 Clipper output over input.

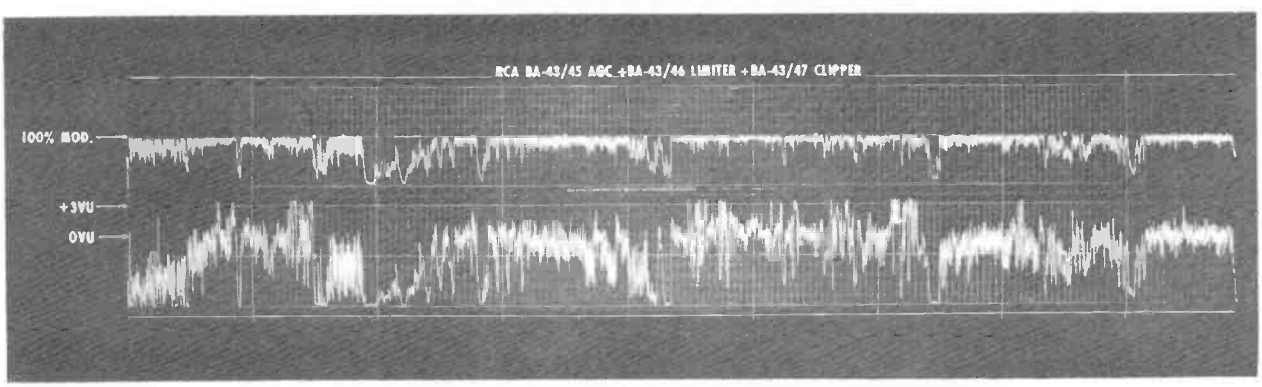


FIG. 13. BA-43/45 AGC with BA-43/46 Limiter and BA-43/47 Clipper output over input.

LOW-COST HIGH BAND COLOR TV TAPE RECORDER, TR-50

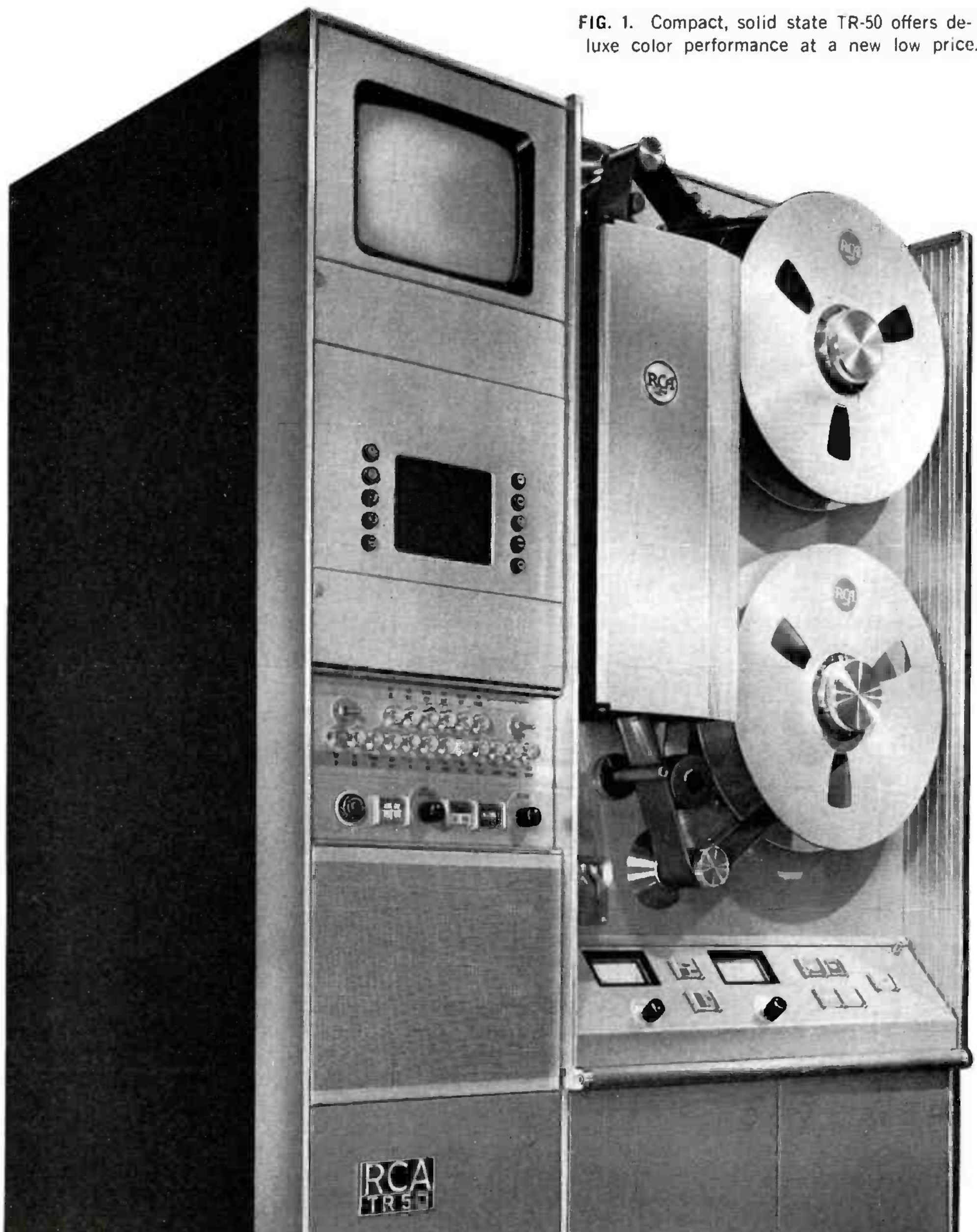


FIG. 1. Compact, solid state TR-50 offers deluxe color performance at a new low price.

New Economy Recorder with Built-In High Band Color and Other Features Found Only in Deluxe TV Tape Recorders

by WILLIAM TRIPPEL
Television Tape Merchandising

This new TV tape recorder will be welcomed by educators, broadcasters and network stations alike, in fact, by anyone who has been looking for a low cost quadruplex color machine with high band standards and the latest state of the art performance. Colors are brilliant and true. Stabilized circuitry assures easy, error free operation. The TR-50 not only incorporates many features of higher priced recorders, but is also tested to the same parameters and exactness before shipment. The recorder is available for operation on either NTSC or PAL color standards.

High Band/Low Band Switchable

The TR-50 is the tape industry's first economy high band color recorder. High band, recognized as providing the ultimate in picture quality with its higher FM recording frequency is built into the TR-50. However, so that tapes made to other FM standards can also be utilized, circuits for low band monochrome and low band color are also built in. A switch provides instant change to any one of the three operating modes. High band circuitry in the TR-50 eliminates any need for time consuming module changes or adjustments when switching from one mode to the other.

Universal Headwheel

To meet the requirements of multiple standards operation, the new TR-50 incorporates the universal high band headwheel which has long been an important feature of more sophisticated RCA tape recorders. The new headwheel uses air bearings for smooth, dependable high band color performance. The headwheel operates on all the switchable high band and low band tape standards.

Completely Solid State

Factory Tested for High Band Color

High Band and Low Band Operation

Color and Monochrome Timing Correction

Voice, Tone or Digital Cue Signal Recording

Compact and Mobile

Can Be Remotely Controlled

Selectable Servo Modes

Accenting the versatility of the TR-50 for just about every installation is a four position switch providing instant selection of tonewheel, switchlock, linelock or pixlock servo modes. Pixlock provides a tight lock on both vertical and horizontal sync to allow special effects mixing of tape signals with other signals. The linelock mode, especially designed for color, is useful when extremely fast recovery is required from disturbances due to improper splices, non-synchronous switches, timing errors or other defects in the recorded tape.

Two Speed Operation

Circuits built into the TR-50 allow choice of either 15 ips or 7½ ips tape speeds. Use of the slower speed permits twice as much information to be recorded on the same length of tape, resulting in substantial savings in tape stock and storage requirements. Use of the 7½ ips speed requires only the plugging in of a narrow track headwheel in place of the standard track, high band headwheel supplied.

Switchable Line Standards

The TR-50 is available in two basic models: a 525 line, 60 Hz machine; and a switchable 525/625/405 line, 50 Hz machine. In the switchable model, 819 line

FIG. 2. Switchable to three FM standards.

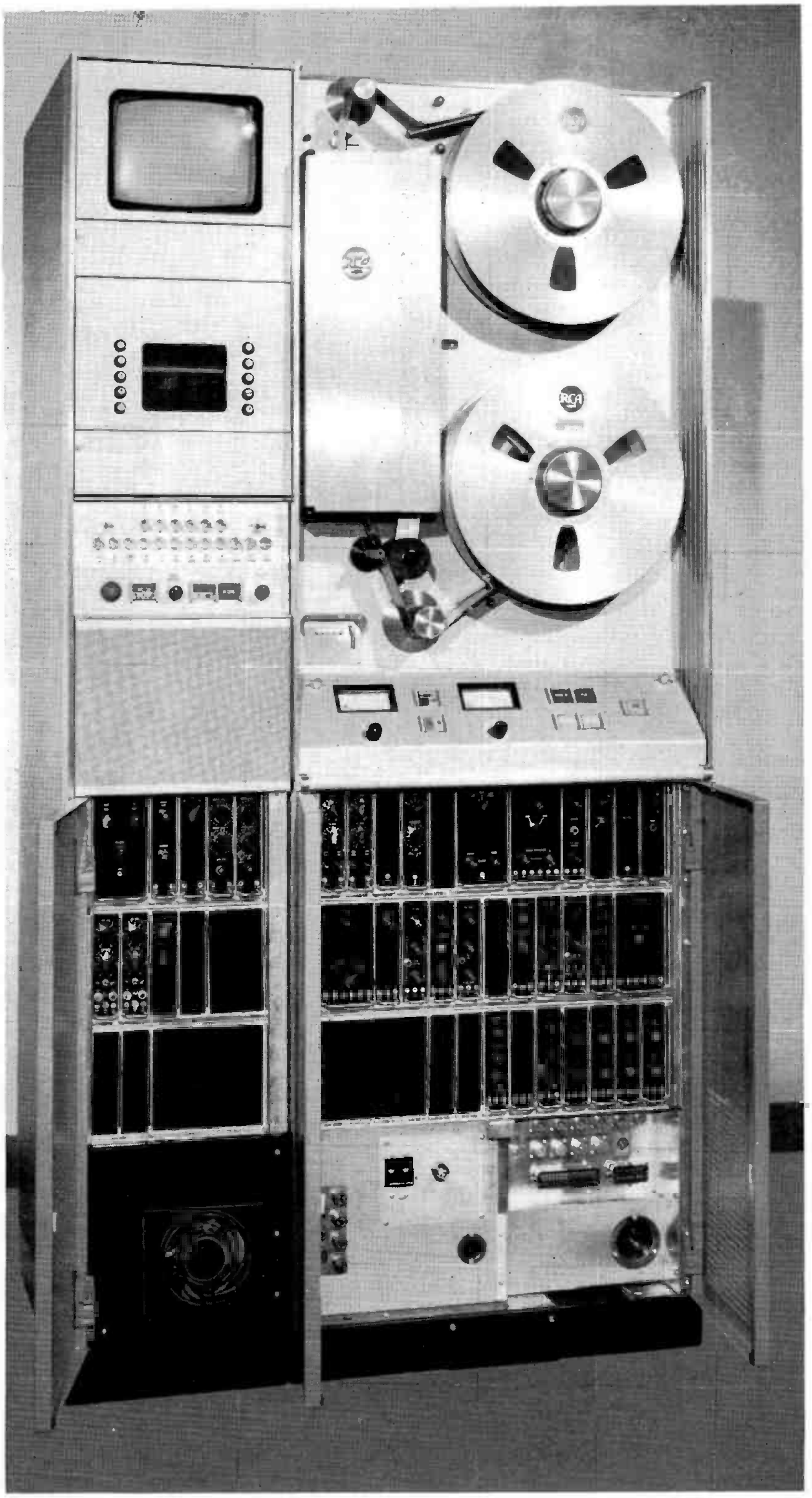


FIG. 3. Styled as part of the complete Matched Line of equipment, the compact, self contained TR-50 is designed to offer operational efficiency with the reliability of solid state electronics.

operation may be specified as the third standard instead of 405 lines. To change from one standard to another in the switchable model, the operator merely moves a selector switch to the desired position. This changes all circuitry including picture monitor and oscilloscope to the desired standard.

Audio Cue Channel

In addition to the standard program audio channel, a built-in audio cue record/playback unit permits the recording of voice, tone or digital cueing information along one edge of the video tape. As in the case of the program audio channel, cue recording can be done independently of and without disturbing the video recording, that is, both program and cue sound can be dubbed in while playing back or previewing the video signal.

Automatic Timing Correction

When ordered as a color machine, the TR-50 incorporates automatic timing corrector circuits for both monochrome and color (MATC/CATC). These solid state, modular plug-in assemblies are fully automatic and require no operating adjustments. The MATC, which is standard for both the color and monochrome machines, maintains near perfect picture geometry by compensating for skewing, quadrature errors and jitter. It provides an automatic error correction factor of 35 to 1 over a total delay range of one microsecond. The CATC operates in conjunction with the monochrome ATC and the pixlock servo system to provide time base correction to the tape playback signal, and thus provide the extreme stability required for playing back color recordings. In addition, the CATC removes the old burst component of the signal and inserts a regenerated burst. The CATC may be added at any time later to convert a monochrome high band machine to color.

Precision Tape Deck

The tape deck of the TR-50 is precision aligned at the factory before the machine is shipped. In this operation, all elements in the tape path are carefully positioned and gauged for the proper angle between tape and pickup heads in accordance with predetermined standards. Precision alignment of the tape path assures high performance repeatability between all tapes made to these standards.

Fully Instrumented

As in the deluxe RCA recorders, record and playback facilities are separated for operating convenience and ease of servicing. Record controls are in the left compartment with picture and waveform

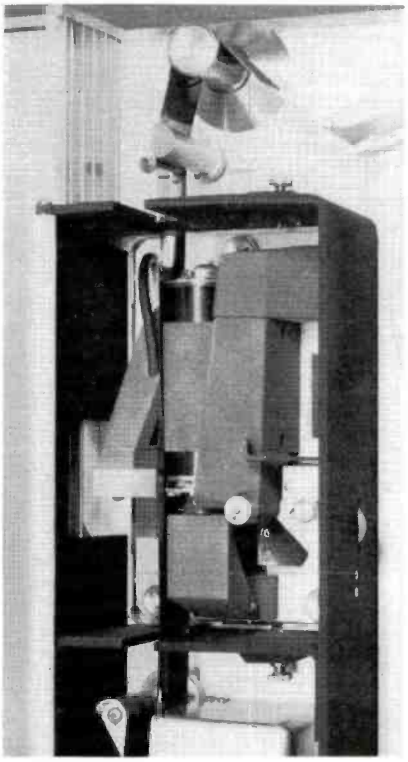


FIG. 4. High band, air bearing headwheel and air lubricated tape guide assure dependable color performance.

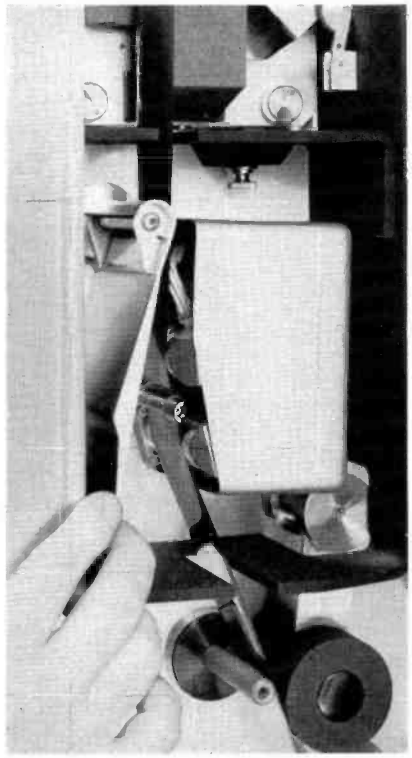


FIG. 5. A second audio head permits independent dubbing and editing of cue sound.

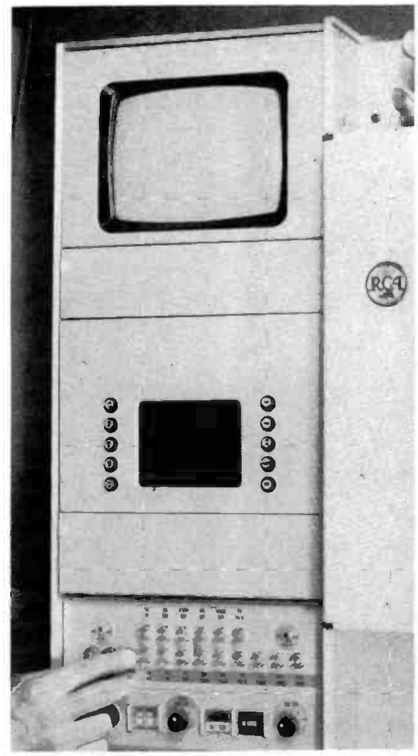


FIG. 6. Signal instrumentation covers more than 20 functions including the important pulse cross monitor display.

FIG. 7. Built in automatic timing circuits (MATC) compensate for skewing, quadrature errors and scalloping to maintain correct picture geometry.

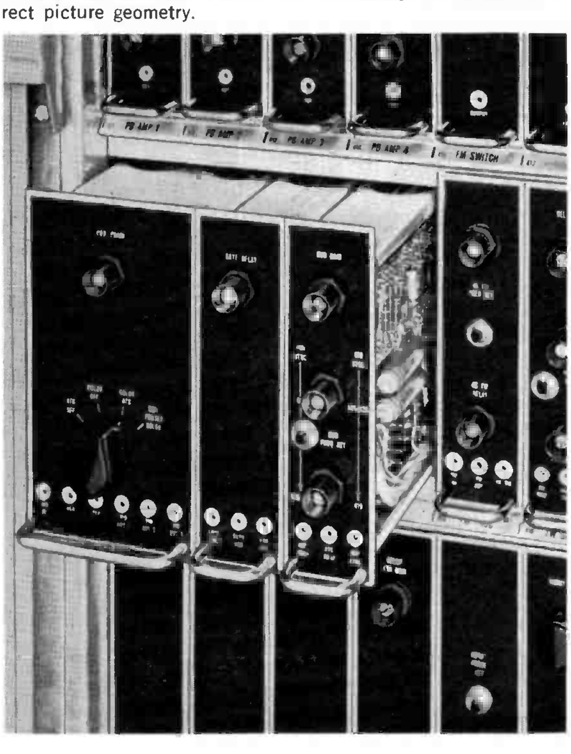
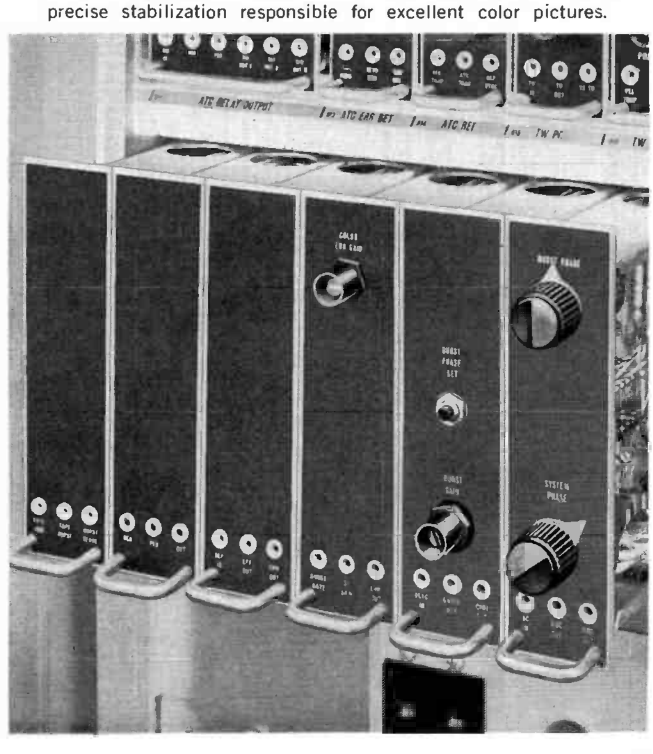


FIG. 8. For color operation, the TR-50 includes color timing correction (CATC) which operates with MATC to achieve the precise stabilization responsible for excellent color pictures.



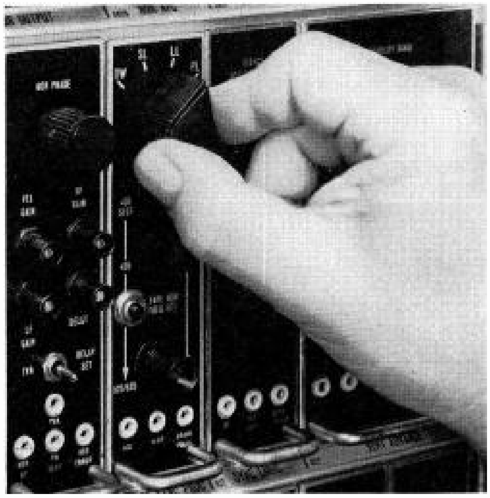


FIG. 9. Switch selects any of four servo modes adapting machine to various operating practices.

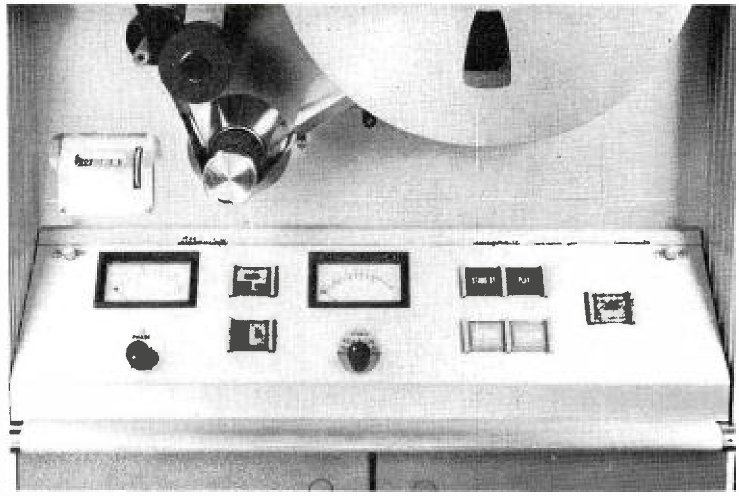


FIG. 10. Playback controls are arranged for simplicity and ease of operation.

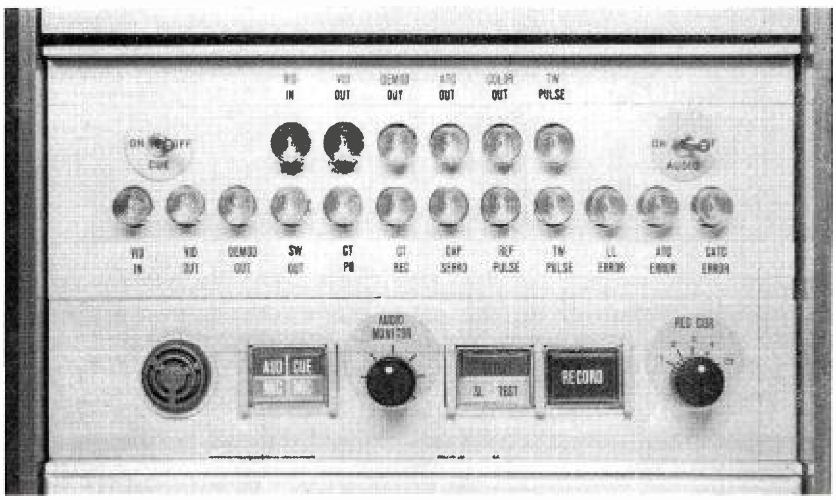


FIG. 11. Recording and monitoring controls are grouped for convenience.

monitors, signal monitoring pushbuttons, speaker and associated electronics. Signal monitoring, in the TR-50, covers more than 20 functions and includes the all important pulse-cross picture monitor display. Waveform presentations include signals from linelock, CATC and record control track circuitry in addition to those usually furnished.

Illuminated playback controls are in the right hand position together with status indicator lights, and meters and switches for measuring video head currents, FM level, and video, audio and cue levels.

Full Line of Accessories

The TR-50 accepts all RCA high band tape accessories such as the Dropout Compensator, Electronic Splicer and the Chroma Amplitude and Velocity Error Corrector (CAVEC). These units are installed in spaces provided for them in the module frame.

A Guide Servo accessory is available for automatically positioning the vacuum guide to eliminate picture skewing. The device can operate in any of four modes—"automatic," "manual," "record" (guide control pre-set to fixed position), or "record set" which allows the operator to set penetration for recording by activating the record control during tape playback.

The Chroma Amplitude and Velocity Error Corrector is a two-purpose accessory that measures and corrects for chroma errors due to variations in the tape to head contact. It also measures and corrects for head velocity errors that would otherwise cause color banding within the picture.

Remote Control

Two console or rack mounting remote control panels are available as accessories. One permits remote operation of mechanical functions such as record, play, stop, fast forward wind and fast reverse wind, while the second panel provides for remote adjustment of signal levels, including video, sync pedestal level, burst phase and system phase.

"Matched Line" Styling

The TR-50 is completely self-contained in a space saving cabinet only 33 inches wide, 24 inches deep and 66 inches high. It is mounted on casters which elevate it high enough from the floor to provide adequate clearance for cables, and impart mobility for movement from one location to another. Compact size adapts the machine to installation in a mobile unit to handle remote assignments. Cabinet finish, styling and even circuit design correspond closely with other TV tape recorders in the RCA matched line. Some of the electronic modules are interchangeable with those in other RCA machines, simplifying servicing and spare unit requirements.

Conclusion

The TR-50 was designed by RCA to fill the need of educators and broadcasters for an economy color recorder with broader capabilities. While much of today's color is still on low band tapes, the trend is almost exclusively to high band. The TR-50,

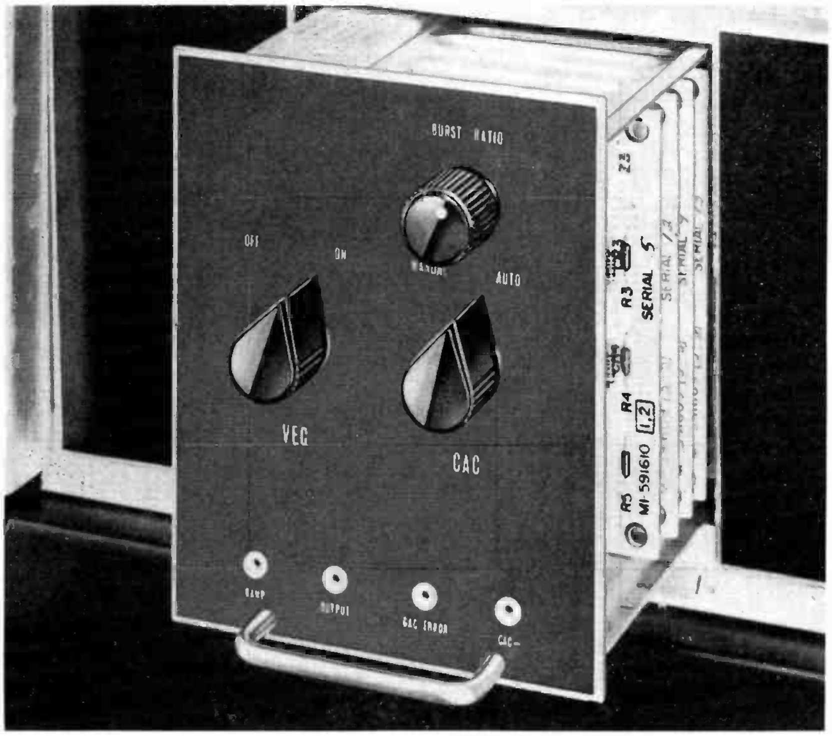


FIG. 12. Chroma Amplitude and Velocity Error Corrector accessory eliminates hue errors and color banding.

FIG. 13. Dropout Compensator accessory overcomes tape imperfections.

therefore, because it operates on all these standards, should have broader application in present and future taping operations. The TR-50 may fill applications that previously were left only to the higher priced recorders, and as a note of economy, two TR-50's can be purchased for about the same outlay as one of the higher priced machines. The result of this "two for the price of one" taping package is increased flexibility with minimal expenditure. With all its built in features, the TR-50 is also the most compact and mobile high band color recorder/reproducer available.

FIG. 14. Electronic Splicer accessory inserts or adds program segments.

FIG. 15. Guide Servo accessory offers automatic as well as manual positioning of the vacuum guide.

RCA Broadcast and Communications Products Division is conducting equipment training seminars in Camden, where RCA customers can learn how to get the very best performance from their new color TV studio equipment. The new service, available at no charge, is intended to assist them in getting the full capabilities from their color equipment.

Approximately 300 TV station and network engineers have attended the courses since they opened in April of this year. The visitor list reads almost like a broadcasters "who's who," but also includes engineers from educational and military closed circuit TV installations.

"Super Sophisticated" Equipment

In the last decade, technical and artistic demands of color television have brought about a technology explosion. Today's equipment is smaller, more reliable, requires less attention—yet, with all, it achieves higher performance standards than did any of its predecessors. On the other hand, the equipment is also far more complex, employing advanced and highly sophisticated circuitry. Through integrated, solid state circuits, for example, a new TV tape accessory with a density of less than half a cubic foot contains the equivalent of 700 transistors, or nearly half as many as in the entire TV tape recorder for which it was designed. Color TV camera circuits, seldom thought about for their speed, actually handle more information faster than many electronic computers. Scanning approximately 400 kilobits to produce a color picture "frame" 30 times each second, is handling information at the rate of 12-bit microseconds. The TV tape recorder packs this information on two-inch-wide magnetic tape. Increased complexity is the price for advancing the performance of all the color equipment—color cameras, color film and TV tape systems. The RCA Color TV Training Center affords engineers and technicians the opportunity of learning how to get finest pictures.

HOW NEW RCA COLOR TV TRAINING CENTER HELPS BROADCASTERS GET BEST PICTURES

EDITOR'S NOTE:

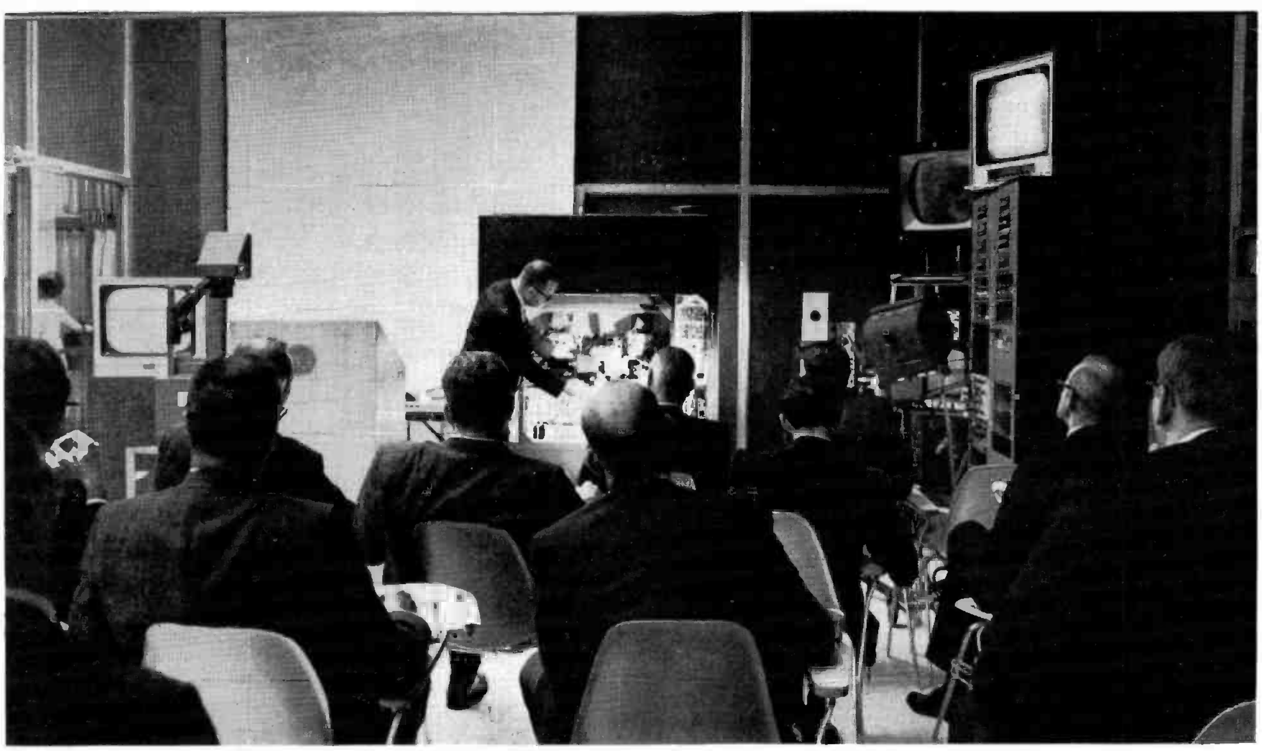
The three-leaf cover of this issue carries a panoramic view of the training center made while classes were in progress. On the front cover are the master control room and film area. The TV tape room can be seen on the inside fold, and the studio is on the back cover.

FIG. 2. Control room where studio and film camera operation is analyzed. Console includes full monitoring and switching facilities for video and audio. Color cameras are rolled into studio at left for live pickups.

FIG. 1. Studio and control room area of dynamic color demonstration facility eouipped like a small TV station.

Shirt-Sleeved Seminars Show Operators How to Get Peak Performance

FIG. 3. Color TV tape room is fully equipped for demonstrations, monitoring, and analysis of signals produced by TV tape equipments. Routine maintenance procedures are simplified.



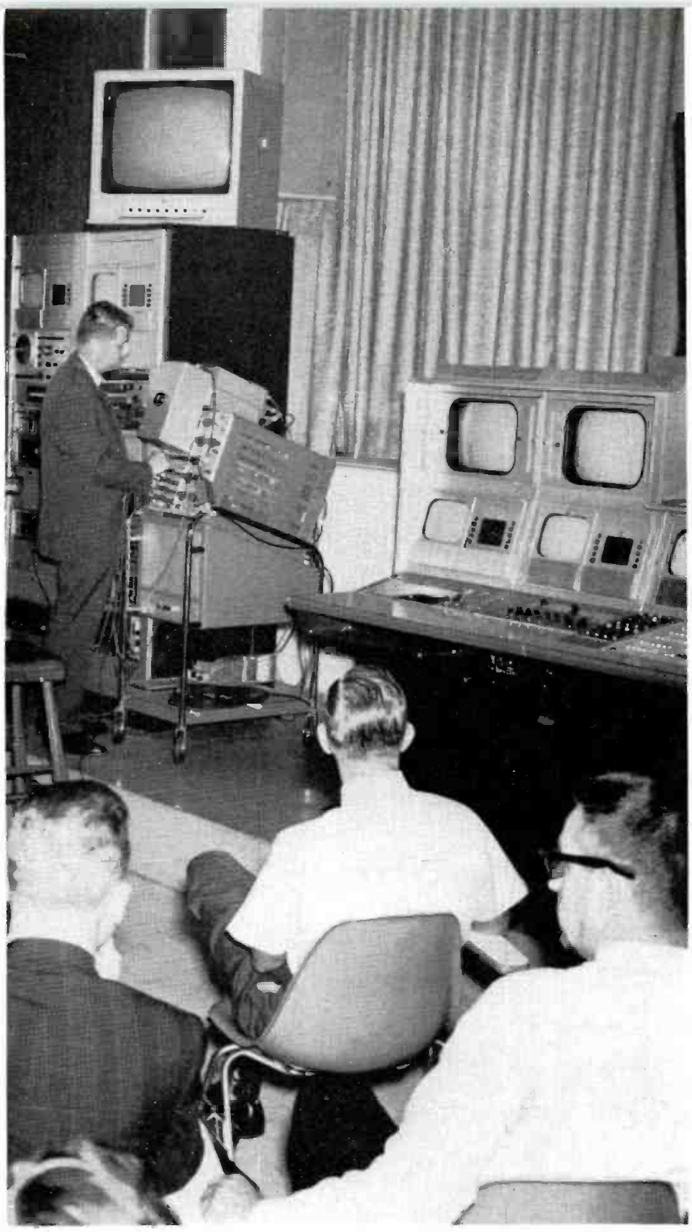


FIG. 4. Small TV camera being set up to display 'scope waveform on large monitor.

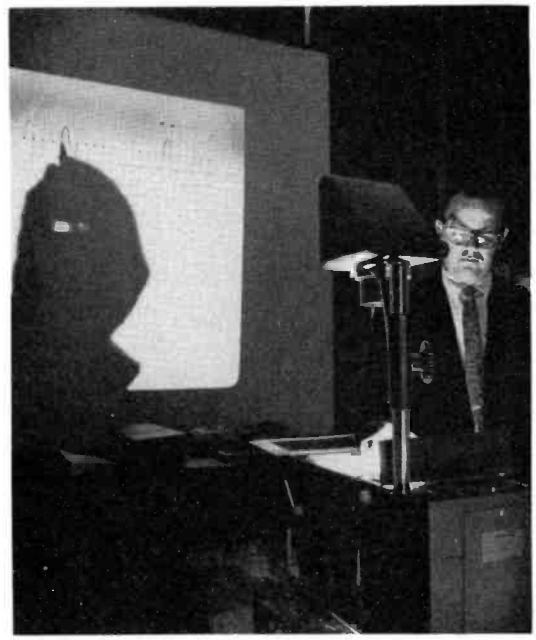


FIG. 5. Large screen optical projection illustrates lecture. Some visitors bring polaroid cameras and portable tape recorders.

FIG. 6. Visitors can operate the very equipment they will be using.

Typical Color Studio

Resembling a small TV station studio, the training center occupies about 7,000 square feet in RCA's main office building in Camden and includes a color TV studio and necessary sets for live camera demonstrations, a color film area, color tape area and master control. Major equipment consists of two TK-42 studio cameras, TK-27 film island, Types TR-70, TR-3 and TR-4 TV tape recorders and a TS-40 switcher.

Quartz Lighting

The color studio is equipped with a modern quartz lighting system employing an overhead grid of more than 50 lamps and luminaires. Performance of the color cameras can be observed for virtually every lighting condition that might be required in color studio operations. Included is floor-mounted strip lighting for creating backgrounds of primary and secondary colors.

Practice and Theory

Courses are conducted by RCA engineers with experience in both practical and theoretical aspects of color TV. These courses give visiting engineers an insight into the reasoning behind the complex new designs, as well as their capabilities. They show how broadcasters can best achieve not only fine pictures but attain operating efficiency and save money too.

TK-42 class visitors see a demonstration in which the color camera handles varied program conditions such as mood lighting,

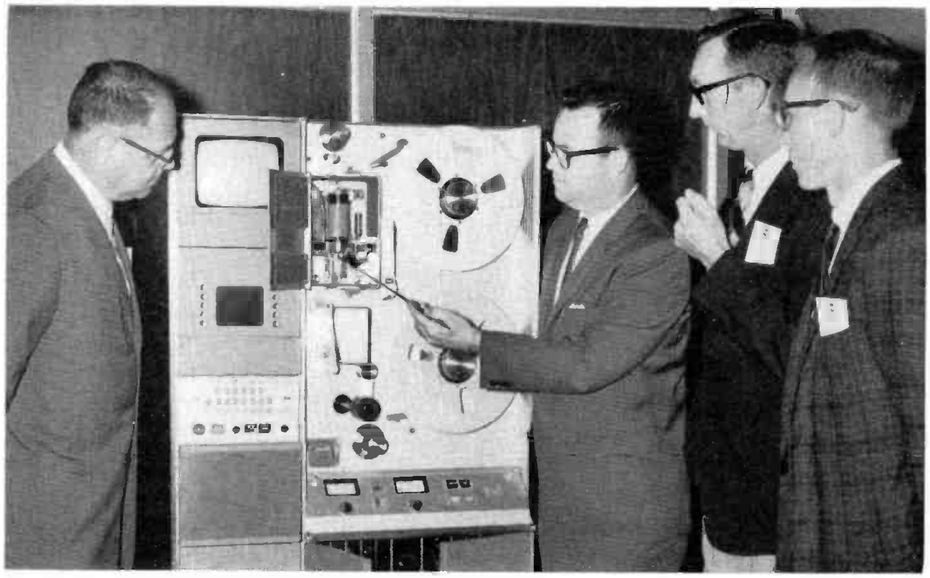


FIG. 7. Classes are small enough for everyone to see and hear, and even perform tests and adjustments for themselves.

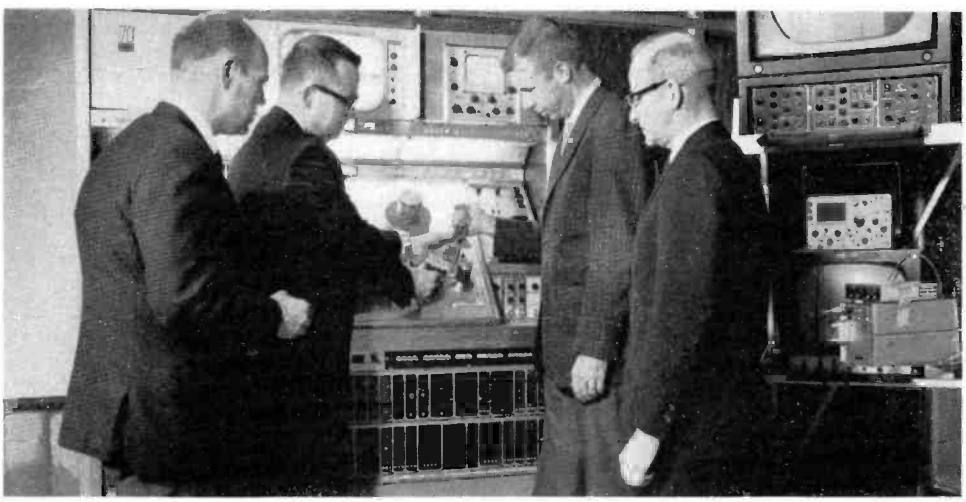


FIG. 8. Broadcasters learn how to make adjustments for best machine performance.

FIG. 9. Merrill A. Trainer (center) director of the training program, discusses TK-42 camera circuits with visiting engineers.

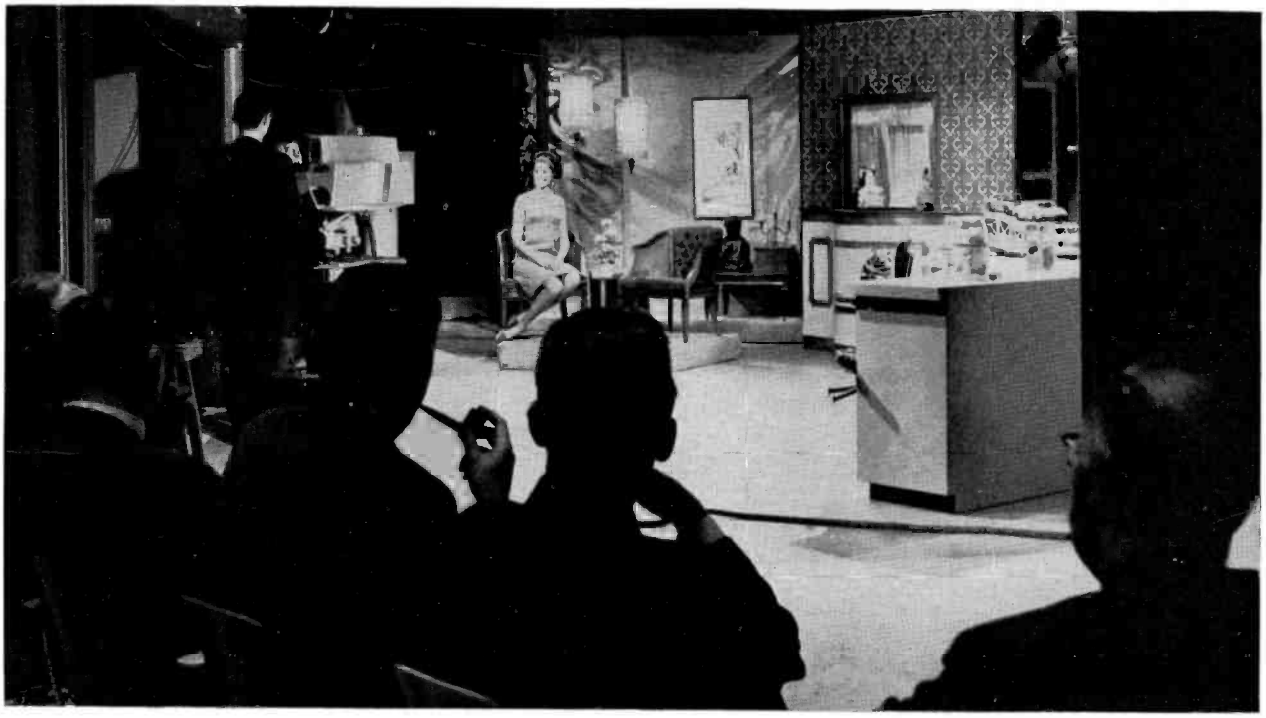
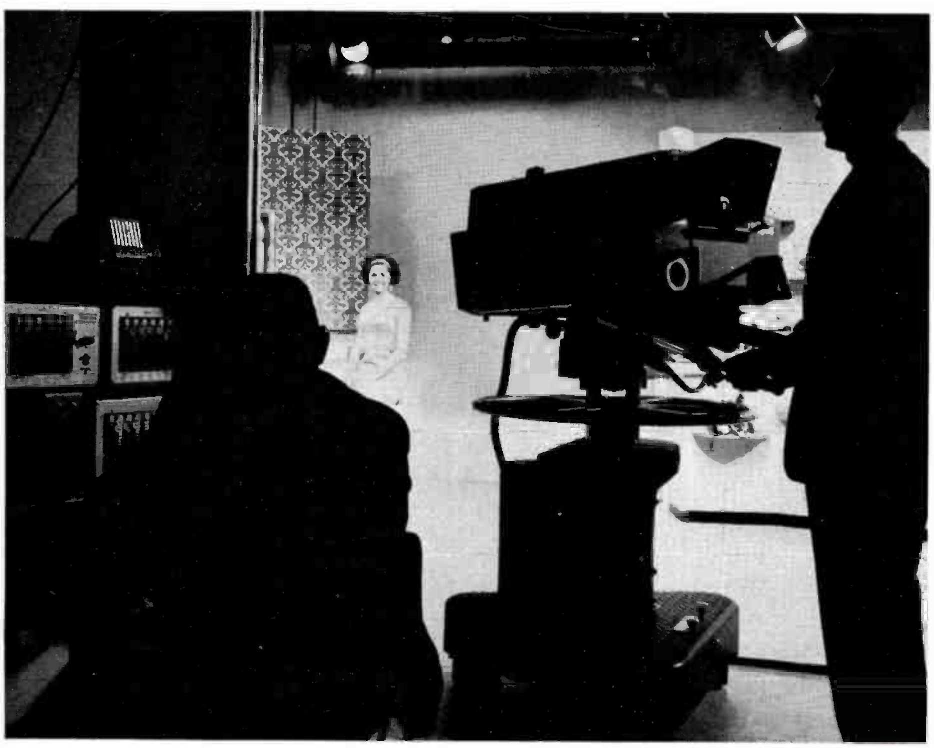


FIG. 10. Class observes camera operation in color TV studio.

FIG. 11. Studio quartz lighting systems tests color camera performance under wide ranges of illumination.



highlights and shadows, color tracking, skin tones, jewelry reflections and color backgrounds. The TV tape class sees a demonstration of how the TR-70 applies error correction to eliminate color banding and other defects in poorly recorded tape.

Repeat Programs

Regular classes are devoted to the TK-42 and TK-43 cameras, TK-27 color film camera, and the TR-70 and TR-3, 4 and 5 TV tape recorders. The TR-70 course runs two five-day weeks. The TK-42 course is one five-day week long, as is the course covering the TR-3, 4 and 5 TV tape recorders. The TK-27 film camera course runs for one three-day week. Classes are limited in size to about 20 persons at the most so that each engineer receives as much individual attention as possible. The courses all repeat and are almost continuous, with sessions planned for most months of the year. This gives the station an opportunity to stagger attendance by its personnel for utmost convenience.

Courses begin with a description of the equipment, circuitry and nomenclature. This is followed by a detailed study of operation, with practical exercises in line-up, maintenance and troubleshooting. Courses close with a question and answer session.

FIG. 12. Lighting system includes strip lighting to create color backgrounds.

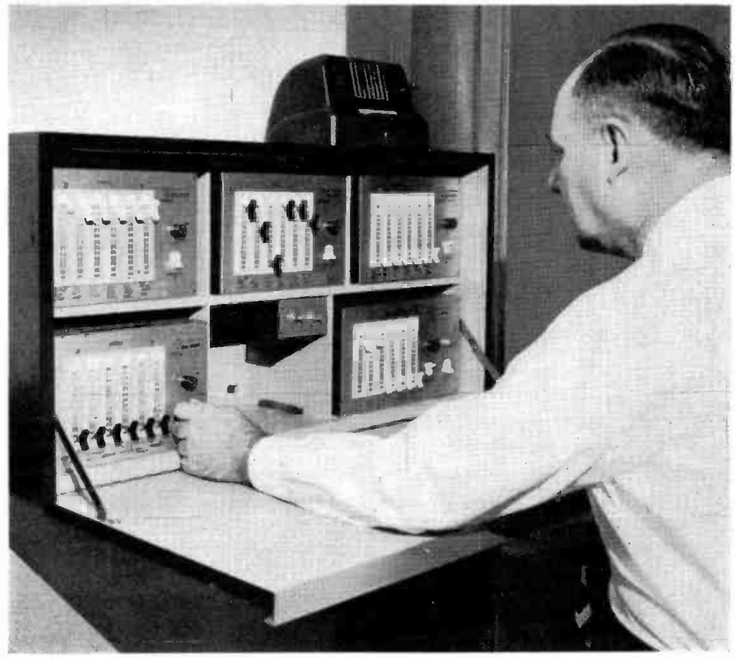


FIG. 13. Studio lighting dimmer board and control console.

FIG. 14. Camera tests include color tracking, skin tone matching, speculars and backgrounds.

FIG. 15. Pictures displayed on control room monitors are compared with the studio scene.

TYPICAL COURSES

TK-42 and TK-43 Studio Cameras

(Five Days)

Basic transistor theory; camera transistor circuits; camera optics, servo and cooling; video, deflection and encoder systems; monitoring system; encoder and camera setup.

TR-70 TV Tape Recorder

(Ten Days)

E-E FM system; record FM system; headwheel panel; playback FM system; headwheel/capstan servo system; monochrome and color ATC; audio system.

Processing amplifier; guide servo; tape transport; power supplies; test equipment; test procedures and signals; performance; maintenance.

TK-27 Film Camera

(Three Days)

Basic transistor theory; film camera transistor circuits; film camera performance; encoder system; video system; encoder setup; camera setup.

TR-3/4/5 TV Tape Recorders

(Five Days)

Basic transistor circuits; TR-3/4/5 transistor circuits; layout and controls; magnetic recording principles; FM system; headwheel panel; modulation and de-modulation demo; record and playback amplifiers; processing amplifiers; machine adjustments; tape transport demo; servos; general circuitry; monochrome and color ATC circuits.

The longest is the ten-day, two week course on the TR-70 Deluxe TV Tape Recorder. The first week covers theory and operation of the FM system, capstan servo, automatic timing correction circuits and audio system. The second week is devoted to adjustments of the processing amplifier, guide servo and tape transport, with demonstrations on the proper use of test equipment with the recorder. The course closes with a step-by-step demonstration of routine maintenance procedures.

Tuition is Free

The equipment training seminar program is directed by Merrill A. Trainer, Manager, Broadcast Customer Relations. According to Mr. Trainer, these seminars give even the most uninitiated broadcasters an opportunity to become familiar with cameras, tape machines, projectors and other apparatus—in the shortest possible time. They receive not only advanced color training, but instruction on the specific types of equipment they will be using.

Some visitors attend the course to learn to operate their equipment before receiving delivery. Others experiment with their cameras and recorders for a time at the station to find out what they will do before coming in for the full course. There is a great rapport among class members in these informal give-and-take meetings, resulting in helpful exchanges of experience and information. No charge is made for the courses. Customers wishing to register may do so through their RCA Representative.

ACTION HIGHLIGHTS IN TYPICAL TV TAPE CLASS

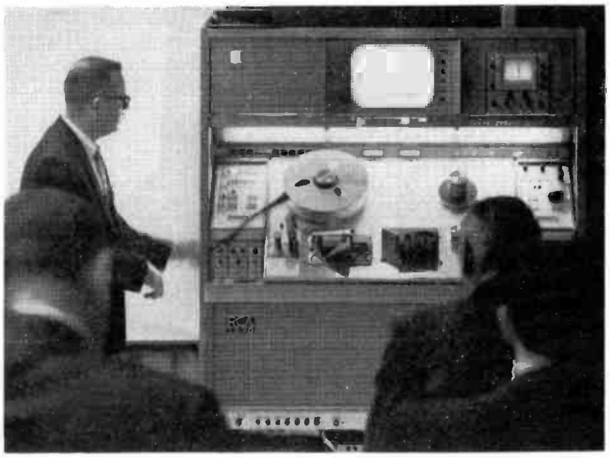


FIG. 16. Checking brake tension on the TR-70.

FIG. 17. Measuring reel torque.

FIG. 18. Adjusting recorder brake assembly.

FIG. 19. Obtaining proper circuit performance.

FIG. 20. Checking front access units of recorder.

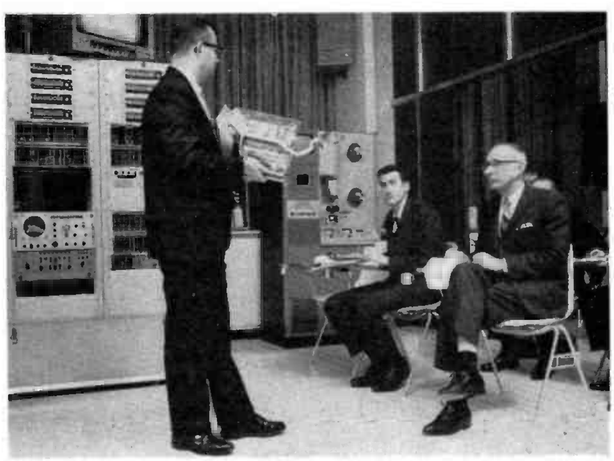
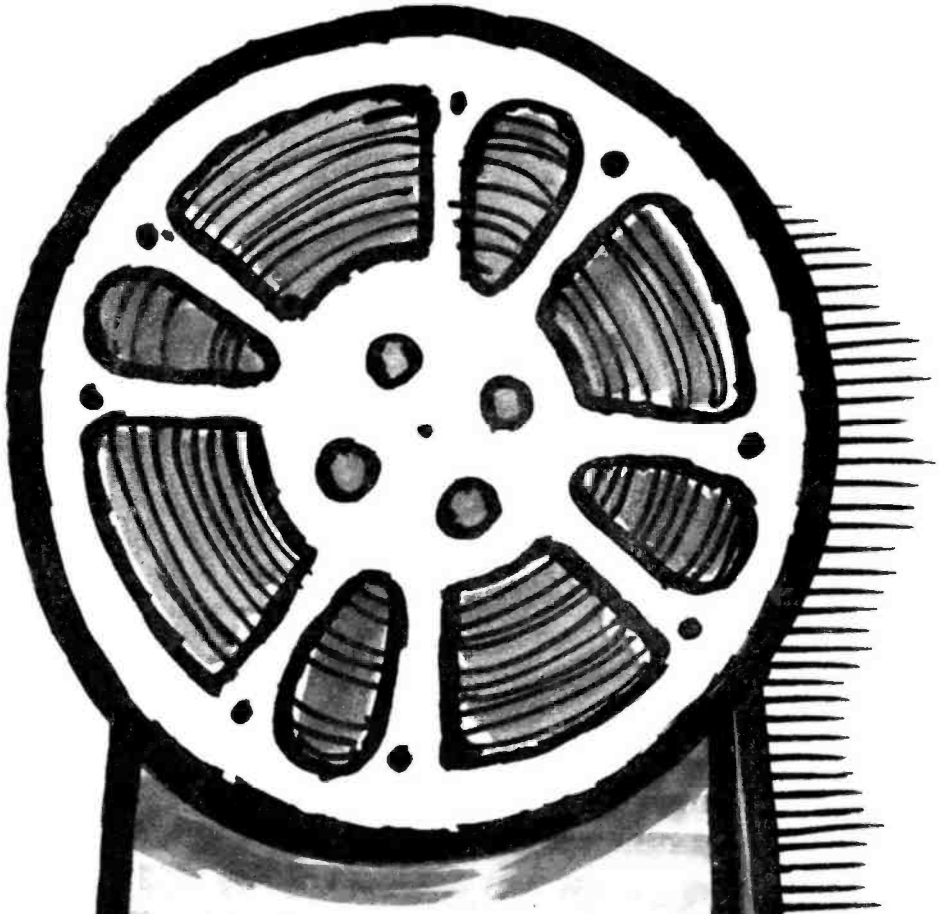
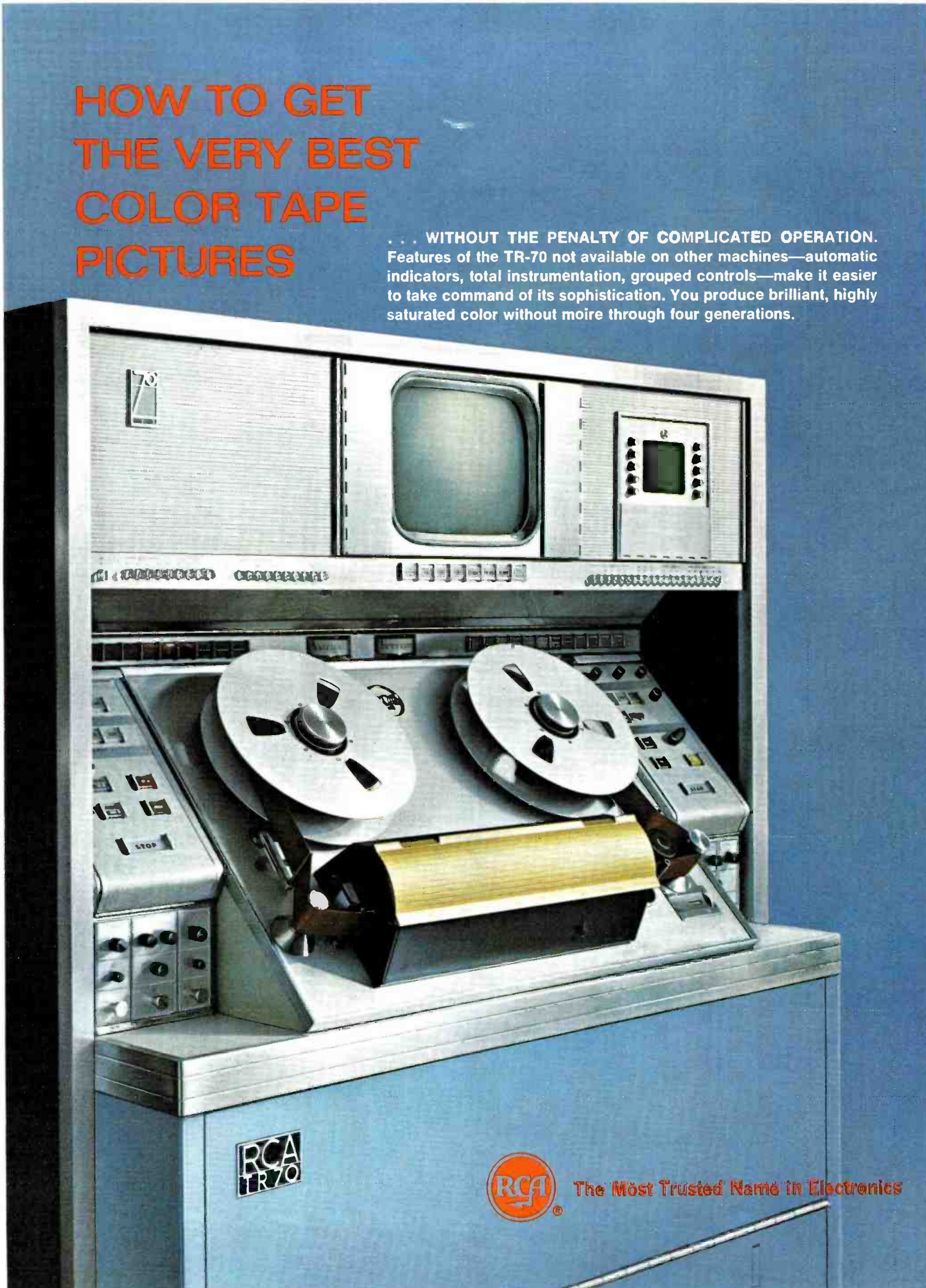


FIG. 21. Removal of power supply.




HOW TO GET
THE VERY BEST
COLOR TAPE
PICTURES
. . . WITHOUT THE PENALTY OF COMPLICATED OPERATION. Features of the TR-70 not available on other machines—automatic indicators, total instrumentation, grouped controls—make it easier to take command of its sophistication. You produce brilliant, highly saturated color without moire through four generations.
RCA TR70
The Most Trusted Name in Electronics

For operator instruction a working TV system is used.
Included is a live color studio, with varied lighting conditions and scenic backgrounds, tape and film areas, switching and effects facilities.