

Broadcast Engineering®

the technical journal of the broadcast-communication's industry



A HOWARD W. SAMS PUBLICATION

Cooling the Transmitter

page 26

NAB Convention Review

Punch Card Broadcasting

Modular Lighting Control





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Broadcast Engineering

The technical journal of the broadcast-communications industry

in this issue...

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- 57 Bi-Directional Current Source.** With appropriate band width design this article idea could easily be adapted to a deflection driver for CRT display devices. **Walter Jung.**

ABOUT THE COVER

Our cover picture this month is a 250A running red in the transmitter at KUDL. Transmitter cooling requirements of various transmitter types are covered in "Cooling The Transmitter" on page 26.

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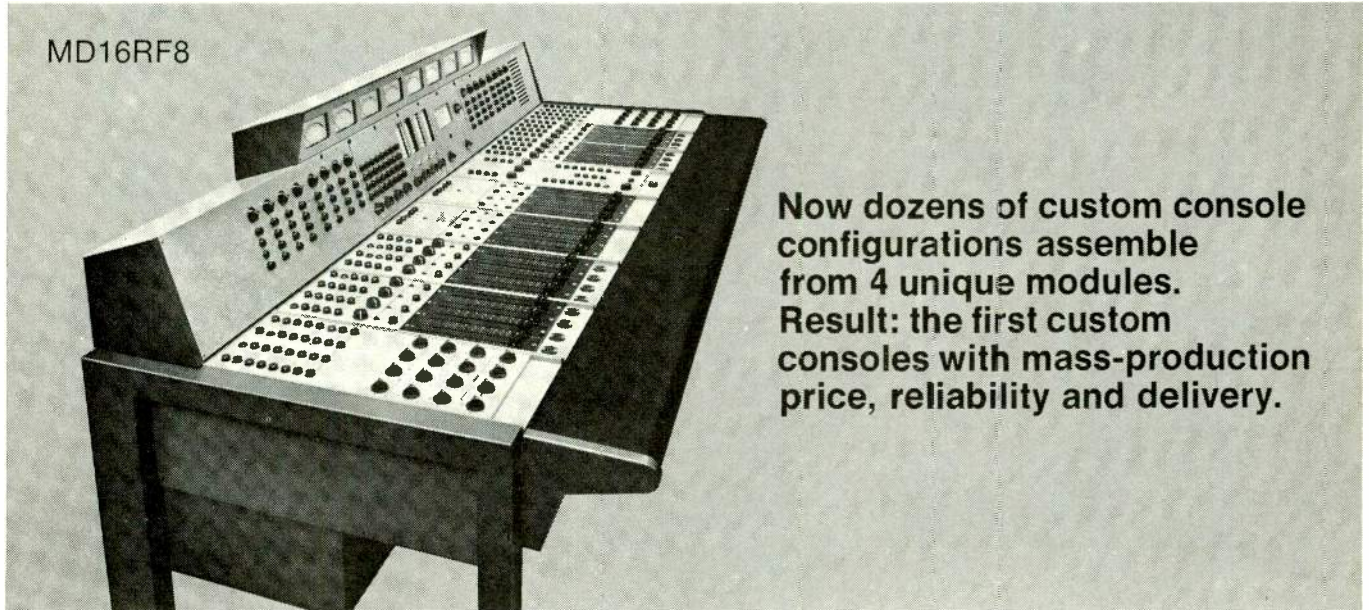
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DIRECT CURRENT FROM D. C.

May, 1970

By Howard T. Head

35th Annual Report Issued By FCC

The 35th Annual Report of the Federal Communications Commission, covering major Commission activities during fiscal year 1969 has been released. The 228 page volume, the most extensive ever issued by the Commission, reports on well over 300 individual topics in ten major categories and an appendix.

Major statistical data in the Report include station totals in the Broadcasting and Safety and Special Radio Services, Broadcasting financial figures, a wide range of Common Carrier financial data and tabulations of such Field Engineering functions as monitoring, inspections and investigations.

Also included in the appendix is a chronological listing of key Commission actions, a complete roster of all members of the Commission from 1934 to the close of the fiscal year, hearing statistics, an updated rundown of broadcast authorizations from 1949 and a revised and amplified list of frequently used terms and abbreviations.

The Annual Report for 1969 continues the larger paged format initiated in 1968. Copies are not distributed by the Commission but may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. The price is \$1.75.

FCC Initiates Study of Frequency Sharing By Satellites and Earth Radio Systems

A technical research study to establish the feasibility of sharing the radio frequencies between one and 40 GHz by communication satellite systems and terrestrial radio systems, and to develop criteria for sharing, has been announced by the Commission. In a letter to all prospective bidders, the Commission stated that it intended to award a single firm, fixed-price contract of \$50,000 for the study.

The study will include all frequency bands other than those already shared by communication satellite and terrestrial radio systems, the Commission explained, and will provide data for frequency sharing proposals that the United States expects to present to the World Administrative Radio Conference (WARC) in Geneva, Switzerland, in 1971.

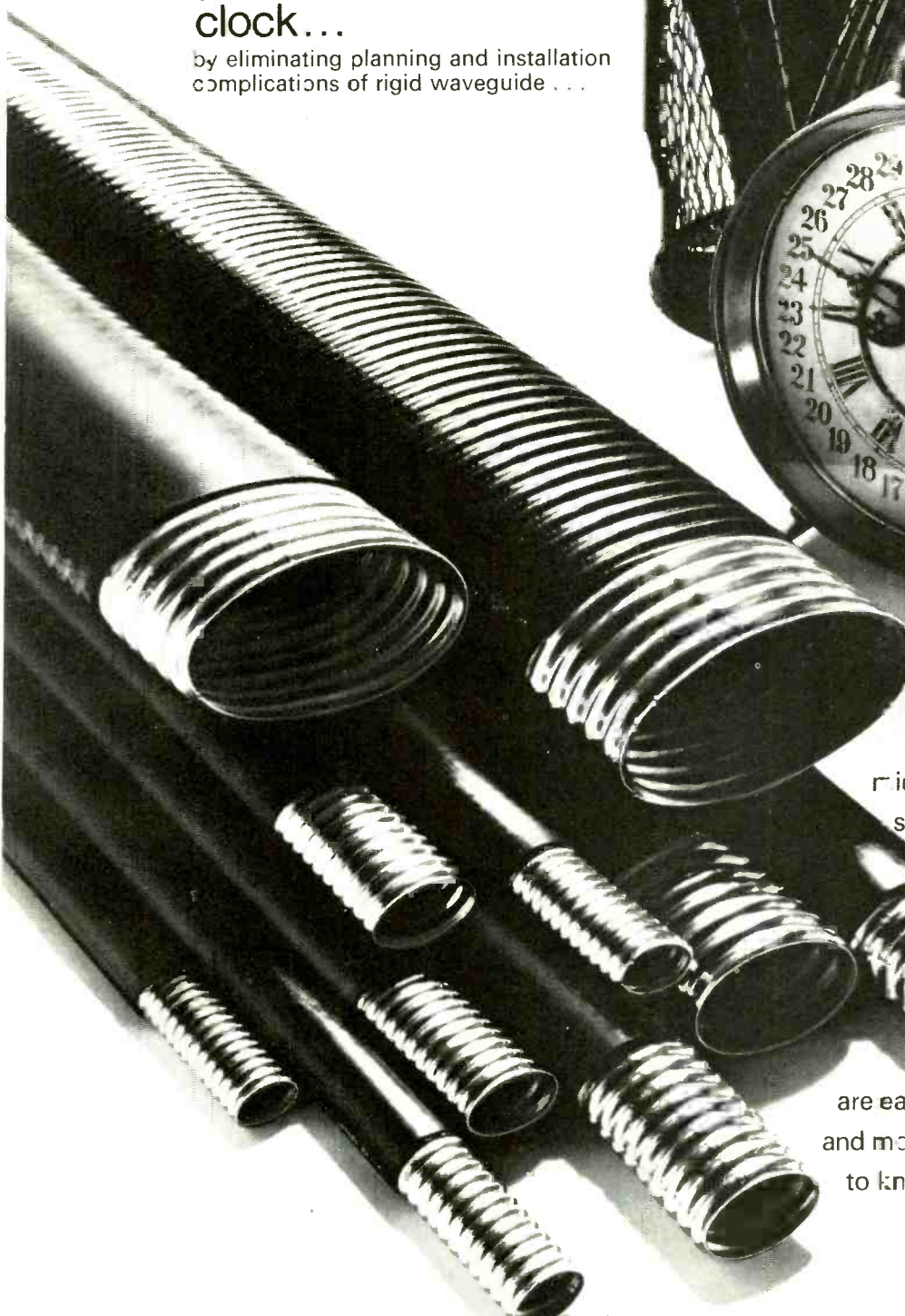
In the letter to prospective bidders, the Commission enclosed material describing the scope of the effort required and stated that many elements involving the approach to be taken by the bidders and the mechanics necessary to implement that approach have been left to the bidders.

(Continued on page 6)

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If the results of the study indicate that sharing is feasible, the Commission said, the criteria necessary for sharing frequencies will be developed for each frequency band, including possible constraints in the coordination distance, transmitter powers, receiver sensitivities, antenna patterns, antenna orientations, and flux densities at the earth's surface.

FCC Says Processing Services By Non-Common Carriers Should Not Be Regulated

Non-common carriers providing data processing services would not come under Government regulation and regulated common carriers would be permitted to provide data processing only through separate corporations under terms of a Tentative Decision issued by the Federal Communications Commission in the Computer Inquiry (Docket 16979).

In a separate action, the Commission issued a Notice of Proposed Rule Making asking for comments on the Tentative Decision and on rules to implement the proposed policy.

The proposed rules would permit common carriers with operating revenues of \$1 million or more annually to engage in the sale of data processing services only through separate corporate entities maintaining separate books, and accounts and operating with separate personnel and facilities. The carriers would be required to file, with the Commission, copies of all agreements with their data processing affiliates. Smaller carriers would be exempt from these requirements.

John McAllister Named Chief of FCC Compliance Branch

John H. McAllister, Attorney Advisor to the Chief of the FCC Field Engineering Bureau, has been appointed Chief of the Compliance Branch of the Complaints and Compliance Division of the FCC Broadcast Bureau. The Chief of the Branch is responsible for the direction and supervision of field investigations of alleged violations by broadcast licensees and others.

A New Method Established For The Statistical Location of Grade A and B Field Strength Contours of TV Stations

A new method for establishing the statistical location of the Grade A and B field strength contours of television stations--of particular advantage to the majority of UHF TV stations, which use the technique of "beam tilt" to provide a more uniform signal--has been adopted by the Commission in amendments to Part 73 of the rules, effective May 8, 1970 (Docket 17253).

All commercial television stations must file a showing as to the location of their Grade A and B contours under the new rules, within 90 days from the publication of the present Commission order in the Federal Register, it was ordered, unless the Commission alters or postpones this requirement by further order. The 90-day requirement is subject to approval by the Bureau of the Budget, the Commission stated.

The Commission adopted a Notice of Proposed Rule Making in this proceeding on March 1, 1967, in response to a petition filed earlier by WKBN Broadcasting Corporation, licensee of UHF station WKBN-TV, Channel 27, Youngstown, Ohio.

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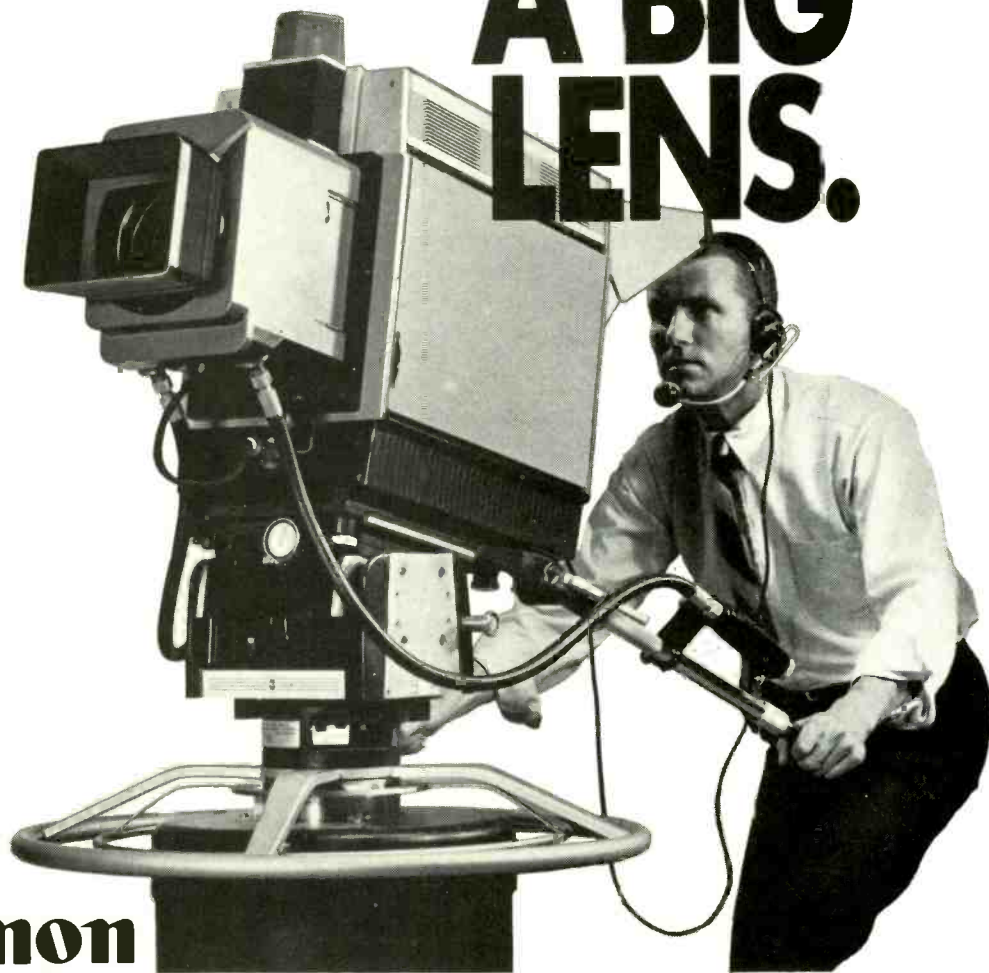
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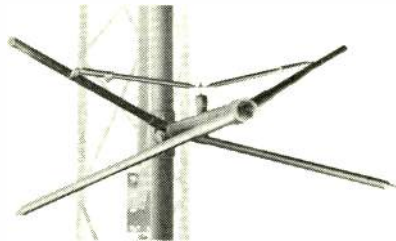
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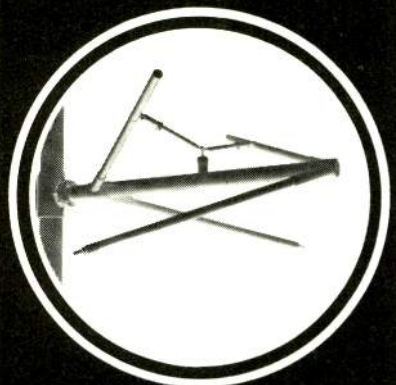
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LETTERS TO THE EDITOR

Finding The Talent

Dear Editor:

Replacements for the engineering staff are very difficult to find. At one time in our industry, money was the limiting factor in finding qualified people. The difficulty now is finding men with a good basic electronics background. In my opinion the man who has good knowledge of basic electronics can be trained for the broadcast industry with a minimum of effort.

I have people stop by looking for employment as a Broadcast Technician or Engineer with backgrounds such as, "I fix my neighbor's radio" or "I replace tubes in my stereo". Many of these people feel there is no need to study electronics.

I am fortunate as I have an inside source of information on possible employees from applications made to a local manufacturer. We recently hired a new engineer who left the company because of a pending move to another state.

In any article on manpower, I feel the disadvantages of being a Broadcast Engineer should be covered. The industry loses good people because of ego deflating janitorial work. Long work weeks (50-60 hours) are a problem in small market stations. The list could be quite long.

Marvin J. Beasley
WJBC AM-WBNQ FM
Bloomington, Ill.

Tech Training

Dear Editor:

Here in the real "grass roots" level, I have found a general problem of comprehension in the field of technical evaluation as applied to maintenance and installation of new and existing equipment. I have found a problem recruiting personnel who have the background to determine if a particular piece of equipment is functioning properly, and, if not, how to keep it performing to manufacturer's specifications.

I feel that the blame for this should go to the manufacturers, for not providing instruction manuals and information thorough enough to provide a basis of insight into the theory and operation of the particular piece of equipment involved. Because of this problem, I feel that here is where the real value of publications such as yours lie.

At many stations, the engineer is nothing more than an employee who signs the logs, or someone in the area who is on a retainer basis. In an effort to keep the costs down, these "engineers" don't avail themselves of the proper information needed to do a good job in their maintenance programs. Sooner or later, it falls on someone else to try to get any of this neglected equipment working correctly. In this vain, the associated instruction manual is grossly incomplete. Sometimes just an article in a technical journal can be of great assistance to an engineer who might be unfamiliar with the equipment involved.

David P. Hebert
Station KXRO
Aberdeen, Wash.

Engineering OJT

Dear Editor:

OJT will work for larger stations who have competent technical personnel to train beginners. Smaller stations would find this almost impossible as the one or two competent engineers are usually so overworked that they can't devote much time to help training beginners. I say "beginners, because many of the newcomers with a ticket today don't even understand fundamental terms like ohms, volts, etc.

Station operation in smaller markets is something else. As you stated, March, 1969-BE, too often, the engineer is looked upon as a necessary evil. The Chief Engineer is often nothing more than a title—he has a ticket and meets the legal requirements. His main responsibility

ties are operating the controls in the control room and being a disc jockey. They may even let him sell on the side if he would like. Perhaps, much of this is the engineers' or rather broadcast engineers collective fault. They do not get across the importance of engineering to the station manager or ownership.

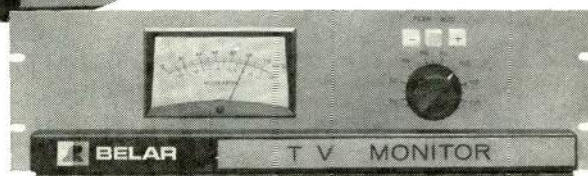
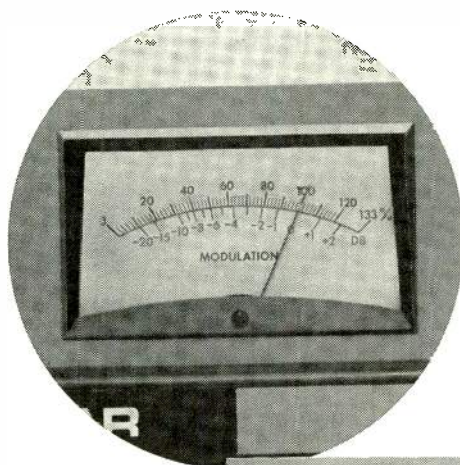
Real broadcast engineers are a strange breed. I have personally known many of them over the years. Money, while it has been important, has not been the prime mover to most of them. Sure, they need a decent wage to maintain a decent standard of living, but once this requirement has been met there have been other important motives: recognition of the engineer's contribution to the success of a station, recognition of his talents and abilities.

Most often his work goes on at weird hours, like the middle of the night. The station may operate reliably, put out a decent signal—but who knows or cares until it quits! Then there may be an outcry. Here again, engineering may be at fault, as I have known few real engineers who were also good public relations men. There is another side to this. Quite often, the engineer may be breaking his back or ruining his health working long hours over just plain junk, trying to keep it going.

Take the case for fines. I don't believe a general statement can be made on who is at fault. I think that should be the core of the question—who is at fault and then fine the one who is to blame. The engineer can often be made the scapegoat for management attitudes. The engineer may know that the station is in violation, even technical violations, and is powerless to do anything to correct the situation. He may warn the manager that a practice is a violation, or he may warn that a piece of equipment must be replaced. What can he do if the manager rejects his views. Should he be fined for the violation? What if he is so overworked that he can't possibly take care of all the details. If he is to pull a full shift announcing, when does he have time to pull a proof? Thus, I would say that blame should first be determined before fines are levied.

Pat Finnegan
Muncie, Indiana

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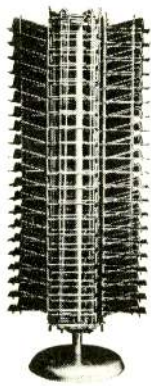
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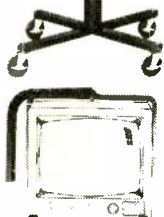
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INDUSTRY NEWS

NAB Proposes Relaxation Of Operator Requirements

The National Association of Broadcasters has petitioned the Federal Communication Commission to relax the first-class operator requirements for AM directional, non-directional and FM broadcast stations.

NAB said that relaxation of existing operator requirements would remove a major obstacle to greater minority employment opportunities and permit a greater number of minority applicants to qualify for jobs in broadcasting.

NAB urged the FCC to initiate the following changes which, it said, would not lower technical standards.

AM Non-Directional

AM Non-Directional Stations: NAB said non-directional stations of up to and including 50KW should employ one first-class radiotelephone license holder either full-time, on-call, or on a contractual basis. All other personnel responsible for the routine transmitting operation should hold third-class licenses with broadcast endorsement.

The present rules require AM stations operating with non-directional antennas and power of 10KW or less to have a first-class operator on hand full-time, part-time or on a contract basis. NAB said that present technology makes the 10 KW limitation unrealistic and requested its deletion. Third-class license holders, said the Association, have the ability of determining the proper operation of a 50 KW transmitter as easily as a 10KW transmitter.

The NAB comments, filed by John B. Summers, chief counsel, noted that "the present 10KW limitation for non-directional stations should be removed so that all such stations, irrespective of power, may operate under the operator requirements as specified . . . in the Commission's Rules." It was emphasized that NAB is not proposing that the third-class operator be authorized to make adjustments or repairs that would endanger his safety in the

presence of highpower transmitting equipment.

AM Directional

AM Directional Stations: NAB said AM directional stations using power up to and including 50KW should employ one first-class radiotelephone license holder on a full-time basis. All other personnel responsible for routine transmitter operation should hold third-class licenses with broadcast endorsement.

Under the present Commission rules, standard broadcast stations using directional antenna systems must have a first-class radiotelephone license holder on duty at all times the station is in operation. NAB commented that these rules were adopted at a time when transmitting equipment and directional antenna systems had not reached the technological development we enjoy today.

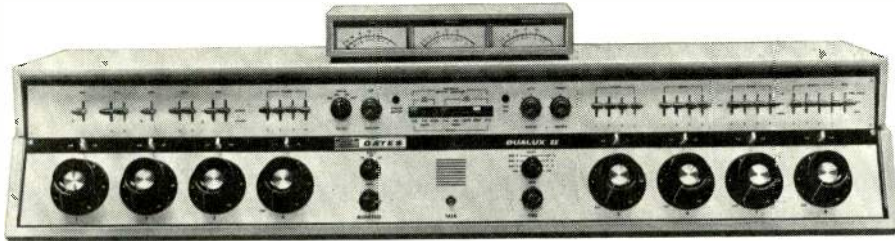
NAB noted the Commission's concern regarding stability of remote control directional antenna systems, but said that with today's "proven directional antenna stability, and the increased capability of adequately monitoring the performance of the directional antenna system at the remote control point, the operator requirement for directional stations could be relaxed without undermining the objectives of the Commission's technical standards."

In most instances, NAB maintained, a third-class license holder can take care of normal operating procedure. NAB said that the majority of first-class license holders at directional stations merely monitor and observe operation through meter readings, and this function could easily be performed by a third-class license holder.

NAB said it believes that first-class operator requirements can be relaxed at directional stations by requiring the full-time employment of one first-class operator responsible for proper operation of the direc-

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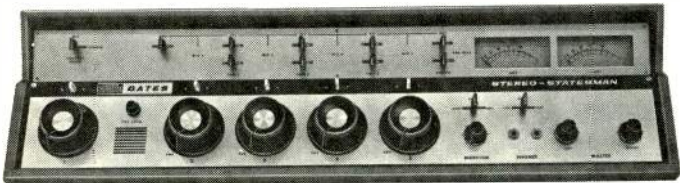
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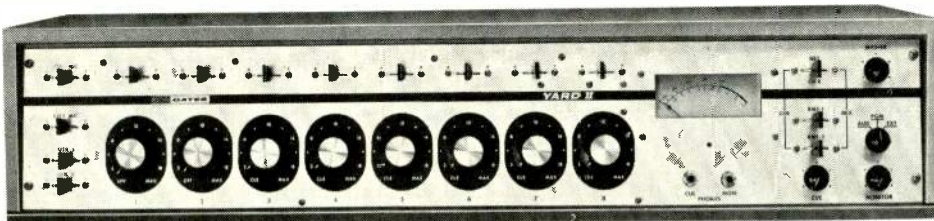
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The Yard II. Eight channel mono console. 12 inputs. Frequency response ± 1 dB, 30 to 15,000 Hz. Compact. Lightweight. Ideal for small to medium size stations. 100% transistorized.

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Circle Number 11 on Reader Reply Card

Industry News

(Continued from page 10)

tional system. A third-class operator could take care of meter reading functions.

FM Stations

FM Broadcast Stations: NAB urged that FM stations using power up to and including 50KW should employ one first-class radiotelephone license holder either full-time, on-call or on a contractual basis. All other personnel responsible for the routine transmitting operation must hold a third-class radiotelephone license with broadcast endorsement.

The current FCC rules allow first-class operator relaxation provided the FM station operates with 25KW or less. NAB said that "in light of the rapid advances made in FM transmitter technology, including stabilized circuitry, solid state devices, etc., the 25KW figure adopted in 1963 is unrealistic and should be removed."

An increase in the power ceiling from 25 to 50KW, said NAB, does not add to the complexity of the transmitter and the third-class license holder could perform the nec-

essary routine operations. In addition, NAB noted that this change would not lower FM technical standards.

Furthermore, NAB's petition strongly urged relaxation of the existing operator requirements to allow more minority applicants to qualify for broadcast employment. Such a move "would open up numerous broadcast position to minority and other job seekers who hold third-class licenses but are deterred from obtaining a first-class license because of the time, cost or requisite technical aptitude involved," NAB commented.

Kassens Is Appointed Rules, Standards Chief

The appointment of Harold L. Kassens to the position of Chief of the Rules and Standards Division of the Broadcast Bureau has been announced by the FCC. He succeeds Hart S. Cowperthwait, who retired in October 1969.

Kassens first joined the Commission in 1941 and since July 1963 has been Assistant Chief of the Broadcast Facilities Division.

FCC Supports President's Plan

FCC Chairman Dean Burch told the Executive and Legislative Reorganization Subcommittee of the House Committee on Government Operations that the Commission supports the President's Reorganization Plan No. 1 of 1970—a proposal to establish a new Office of Telecommunications Policy in the Executive Office of the President and to abolish the office held by the Director of Telecommunications Management in the Office of Emergency Preparedness.

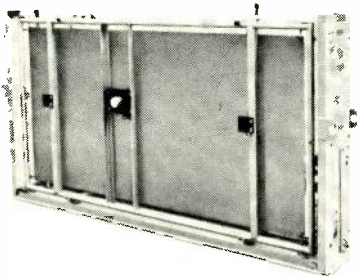
The Director of the new office would be responsible for assignment of Government radio frequencies—functions presently delegated to the President under the Communications Act of 1934. The President also stated that the new Office would be assigned functions now under the Director of Telecommunications Management.

In addition to serving as adviser to the President on telecommunications policy and coordinating Federal communications operations, the new office would represent the executive branch in discussions of the communications matters with the Congress and the FCC. Chairman Burch noted that the President, in his letter transmitting the plan to Congress, stated that, "This action would take away none of the prerogatives or functions assigned to the Federal Communications Commission by the Congress."

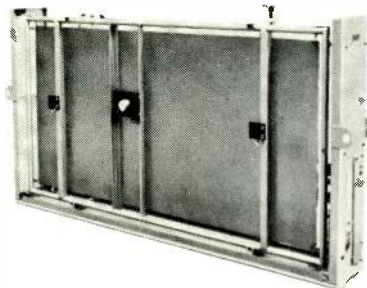
In his testimony, Chairman Burch said that the Commission has "consistently favored a strong, centralized entity to deal with telecommunications issues within the executive." He expressed the belief that there should be "a continuing close scrutiny" of the government's spectrum use to "insure optimum utilization. . ."

Chairman Burch said it would be helpful to receive the Executive views on "significant" matters of communications policy. He noted, however, that the Office would need "adequate staffing and resources" to participate "effectively" in communications policy discussions, and he suggested that these resources "should not be at the expense of those allocated the Commission."

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New Task Force Ready For Action

Deputy Chief Engineer Raymond E. Spence, Jr., has been assigned to head the new Task Force which will concentrate its initial efforts in the Land Mobile radio services field. The Commission has been authorized to request funds in its fiscal 1971 budget for a prototype Regional Center. The Center, planned for the Chicago area, is scheduled to be operational by June, 1972.

The Task Force will be responsible for the development of policies, standards, criteria and guidelines for non-Government frequency management, coordination with Government agencies and foreign nations, and maintenance of spectrum occupancy data, in addition to working out organizational and management details for National and Regional Spectrum Management Centers.

The National Spectrum Management Center would formulate policy and provide direction for several Regional Spectrum Management Centers in a decentralized frequency management program. The Regional Centers would be responsible for carrying out application processing, engineering and assignment of land mobile frequencies.

The Task Force will be part of the Office of the Chief Engineer but will report directly to the Commission.

Engineers Keep The Industry Moving

Donal B. Leith has been named chief engineer for WPHL-TV, U.S. Communication flagship station in Philadelphia. Formerly assistant chief engineer, Leith has been with the company since 1965, when he was one of the original group of engineers involved in getting the station on the air.

Prior to his association with WPHL-TV, Leith was with Halli-crafter Company, Chicago; WNBQ-TV, in the same city; and WEAT-TV, West Palm Beach, Florida.

Gerald E. King-Ellison has been promoted by WCCO Television,

Minneapolis-St. Paul. A member of the engineering department at the station and its radio predecessor since 1935, King-Ellison has been named senior transmission engineer. He succeeds Neil B. Coil, who has retired.

In this position, King-Ellison will be responsible for the maintenance and operation of the WCCO Television transmitter. He will also supervise the five-man staff which mans the transmitter.

Benjamin Wolfe, Vice President for Engineering for the Post News-week Stations, has been appointed to the Broadcast Engineering Technology Advisory Committee of the Northern Virginia Community College.

Gerald Plemmons has been named chief engineer at KQED-Channel 9, San Francisco's public television station. Plemmons, who has been studio engineering supervisor for the last two years, came to KQED in 1963 and has worked in every area of studio and transmitter operations. In 1966, on a two-year leave of absence from the station, he served as senior staff engineering consultant to the Voice of Kenya, the government-owned radio and television station in East Africa. Prior to joining KQED, he worked at Channel 7, the ABC affiliate in San Francisco.

William A. Kehoe, Jr., a trial attorney in the Hearing Division, has been appointed Chief, Renewal Branch, Broadcast Bureau. In his new post, Kehoe will supervise the review of renewal applications filed by broadcast licensees.

Kenneth R. Goodwin, joined the Commission, March 23, 1970, as Planning Officer assigned to the Office of the Chairman. Goodwin, now a budget examiner at the Bureau of the Budget, will assist in the review and coordination of all policy research and long-range planning at the Commission.

Buying? Selling?

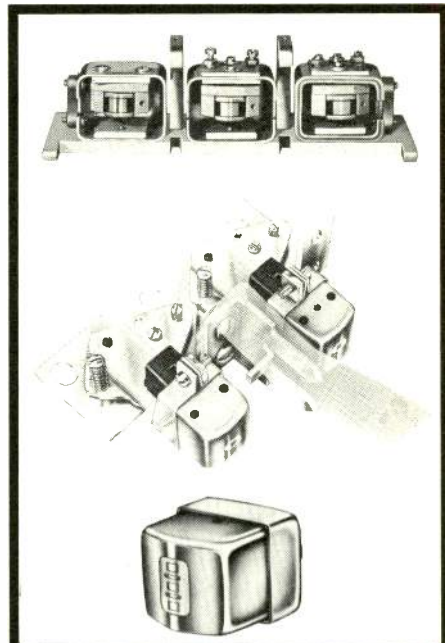
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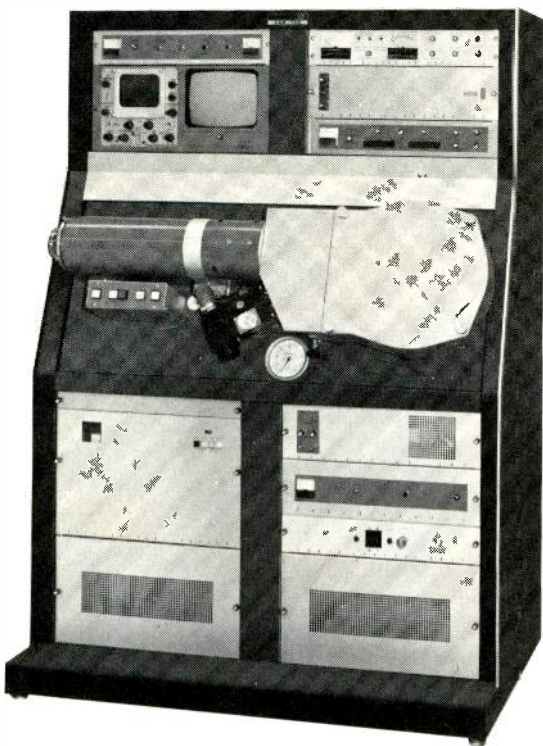
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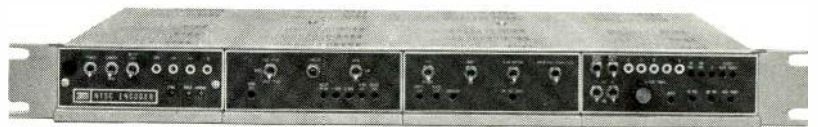
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EBR-100 Electron Beam Recorder — the better way to transfer tape to film. Here's why:

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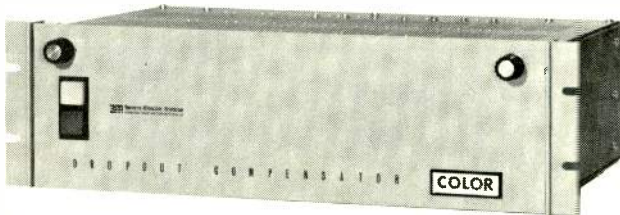
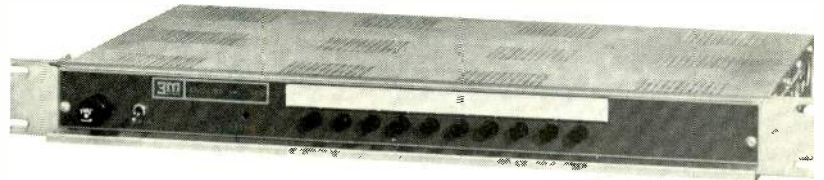
Most advanced tape to film transfer system in the world.



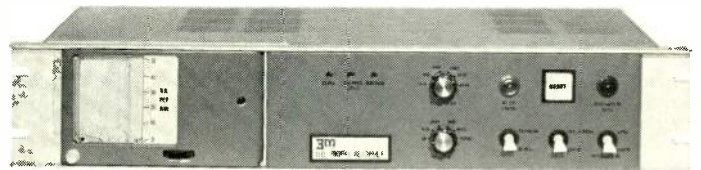
Color Video Encoder has (2) one-of-a-kind unique features. First, the color bar generator is completely digital. You get a signal that's accurate. It needs no adjustments. And it's easier to use and maintain. Second, input clamping of video signals eliminates low frequency hum, noise and other unwanted effects on the matrix. Works with smaller, less expensive cameras as well as large ones. The SMPTE color test will give you the proof. It meets all FCC and EIA specs. And features special monochrome switching.

Look to 3M for specialized products for high quality video performance.

The Bridging Video Switcher is a 10 input switching video distribution amplifier with extremely high quality video performance specifications. Audio-follow switching is included as standard equipment. Loop inputs and stacks can make routing switchers up to 10 x 20. Input and output grounds are isolated. The video ground as well as the coax center conductor is switched through to the output. One switching does not cause a visible disturbance to other switchers looped to the same input line. For maximum signal handling performance at minimum cost, rely on the 3M Brand Bridging Video Switcher.



Dropout Compensator (DOC) replaces color dropout on your VTR reproduction with correct color video—all within the signal itself. In fact, the DOC detects dropouts as they occur and replaces the "lost" signal with stored information from the previous scan line of the same field. It provides precise color match and complete freedom from switching transients. The self balancing video switch prevents white flashes. Dropout disturbance to the time correction unit is eliminated.



Dropout Profile Recorder (DPR) is the perfect companion to the DOC. DPR produces a permanent strip chart of dropout rate during normal on-line video tape playback. It performs this evaluation electronically while the 3M DOC is compensating dropouts. DPR indicates when a tape is too degraded to use for valuable new recordings. Built-in precision calibrator. Five inches of chart reads one hour. Chart can be torn off and stored with the video tape.

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EDUCATIONAL BROADCASTING

Looking Inside Non-Commercial Broadcasting

Educators Assisted By CATV?

Ways in which cable television can be a useful financial and programming resource in education are explored in an article entitled "Dollars for Education in CATV?" in the April issue of the **Educational Broadcasting Review**, the bi-monthly journal published by the National Association of Educational Broadcasters. According to FCC regulation, authors Louis Schwartz and Robert A. Woods point out that educators may properly own and operate CATV systems on a profit or non-profit basis.

"The economics of CATV dis-

tribution systems are such, however, that it seems unlikely that non-profit operation of CATV distribution systems, except by governmental entities or others with solid legislative appropriations, will prove to be of widespread practice," the authors, both members of the Bar of the District of Columbia, noted. They concluded that the "only practicable manner in which educators may consider CATV ownership and operation must be upon a straight commercial for-profit basis. We believe that educators should give serious consideration to the clear pro-

gramming and financial benefits afforded by commercial CATV operations." They also suggested that even in instances where educators are unable to undertake CATV operations alone, they may, nonetheless, participate in CATV on a shared-ownership basis.

Schwartz and Woods emphasized that "cablecasting requires local production facilities and a degree of local programming expertise which many existing CATV operators lack. Many educational stations and institutions possess both the production facilities and the programming expertise which could prove a marketable asset to assist in resolving the cablecaster's dilemma or in fulfilling the cablecaster's desire to provide local origination."

The authors cautioned, however, that it is essential that educators, in considering any commercial enterprise, avoid jeopardizing their eligibility as noncommercial broadcasters with respect to the FCC and the Department of Health, Education and Welfare. If a noncommercial broadcaster is involved in a CATV operation, it must be maintained as separate and distinct from his tax-exempt organization.

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CATV, the authors state, "is a natural extension of the regular interests and concerns of educational broadcasters or educators desiring an integrated distribution system for all forms of electronic communications . . . we believe that there is a definite and even ordained future for educators in CATV. That future can embrace both attainment of diverse programming and non-programming goals and achievement of a sounder financial base for educational purposes."

Yale Engineer To Direct Study

The Department of Surgery at Yale University School of Medicine has recently been awarded a grant to support a multidisciplinary study of post-accident injury and death. Thomas Brask, University Communications Engineer, has been selected to direct the Communications group for this Trauma Program. The engineers and technicians of this group will evaluate, design and develop television and radio communication systems to aid in the study and treatment of the trauma victim, and to make the information gained in the program available for teaching and publication.

Brask has been engaged for a number of years in the design and engineering of specialized television and communication systems for educational and medical facilities in New England and Florida. He is also an experienced television broadcast engineer, most recently having worked in the engineering department of the National Educational Television Network, and was chief engineer for the Florida State University radio and television stations. He is presently designing a telecommunication system for Yale University that includes extensive microwave and cable transmission systems, and he has done the engineering designs for the educational television station proposed for the New Haven community.

Engineering Concepts- Subject Of New Courses

The Center for Management and Technical Programs and the College of Engineering, University of Colorado, has developed "Engineering Concepts 70," a series of con-

FCC Amends ITFS Rules

Rules governing Instructional Television Fixed Stations (ITFS), permitting data transmissions on ITFS response stations in the frequency band 2686-2690 Mc/s, have been amended by the Commission, effective April 17, 1970 (Docket 18346). The Commission found that use of data transmission on ITFS circuits, as well as use of currently authorized voice signals, represent "a distinct advantage in the instructional process." Among the uses for the service would be testing and scoring of tests.

The present Commission action amends Subpart I of Part 74 of the rules, and follows a Further Notice of Proposed Rule Making, issued on July 15, 1969. They also released a First Report and Order on July 15, 1969, adopting rules authorizing low-power ITFS response stations using voice transmissions at remote classrooms to permit students to communicate with the instructor at an ITFS station during classroom periods. The action was in response to a request by Leland Stanford

Junior University, Stanford, Calif.

Stanford, in asking for authorization of voice transmissions, had also suggested the future use of data transmissions on these channels. Because of lack of specific information on use of data transmissions for this service particularly as to bandwidth requirements, the Commission issued its Further Notice of Proposed Rule Making.

Comments or reply comments on the proposed rules changes were received from International Business Machines Corporation, the National Association of Educational Broadcasters, Micro-Link Systems of Varian Associates, the University of Michigan, and Stanford.

The Commission said there appeared to be a need for data type transmissions on talk-back channels and that it would consider "experimental/developmental" applications advancing programs for expanded uses and technical developments of the ITFS service, "if they show a reasonable chance of furthering the state of the art."

centrated, relevant one-week courses designed for the engineer who realizes that his effectiveness depends on his comprehension and application of the new developments in modern engineering and the fundamentals on which these developments rest.

All courses will be conducted at the University during the summer months. These concentrated five-day courses, designed by the Engineering faculty, have one underlying objective—to transmit and translate knowledge of the latest engineering concepts and future trends in a practical, usable form.

Course materials, including texts, will be furnished for each course. Enrollment will be limited to insure educational quality and individual attention.

If interested, write or call The Center for Management and Technical Programs, Business Building 139, University of Colorado, Boulder, Colorado.

Frequencies Made Available By FCC

Frequency bands in the Government radiolocation service have been made available for shared use with the non-Government relocation service in an amendment to Parts 2, 89, 91 and 93 of the rules, effective April 1, 1970.

The bands allocated to the non-Government radiolocation service are: 5250-5350 MHz, 8500-9000, 9500-10000, 13400-14000, 15700-17700, 23000-24250, 33400-36000.

The non-Government user will be required to protect both existing and future Government operations from harmful interference, the Commission said, but the non-Government user would not be protected from interference that might result from any operation in the bands.

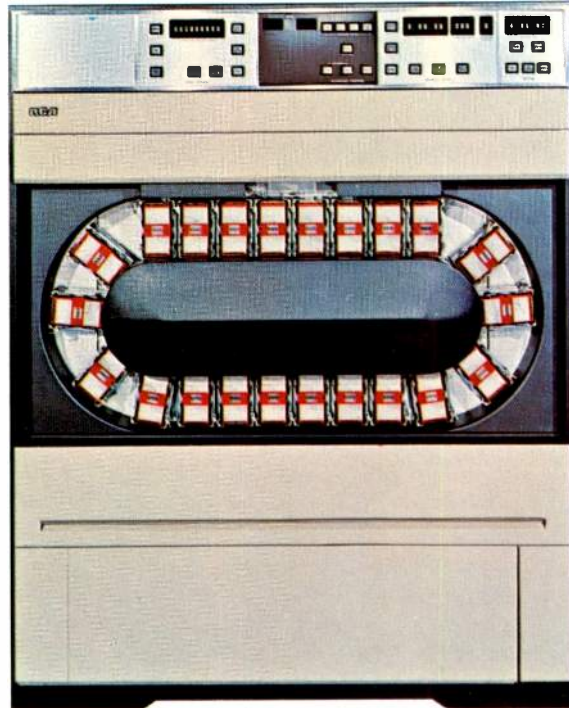
The amended rules specify that the non-Government radiolocation service in the bands will be secondary to the Government radiolocation service and to airborne doppler radars at 8800 MHz.

**See "Modular Lighting"
On Page 52**

The station break



The automatic station break



A bunch of VTR's.
Film chain. People.
Flying fingers. A late
cue. A noisy picture.
A cut-off ending. Pic
but no sound. Panic.
Go to black. The
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Or. RCA's Television Cartridge Re-
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perfect Automatic Station Break after
another.

So the people and equipment you've
been tying up are free—for more re-
hearsal time, for new production time,
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And you get consistently good pictures.

RCA's TCR handles 22, 3-minute
cartridges. You can set its programmer

to run nine sequences
of eight events each.
Could be nine station
breaks. Could be the
night shift.

The TCR works off
the electronics of our

TR-60 or TR-70 reel to reel recorders.
The TR-70 and TCR can cue each other,
or devices like your film chains. And
later, you can add modular electronics
that let the TCR stand alone.

You can automate your station breaks.
Now. You can get the nucleus of a full
automatic programming system. Now.
Your job has its problems. Our
job is finding
solutions.
Automatically.

RCA

SCANNING THE CATV SCOPE

By Harry Etkin

CATV Eyes Automation

In recent months there have been a number of spikes added to the shape of CATV. One of the most important of these has been the FCC's local origination requirement for larger systems. And since CATV has the potential to offer an ever increasing variety of services to the subscriber, there is little doubt that operators will someday be taking a long, hard look at automation.

This will become especially important to CATV operators, because multiple service offerings will eventually develop problems that may best be handled by some assist from automation, especially EDP. But while this idea may temporarily be shelved as an intriguing possibility, it should be placed adjacent to early experiences in broadcast automation. Already there have been cases of abortive operations due to a lack of understanding of system interface and system maintenance. Catch-up training is a tough game to play and doubtless, it will be batted around (hopefully with positive results) at future conventions.

Before striding off blissfully into the future, let's review the initial inroads of automation on CATV operations.

Current Applications

One of the oldest forms of automation in CATV is the weather scan unit that offers continuous information on weather local time.

Background music normally accompanies visual presentation. In conjunction with the built in slide projector, an audio programmer can be used, enabling audio spots or announcements to coincide with the slide display.

An automatic advertising display unit facilitates TV announcements. It is an automatic device for displaying messages and pictures on the TV screen. Used as a TV bulletin

board it can handle a number of display units related to public service announcements, advertising messages and photographs. The data on display can be carried on a separate channel or integrated into other programming.

This arrangement, combined with the use of the slide projector and its audio spots, gives cable system operators an effective, relatively simple means of televising ads from local merchants, audio/visual classified columns, program announcements and public service messages.

Automatic audio spot announcements permits spots to coincide with automatic slide presentations. Background music during audio spots are automatically attenuated. Another new automatic system for providing selected music programs to CATV subscribers has been developed. This system is capable of inserting weather announcements, time calls, station ID, or other spots between music numbers. An example of this system is the tape transport version. Using a multiplicity of transports, the system is capable of passing on a variety of moods or tempos of music for specific times of the day.

These automation units can be interconnected with various types of audio programmers, non-duplication programmers, screen splitter units, and switching, synchronizing and control units to provide a system capable of transmitting a more varied program format.

Feasibility Of Program Automation

While these automated units have a great deal of public service value, there is another type of automated programming which CATV system operators are being encouraged to originate: live and video-taped programs of local events; instructional and educational programs for

schools and industry and entertainment.

In the foreseeable future, that is, in the next two years, it does not seem likely that CATV systems will automate this type of programming to any great extent. At this stage, the primary concern of most systems is the development of manpower, studio facilities and production techniques to make local origination a reality. Although software programs from sources outside the industry will no doubt proliferate, the majority of cable systems will, in the immediate future, use only limited automation devices such as interspersing spots with videotaped programs. Sophisticated program automation systems for cablecasting will probably have to wait the development of 20-40 channel systems in the larger markets.

V. W. Riley, RCA Administrator of Market Planning (CATV) specifies that, "With regard to 'automated' services for cablecasting, let me say that if you refer to the sophisticated operation being contemplated by broadcasters wherein all transmissions are controlled by a computer which inserts the appropriate commercials, bills the clients, etc. I don't think it will happen for some time. It will occur eventually because broadcasters will become cablecasters when access to a high-quality cable that reaches all homes in a community is possible. Such a channel will operate in that portion of the cable spectrum allocated for the common carrier offerings of the local cable system.

"If, on the other hand, you refer to such services as weather, news and stock ticker, I'm sure that there will be other one-way informational services that will be added and that associated 'black boxes' will become more sophisticated.

"The exciting thoughts for the future, however, are those associated with the two-way possibilities of the cable. The recent EIA filing in response to the FCC's Notice of Inquiry (December 13, 1968) is a good example of things to come."

John R. Barrington, TelePromp-ter Vice President of Public Relations, says, "Our engineers who follow the state of the art closely, tell us that several companies are working on the technology for TV program automation, but that none, to date, have succeeded in devising a

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system that will meet broadcast standards. However, they do consider such a system both possible and feasible."

Among the companies they mention doing r & d on the problem are CBS, RCA, Sony, Panasonic, ITV and Bell & Howell. Even if technology were perfected tomorrow, there is still no one to our knowledge yet producing video programming specifically for automated tape purposes.

Sophisticated Operation

Some equipments developed for TV program automation which might be considered available for the very near future for automated cablecasting activity include:

1. CBS EVR System.
2. RCA "Automatic" VTR and possibly the more sophisticated cart-ridge video tape recorder/player.

CATV System Operator and Technician Training

What is required to assist CATV system operators to operate and maintain a well planned and coordinated cable TV program automation system economically?

One of the major proposals would be to urge that cable system operators to be provided with technicians of the highest echelon of technical competence to cope with the problems related to automation equipment.

Automated equipment for CATV system operation normally saves manpower, provided it operates correctly. When it fails it can cost plenty in lost revenue in advertising and possibly public support. Cable TV system automated technology is the major difficulty in automated systems due to unfamiliarity with the equipment. It is certainly necessary to learn the techniques of repairing, maintaining and trouble-shooting automated equipment.

Industry Support

What can be done to train cable TV system operators and technicians? Training sessions should be developed and workshops conducted by industry, NCTA and technical schools which should be open to all interested CATV system personnel who wish to become competent and highly skilled automation system technicians. The CATV industry should provide different current automation units and have

available individual consultation representatives to demonstrate the working principles, A possible solution to the training problem would be to establish an on-the-job technical training program within the cable TV system companies so that the individual technicians could achieve the ability to troubleshoot, repair and maintain the entire system proficiently during an emergency period.

Test equipment such as the Sin² Pulse/Window Generator, Stairstep signal generator, multiburst generator, modulated pulse generator and possibly Video waveform and picture information units should be available for the technicians' use in order to help CATV operators maintain a high quality video signal throughout their systems.

Technical Schools

Specialized technical schools have been established by CATV industry equipment manufacturers throughout the U.S. and Canada. Engineers and technicians are offered various subjects dealing with CATV hardware, operations and theory.

An excellent training facility, The National Cable Television Center, has been established by a grant from NCTA to the Pennsylvania State University Continuing Education Service. This service offers conferences and short courses for technical and management personnel in the cable TV industry. A correspondence listing, that has recently created a great deal of interest for CATV personnel are the four courses designed to provide the electronics and mathematical background fundamentals to the CATV industry; apply this fundamental knowledge to CATV systems; acquaint the student with the test and measurement procedures of the industry; and also offer a detailed study of the technical problems peculiar to the CATV industry.

For information and catalog of courses available to CATV personnel, one should write to: National Cable TV Center, The Pennsylvania State University, 501 J. O. Keller Building, University Park, Pennsylvania 16802.

Canadian CATV Notes

The Canadian Cable Television Association (CCTA) is assisting CATV system operators in making intelligent decisions relating to the

Canadian Radio-Television Commission's (CRTC) newly proposed CATV regulations.

CATV system operators are concerned with the present and proposed CRTC rules concerning the Copyright Act, introduction and operation of local programming services, both automatic and live cable casting and the introduction of new rules of procedure.

Many timely topics of proposed rulemaking by The Federal Communications Commission (FCC) are discussed in the CCTA Bulletin. These are, "FCC Suggests no Exclusivity for under 500 subscriber systems" and "FCC to consider waiver of microwave rules".

The CCTA 14th Annual Convention and Trade Show was held on May 11-14, 1970 at the Hotel Vancouver, Vancouver, B.C. The theme was "Cable Television—a Service to the Community."

Program Service

The cable television industry will hear for the first time at the Programming Conference, sponsored by National Cable Television Association, April 30-May 1 in Chicago, about a National Library of programming for cable television.

The Library, named National CATV Program Library, Inc., with home offices at 1004 Stemmons Tower South, Dallas, Texas, will be distributed largely from Dallas Texas, because of the central location and its' Dallas based Duplication Center. The Library will supply a full variety of entertainment programming—movies, cartoons, children shows, spectaculars, sports, game shows, cooking shows, country and western and even some special shows that are designed to acquire new subscribers for the cable systems. All of the programming is made available on a Library basis, at a rate of approximately ½¢ per subscriber.

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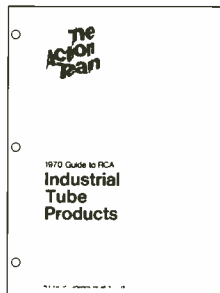
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In power tubes, for example, brand preference studies by leading electronic publications have listed RCA as the first choice of professional designers year after year!

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Need more reasons? Call your local RCA Broadcast Tube Distributor. For starters, ask him for the new 1970 Guide to RCA Industrial Tube Products, or write: RCA Electronic Components, Commercial Engineering, Dept. E115SD, Harrison, N. J. 07029.

P.S. Your RCA Broadcast Tube Distributor is also the man to call for RCA Starmaker Microphones.



Circle Number 46 on Reader Reply Card

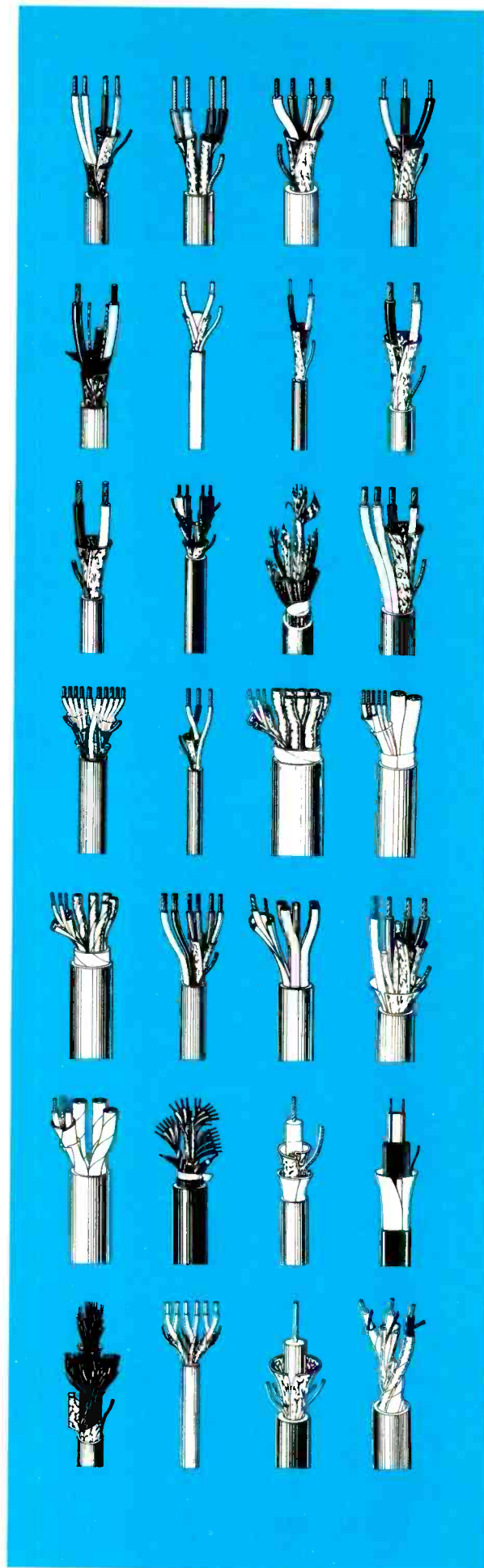
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It's the cable with virtually perfect shielding. It's a Belden exclusive. Beldfoil ISO-Shield is like a continuous metal tube enclosing each pair of conductors in a cable. It locks out crosstalk or interference . . . whether from outside sources or between shielded elements in the cable.

Beldfoil is a layer of aluminum foil bonded to a tough polyester film (for insulation and added strength.) To form an ISO-Shield, we apply it in any one of several unique ways to meet the requirements of different applications. (See Figures 1 and 2, for example). Each gives more physical shield coverage than braided wire or spiral wrapped (served) shields. And greater shield effectiveness . . . even after repeated flexing.

Beldfoil ISO-Shielded Cables are small, lightweight. They terminate easily. They're modest in price. Your Belden Distributor stocks a wide variety of standard Beldfoil shielded cables as listed in the "Belden Electronic Wire and Cable Catalog" (ask him for the latest edition). And, should you have specifications no standard product can meet, ask him to quote on a specially engineered design. Or, if you choose, contact: Belden Corporation, P. O. Box 5070-A, Chicago, Ill. 60680. Phone (312) 378-1000.

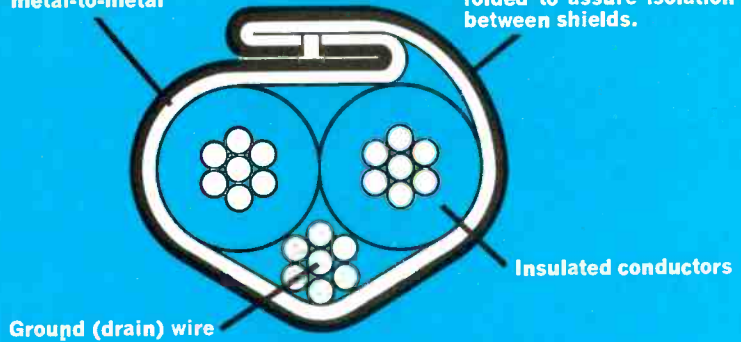




Metal (shield) foil, folded to assure metal-to-metal contact.

FIGURE 1

Polyester insulating layer folded to assure isolation between shields.



Beldfoil Multiple Pair Individually Shielded Cable

The Figure 1 cross-section shows Belden's exclusive Z-folded Beldfoil ISO-Shield. Note the metal-to-metal contact between the two edges of the aluminum foil. In essence, you have a continuous aluminum tube. And the polyester layer on the outside of the fold assures the isolation between shields so necessary for best performance in the field.

Technical Data

Nominal values for multiple pair individually shielded cables containing 3 to 27 pairs (including 8769 and 8773 through 8778 Series cables)

Suggested working voltage: 300 volts rms max.

Working voltage between adjacent shields: 50 volts rms max.

Capacitance between conductors in a pair: 30 pf per ft. nom.

Capacitance between one conductor and other conductor connected to shield: 55 pf per ft. nom.

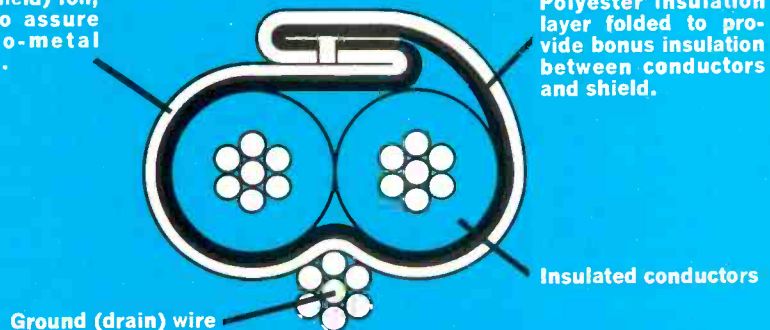
Capacitance between shields on adjacent pairs: 115 pf per ft. nom.

Insulation resistance between shields on adjacent pairs: 100 megohms per 1000 ft. nom.

Metal (shield) foil, folded to assure metal-to-metal contact.

FIGURE 2

Polyester insulation layer folded to provide bonus insulation between conductors and shield.



Beldfoil Shielded Single Pair Cable

The Figure 2 cross-section shows the exclusive Belden Z-fold with the polyester insulating layer inward. This makes use of the high dielectric strength of the polyester film as bonus insulation between the conductors and the shield. (The cable jacket provides the primary insulation of the shield from outside objects or adjacent cables.)

Technical Data

Nominal values for 8451 Shielded Pair Cable

Suggested working voltage: 200 volts rms max.

Capacitance between conductors: 34 pf per ft. nom.

Capacitance between one conductor and other conductor connected to shield: 67 pf per ft. nom.

BELDEN 

new ideas for moving electrical energy

Circle Number 19 on Reader Reply Card

Cooling The Transmitter

By Pat Finnegan*

One of the essential factors necessary to long life and stability of any broadcast transmitter is its cooling system. How effectively this internal system can do its job will depend greatly on how well the system is maintained, the external environment, and the manner in which the transmitter is operated.

The enemy is heat, especially excessive heat. When you consider the transmitter RF power output against the power line consumption, you know that transmitters are not the most efficient machines. A majority of transmitter components, whether they be tubes, resistors or transformers, contribute a considerable amount of heat to the internal environment of the transmitter.

All tubes and components are designed with a reasonable tolerance for heating within limits. Above these limits, the excess heat must be removed quickly or components may be damaged. A reasonable amount of heat is both necessary and desirable. But even as the lower limits are exceeded, components will not function properly. (See April, 1970-BE, page 46 for article on heat vs. components.)

The excess heat developed within the transmitter is undesirable and must be quickly removed from the transmitter as a "waste product".

Since the Station is paying for this waste product through its power bill, it is logical that this unwanted heat be put to useful work heating the building.

Major Cooling Divisions

Internal cooling systems may be divided into three categories: power tubes, cabinet and specialized spot cooling. How simple or complex these systems are will depend upon the transmitter output power and type of service. Small, low power AM transmitters use a single blower to cool everything, while high power UHF transmitters may use a combination of several methods inside and outside the transmitter.

Power tubes are the largest heat producers. The amount of heat will depend upon what service a tube is performing, its required output, relationship of input to maximum ratings and proper stage adjustment.

A tube that is working very near its maximum ratings will develop more excess heat than one that is "loafing". How a tube is working depends upon the transmitter designer and his thinking. Some manufacturers have been known to work their tubes right at maximum ratings as an economy measure in keeping down the price of the transmitter. The station engineer should investigate how his transmitter has been designed in this respect.

How well the stage is adjusted will have an immediate bearing upon the amount of heat produced. This is especially true of RF stages.

An RF stage must be properly tuned and loaded to get an efficient transfer of power to the next stage or load. Mistuning will cause the tube efficiency to drop and the RF power dissipated in the tube plate circuit to rise. Increased drive will be necessary to get the desired output. This increased drive will cause additional RF heating at the tube input.

All the tube internal elements must be able to quickly transfer their excess heat to the outside of the tube where it is carried away either by air or water. If this transfer cannot take place quickly, the internal elements will sag or melt, or the tube glass or ceramic to metal seals may open, allowing air to enter and destroy the vacuum.

Air Cooling

Power tubes are cooled either by high speed air blowers or by water systems.

Air cooling is used in the majority of transmitters for power tube cooling. Air equipment is somewhat easier to handle and requires little space. Moving air and blower motors do generate noise and vibration. The amount of noise and vibration increases as the volume and flow are increased.

Blowers are generally mounted within the transmitter itself, while some transmitters allow for external blowers. These external blowers may be mounted a short distance from the transmitter. The load increases as this distance is increased.

Water Cooling

Water cooling is used in all high power UHF transmitters for the klystrons. Some of the older medium power UHF tetrodes and some 50 kW AM transmitters use water cooling.

There are two versions of water cooling. The newer version is called Vapor Phase cooling. The Vapor Phase system uses water until it reaches the klystron where it is converted to steam to carry off the heat to a heat exchanger, whence it condenses to water again. The main advantage is smaller components and a smaller heat exchange which saves space. Both versions are in use today.

*BE Maintenance Editor and Engineering VP at WLBC, Muncie, Ind.

Cabinet and Spot Cooling

Cabinet cooling usually incorporates small exhaust fans mounted in the top of the cabinet. They provide a generalized cooling of all the components within the cabinet. Since the air flow is from the bottom to the top of the cabinet, the air gets progressively warmer as it nears the top. Along the way it has picked up warmer air from the components it has passed. Placement of components within the cabinet is a design problem and there is little the station engineer can do if the design is poor.

Air must flow freely and no pockets allowed to develop which can trap air and cause component overheating. The station engineer often makes modifications for various reasons. When these modifications are made, free air flow must be given consideration. For example, it may be necessary to add a shield between two stages, or completely enclose some components in a metal box. Care must be exercised to insure free air flow to these components.

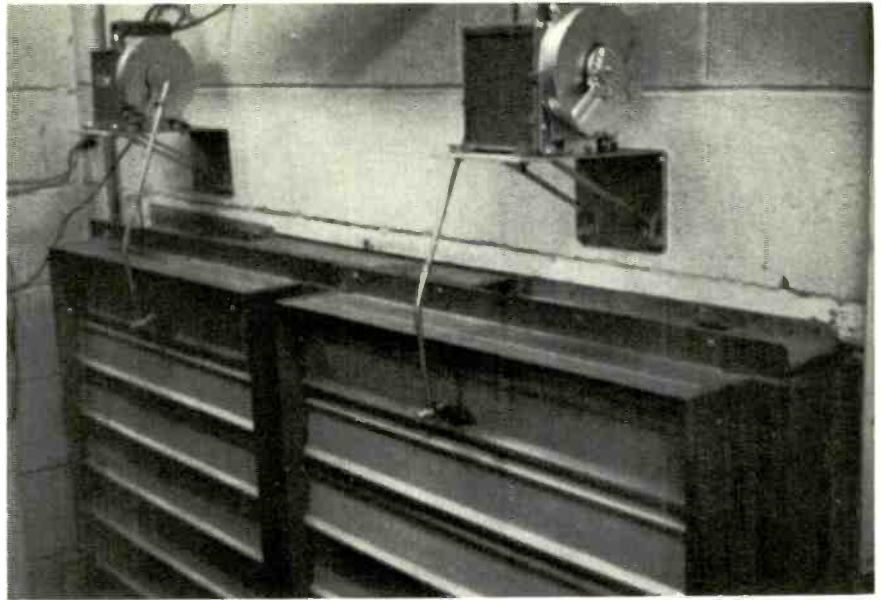
Specialized spot cooling is quite often used on some particular component or tube part when it is difficult to get adequate cooling from the general cabinet cooling or main tube cooling. These generally take the form of small, high speed blowers with a nozzle to direct the blast of air directly onto the component that requires special cooling.

Environmental Cooling

The environment in which the transmitter operates and how this is handled can air or inhibit the transmitter blowers. Much, of course, will depend upon the size and service of the transmitter.

Low power AM transmitters often need only ample external space around the transmitter for air movement. Air is taken into the transmitter at floor level and then exhausted out the top into the room. The normal room heating and cooling systems take on the additional load.

Medium power transmitters require more consideration. Fresh air from outside the building should be brought into the transmitter inlet, while the hot air is exhausted



Fresh air inlet to the system using motor-controlled levers.



Ductwork in an air cooled system used on a UHF transmitter.

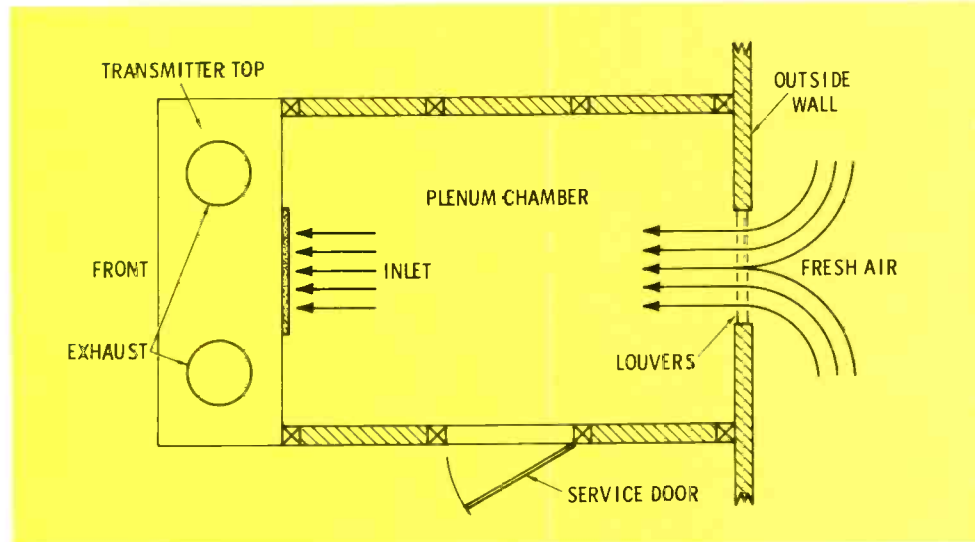


Fig. 1 Rear of the transmitter here is enclosed to form a plenum chamber for the fresh air inlet.

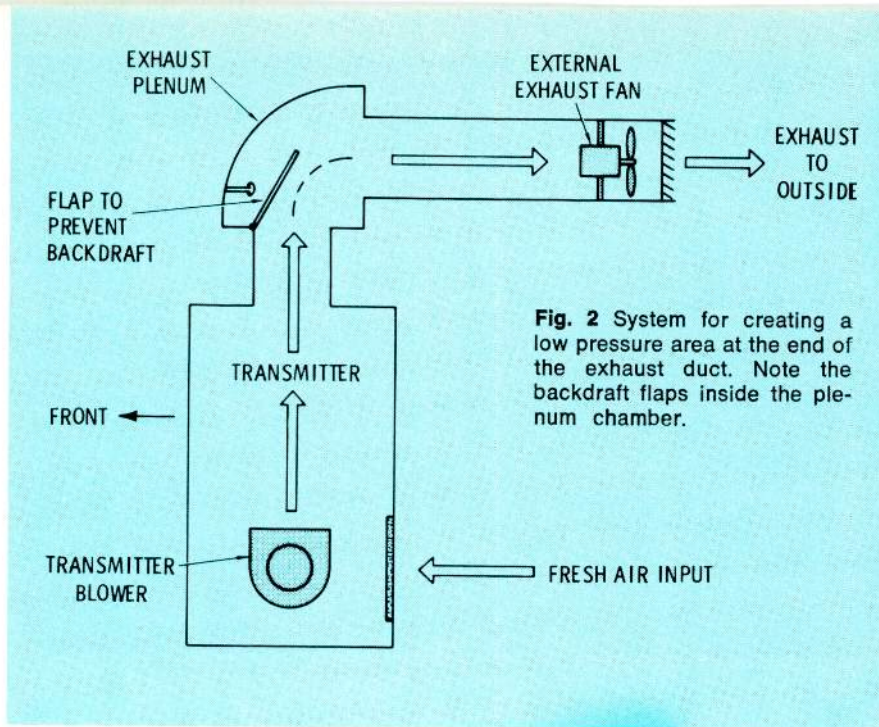


Fig. 2 System for creating a low pressure area at the end of the exhaust duct. Note the backdraft flaps inside the plenum chamber.

through a duct to the outside. This may be a simple opening in the outside wall. Under this arrangement, some of the room air will also enter the transmitter. If it is desired that only outside air be available for the transmitter, the intake may be run through a duct to the outside opening, or the rear of the transmitter may be enclosed in a room to form a plenum chamber (See Figure 1). During frigid weather, use of only outside air to the transmitter can create problems within the transmitter unless it is tempered.

If the outside fresh air louver is controlled by a thermostat, and part of the hot exhaust air is permitted to mix with the incoming air, the frigid air can be tempered and not cause problems during winter operations.

A further refinement of the air system would be to incorporate the intakes and exhaust from the transmitter into the building systems. This additional heat will reduce the fuel bills.

Plant Considerations

When a new installation is planned, it would be well to consult with heating and air conditioning experts so that the transmitter system can be incorporated into the building system. The engineer should know what must be accomplished at the transmitter so that the transmitter cooling ends are not, along with handling the off waste

heat. The transmitter spec sheets should show the required air movement in cubic feet per minute (CFM). Correct information about the transmitter requirements will assist the heat and cooling engineer in the design of the building system and the incorporation of the transmitter system.

Air can be compressed, restricted and directed. In each of these cases the air movement is not always what one might expect it to be, so here are some things to remember.

Fresh Air Inlet: The opening in the outside wall should at least equal the square feet or square inches of the transmitter inlet. This is the minimum. It is better if the outside inlet is larger because the air filters will reduce the effective inlet area. As the filter clogs up with dirt, the air flow will be further restricted.

When designing inlet dimensions, try to select a size that will allow the use of standard air filters. If special filters must be made or ordered because of size, replacement at a later date may be a problem.

Duct Resistance of the exhaust is important. Forcing air through a duct is not easy. The duct will compress the air into a confined space and increase the resistance. This resistance adds a load to the transmitter blowers and slows down the air movement.

Exhaust Considerations

Create a Low Pressure area at the

end of the exhaust duct by the use of external blowers. In order that a low pressure area may be created, the exhaust blowers must be capable of moving more than the total air that will be entering the exhaust and at an equivalent speed or faster. In effect, these blowers are pulling air away from the transmitter blowers which will work easier without back pressure on them.

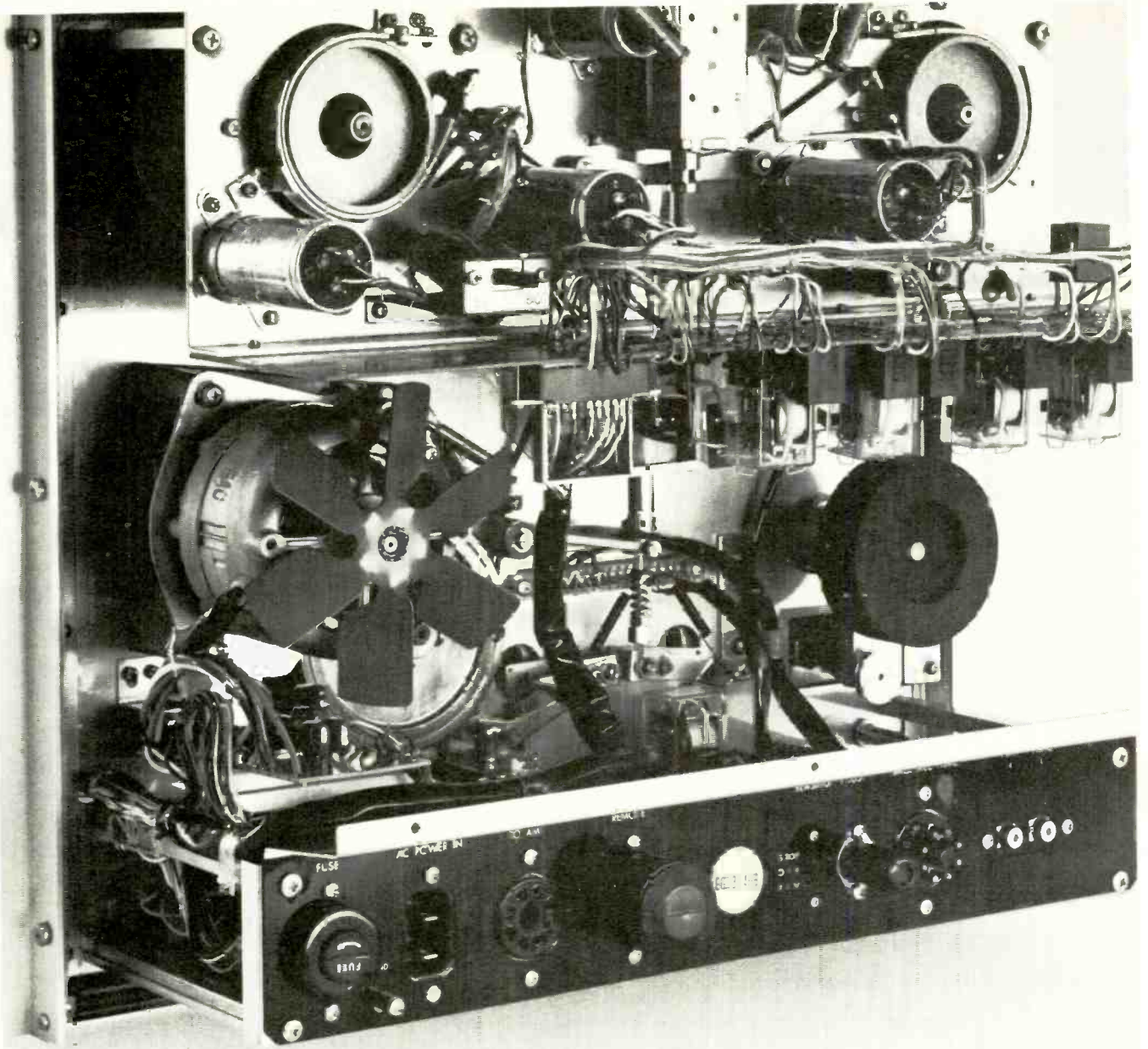
The input-output air volumes should be equal. That is, fresh air should be replacing the exhaust air in the same volume and at the same rate. Should the inlet to the building be too small, the transmitter will be exhausting more air than is entering. This will cause the building pressure to be reduced. When the building pressure is reduced, outside air will find any easy opening to enter the building.

Backdrafts then become a problem when the building pressure is reduced. In a very small building this may do no harm except to reduce the transmitter cooling efficiency. Should the transmitter room be part of the studio/transmitter building, low building pressures can be a real problem, depending upon how low these pressures become. Serious consideration must be given to furnace vents and vents that exhaust other fumes (such as ammonia from an office copier) to the outside. Backdrafts will cause these fumes to be pulled into the building.

Countermeasures call for small exhaust fans to be installed in the chimneys and vents of furnaces, etc. so that the fumes will continue to be blown outside the building. These blowers, however, will contribute to making the building pressures lower.

At sign-off when the transmitter is shut down, another problem will be created. The countermeasure blowers will still be working, so that now the outside air will flow back through the inactive transmitter exhaust. During frigid weather, this cold air on the tubes and components all night long means the transmitter will "wake up with a headache".

To prevent the backdraft through the inactive transmitter exhaust, small flaps may be installed that



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will drop shut when the blowers are turned off. They should be such that the transmitter blowers can pop them open easily. The motor driven

louvers should go to a closed position when the system is turned off.

Auxiliar heaters are required in the transmitter room with any sys-

tem that uses the transmitter heat for the room. If it is part of a total system, the normal building heating plant will supply the required heat. During winter it doesn't take long for the transmitter room to cool off.

Typical Air System

In a typical air system, the fresh air enters through thermostatically controlled louvers into a plenum chamber and on to the transmitter inlets. The exhaust air from the transmitter enters a plenum chamber above the transmitter and then through the exhaust ducts to the external blowers, and on through thermostatically controlled dampers or deflectors and on to the outside. During cold weather, the exhaust deflectors cause the hot air to deflect into the intake plenum so that it mixes and tempers the cold air. The inlet and deflectors, louvers and dampers should be operated from the same thermostat so that all these items work together. Additional dampers and thermostats may be used when some parts are not desired to work as one and when the transmitter system may be included in the building system. Once set, these thermostats will cause the dampers and louvers to "modulate"; that is, constantly changing the amount of opening by small amounts, and will keep a relatively consistent temperature to the transmitter cooling air.

Water Considerations

Water systems depend upon the type of tube that is being cooled for some of its basic requirements and treatment.

Purity of the water is based upon the need for low current conductivity. In a system where there is a high voltage potential across the water, its electrical resistance must be quite high; otherwise, it will put a leakage or short across the high voltage supply.

Demineralization is a constant battle if there is high voltage across the system. Electrolysis caused by the interaction of copper, oxygen and electrical current results in copper oxide deposits building up in the system and especially on the anode of the tube. These deposits actually temperature insulate the

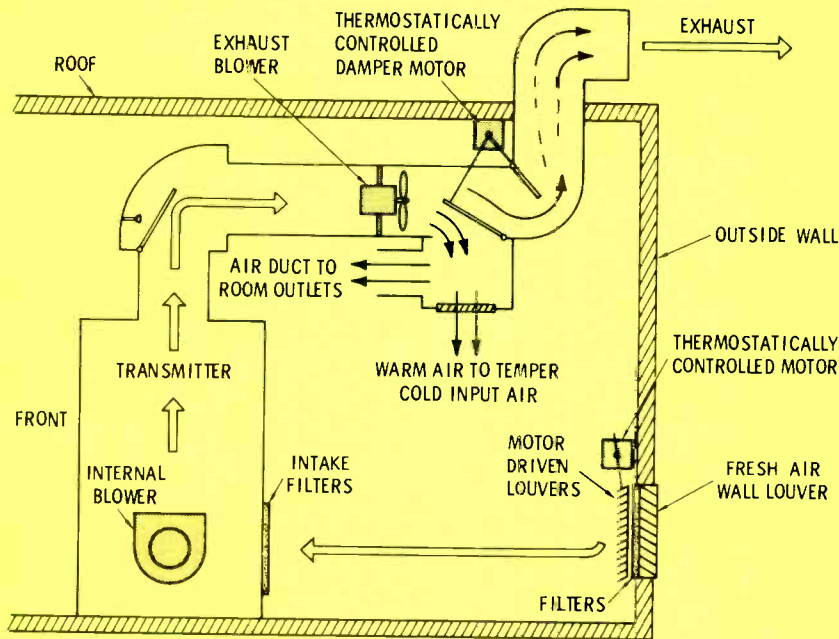


Fig. 3 Typical air cooled system. Some of the warm exhaust is retained in the building.

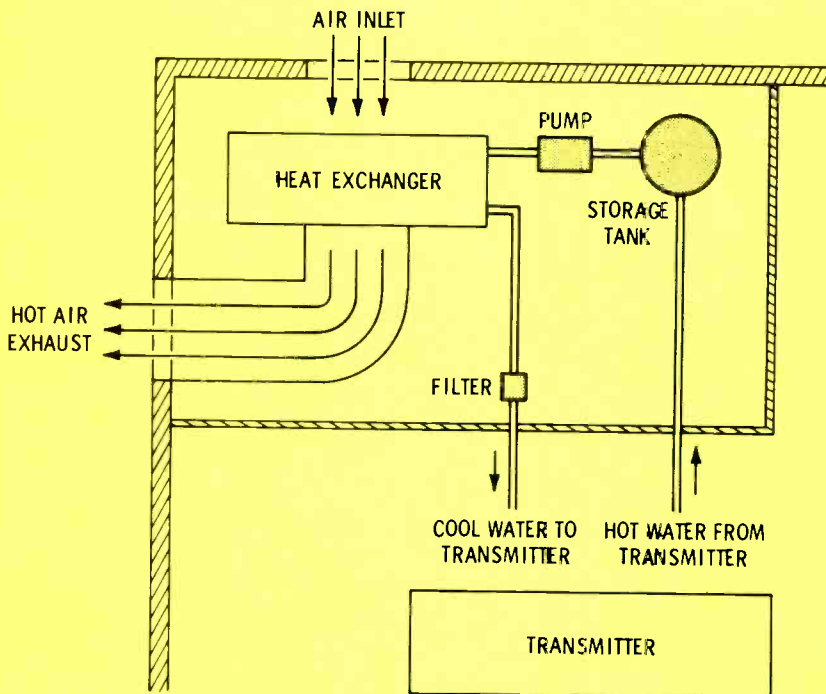


Fig. 4 A typical water cooled system.

part to be cooled which has the effect of decreasing the system cooling efficiency and shortening the life of the tube.

Part of the technique for demineralization uses a blanket of nitrogen at the top of the water in the storage tank. This keeps additional oxygen from being absorbed into the water.

Hoses of good quality are necessary where the connections are made to the tube. Good hoses, however, have a high copper content which contributes to the copper oxide deposits. Hoses should be replaced in such a system about every 60 days.

Low Potential systems, such as klystrons, do not need the insulating quality of the water as do the previously discussed systems. This is not to say that klystrons do not use high voltages—they do. The anode, however, is a ground potential, so that electrolysis is not as much of a problem. The cooled surfaces in klystrons are broad, so that there are no small ports to get clogged.

Heat Exchangers

Heat exchangers must be protected from freezing weather. Cool air from the outside is used to cool the liquid in the system at the heat exchanger. There are various approaches to this problem. Liquids other than water have been tried, but in the high voltage system, they proved less than satisfactory from a cooling point of view.

The general approach to this problem has been to revert to air techniques around the heat exchanger. That is, the water system is placed in a room by itself so a plenum chamber is formed. Thermostatically controlled louvers and dampers control the outside entering air, the exhaust hot air and the mix of the two, so that the incoming air to the heat exchanger never drops below 40 degrees fahrenheit. Also, as with air systems, the waste hot air from the heat exchanger may be incorporated into the building air heating system.

Water Installation

Cool water is pumped through the system to the tubes where it cools the desired surfaces, absorbs the heat and carries it away from

the tube. In a vapor system, the water is allowed to boil into vapor or steam as it picks up heat from the tube, later to be condensed. Filters are placed in the lines at various places to clean up impurities that may be floating in the system. The water goes to a storage tank, then on to the heat exchanger where it is cooled and the cycle repeats itself. Blowers force air through the heat exchanger so that the heat from the liquid inside is given up to the air, which must be exhausted as waste heat. The air around the heat exchanger is temperature controlled so that freezing of the water in the system does not occur. Should the water freeze, sensors in the transmitter would shut the transmitter down (or prevent it from coming on), to protect the tubes.

Maintenance

Observation of the cooling system should be part of the daily inspection. This inspection should include checking water gauges, listening for any unusual bearing noise from pumps or blowers, unusual vibrations, water leaks and apparent room temperatures, cabinet or cavities temperatures. These need not be measured with a thermometer. Once the engineer becomes accustomed to a particular installation and if he is alert, he will be able to sense that the room temperature is incorrect, or that the transmitter panels or cavities appear to be warmer or colder than usual.

The transmitter room door itself will give hints to the alert engineer. This is especially true of a system that incorporates the transmitter system with the building system. In a normally operating system, the door will operate just like any other door.

Should the outside vents be closed for some reason (when they should be open), the exhaust heat will be dumped into the room raising its temperature considerably. At the same time, the blowers are building up the room pressures. Should there be other exhaust blowers in the building, they will pull on this high pressure which will cause the door to show some slight resistance to opening.

If the outside fresh air vents are closed when they should be open,

the room pressure will be lowered by the exhaust blowers. The door will swing into the room as air from the outside rushes in to equalize the pressures. The amount of these movements is not great, so it depends upon the alertness of the engineer to detect them.

All systems should be kept tight, especially water systems. Leaking air will decrease the system efficiency, but a leaky water system is something else. An engineer who has had the experience of opening up the station some morning to find the floor covered with water, can vouch for what happens to one's disposition. More joy when the leak occurred inside the transmitter!

Air ducts should be checked for leakage. They should be both held together with sheet metal screws and the joints sealed with tape. Leaks will decrease the efficiency.

Water systems having electrolysis problems should be purged on a regular basis. Experience with a particular installation will dictate the frequency, but engineers find that purging with citric acid once a month for copper oxide contamination is necessary.

The fresh air inlets to the building should be kept clear of obstructions, which can take the form of clogged air filters, snow, leaves and weeds.

The air filters throughout the system should be inspected regularly, and changed as the need dictates. While most filters in the system can be checked with the system in operation, those in the transmitter generally need to be inspected after the equipment is turned off. Because of this, they may be neglected.

Blower motor belts should be inspected often, as they can come apart during operation and shut the equipment down. Much air time could be lost to transmitters that are on remote control from some distance. It is better to replace belts well before they show signs of imminent failure than to lose costly air time trying to save a few cents on belts.

A correctly installed and maintained cooling system will contribute greatly to transmitter stability of operation and extended life for tubes and components. ▲

"The Best Is Yet To Come"

NAB Convention Coverage

NAB President Renews Attack On Commission

Vincent T. Wasilewski, president of the NAB told convention delegates that actions to divorce radio, television and newspaper ownership are an attempt by the federal government "to break the (broadcast) industry into small and manageable pieces."

He noted that the Federal Communications Commission has sought to justify such attempts on the grounds that media diversity is needed. But, he declared, the FCC "has struck shattering blows at the industry based on little more than a vague and unsubstantiated feeling" which is "not a sound basis for such radical action."

In a speech at the opening session of the NAB's 48th annual convention, Wasilewski accused the FCC of "perpetrating" an annual "spring outbreak"—just before the NAB convention—"as reliable as the swallows returning to Capistrano."

He referred to the Commission's new rule which prohibits new ownership of radio and television stations in the same market and its proposal to extend this to combination newspaper and broadcast ownership in the same cities.

He also predicted that the coming year will see another "issue of prime importance—the preservation of the independence of our news reporting function in broadcasting."

Recent examples, he pointed out, include government attempts to subpoena records of newsmen which "would literally destroy broadcasting's ability to function as a news medium" and the proposal by "the President's Commission on the Causes and Prevention of Violence . . . that a government-appointed



Wasilewski—"Now the Commission proposes to take radical action. . . ."

surveillance body be set up to watch over news media."

The NAB president also referred to Vice President Spiro T. Agnew's criticism of broadcasting which he said appeared to be only criticism rather than attempted intimidation.

"We in broadcasting sincerely hope that the matter will rest there," he said.

Referring to the FCC actions to divorce news media in the same market, Wasilewski said: "Newspaper ownership (of broadcast stations) has existed since the first days of radio in the early 1920's. Radio and television ownership has existed since the radio pioneers founded the television industry nearly a quarter of a century ago.

"Now the Commission proposes to take this radical action in the absence of any factual research; in the absence of any real attempt to investigate whether, in fact, undue influence has been exercised, or in fact even exists; in the face of facts showing an increasing number of

voices and more competition in almost every market.

"The Commission has made no real attempt to study what negative effects their proposals would have. For example, it is virtually certain that in some cases they would result in a net subtraction from the number of voices in any given community, not an addition," he continued.

"The Commission has never demonstrated that there is a major problem of concentration. Yet it has struck shattering blows at the industry based on little more than a vague and unsubstantiated feeling. Such a feeling is not a sound basis for such radical action."

Last year the FCC—just before the NAB Convention—celebrated its "annual wrong of spring", Wasilewski said, with its WHDH decision which declared, in effect, that "no (station) license—in a large market or small, radio or television—would be safe from the depredations of those who would promise anything to get it."

He recalled that in his 1969 convention speech he proposed legislation that would "require the FCC to first determine that a grant of the application of the renewal applicant would not be in the public interest before accepting the application of any other person for the license."

ITFS Rules Changed

Section 0.281 of the Rules has been amended to include delegation of authority to the Chief of the Broadcast Bureau, to grant rule waivers for instructional television fixed stations.

Section 0.281(11) presently delegates similar authority to the Chief, Broadcast Bureau, in connection with noncommercial educational television broadcast stations.

See Industry News

Page 10

BROADCAST ENGINEERING

Nelson Says Engineers Can Handle Lighting

Television stations which lack full-time lighting directors can have an engineer learn to handle the basic lighting techniques, Larry E. Nelson, national TV sales manager, Centry Strand, Inc., Los Angeles, Calif., told an engineering session group.

Nelson discussed in detail the six special types of light required to light the average television set. These are key light, back light, base light, fill light, set lights and effects lighting.

Key light, Nelson said, is the main source of illumination on the set. This light must make the subject or subjects stand out from the background and highlight them to draw viewer attention. The most versatile fixture for key lighting, he noted, is the quartz iodine Fresnel spotlight.

Backlighting separates individual subjects from the background. Without properly applied backlight, the television picture has a flat, dull appearance, Nelson explained.

Fill light, he went on, is used in studio lighting to mask the mistakes created by the individual who is doing the lighting. Thus, fill light covers up and fills the shadows created by the key light and, in addition, can be used to improve the subject's appearance by use of soft, direct lighting. He also explained that a fill light which is properly positioned can act as a base light. The converse also is true, he said.

Nelson stated that lighting techniques evolve from a series of experiments and applications. Rules and principles are only intended as a starting point, he added.



Burch—I want a strong, confident broadcast industry, not a tattered figure patched over with surefire remedies.

Burch Sees Changing FCC

“First of all, it is obvious to me—and I’m sure to you—that if the Commission is to determine policy on the issues before us rather than be engulfed by them, our procedures must be revised and simplified and up-dated. However economically unsatisfactory it may be to some of the attorneys who daily wend their way through the maze of rules, regulations, delegations of authority, policy statements, petitions, and all the other paraphernalia of regulation, it is clear that the Commission must catch up. The only reason for procedure is to guarantee substance and a delay of 10 years on a matter cannot be considered just—regardless of the outcome.

“I recently created in the Commission a special group to work with all interested persons to consider changes in our procedures that will take some of the aches and pains out of our procedural joints. Whether this effort will be all-successful or not, it is quite clear that in this area at least there is no merit in the status quo.

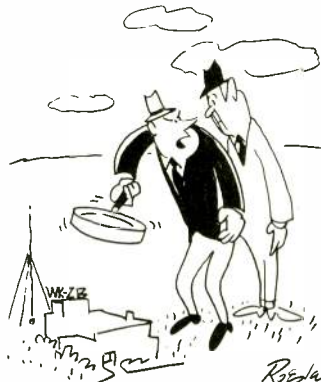
“First, let’s consider our recent policy statement on comparative hearings at renewal times. The WHDH decision, in my opinion, confused the industry and caused a

justifiable concern which led to the introduction by Senator Pastore of S. 2004. By our policy statement we have attempted to reconcile two points of view—that is—the absolute necessity of preserving stability in an industry requiring large investments as well as the necessity of providing the public the opportunity to challenge the minimal operator. We have attempted to be as clear as we possibly could in advising the industry of our policy in resolving the problems in this area.

“It is clear, first of all, that the broadcaster doing a good job has nothing to fear at renewal time. His license will not be turned over to someone else who, without any responsibility for actual operation, may be able to promise more.

“More recently, the Commission has dealt with the subject of concentration of media ownership—a subject of great controversy which has and will continue to receive great attention from the press, from the industry, from the politicians, and—significantly—the public. I do not intend to apologize for these actions—regardless of my personal feelings about some of the proposals. Neither, however, do I suggest

(Continued on page 34)



“THEY CALL IT STATION ‘MINIATURIZATION,’
... I CALL IT RIDICULOUS!”

(Continued from page 33)

that the Commission is in some way infallible and that all of you must simply accept as gospel that which the Commission proposes. What I would hope is that recognition be given to the legitimacy of the examination and that all of us explore the proposals not in the narrow context of pro-industry or anti-industry—but with the objective of giving the Commission and the Congress facts and data upon which a decision can be reached—a decision which historians will judge as correct.

"I do not intend to nag you constantly—I do not intend to call you names, however picturesque and attention-grabbing a word like "rapist" may be. I do not intend to tinker endlessly with the way in which you go about your business for the sake of showing how activist I am. I want a strong, confident broadcast industry, not a tattered figure patched over with surefire remedies that do not work and reeling from side to side as the Commission kicks it first in one direction and then in another for the claimed purpose of making it walk straight. I will endeavor to create a climate that allows you to flourish and maintain your healthy growth. But it is only fair to make just as clear that I believe you have a responsibility to the public and that you must be accountable for your stewardship. No responsible broadcaster thinks of himself in any other terms. Responsibility is the essence of our complementary tasks in giving the American public the best broadcast service of which resourceful and imaginative man is capable. The times demand it. And, frankly, so do I—but—more importantly—so do you."



"WHY DON'T YOU UNWIND WITH A MARTINI,
- LIKE EVERYONE ELSE?"

Apollo Coverage

Pride Of The Entire Industry

NASA's Apollo 11 Astronaut Michael Collins congratulated the nation's broadcasters today for "giving the people of the world a sense of great personal involvement" in the Apollo moon landings.

Collins, now assistant secretary of state for public affairs, made the comment in accepting special citations for himself and his compatriots, Edwin E. Aldrin and Neil Armstrong, for their historic moon-landing on July 20 of last year.

Collins, who piloted the command module while his fellow crew members landed on the moon, said humanity received "a feeling of unity" as the result of the news coverage which was "instantaneously available."

Willard E. Walbridge, chairman of the NAB board, and NAB President Vincent T. Wasilewski made the presentation a management luncheon during the convention.

In his comments, Walbridge said: "The flight of Apollo 11 was an undertaking of massive proportions which has been called the proudest, boldest, and most demanding effort in history. It certainly ranks as one

of the most historic events in the whole history of mankind. We in broadcasting are proud and yet humble to have been a small part



Collins—"A feeling of unity"

of it."

Collins, in recalling that he was "one of the few individuals who failed to see the landing on television" said that after he made this complaint "one of the networks sent me a video tape and I'd like to figure out how to play it."

The Satellites Are Coming

Five experts on satellites discussed the technology of satellite communications systems at a television conference held during the convention.

The moderator was James Ebel, Chairman of the Satellite Committee of the CBS-TV Affiliates and vice president, Fetzer Broadcasting Co., Lincoln, Nebr. Ebel replaced Jules Bergman, science editor of ABC News who could not attend.

Joining Ebel in the discussion were Dr. Joseph Charyk, President of COMSAT; Dr. Coleman Raphael, vice president and general manager, Fairchild Hiller Corp., and Dr. Edward C. Welsh, former executive secretary, National Aeronautics and Space Council. Allen R. Cooper, vice president for planning, NBC, substituted for George Fuchs,

NBC executive vice president who was unable to attend.

Dr. Charyk told the television assembly that the development of satellite communications is still rudimentary. Noting that the discussion was held on the fifth anniversary of the launching of the Early Bird satellite, he said, Intelsat III has since been developed and now operate over each ocean, linking together three dozen earth stations. He estimated that by 1972 some six dozen earth stations will be in operation.

Cooper told the broadcasters that a domestic satellite system could be very important in satisfying television's needs in program transmission costs. He said AT&T costs are so high that NBC and several other groups are studying the possible alternatives to the existing AT&T system.

FCC Adopts New Contour Rules For Television Stations

A new method for establishing the statistical location of the Grade A and B field strength contours of television stations—of particular advantage to the majority of UHF TV stations, which use the technique of “beam tilt” to provide a more uniform signal—has been adopted by the Commission in amendments to Part 73 of the rules, effective May 8, 1970 (Docket 17253).

All commercial television stations must file a showing as to the location of their Grade A and B contours under the new rules, within 90 days from the publication of the present Commission order in the Federal Register, it was ordered, unless the Commission alters or postpones this requirement by further order. The 90-day requirement is subject to approval by the Bureau of the Budget, the Commission stated.

The Commission adopted a Notice of Proposed Rule Making in

NAB Engineering Report

The relaxation of operator requirements for AM and FM broadcast stations and other technical issues being dealt with by the Engineering Advisory Committee of the National Association of Broadcasters were reported to the NAB delegates by Albert H. Chismark.

this proceeding on March 1, 1967, in response to a petition filed earlier by WKBN Broadcasting Corporation, licensee of UHF station WKBN-TV, Channel 27, Youngstown, Ohio.

The Commission stated that WKBN claimed that using the power radiated in the horizontal plane, as prescribed in present rules, is not the proper way to estimate the distances to the various field strength contours, particularly when the station employs a high gain transmitting antenna with a relatively narrow vertical radiation pattern and also uses the “beam tilt” technique.

Chismark, director of engineering, Meredith Corp., Syracuse, N.Y., and Chairman of the NAB Engineering Advisory Committee, outlined the highlights of the Committee's accomplishments during the past year.

Operator Requirements

Chismark said the most important achievement of the Engineering Advisory Committee in the last decade has been the recent NAB proposal before the Federal Communication Commission to relax operator requirements across the board for all AM and FM stations. The Committee, he said, is still working on the problem of VHF-TV remote control.

“After supplying the Commission with untold reports and a further multiplex test last November,” he said, “we are still awaiting an affirmative decision.”

In reporting on other developments, Chismark said field tests conducted at stations in strategic locations “have proved that no interference would exist when utilizing subaudible tones for return metering information.” He said the FCC amended its rules to permit such usage on December 8—an important step forward “since it now completely frees the AM facilities from reliance on the common-carrier for interconnecting facilities between the AM studio and transmitter.”

A petition still awaiting action at the FCC, he said, is one that requests a relaxation of the so-called “two-hour” inspection requirement and remote logging.

Part 74

Chismark told the group that the Engineering Advisory Committee also is concerned with the revision of Part 74 of the FCC Rules and Regulations. Part 74 deals with auxiliary broadcasting services which pertain to radio remote pickup, studio-to-transmitter links, TV STL, remote pickup and intercity relays. He said this portion of the Rules “is woefully out of date and in need of revision.”

On Dreaming Of The Future

Fifty years of broadcasting, and the best is yet to come. That was the theme of the NAB convention in Chicago. Whether or not this optimistic theme will prevail throughout the industry in the coming decades will depend upon the recognition of hard facts and the desire to work with these facts.

The “best” doesn't really mean better engineers—we would do well to maintain the Phil Whitney's and the Bagio Presti's. But the best might mean that we offer more association sponsored seminars, listen to their problems, and actively work to attract new blood and provide whatever it takes to keep them.

Manufacturers and industry visionaries might suggest that the home communication center is that “best” to come. And while it is possible to picture that dream, it obviously will not be the best for some time to come.

Completely solid state stations. .

. . . satellites . . . they're close, and they could be another facet of the best to come.

Trouble is, if we're going to realize the best to come, we need to start working on it today. Just what involvement broadcasters will have in the future will be directly related to the combined effort they put into affecting changes during the 1970's.

Obviously, the best doesn't begin and end with the technical state of the art. Granted, there is a need to improve the technical standards. But the environment will continue to be a controlling factor in determining the limits of “best”. The stance of the FCC will make the difference here.

Logic must dictate to us today that if there is going to be a “best” yet to come, we must all go seeking it. As it stands now, the best is only firmly planted in dreams. Whatever the future, it will be either the result of action or the lack of it. And that's the way it always will be.

IF Modulation...

A new twist on VHF color

Because of Gates' delay in entering the VHF color television field, it was to be expected that they would be taking a new approach to some of the old problems. It's too early to tell how significant this concept will be. But since you may still be asking "What is IF modulation?", let's see how the Gates TV project team describes intermediate frequency modulation.

By Hans Bott, Otto Fried, Dan Maase, Leon Stanger and Hardin Stratman*

*Design Engineers of the Gates Radio Company, Quincy, Ill.

Television, as we know it, began about 20 years ago. In early transmitting equipment, the major problem (and we were dealing with a black and white system) was to obtain power and bandwidth. Practically all power tubes available 20 years ago were designed for narrow band, CW applications.

With the introduction of color into the television system, this old equipment was without exception only modified, not redesigned. Most equipment, as a result, showed very marginal performance. Nearly all of the old VHF transmitters used high-level modulation, largely dictated by the availability of power tubes.

When planning started at Gates several years ago, engineers had to

decide whether to use high or low level modulation or to move in a new direction and use IF modulation.

Before making this decision, considerable study was done on all systems. The greatest amount of information on IF modulation systems is available in the European literature. However, in the last few years, several domestic and international manufacturers have attempted to introduce IF modulation in the United States.

As a result of this study the following significant high level modulation facts were isolated:

1. The video modulator in many of the older transmitters must supply video voltages up to several

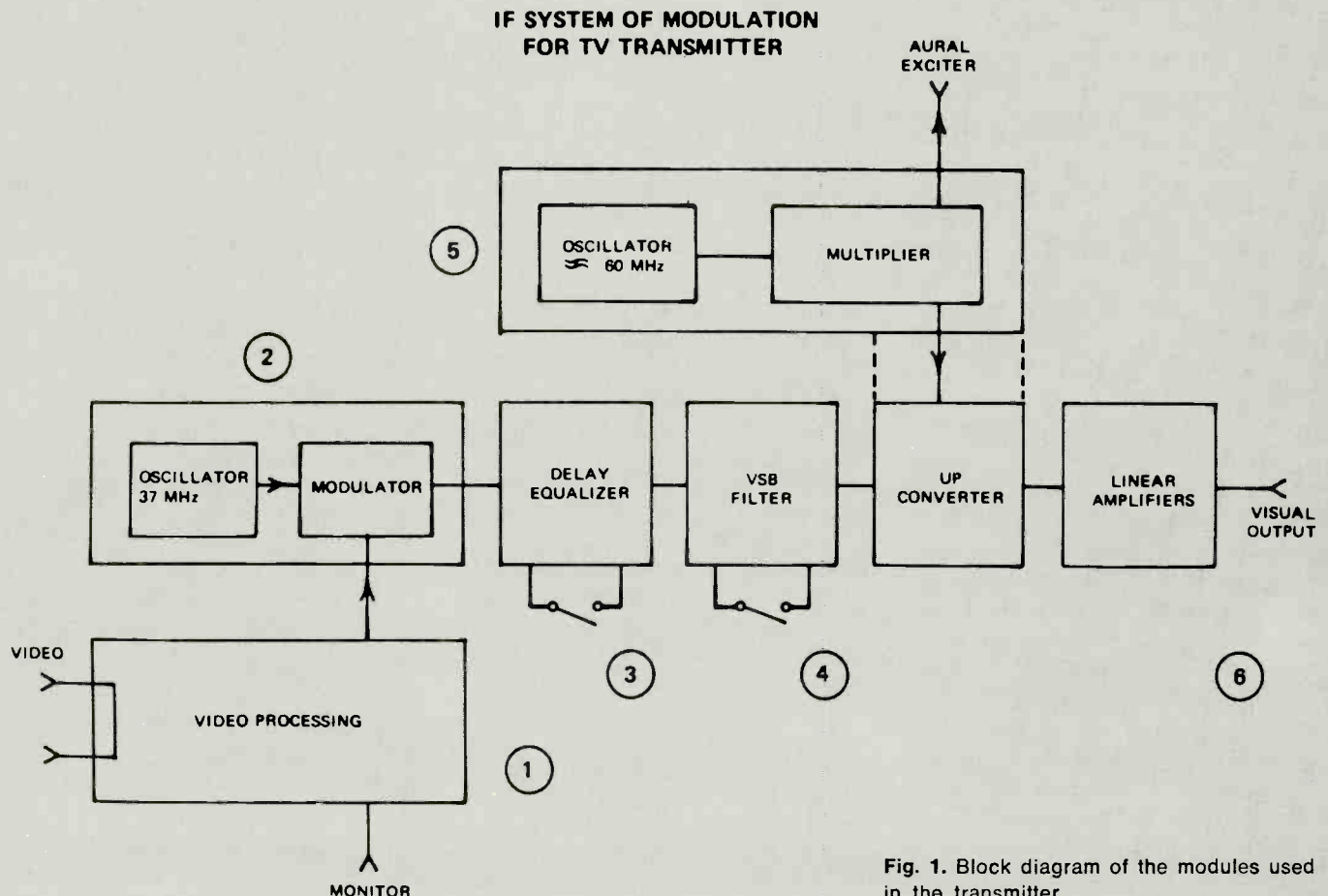


Fig. 1. Block diagram of the modules used in the transmitter.

hundred volts into highly capacitive loads, and

2. The modulated stage is grid modulated and therefore presents a varying load to its RF drive, not particularly significant in the black and white system where the signal content at high video frequency is low and requirements for differential gain in amplitude did not exist.

Most high level transmitters are limited in power output to approximately 5 kW. Higher outputs are usually obtained by driving linear amplifiers from this point on. Therefore, this combination could be called a modified high level system once power is in excess of 5 kW.

Low level modulation which also has found acceptance can exhibit considerable non-linearity in the amplifiers, low stage gain and difficulty in obtaining band width.

Looking Inside

IF modulation has become technically feasible through technological advancement in two areas. First, solid state devices including hot carrier diodes, low noise transistors, integrated circuits, and, second, the availability of high gain, highly linear power tubes especially designed for wideband application.

The modulation problem is handled by modulating a low frequency carrier at low power levels. The modulated stage in the Gates IF system uses a ring modulator. This device exhibits very low linear distortion, high modulation capability, and low differential gain and phase discrepancies. Following the modulator, linear amplification will raise the power level. At this low level one can be wasteful with respect to efficiency to assure ultimate performance.

The lack of gain and lack of linearity are overcome by power tubes that exhibit high stage gain and extremely low non-linear distortion. The tubes used were not available five years ago.

The need for a high power vestigial sideband filter, for video equalization, and an equalized video low pass filter, are eliminated in the IF system by employing a low level IF vestigial sideband filter which is designed not only to shape the lower sideband response but also the higher sideband response. Equalization is performed at IF levels which is the same as performing the equal-

ization on carrier: it corrects a fault at the source.

In this project the engineers felt they had taken one big step by designing a continuously variable, solid state delay equalizer, the first such unit that has found commercial application anywhere.

System Definition By Modules

To more clearly define the system, Figure 1 shows six significant modules. The first module is video processing. It employs solid state devices and integrated circuits. It is protected against excessive voltages appearing on the video cable and will accept a standard sync negative video signal to a loop through input. Extremely fast back porch clamp which will not interfere with the burst is used to provide linearity correction and a monitor output.

The second module is a ring modulator including its crystal-controlled 37 MHz carrier generator. The output from the ring modulator is an amplitude modulated 37 MHz double sideband signal. Oscilloscope photos were taken of the output of this modulator, shown in Figure 2. This picture was taken with a dual input oscilloscope showing a sync positive ramp signal (the heavy line) and purposely slightly offset in the vertical scale and amplitude modulated 37 MHz carrier. The linearity can be judged by observing the constant displacement between the modulated envelope and the vid-

eo input signal. This picture was taken without any filtering in the output of the modulator, evidenced by a small amount of harmonic content of the carrier (the shading of the area under the curve).

The third module is the delay equalizer consisting of three circuit boards individually switchable, each acts as one all-pass section except that its delay maximum, and the frequency of maximum delay are continuously variable. The design of the equalizer boards will also allow a small degree of amplitude compensation.

The fourth module comprises the vestigial sideband filter. Sideband filter and delay equalizers can be switched in and out of the circuit in several combinations. The design of the sideband filter at low IF frequency leads to the sample which is shown in Figure 3. This picture was taken with an early model sideband filter and has since been considerably improved. Yet, it can be seen that the lower as well as the higher frequency slope of the sideband filter is well controlled.

The next building block is number five (See Figure 1). This unit is a mixer or "up-converter" which changes the IF frequency to the final frequency, wherever the final frequency may be. Up to this point, all exciters for VHF high band or low band transmitters as well as UHF transmitters are identical. The converter also utilizes a ring modulator very similar to the one em-

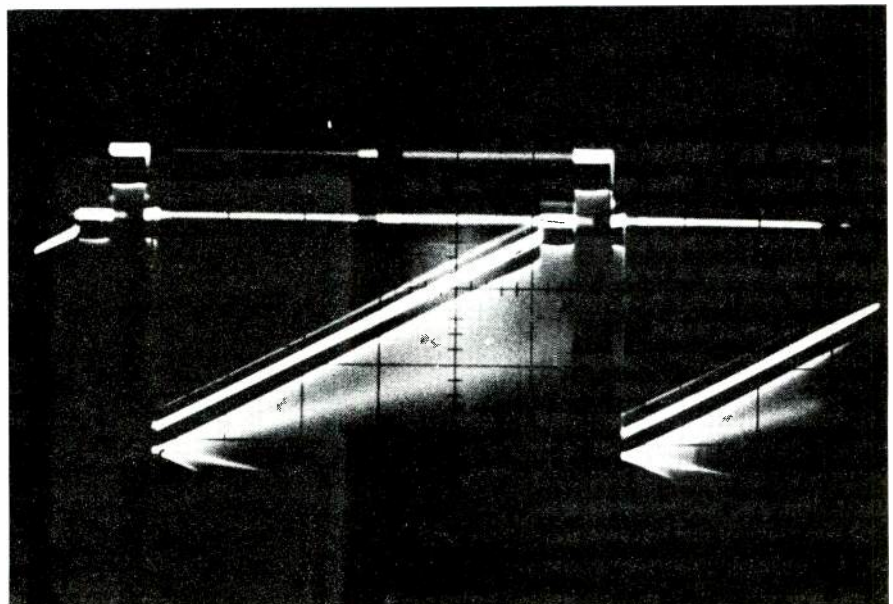


Fig. 2 Scope display of the output of the ring modulator AM modulated at 37 MHz (double sideband).



Slow it.



Stop it.

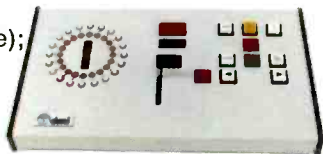
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Play it back.

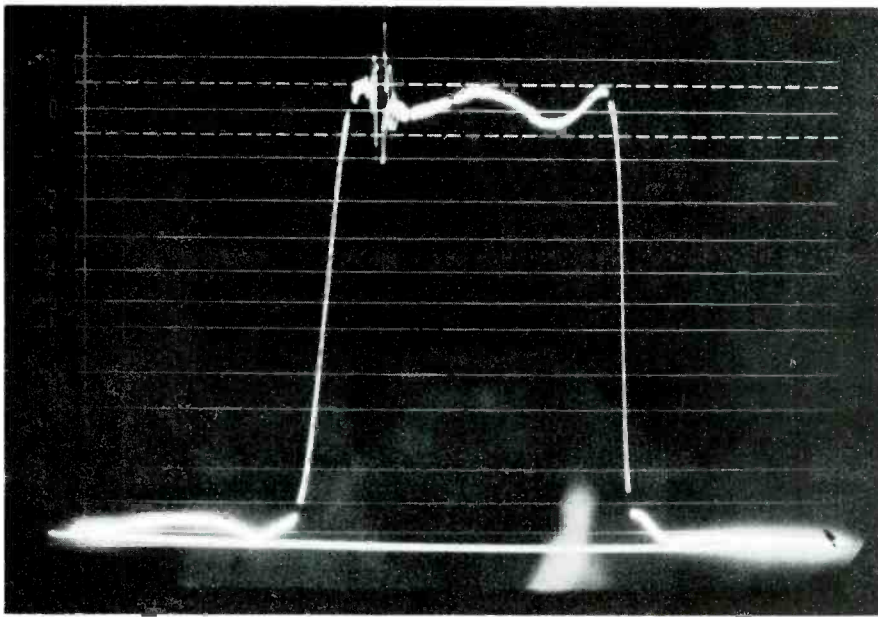


Fig. 3 Display of the sideband filter at low IF frequency.

played as a modulator. It is obvious that any approach using conversion must aim to reduce spurious and unwanted frequencies to an absolute minimum.

The last building block is number six into which all linear amplification is lumped, from the output of the mixer to the final operating

power. In the exciter, about 30 dB of gain are contained in a non-tuned wideband amplifier. An additional 10 dB gain is added by a single tuned linear amplifier, leading to a power output of 1 watt from the exciter.

Once the sideband filter is adjusted no further tuning is required

in the exciter. The tuned circuit of the last amplifier is merely peaked for maximum power output since its overall bandwidth is in excess of 30 MHz. The output signal of the exciter, being on-carrier can be used as a test signal for either transmitter or monitoring equipment. From here on, all amplifiers have 50 ohm inputs and outputs, and can be checked individually or cascaded.

The output signal of the exciter is of such quality that it becomes difficult to distinguish between the video input signal to the exciter, and the demodulated output signal from a demodulator (assuming no receiver predistortion is used). The only clue is symmetrical ringing as a result of the prescribed bandwidth limitation of a TV system. Following the exciter the only remaining task in an IF system is suitable amplification.

This amplification must be performed with proper bandwidth and linearity if the quality of the exciter signal is to be maintained. Here the high gain of new power tubes comes into play permitting power levels of 35 kW or even 50 kW peak of sync with only four

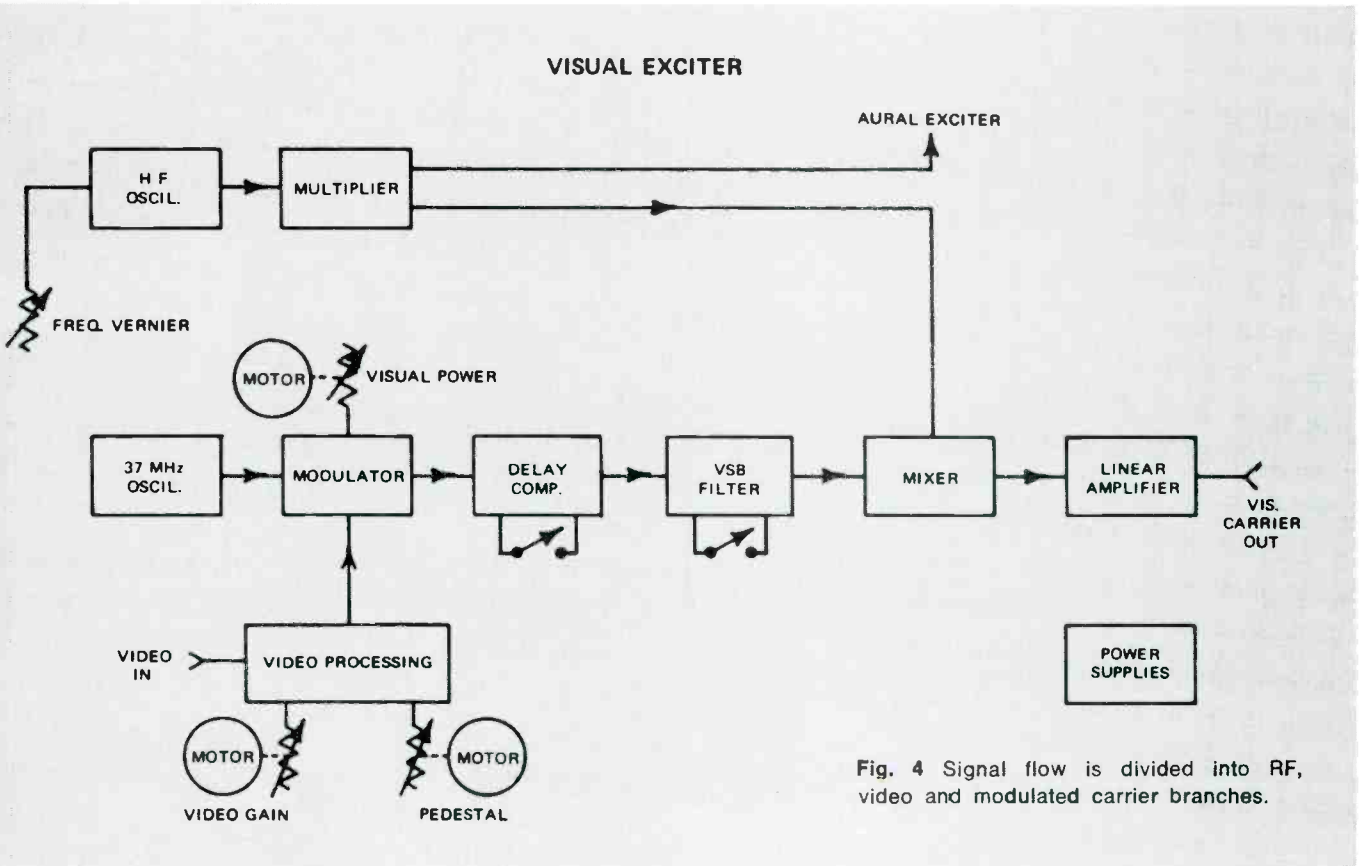


Fig. 4 Signal flow is divided into RF, video and modulated carrier branches.

stages, three of which are double tuned. Typically, a 25 kW peak of sync transmitter requires two double tuned stages.

The frequency of the master oscillator can be varied approximately ± 500 Hz through a capacitive diode, with the DC control mounted on the front panel. This arrangement allows the operator to set precisely the frequencies of both visual and aural carriers with a single control.

The 37 MHz oscillator is also crystal controlled and mounted in an oven. A varicap provides approximately ± 40 Hz adjustment. The DC control is mounted inside the shelf and should not be used for normal carrier frequency adjustments.

The video signal is brought in through a connector on the rear of the exciter shelf and fed into the video amplifier. It will clamp the incoming video signal once during each line (backporch) and provide

linearity correction when required. The video amplifier also provides drive stages for the modulator and external monitor. The input impedance is great enough to assure over 30 dB return loss with "loop-through" operation. A transient protection is provided to safeguard the solid state devices used in the input circuits. The signal level is adjusted by a control mounted on the front panel to accommodate input levels and 1V P-P ± 3 dB.

Modulator-Amplifier

The fully processed video signal is then brought to the modulator-amplifier assembly where it is direct-coupled to a double balanced modulator. The other input port of this modulator is driven from an amplifier stage which serves as a buffer-amplifier for the 37 MHz oscillator. Output of the balanced modulator consists of sidebands displaced by the modulating frequency above and below the carrier frequency.

The modulator is a solid state device requiring absolutely no tuning or adjustments.

The VSB filter and envelope delay compensating circuit are connected to the IF amplifier through a 4-position switch mounted on the front panel of the visual exciter. This arrangement allows by-passing of either or both of these sub-assemblies during tune up of the power stages or whenever it is desirable to display the overall bandwidth of the system. The output level of the modulated IF is controlled by a variable attenuator with adjustment of approximately 6 dB. This control also provides power output adjustments of the overall visual transmitter.

The modulated 37 MHz and the output of the multiplier are heterodyned in a double balanced mixer, a solid state device requiring no tuning or adjustments. The result is a fully modulated visual carrier on the desired channel.

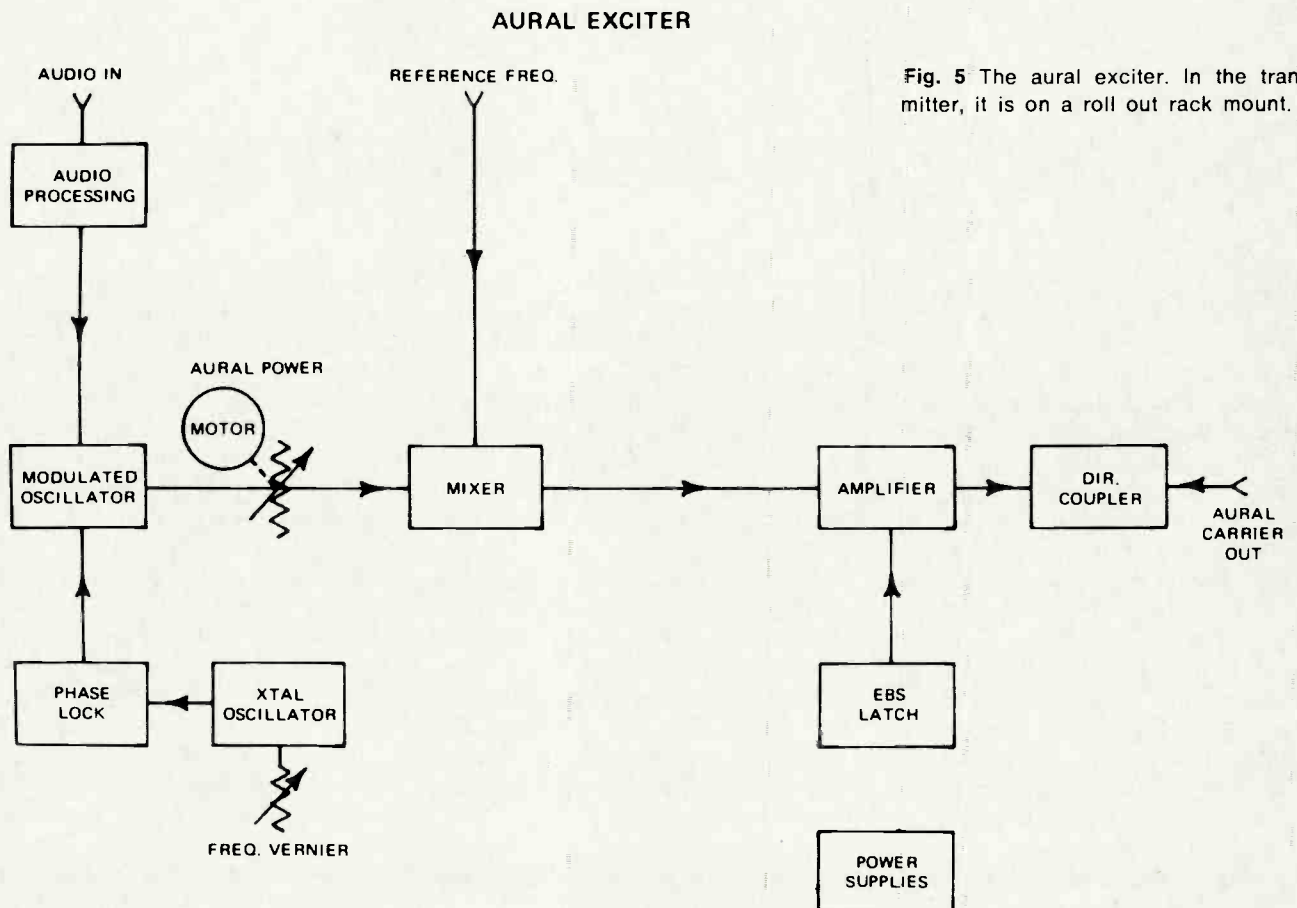
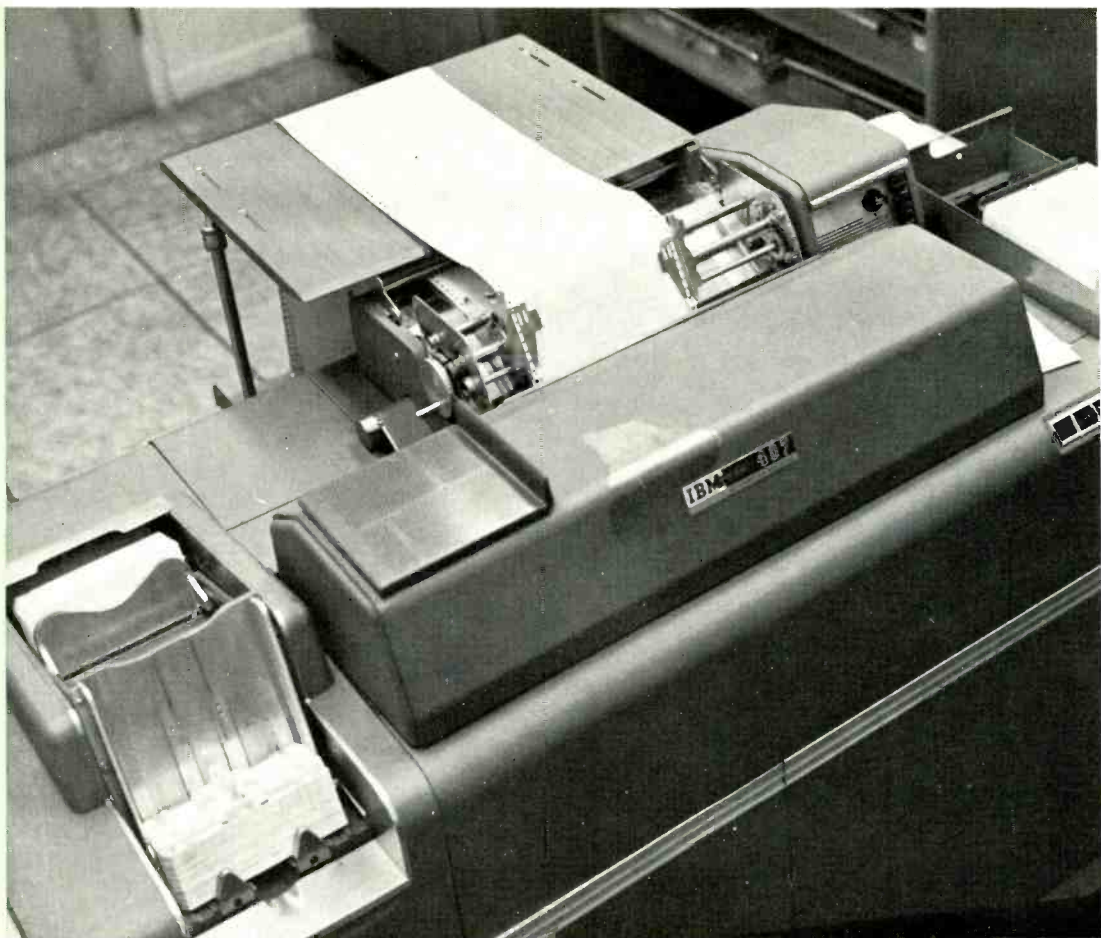


Fig. 5 The aural exciter. In the transmitter, it is on a roll out rack mount.

Fig. 1 The IBM 407 accounting machine may be used to produce program logs, availability listings, account billings and similar print-outs from a deck of punched cards.



Punched Card Broadcasting

By Morris Courtright*

To automate or not to automate? That is the question. Wallow through reams of types and handwritten logs or trade them for a flood of punched cards? That, oft times, is the real question. Punched cards signify a computer somewhere in the system and the computer is frequently thought to be the cure-all for operating problems. Nothing could be further from the truth. A computer is a machine that can do wondrous things, but it is still just a machine. And, to efficiently use a machine, you must first know how it works and what it can do.

Program automation systems and punched cards have been adopted by many stations, and many more are considering the move to auto-

*BE Automation Editor

mation. Most automation systems establish program format by various combinations of thumb wheel settings, switch positions and plug board setups so that tone cues can air the program material according to the established sequence. How, then, are punched cards used and what can they do for the broadcaster?

First, the punch is a computer input media originating in the field of statistics and business data processing. Second, most small computers and unit record equipment that handle punched cards are designed for business data processing applications. Thus, punch cards are most readily adapted to the business, statistical, traffic and accounting functions of station operation. However, as we shall see, they can be quite useful to station on-air operations. In essence, hole patterns

are punched into the cards to represent alphabetical, numerical or special characters according to the long established Hollerith code. The various pieces of equipment used with the cards are designed to sort, collate, print, tabulate, rearrange and process the data by sensing the hole patterns.

A punched card system begins with a card punch such as the IBM 026 or 029. Characters are keyed in and the machine automatically punches the code patterns in the card. A verifier, which looks similar, may be used to check the information; or if the keypunch has the printing feature, the characters may be read along the top edge of the card. By themselves, however, the cards are of little value. To use them you must have an automation system that uses cards, such as the IGM 600, or you must have an

| SKFD | ACTUAL | | PROG PROG COMM | | | |
|----------|--------|--------|----------------------|------|-----------|---------------|
| TIME | START | FINISH | PROGRAM-SPONSOR | CODE | TYPE SRCE | TYPE DURATION |
| 06.00.00 | | | SIGN-ON | | | |
| 06.01.00 | | | EARLY RISER SHOW | | E L | |
| 06.02.00 | | | WESTERN CORRAL A | 0142 | C CA | .60 |
| 06.03.00 | | | MUSIC | | | |
| 06.03.15 | | | WESTERN CORRAL 1 | 0142 | C CA | .30 |
| | | | BEN-S FFED | 0153 | C CA | .30 |
| 06.29.00 | | | FARM SUPPLY | 0213 | C CA | .60 |
| 06.30.00 | | | ID | | | |
| 06.30.15 | | | TIME | | | |
| 06.30.30 | | | EARLY RISER (CONT-D) | | E L | |

Fig. 2 Program log print-out produced from the IBM 407 and the cards shown in Figures 3 and 4.

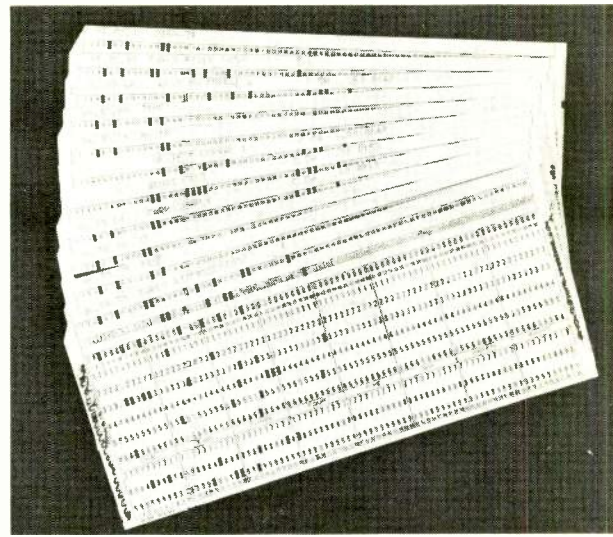


Fig. 3 Punched cards used to produce the sample log. A field of data on the card may be printed any place desired on the output listing.

accounting machine.

The IBM 407 shown in Figure 1 was used to produce the program log shown in Figure 2. Note that the 407 does not have the colon as a special character, so the log uses the period to separate hours, minutes and seconds. This is an example of how the broadcaster will at times have to adapt to the machine capabilities.

A card was punched for each line entry and the resulting deck was printed by the 407. In this case standard paper was used; however,

forms preprinted with station identifying data and column markings may just as easily be used. The log produced from cards is used by the staff members just as they presently use a typewritten log. The major difference, and one of the advantages, is that changes to the program are made by removing or inserting cards; not retyping a log or making pen and ink changes. The card deck may also be used over and over to produce logs for each day's operation, and the cards may be sorted to produce other listings. If special

characters or codes are included to mark spots, the decks may be sorted to produce availability listings, account status, customer billing, etc. The accounting machine may also be used to produce music listings for recording tapes to be used on an automation system, for inventory or stock control, and even to produce the payroll.

Data Formats

Before embarking upon the sea of punched cards, considerable thought must be given to data for-

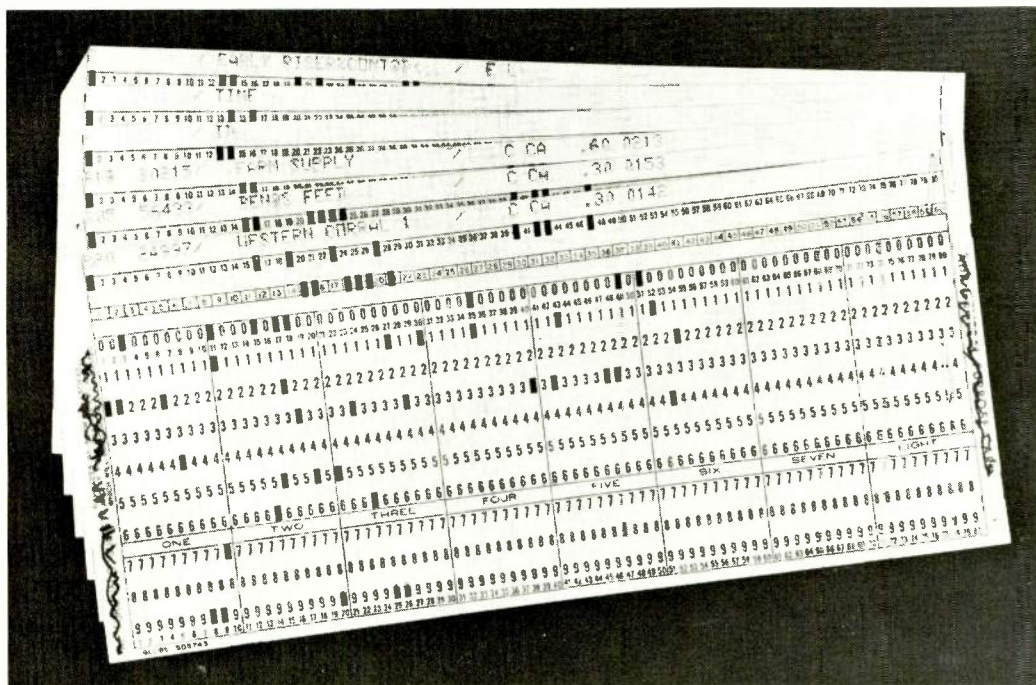


Fig. 4 Punch cards formatted for a current broadcast automation system. Proper choice of card layout for accounting machine use allows for an easy transition to a format like this.

mats and field layout on the card. That is, how is the information to be grouped in the 80 spaces available. Once established and in use, a card format change only creates mass confusion and expense; not to mention the weeping, wailing and gnashing of teeth among the staff.

The straightforward approach shown by the sample log can easily be quite wasteful. If the cards are punched with blank spaces for all blank spaces, you will quickly use up all 80 card columns. The cards in Figure 3 illustrate how the data may actually be grouped in one place without extra spaces and then printed wherever desired in the listing. (Note that the code numbers which appear right after the program-sponsor column are actually punched last on the card.) The spaces gained by data grouping can be used for accounting and traffic codes.

This may seem like a lot of trouble when the log could be typed. However, producing the log is just the first use of the cards. The codes added to the program item informa-

tion are the key to the traffic and accounting use of the cards. The sample codes shown are rather simple, but illustrate the principle involved. The first two digits are the salesman number and the second two are the account number. If desired, a special code can be included to show availabilities.

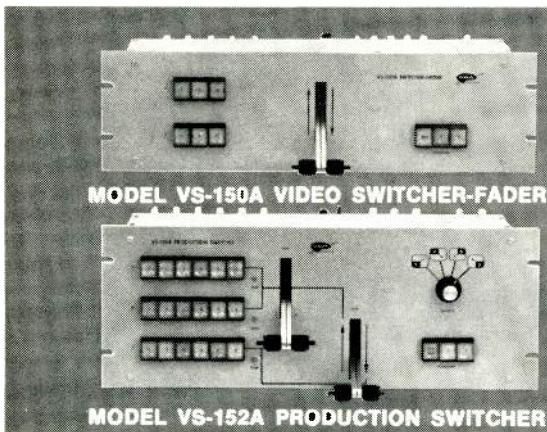
A few moments thought will show that the number and variety of reports and listings that can be generated based on these codes and using the one deck of cards is limited only by the needs of the station and your imagination. For example, sort and list the 01 codes above and you have that salesman's activity; sort on 42 and you have the account activity. The accounting machine will even add up the time and number of spots for you. If the completed log is used to check for any spots that didn't run, the cards may then be used to add to the customers account record.

Figure 4 shows the same program segment formatted for use on the IGM system. A comparison of Figures 3 and 4 shows that the major difference is in columns 1-11. Thus,

if the format is chosen carefully at the beginning, a future transition to total automation can be made with very little change to the card handling and processing procedures.

The use of punch cards as an aid to broadcasting can be further simplified by use of colored cards. If all spots are punched on one color, PAS's on a second, ID's on a third, availabilities on a fourth, and so on, it becomes quite easy to locate and change them in a day's deck. Decks can be arranged by hour, day or week as desired to suit your particular operation. They may be kept in drawers or indexed files. You can write on the deck edge to easily identify it or draw a slanted line across it to provide a quick visual check of proper sequence.

All in all, punched cards can be quite useful to broadcast station operation, even before automating on-air operations. Thoughtful system design in the beginning will allow easy transition to on-air automation when that day finally arrives. So join the parade and update your operation, and welcome to the world of punch cards.



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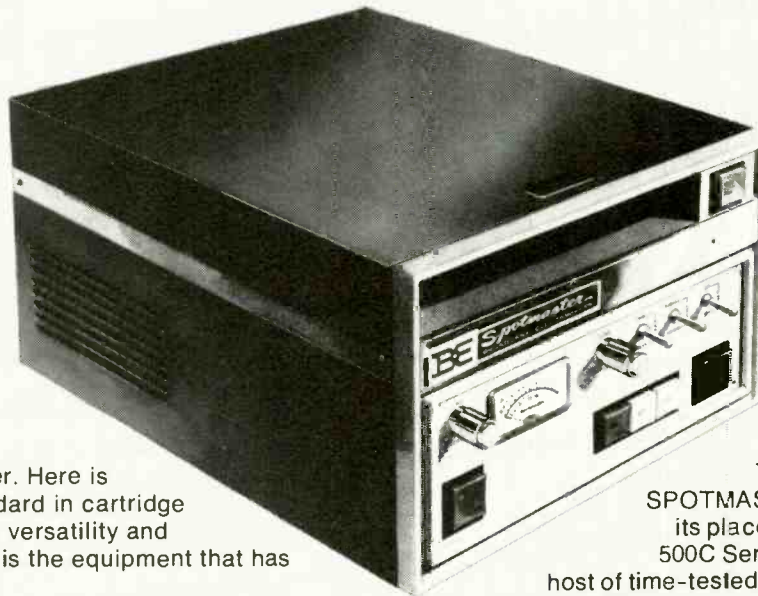
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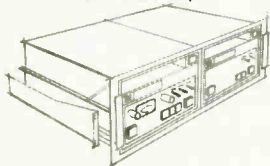
Ten/70



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Principles and Practices of SCA Multiplexing

By Thomas R. Haskett

Every since 1950, many FM stations have found additional revenue by reaching a specialized audience. Since 1955, this technique has been known as SCA multiplexing. Without disturbing the public programming on the main channel, an SCA subchannel is additionally transmitted by the station. This SCA subchannel, which may carry background music or other specialized services, is then sold or leased to paying subscribers.

This article will show you how to get into SCA multiplexing, what current practices are, and how to keep your signal clean and your subscribers happy.

FCC Rules For SCA

Any FM broadcast licensee (or permittee) may apply for an SCA (Subsidiary Communications Authorization), using FCC Form 318. You must specify what use you intend for the SCA. There are two categories of permissible SCA use:

1. Broadcast-type material intended for limited segments of the public (as contrasted with the public in general): Services include background music, storecasting, specialized news, detailed weather forecasting, special time signals, and medical or educational information.

2. Signals directly related to the operation of the FM broadcast station: Services include relaying of

program material to other FM and AM stations, remote cueing and order circuits, and remote-control telemetering functions associated with authorized STL operations.

Whenever the SCA is operating, the main channel must be programmed; otherwise there is no time limit on SCA operation.

The SCA is an inseparable part of the regular FM station license, and may not be transferred without also transferring the main license, subject to FCC approval. Note that when you renew your main license, you must also apply for renewal of the SCA; it's not renewed automatically.

In terms of getting a grant or a renewal of the main station license, you get no credit for SCA operation. The station must establish that its operation is in the public interest wholly apart from SCA operation.

Once you've been granted an SCA to engage in one type of service, you may not engage in another type of service without FCC permission.

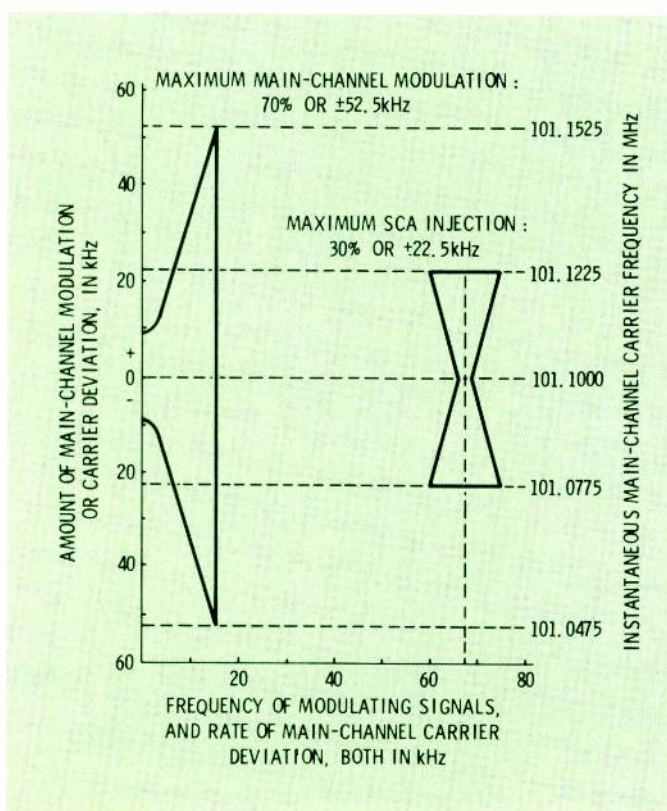
With FCC permission, superaudible and subaudible tones and pulses may be used to activate and deactivate subscribers' receivers. You may not delete main-channel material by any means.

If the SCA subchannel is leased to another party (instead of the station operating it), the station must retain control over SCA material. That means your SCA lease contract must allow you the power to delete any SCA material you deem inappropriate or undesirable. SCA lease arrangements must be made in writing and filed with the FCC.

Technical Rules

Only frequency modulation may be used in the SCA subchannel. At a mono station, SCA subcarrier frequencies must at all times be within the range of 20 to 75 kHz. Refer to Figure 1, which is a diagram of the signals placed on the carrier in the main-channel FM transmitter. Main-channel audio appears in the range of 50 to 15,000 Hz, causing modulation of up to 70%, or main-carrier deviation up to ± 52.5 kHz. (The amount of modulation is not the same at all audio frequencies because of the preemphasis curve.)

Fig. 1 Diagram of the signals placed on the carrier in the main channel FM transmitter.



The SCA subchannel may be located anywhere between 20 and 75 kHz, but in practice its center frequency is most commonly 67 kHz, as shown.

Assume for a moment that the SCA is merely an unmodulated, sinewave carrier at 67 kHz. This subcarrier is injected into the main transmitter, thereby causing main-carrier deviation. The amount of this main-carrier deviation caused by the SCA subcarrier is called injection. At a mono station, the FCC-established limit of total SCA injection is 30%, or a main-carrier deviation of ± 22.5 kHz.

Since the SCA injection is 30%, the main-channel modulation must be backed off to a maximum of 70%, as shown. The total of all main-channel modulation must not exceed 100%. Of course, the SCA subcarrier is itself modulated by background music or whatever service is being carried.

At a mono station, it's also possible to run two SCA subchannels.

The situation is shown in Figure 2. One sub is at 67 kHz and the other at 41 kHz, the second most common frequency. Main-channel modulation is as before.

The total injection limit is 30%; therefore if two SCA subchannels are in use it's reasonable to assume that each is injected 15%. Some stations, however, inject subcarriers by unequal amounts.

At a stereo station, SCA subcarrier frequencies must at all times be within the range of 53 to 75 kHz. Refer to Figure 3. The situation shown is for the maximum stereo signal—an L-only (or R-only) signal. Main-channel audio appears between 50 and 15,000 Hz with maximum modulation of 40%. (± 30 kHz deviation). The stereo pilot carrier appears at 19 kHz with injection of 10% (± 7.5 kHz deviation). The stereo sidebands appear between 23 and 53 kHz (with a hole around 38 kHz where the stereo subcarrier has been suppressed. The stereo subchannel is

actually a double-sideband, suppressed-carrier AM signal). These AM sidebands modulate the main carrier to a maximum of 40% (± 30 kHz deviation).

If the SCA subcarrier deviated below 53 kHz it would obviously interfere with the stereo sidebands. And, as stated before, it must not extend above 75 kHz. Thus the usual SCA center frequency is 67 kHz. At a stereo station, SCA injection is limited to 10%, or ± 7.5 kHz. The modulation levels are then: Main channel: 40%; Stereo sidebands: 40%; Stereo pilot carrier: 10%; SCA subcarrier: 10%; Total: 100%.

When an SCA subchannel is added to the other material broadcast by an FM station, the SCA obviously causes some interference, no matter how small. Crosstalk by the SCA into the main channel or the stereo sidebands must be held to at least 60 dB below 100% modulation of the main channel or stereo sidebands.

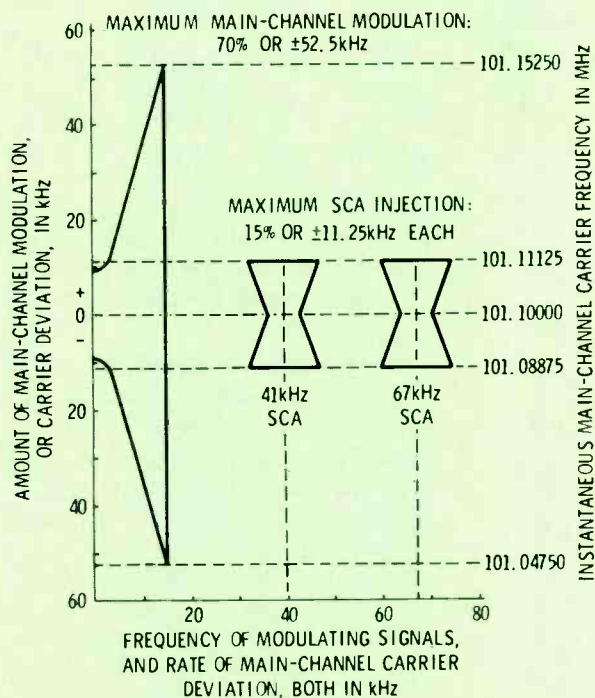


Fig. 2 At a mono station it is possible to run two SCA subchannels. In this case, 67 kHz and 41 kHz would be used.

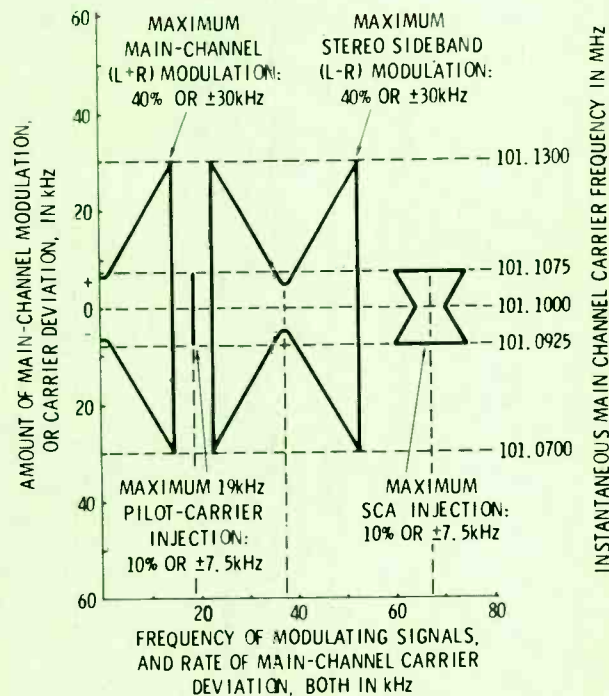


Fig. 3 At a stereo station, SCA subcarrier frequencies must be within the range of 53 to 75 kHz. Situation shown here is for maximum stereo signal—an L- only or R- only signal.

Logging Requirements

As an SCA operator, you must maintain a program log for the SCA operation. Once each day you must enter a general description of the type of material transmitted. In addition, if there is any change in the type of material transmitted, you must make an entry noting the time of change and a description of the new type of material.

The SCA operator must also maintain a daily operating log of SCA operation. The following entries must be made in this log:

1. Time the subcarrier generator is turned on.
2. Time modulation is applied to the subcarrier.
3. Time modulation is removed from the subcarrier.
4. Time the subcarrier generator is turned off.
5. An entry describing the results obtained in determining the frequency of each SCA subcarrier.

You don't have to log, however, a subcarrier interruption of 5 minutes or less. And both program and operating logs may be kept on special columns on the station's regular program and operating logs.

The frequency of each SCA subcarrier must be checked at least once each day, and more often if

suspected of being off frequency. The tolerance is ± 500 Hz of the authorized frequency.

Current SCA Technical Practice

Since the first SCA operations in 1955, subcarrier frequencies of 26, 27.5, 32.5, 41, 42, 58, 65, and 67 kHz have all been used at one time or another. Today, 67 kHz is the most popular frequency, simply because it can be used at both stereo and mono stations. Also, most home stereo receivers contain SCA interference traps tuned to 67 kHz. At mono stations with two SCA's, 41 kHz is usually the other frequency. Most available equipment is built with these two frequencies in mind.

In Figure 4 you see the signals present at the output of a typical SCA subcarrier generator. In this example, the subcarrier center frequency is 67 kHz. As audio is fed to the generator, it causes the subcarrier to deviate away from the center frequency. There are no applicable FCC rules, and several industry practices. At many mono stations, 100% subcarrier modulation is deviation of ± 7.5 kHz. Most stereo stations set their SCA 100% modulation limit at ± 3.5 kHz. Similarly, there are no FCC requirements governing frequency response of the SCA subchannel. The usual

practice followed by generator and receiver manufacturers is to limit frequency response to about 30-7500 Hz, or sometimes 50-5000 Hz.

Premphasis is used, just as on the main channel. Again, there are no FCC requirements, and 50-, 75-, and 150- μ sec curves are used.

Referring to Figures 1, 2, and 3, note that SCA subcarrier injection on the main carrier is constant (vertical axis). This subcarrier is then frequency-modulated by audio (horizontal axis). The SCA system is therefore FM on FM. Since SCA injection is low (compared to the main channel) this FM-on-FM feature provides just about the only means for obtaining a reasonable signal-to-noise ratio in the SCA subchannel.

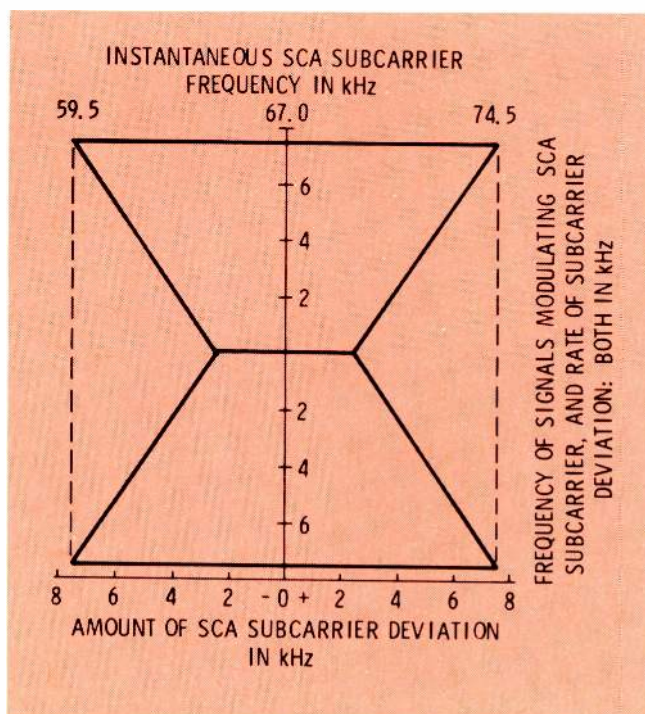
Probably few mono stations use 30% injection of a single SCA, for several reasons. If the station wishes to remain mono, there remains the lucrative possibility of starting a second SCA to obtain more revenue. With two SCA's in service, each is then limited to 15% injection, and the first customer is going to have his signal-to-noise ratio worsened by the lower injection. Furthermore, if the station decides to go stereo, the SCA must be backed off to 10% injection, affecting the s/n ratio still more.

The practice seems to be 10-15% injection on each SCA, with few exceptions. One such case is an SCA contractor who transmits news to airline passengers. His receiving antenna is inside the airplane's steel body, and he insists on 30% injection to give him the best possible s/n ratio leaving the transmitter.

Equipment Required

In Figure 5 you see a block diagram of a typical SCA operation, from origination to destination. The program material usually is taped. Music tapes are often 3 $\frac{3}{4}$ ips reel-to-reel, although sometimes they are cartridge. Voice announcements are usually done on cartridge tape. Often two music tapes are used, with a third machine for voice. Some form of automation is used, often simply a preset switcher. There are several configurations—time clock plus silence sensor, time clock plus cue tones, or simply cue tones.

Fig. 4 Signals present at the output of a typical SCA subcarrier generator. Subcarrier center frequency used here is 67 kHz.



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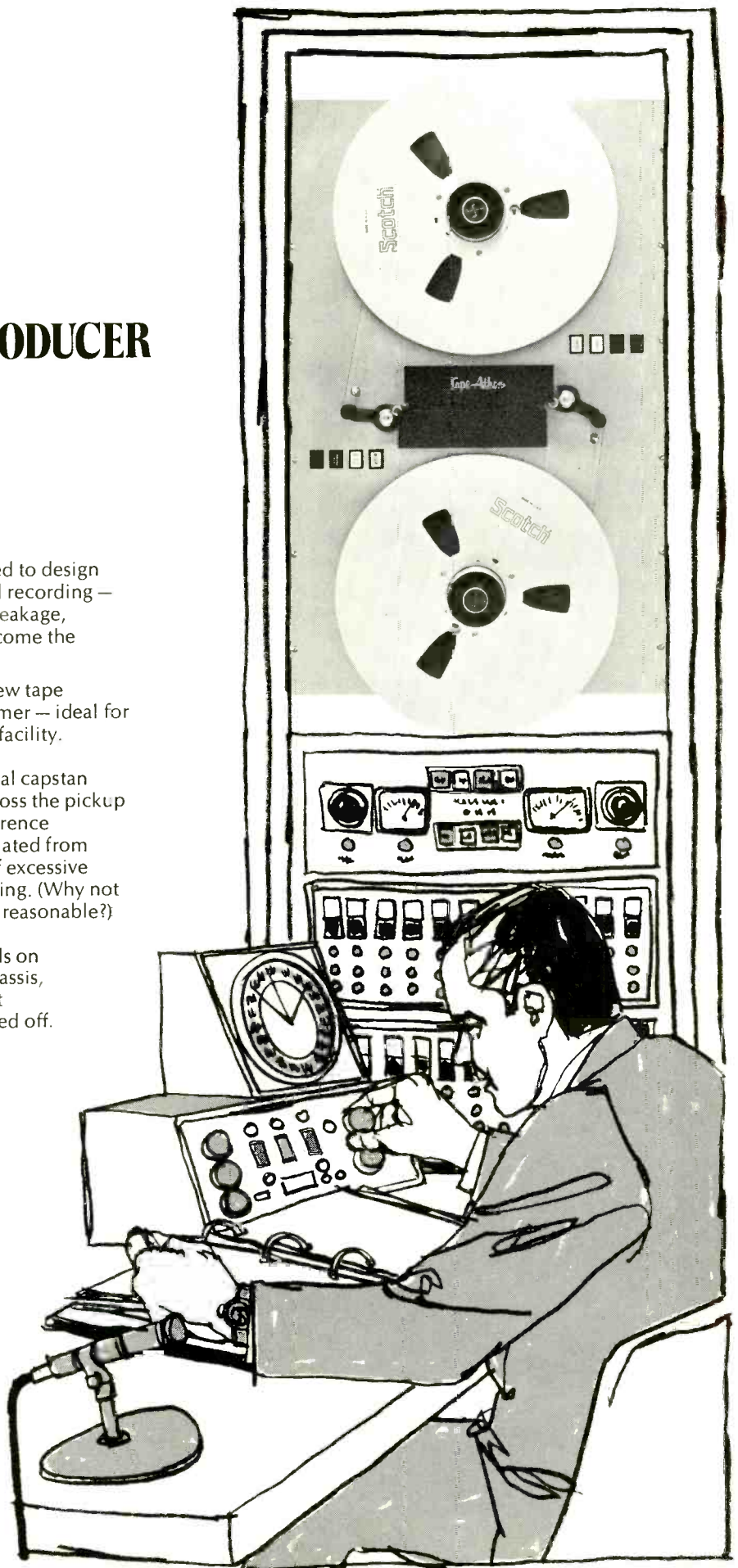
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An AGC (or compressor) amplifier is a necessity for SCA audio. The best obtainable signal-to-noise ratio is only about 50 dB, and practice has shown that you cannot use much dynamic range on the sub-channel. It is essential to keep average modulation as high as in Top-40 AM broadcasting. Some stations use two AGC amplifiers in cascade, or an AGC amplifier followed by a peak limiter. If the originating tape gear is at one location and the SCA generator at another with a Telco line in between, best practice is to use one level-controlling device at each end of the Telco line.

Some stations use pre-emphasis before compression or limiting at the SCA generator. This is, of course, the reverse of the usual procedure. The advantage is that high-audio-frequency SCA modulating signals are limited and cannot overmodulate (overdeviate) the SCA generator. When such overmodulation occurs, the SCA causes crosstalk in the main channel or stereo sidebands. The only disadvantage to using preemphasis before compression is that excessive high-frequency program material causes extreme compression, and "punches holes" in the program.

The SCA generator converts the audio into RF and drives the exciter in the main transmitter. Note that some existing main-channel exciters have plug-in capability to accept a

specific SCA generator made by the same company. In at least one case, you cannot drive the exciter direct with the SCA generator, but must drive the exciter with a stereo generator, and drive the stereo generator with the SCA generator.

The SCA generator normally mutes itself (i.e., kills RF output) in the absence of modulating audio above a preset threshold level. The receiver is set up so that when it loses subcarrier RF, it mutes itself also. There is a certain time delay to each muting circuit, to prevent muting between words in announcements. But muting is necessary to mask crosstalk in the SCA during silent audio periods.

Speaking of audio, another piece of equipment is essential to proper SCA operation—and it's not in the SCA audio chain. If you aren't already using a high-frequency limiter in your main-channel audio line, you should invest in one. If you don't have high-frequency audio limiting in your main channel, you will create interference in the SCA. If you are operating stereo, you will of course need a stereo high-frequency limiter.

The main FM transmitter drives the transmitting antenna. Both must be free from undesirable reactance and phase shift. If you are presently mono and your transmitter and antenna are old, you will have to clean them up or replace them. It may be

necessary to sweep the antenna with a generator and readjust it for lowest VSWR. This may require hiring a consulting engineer with the necessary test equipment. His daily fee will be \$100-200 and it may take him several days to clean up your installation.

If you are presently stereo, your transmitter and antenna will probably accept SCA without much trouble.

The next item you will need is a type-approved SCA monitor. You already have a main-channel frequency monitor, and a main-channel modulation monitor. You may also have a stereo modulation monitor. But none of your present monitors will satisfy all the FCC requirements for SCA monitoring.

You are required to have type-approved monitors which indicate percentage of main-channel modulation, SCA injection, total modulation by the main and all SCA's, SCA subcarrier modulation (or deviation), and main-channel crosstalk caused by the SCA. Some mono and stereo monitors additionally indicate SCA injection. You only have to obtain what you don't already have. Some are add-on units which are driven by that manufacturer's main-channel modulation monitor. Others are complete SCA units, driven directly by your transmitter.

At the receiving end, you will need an FM receiving antenna cut to your main-channel frequency. Almost everyone uses 72-ohm yagis, gamma-matched to 71-ohm coax. For close-in work a 2-element model will work, but for field jobs you may need 7- or even 10-element models.

You will also need an SCA receiver at the subscriber location. Tuners are simply that; you must add your own audio amplifier. A receiver drives a speaker. Models with various power-output ratings are available. Of course, you won't use the same amount of audio power at each location. A small room might require only one or two speakers and 15 watts of audio. A large cafeteria or factory might require 10 or 20 speakers and 50 or 75 watts of audio.

In the next part of this article we will include a manufacturer's listing of equipment needed.

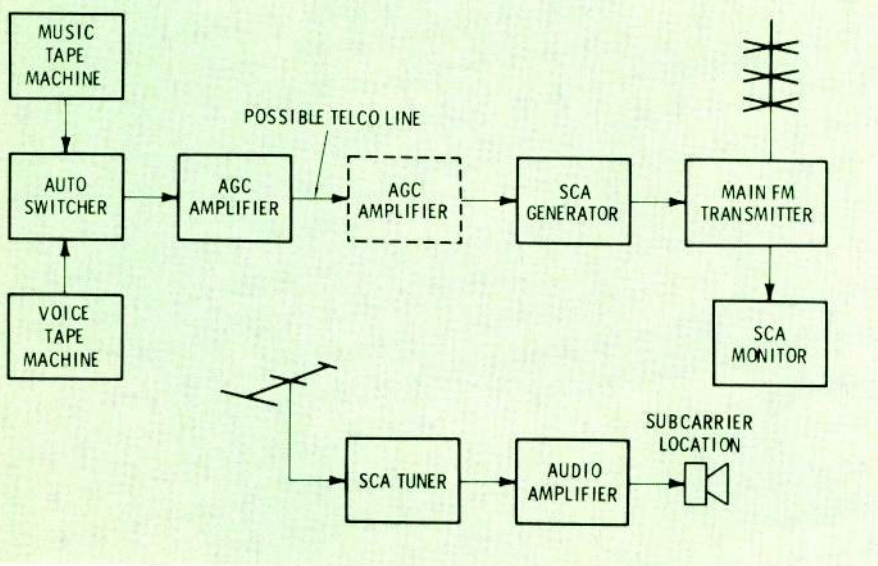


Fig. 5 Block diagram of a typical SCA operation from origin to destination.

Attention TV Stations:

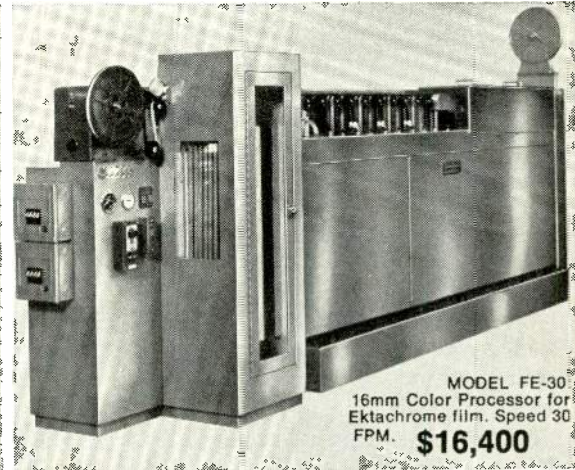
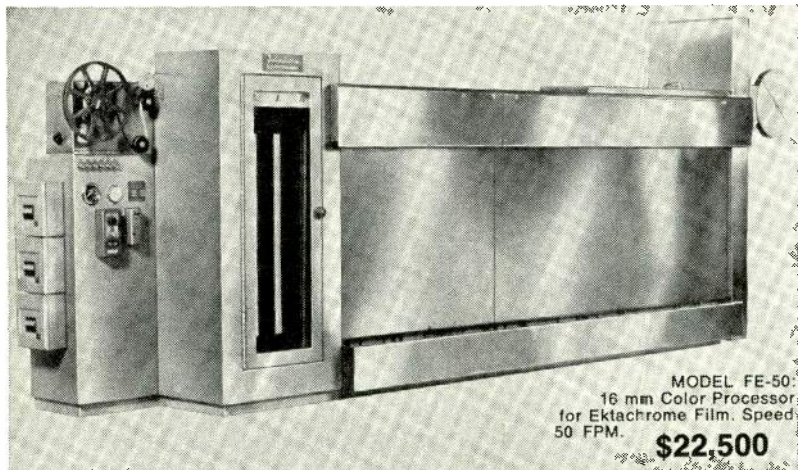
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Modular Lighting Control Systems

By Stephen J. Skirpan*

In the last decade, many new television studios with moderate or heavy production schedules have incorporated solid state dimmers for lighting control. Early in this period, the high-current SCR made its appearance.

Initially, the SCR or solid state dimmer suffered a few growing

*Skirpan Lighting Control Corp.

pains in its acceptance. In the beginning of the 1960's, SCR's lacked the current inrush ratings required for incandescent lamp control and also produced fast lamp load current rise times which generated audio frequency interference and made most lamp filaments sing like a hive of disgruntled bees.

By the mid-sixties, SCR current ratings had increased so that damage by transient currents was no longer a factor and specially de-

signed inductive filters increased current rise times to completely eliminate all RFI and lamp sing.

With the elimination of the electronic bugs in solid state dimmers, attention could now be focused on other important design considerations associated with complete lighting control systems. The first was to find ways to cut system cost so that even a very small station with a limited budget could afford electronic lighting control. The second was to provide a lighting control system which is always easily expandable and can grow as the station's requirements grow, without any loss in the initial capital invested. Our solution to both of these objectives is standard modularization.

Because of the rather rapid swing from large mechanical dimmers to electronic control, most engineers concerned with the design or application of lighting systems still think in terms of custom fabrication of lighting control consoles and dimmer racks. In today's era of plug-in modularization and solid state components, this technique of system assembly is seldom necessary.

Fig. 1a Front view of 12-channel rack mounting controller panel.

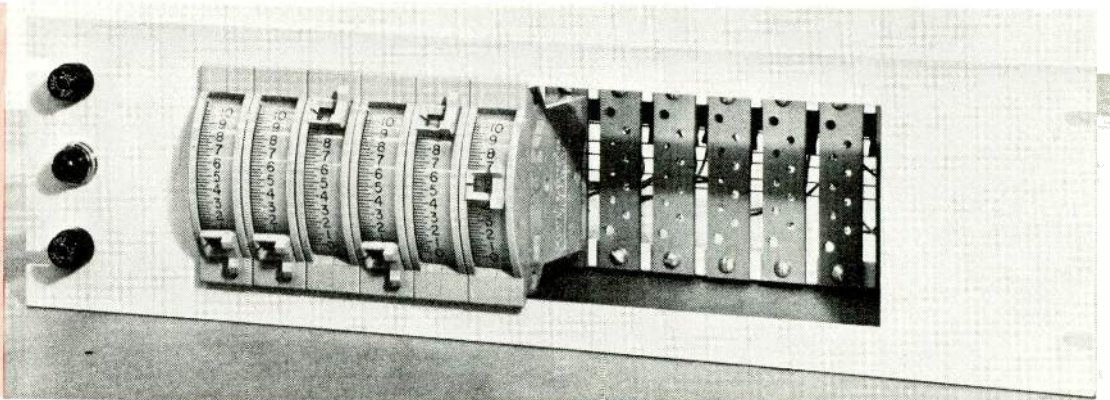
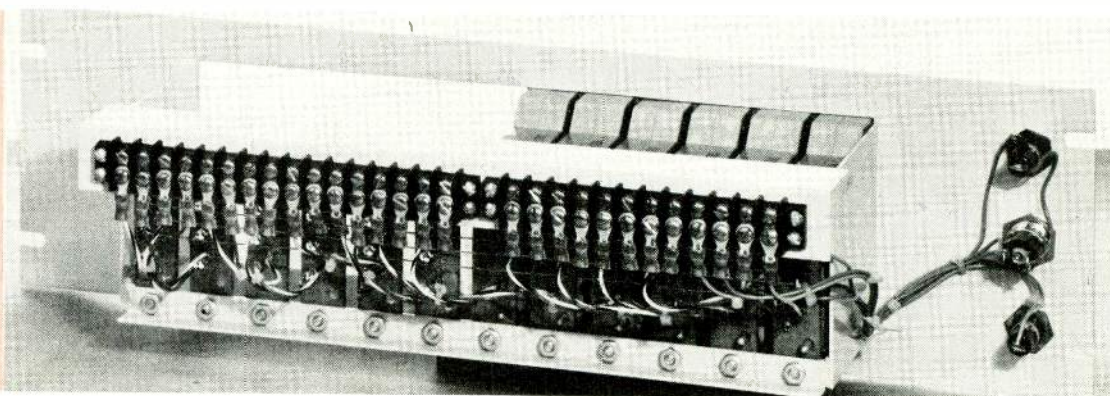


Fig. 1b Rear view of 12-channel rack mounting controller panel.



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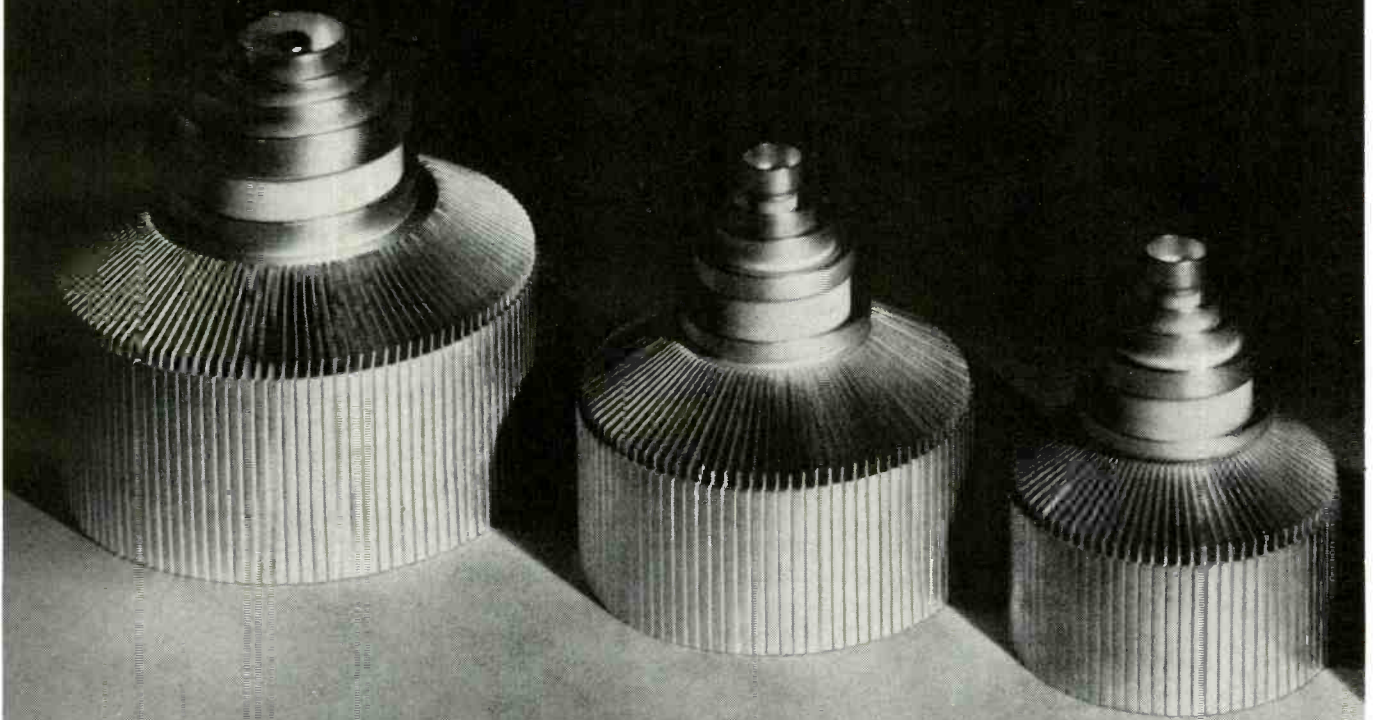
All ceramic-and-metal construction assures long life and reliability under severe environmental conditions. Hundreds are in field use today at low operational costs. These tetrodes are part of the

most comprehensive line of UHF tubes available. They can be driven by our 20 dB gain triodes thereby permitting use of a solid state exciter.

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|-----------|-------------------------------|------------------------------|---------------------|------------------|
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| TH 331 | 3500 | 1.8 | 50 | 1000 |
| TH 290 | 3500 | 3.0 | 100 | 2000 |

*THREE-TONE TEST **peak sync level in class A operation.



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Fig. 2 Rack mounting dual master panel.

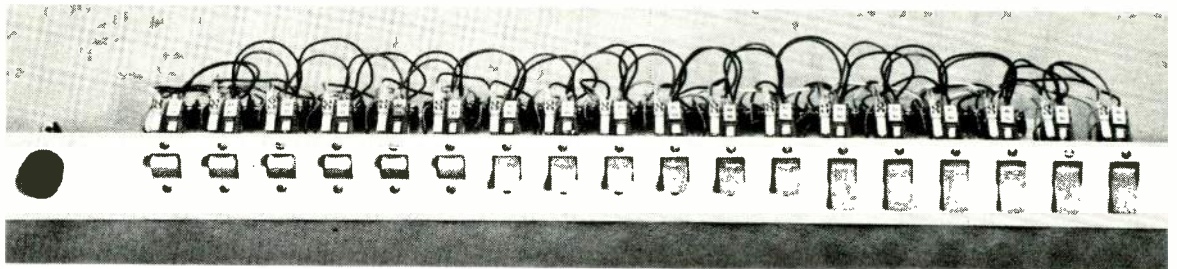
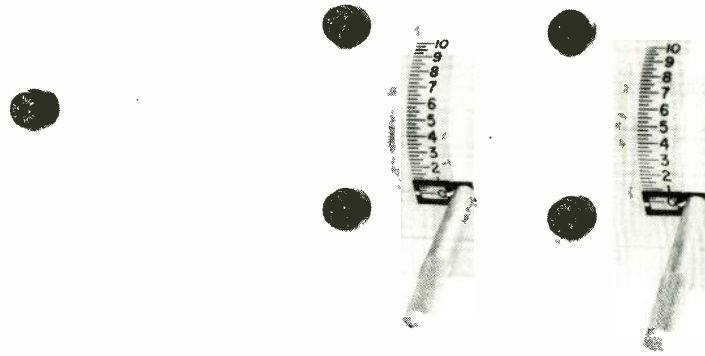


Fig. 3a Front view of an 18-channel rack mounting switch panel.

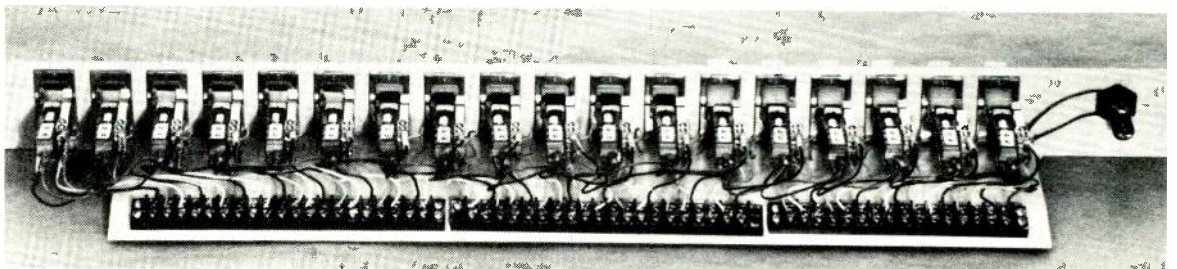


Fig. 3b Rear view of an 18-channel rack mounting switch panel.

New high-current semiconductor techniques have not only reduced the size and weight of electronic dimmers, but have also reduced the complexity of lighting system circuits. When these facts are correlated with the additional fact that a lighting system is the duplication of the same control and power elements many, many times, an expandable modular approach is an obvious refinement.

The demand for miniaturization, modularization and standardization which has been prevalent in all facets of electronic system design in the past five years, has also revitalized the old relay rack approach based on EIA Standard RS-310. Today, a vast variety of standard modular enclosures, ranging from small tabletop units to large desk-type consoles and vertical racks, is now available to accept 19 and 24 inch control panels. Practically all audio, video and computer

equipment is now designed to fit modular enclosures which have come a long way from the days of the black wrinkle finish in functional versatility as well as eye appeal.

Control Consoles

Regardless of the system control complexity or total power capacity, all lighting control consoles can be reduced to combinations and quantities of the following modules:

- A. Controller panels for presetting and manual control of remote dimmers;
- B. Master panels for group mastering of individual controllers;
- C. Fader panels for cross-fades between presets;
- D. Switching panels for circuit assignment of controllers and masters.

Figure 1a is the front view of a 12-channel controller panel with six

of the plug-in controllers installed and six removed to show panel construction. The panel is $5\frac{1}{4}'' \times 19''$ and includes front access fuse protection as well as a pilot light to indicate that the controllers are energized. All control scales are rear-illuminated.

Panels of this type are factory wired and assembled with six, twelve or eighteen controllers per panel. The rear view of the same panel is shown in Figure 1b. Input and output connections to the panel are provided on a standard terminal strip. The panel requires a 24-volt AC input of about one amp for panel illumination and signal supply. Internal silicon rectifiers in each controller produce the 12 adjustable DC outputs for the control of the remote electronic dimmers.

In a simple initial setup, without presetting or mastering, this panel, with its associated 24-volt transformer, would be the only control

module needed for a 12-dimmer system. At a later date, however, the same panel may be used in a system incorporating any quantity of dimmers or presets. A standard panel with two masters is shown in Figure 2. Up to 200 controllers can be switched or permanently assigned to the output of each master for cross-fades or group control. Figures 3a and 3b show the front and rear views of a typical switching panel which is normally used to assign individual controllers to various masters. All switches are also rear-illuminated and color coded to show position.

All modular control panels are mounted within a stock low-silhouette turret console with a panel area of 19"x19¼". This system provides 12-channel, two-preset control with A and B submasters in each preset, as well as grand-master control. Two 5¼"x19" panels mount the 24 controllers; two 1¾"x19" panels mount the 24 A-B master selection switches; and one 5¼"x19" panel mounts the five

masters. This entire lighting control console can be assembled and wired in two days using prewired relay rack panel modules. The console illustrated in Figure 4 was assembled by the electric shop at WNBC-TV, New York City, for use on remote locations. It is constructed of two standard modular frames and provides 24-channel, three-preset control with A and B submasters in each preset.

Dimmer Power Racks

The other end of the system which does the work of controlling the power dissipated in the lamp loads can also be reduced to combinations of three modules independent of system capacity as follows:

- A. Relay rack adapter cradels containing solid state plug-in dimmers;
- B. Patch panels for lamp load assignment;
- C. Circuit breaker panels for load circuit protection.

Solid state dimmers are commercially available in individual power

capacities ranging from 2 kW to 12 kW. Since the signal requirements for these dimmers are the same regardless of the individual dimmer power capacity, the control consoles previously described may be used with any combination of dimmers.

Again, it is quite easy to start with a few dimmers and build up to any quantity desired without any loss of money, function, or the professional appearance of the final system.

Power patch panels for programming the dimmer outputs to various lamp loads and circuit breakers panels for load circuit protection are easy to assemble on standard relay rack panels using commercially available high-current plugs, jacks and circuit breakers.

Of course the possible control and power configurations of lighting systems built with modular components is almost endless. This approach, however simple or complex the system may be, offers versatility in system design and assembly and wiring by station personnel.

METROTECH PROFESSIONAL RECORDERS

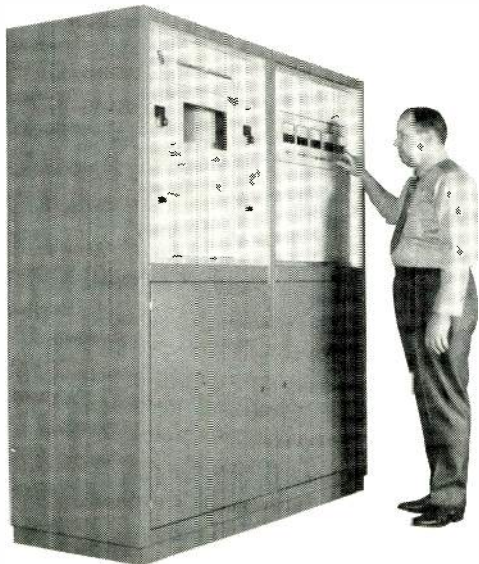
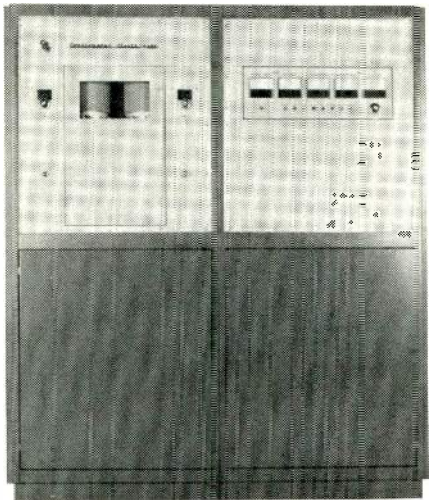
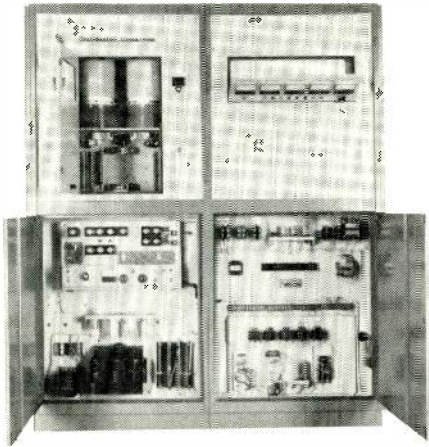
Meets or exceeds all NAB specifications, and offers substantial savings in either mono or stereo models. **Metrotech Recorders, Reproducers and Loggers** — in networks and major stations everywhere. Write for complete information.



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670 National Avenue
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A Division Of Dictaphone

Circle Number 26 on Reader Reply Card



NEW SOLID- STATE 10 KW 5 KW AM TRANSMITTER

Continental's Type 316F 10 KW and Type 315F 5 KW broadcast transmitter has 100% solid-state exciter. Amplifier has two tubes, only one tube type. Other advantages include: built-in solid-state Magniphase antenna protection circuit, low power consumption, dual-level collector modulated solid-state driver and push-pull modulator without transformer,* high fidelity signal with 100% modulation capability from 2 to 20,000 Hz, compact and self-contained.

For complete information, write Broadcast Sales, Continental Electronics Manufacturing Co., Box 17040, Dallas Texas 75217

*US Patent Pending

Continental Electronics 
MANUFACTURING CO. SUBSIDIARY OF RESALAB, INC.

Circle Number 27 on Reader Reply Card

Bi-Directional Current Source

By Walter Jung*

Electromagnetic coils for vidicon beam alignment require a bi-directional source of regulated current. This current must be stable against temperature and load variation. The circuitry described here is capable of supplying a regulated ± 40 ma of current to a 140 ohm ± 10 percent coil in a 0-50°C ambient through 600 feet of No. 22 cable.

Although this design is described for a specific application, the concept can be extended to other areas where current sources are necessary. With appropriate bandwidth design the idea could easily be adapted to a deflection driver for CRT display devices.

The basic concept is illustrated in Figure 1. Currents I_1 and I_2 are summed at point A, and the ensuing difference current, $I_1 - I_2$, can be made to swing from a negative value through zero to a positive value. If I_1 and I_2 are regulated currents, then $I_1 - I_2$ must also be regulated.

Figure 2 is the circuit which utilizes this concept. $Q_1 - Q_2$ form one current source I_1 , and $Q_3 - Q_4$ form the other I_2 . R_{1a} and R_{1b} are ganged potentiometers connected such that as I_1 increases, I_2 decreases and vice versa.

Transistors Q_1 and Q_3 are the common base elements of the current sources, with R_{1a} and R_{1b} furnishing variable reference voltages to their bases. D_1 and D_2 provide

*Forest Hill, Md.

a match to the temperature dependent V_{be} of Q_1 and Q_3 . The variable reference scheme of R_{1a} and R_{1b} was necessitated by the requirement to deliver up to 10 volts to the load from a 12 volt supply. Low voltage zeners of the same voltage would not have matched the TC of Q_1 and Q_3 as the 1N914 diodes do. The remaining two transistors, Q_2

and Q_4 , are power amplifiers, conducting the major portion of the output at maximum load current.

The composite regulator will deliver a constant current to its load which is independent of cable length, and coil temperature rise. Temperature stability of the regulator is less than one percent over the environmental range specified.

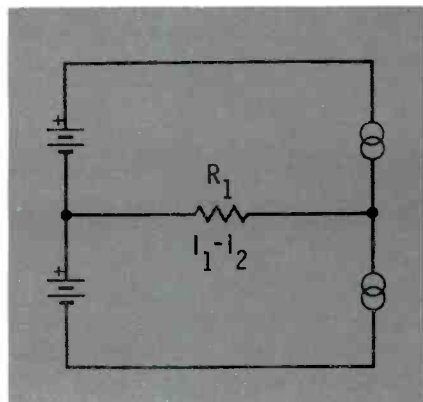
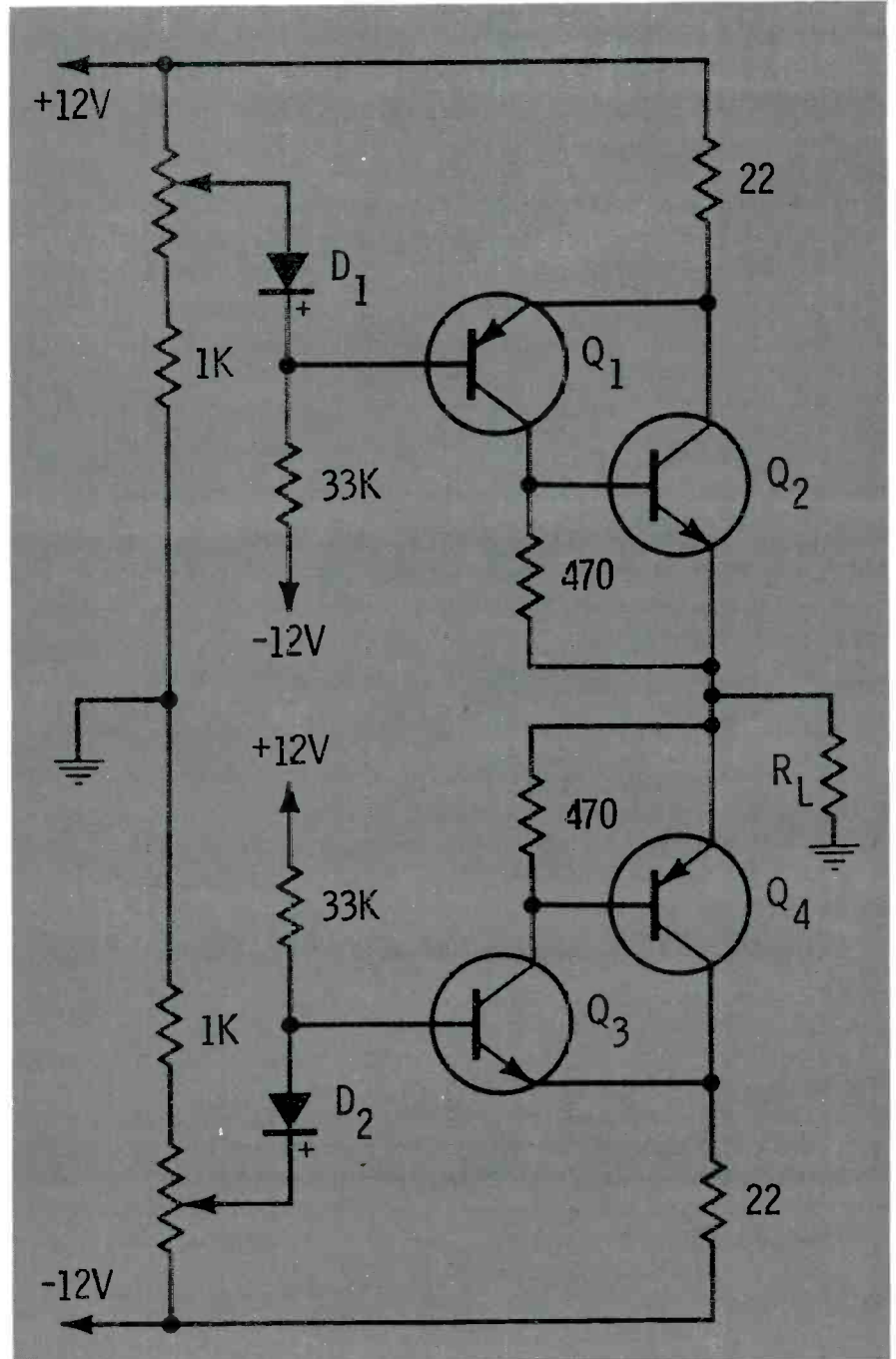


Fig. 1

Fig. 2



They're here!... Automated scene stealers from Ampex!

Introducing the new, completely automatic generation to the television scene.

The revolutionary AVR-1 recorder. A totally new concept in videotape recording. Designed from the ground up for the automation age!

And here's another scene stealer—the most stable, hands-off color camera. The new Ampex BC-230, with the sharpest, most brilliant picture in television. Fewer controls, greater simplicity.

Ampex is the first to unveil the totally automatic TV scene from camera to antenna. To get the complete picture, just call your Ampex Sales Representative, or write: Ampex Corporation, 401 Broadway, Redwood City, California 94063.

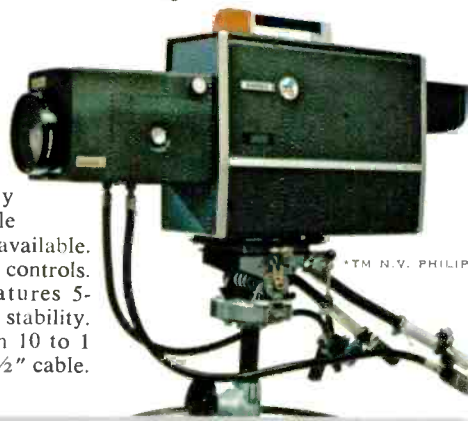


New AVR-1 Color Videotape Recorder

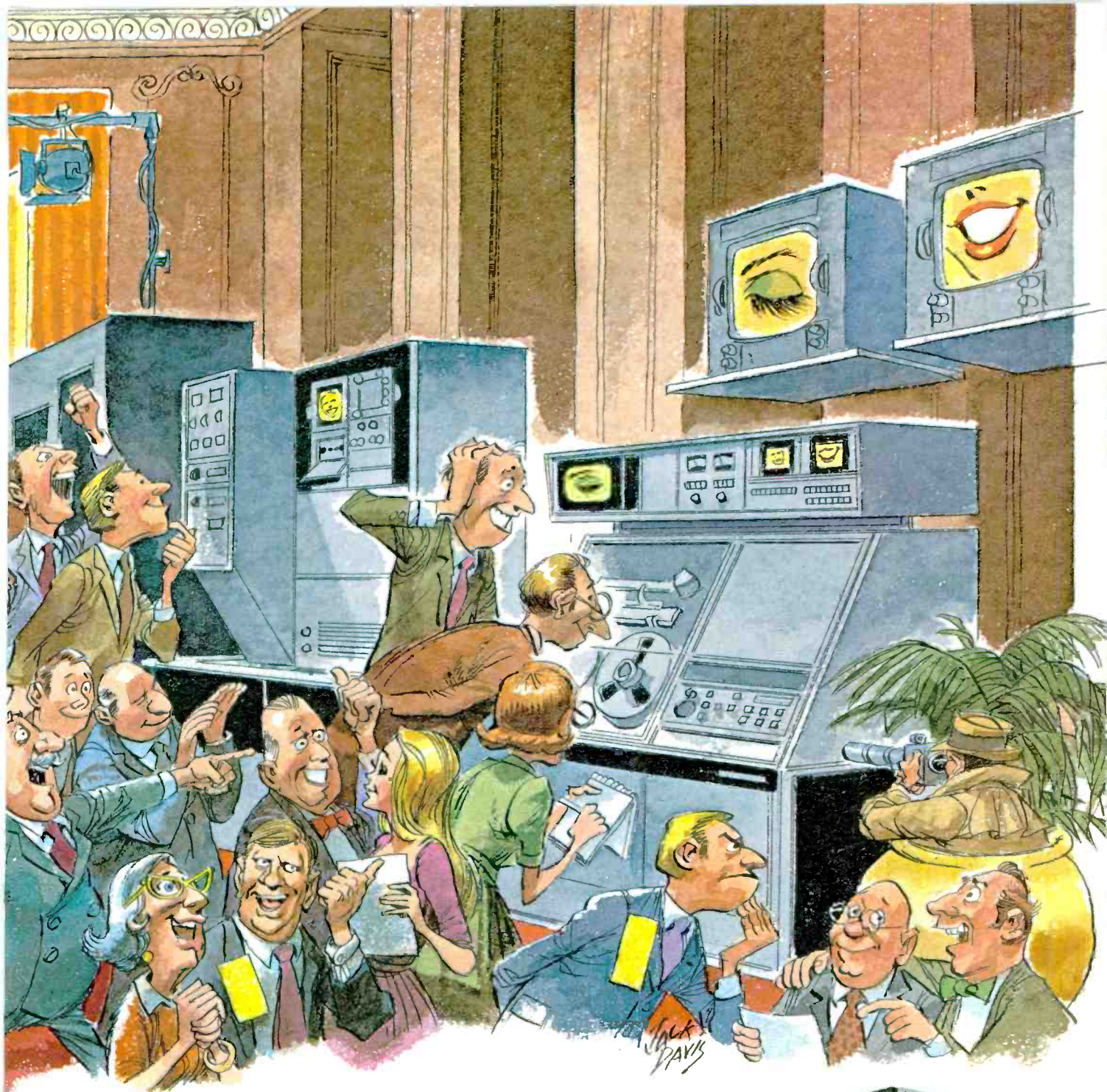
Designed for automation—delivers "instant video" (just like a camera). The ultimate in reliability. Easy threading with precision vacuum tape control. Automatic standard selection on playback. Editor, band-by-band and line-by-line autochroma, auto tracking, velocity compensator and other automatic functions available as simple plug-in options.

New BC-230 Color Studio Camera

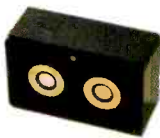
Gives brilliant, sharp color at only 25 foot-candles. The most versatile three-tube Plumbicon® camera available. Allows faster setup with fewer controls. Requires less adjustment. Features 5-minute warmup and long-term stability. Weighs only 60 lbs.; 77 lbs. with 10 to 1 zoom lens, and uses lightweight 1/2" cable.



TM N.V. PHILIP



**New ACR-25 Cassette Recorder and
ADR-150 Contact Duplicator**



New video cassette recorder features exclusive Ampex 6-minute refillable cassette. Adds unmatched versatility to your broadcasting operation. New high speed duplicator copies 30-minute program in only *three* minutes! Provides economical, mass duplication of spots and programs for national syndication and fast distribution.

VS-600 Production Video Switcher

Top performance for studio, master control, or network control. Modularized switch matrix and control logic, amplifier, tally control and power supply. Serially-coded control system requires only a single small connecting cable. Control panel can be located up to 1500 ft. away. Available in standard and custom designs.



**Complete line of VHF
and UHF Transmitters**

Latest state-of-the-art design in modular transmitters and translators with solid state circuits. Low level modulation and low level sideband filtering. Available with hot standby, parallel operation or exotic system control. New, complete "Director" line of antenna systems including all transmission line components from one manufacturer.



**The total
TV scene.**



Numbered Cart Control System

The system of designating what spot is on each tape cartridge by using pre-gummed labels on masking tape is a time consuming method that has proved unsatisfactory for KJCK AM-FM.

We started using a cartridge labeling system a number of years ago that has been very successful. All cartridges are permanently numbered and kept in the racks in numerical order. Undoubtedly, this system is not new to many stations, especially those using hundreds of tape cartridges. The system has quite a number of advantages for both the announcer and the continuity department. Some of them are: cartridges are easily located for immediate use by the announcer because of the numerical order and it is easy for the continuity department to keep a running record of what is on each cartridge and where to find a particular cartridge.

The number of each cartridge to be used is entered after the sponsor's name on the program log as it is prepared.

A record of what is on each cartridge is kept on a large wall chart in the continuity room. The chart was constructed by building a wooden frame around white posterboard. Numbered slots were ruled off on the posterboard with a felt marker with extra slots drawn in for future expansion of the number of cartridges in use. (Our present chart is 7' x 4'.) Then the posterboard was covered with a heavy gauge of the clear type of plastic used for stormwindows. The plastic is available at hardware stores and lumber yards. It makes a good surface to write on with a grease pencil and can be easily erased with a flannel cloth. Instead of changing the label on a cartridge when the recorded material is changed, the board is erased and new information is written in.

To keep track of different length cartridges, certain segments of num-

bers are all 30-second cartridges such as the numbers 1 through 100 and another segment of numbers is 70-second cartridges, etc. This way there is no need to label each cartridge according to the length of playing time available. The only cartridges left unnumbered are ones used for production or programmed at random such as promos which are not scheduled on the program log. These cartridges usually have a permanent label on them to designate their use.

Charles Preston
Chief Engineer
KJCK-AM-FM

Rewind Audio

Occasionally, but far too often, the audio man has failed to disconnect, by key or push button, the output of a video tape recorder immediately after its use in a program being broadcast or taped, with the result that bothersome high pitched rewind audio is heard in the program. This happens as the tape operator puts the video tape recorder in the rewind mode in order to remove the played tape from the recorder. This usually occurs when both men are extremely busy, such as during a news broadcast.

We use two RCA video tape recorders, an up-dated TRT-1A and a TR-4B. Both video tape recorders were modified to eliminate the rewind audio by the installation of a Potter Brumfield KRP-11D (24

Volt DC coil) double pole, double throw relay, at the audio output terminals of each recorder. The relay is also wired that the normally closed contacts terminate the audio output of the recorder in a 600 ohm load resistance, when in the Rewind mode. In the Play or Record mode the relay is energized by the voltage drop across the capstan pinch roller solenoid, connecting the audio output of the recorder to its normal audio load in the audio control room. The recorder capstan pinch roller is only actuated or energized during Play and Record modes, hence it provides a convenient connection point for the additionally installed audio relay.

In the TRT-1A, the relay coil connection was made to the terminals "K" and "M" of J 21. In the TR-4B, the relay coil was connected to the terminal strip near the pinch roller solenoid. See Figure 1.

This modification in no way affects the normal audio monitoring functions at the video tape recorder. The TRT-1A has been modified for about five years without any malfunction. The TR-4B was recently modified. This idea could be applied to other brands of recorders.

Care should be taken that the current requirements of the relay, if another brand or type of relay is used does not overload the recorder circuitry. Similarly, if modifying another brand of recorder, check the voltage and current rating of the circuit to which the modification is to be made.

Alvin H. Smith
Chief Engineer
KTIV-TV
Sioux City, Iowa

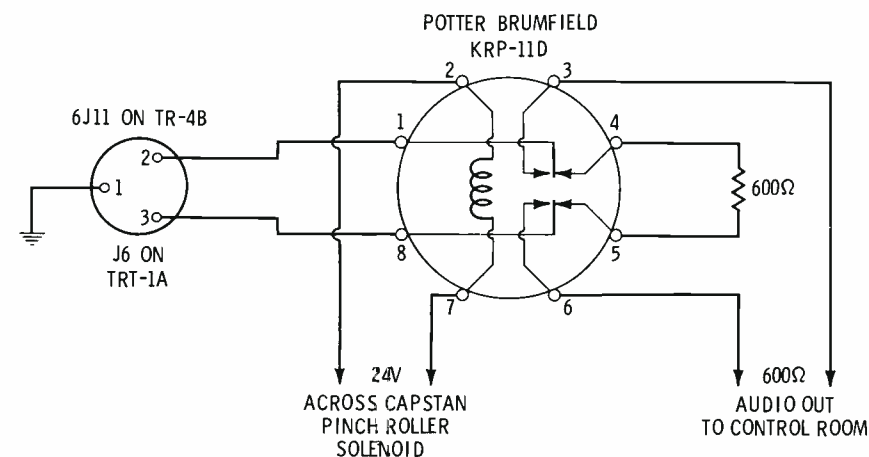


Figure 1

Dean Burch Supports Public Broadcasting Financing Act Of 1970

FCC Chairman Dean Burch told the Subcommittee on Communications of the Senate Commerce Committee recently that the Commission supports the "Public Broadcasting Financing Act of 1970" as a "needed extension of the interim financing for the Corporation of Public Broadcasting. . ."

The bill would authorize annual appropriations for the Corporation through fiscal year 1973 and would provide for matching Federal funds for contributions to the Corporation. It also eliminates the \$250,000 limit on contracts or grants to single stations.

Chairman Burch said the Commission favored "the anticipated stimulation of increased contributions from private sources" by means of the incentive in the fund matching provision. Commenting on the three year authorization, he expressed the view that the Corporation's fund requirements would be likely to increase during this period and noted that "the open end provision for authorization of such sums as may be necessary, taken together with the . . . matching process, will . . . provide suitable flexibility to meet these rising needs."

Chairman Burch emphasized the Commission's concern with the need for establishing for the Corporation "a permanent financial base not dependent upon annual appropriations" at the earliest possible moment. He said that the development of the Corporation and the nation's noncommercial educational television system would be "adversely" affected by "too great a delay in finding the permanent financing solution . . ." and offered the cooperation of the Commission and its staff in achieving a solution to the problem.

Panel Selected To Advise On UHF Tuners

A three-member panel has been established by the Federal Communications Commission in the Office of the Chief Engineer to advise the Chief Engineer on questions relating to the Commission's recently

adopted rules requiring manufacturers of television sets to provide comparable ease of tuning for VHF and UHF channels.

The panel, organized to provide for consistency and efficient administration of the rules, is headed by Arnold G. Skrivseth, Assistant Chief Engineer in Charge of the Research Division. Other members are William K. Roberts, Assistant Chief of the Laboratory Division, and Herman Garlan, Chief of the RF Devices Branch. Upton K. Guthrey, attorney on the General Counsel's

staff, will serve as secretary of the panel.

The new regulations, amending Part 15 of the Commission's Rules, were adopted on January 28, 1970.

Manufacturers and others with questions about the regulations may contact the panel with inquiries and requests for consultation. Inquiries should be in writing and should be addressed to the Television Tuning Panel, Federal Communications Commission, Washington, D. C. 20554; Attention: Upton Guthrey, Secretary.

NEW!

FAIRCHILD PORTABLE MIXING CONSOLE!



MODEL FPC-50



The FAIRCHILD PORTABLE MIXING CONSOLE is the world's first truly portable mixing console . . . it goes wherever you go! It weighs only 45 pounds complete and is about the size of a suitcase, but only 2" thin. Put it on a desk, table, or stand, plug it into an external power supply or use the battery power source and it's ready to mix up to 16 inputs and 8 outputs including monitoring on each channel. One set of batteries (16 alkaline or ordinary flashlight "C" type batteries), self-contained in the arm rests, will provide 25 hours of continuous operation.

A complete 16-input, 8-output system with monitoring capability costs only \$7990.00. (About \$6000.00 less than a standard console with comparable facilities.)

Outstanding performance, reliability, and durability are assured because the FAIRCHILD PORTABLE MIXING CONSOLE consists of the identical component circuitry which has made FAIRCHILD standard consoles the pacemaker in motion picture, television, radio and recording studios throughout the world.

Take a FAIRCHILD PORTABLE MIXING CONSOLE to your next recording session. The quality is unquestionable, the portability is obvious and, of course, the price is right!

FIVE MODELS AVAILABLE:

- 16 inputs _____ 8 outputs
- 16 inputs _____ 4 outputs
- 16 inputs _____ 2 outputs
- 12 inputs _____ 4 outputs
- 12 inputs _____ 2 outputs

FAIRCHILD PORTABLE MIXING CONSOLES
from \$4990.00 to \$7990.00.

For complete details and performance specifications write to:

FAIRCHILD SOUND EQUIPMENT CORPORATION

Dept. BE-5 10-40 45th Avenue • Long Island City, N.Y. 11101

NEW PRODUCTS

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

Convention Coverage Of New Products To Be Continued

Due to the conflict of convention dates with publication dates, it is not possible for us to bring you a complete coverage of the truly innovative new pieces of equipment that were on display at the convention in Chicago. We will be giving considerable space in upcoming issues to describe this equipment.

TV Switching

Sarkes Tarzian, long noted for their work in television station automation has introduced a new switching system. Called the Selectec III, this system is not an improvement of an old design: it's a totally new approach.

Selectec III can handle a diverse number of TV station switching requirements. This includes studio production, video processing, and distribution. And since the system is basically designed as a master control, it also is capable of handling machine delegation and effects. Deceptively simple in appearance, and compact in size, the system will not crowd out the space needed for other basic units.

Circle Number 59 on Reader Reply Card

Color Camera

Philips Broadcast Equipment Corp., unveiled its new Norelco PC-100. Under development for the past three years, the PC-100 uses three electronic bays in the camera head, one for signal processing, one for deflection and one for power supply, contain the all-solid-state circuitry on 3 x 5" plug-in boards. Some 86 digital signals are converted into analog camera control signals by a unique digital/analog converter card. Digital signals are multiplexed with the audio signals and transmitted to the camera on high-frequency carriers. Thus all video, audio, control signals and power are combined and carried on two of the three triaxial conductors (the outer triax conductor serves only as a shield).

Completely noise-free pictures were shown at 20 foot candles, and nearly noiseless pictures in light ranging below 10 foot candles. Stark-white colors were handled with no trace of blooming. Norelco engineers attribute the dynamic range of the PC-100 to its one-inch separate-mesh ACT Plumbicon sensors, new optics and new 50 dB signal-to-noise F.E.T. pre-amps.

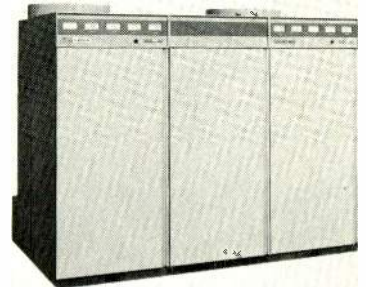
As in the Norelco PC-70, all op-

erational controls for the PC-100 are at the camera control unity, a 7" rack housing a 2-level card bin. The CCU, registration and operating panel and DC power supply can be accommodated either in a standard 19" rack or transit case.

Circle Number 60 on Reader Reply Card

55 kW UHF Transmitter

Gates Radio has introduced a new 55 kW UHF transmitter that now places the company in a position of having a full line of competitive TV transmitters.



Gates BT-55U

The new model BT-55U uses Gates' IF Modulation along with a five-cavity vapor cooled internal klystron. The only tube-type component in the entire UHF transmitter is the klystron, which is driven by a Gates self-contained, solid state exciter. This approach reduces the overall transmitter size.

Winding up a three year development program, the BT-55U was type accepted by the FCC on March 10 of this year.

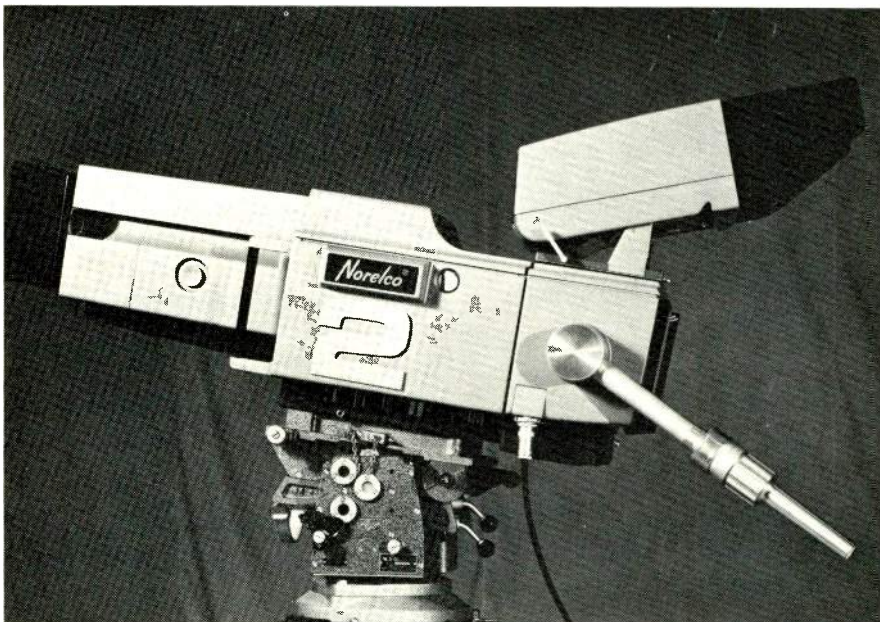
Circle Number 61 on Reader Reply Card

Slot Antenna

American Electronic Laboratories, Inc., Colmar, Pa. announces the addition of the AEL Crossed Slot Antenna, Model ACS 1331A, featuring rugged construction, flush mounting, hemispherical coverage, and circular polarization, to its diversified antenna product line.

The AEL Model ACS 1331A Crossed Slot Antenna provides near hemispheric radiation pattern coverage in the frequency range of 1430 to 1540 MHz. This rugged, circular polarized antenna is designed to meet stringent modern day aircraft environments including temperature extremes of 250°C. Fed by a novel double re-entrant excitation system this high efficiency unit is capable of radiating continuous powers in excess of 100 watts.

Circle Number 62 on Reader Reply Card

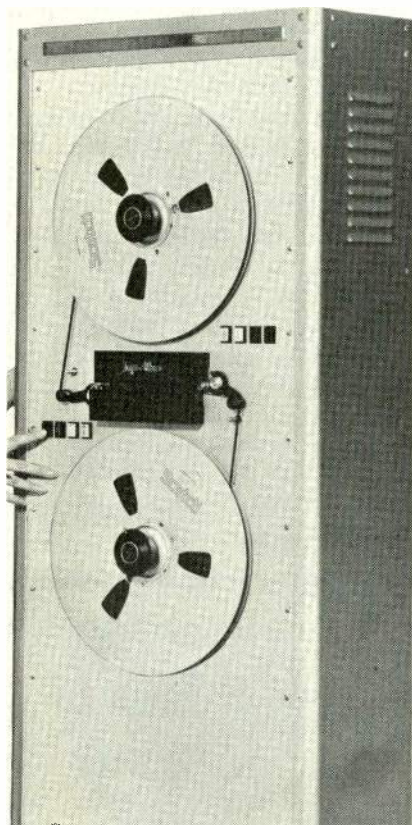


PC100 Color Camera

14" Playback Unit

Tape-Athon Corporation has announced a new tape transport unit using 14" tape reels, designed to facilitate automation of AM and FM broadcasting stations.

Shown for the first time at the National Association of Broadcasters convention in Chicago, the new transport, System 1400, is basically a playback unit capable of holding up to 9600 feet of 1/2 mil tape on a single reel. In terms of playing time, 9600 feet of tape running at 3 3/4 inches per second will operate con-



System 1400

tinuously for 16 hours. A playback system capable of playing unattended for such a duration allows the typical radio station to put an entire day's programming including all music, commercials, announcements, I.D.s, etc. on a single reel.

Circle Number 63 on Reader Reply Card

Video Cassette Recorder

Ampex Corporation has developed a video recorder/player capable of automatically playing up to 25 commercials or other programs ranging in length from 10 seconds to 6 minutes.

The Ampex ACR-25 compares in simplicity with that of carousel cartridge systems used in automated radio stations. The machine is de-

Ask these people how to process 16mm and 8mm Ektachrome film fast.

WANE
Ft. Wayne, Indiana
Corinthian Stns.

KARD
Wichita, Kansas
Kansas State Network Inc.

**EASTMAN KODAK
COMPANY**
Rochester, New York

KAUZ
Wichita Falls, Texas
Bass Bcstg. Stns.

**RAY-CHRIS
PRODUCTIONS**
Little Rock, Arkansas

CBS NEWS
New York, New York

CBS NEWS
Washington, D. C.

KCBD
Lubbock, Texas
Caprock Bcstg. Co.

WCTV
Tallahassee, Florida
J. H. Phipps Bcstg.
Stn.

KDVT
Dallas, Texas
Doubleday Stns.

**GENERAL DYNAMICS
CORP.**
Ft. Worth, Texas

KFDA
Amarillo, Texas
Bass Bcstg. Stns.

KHOU
Houston, Texas
Corinthian Stns.

**CHRYSLER
CORPORATION**
Chelsea Proving Grounds
Chelsea, Michigan

WHTN
Huntington, W. Virginia
Reeves Bcstg. Stns.

KHVV
Honolulu, Hawaii
Western Telestations

WISH
Indianapolis, Indiana
Corinthian Stns.

KJAC
Port Arthur, Texas
Jefferson Amusement Co.

WJAR
Providence, Rhode Island
Outlet Company Stns.

WKY
Oklahoma City, Oklahoma
WKY-TV System Stns.

NEWS FILM LAB. INC.
Hollywood, California

WNDU
South Bend, Indiana
Notre Dame University

UNIVERSAL LAB.
Kowloon, Hong Kong

KNXT
Los Angeles, California
CBS Owned Stations

**ROJANASIL COLOR
PROCESSING LAB.**
Bangkok, Thailand

KOSA
Odessa, Texas
Doubleday Stns.

KOTV
Tulsa, Oklahoma
Corinthian Stns.

KRBC
Abilene, Texas
Abilene Radio & TV Stns.

WRDW
Augusta, Georgia
Rust Craft Bcstg. Stns.

KRGV
Weslaco, Texas
Manship Stns.

WSWO
Springfield, Ohio
South-Western Ohio TV Inc.

KTVT
Ft. Worth, Texas
WKY-TV System Stns.

KVII
Amarillo, Texas
Marsh Media Ltd.

KXTV
Sacramento, California
Corinthian Stns.

**RAI RADIO TELE-
VISIONE ITALIANA**
Rome, Italy
Italian National Network

WBRZ
Baton Rouge, Louisiana
Manship Stns.

KCST
San Diego, California
Bass Bcstg. Stns.

WLUC
Marquett, Michigan
Post Corp Stns.

KNTV
San Jose, California
Std. Radio & T.V. Co.

KTUL
Tulsa, Oklahoma
Griffin-Leake Stns.

SOUND PHOTO LAB.
Lubbock, Texas

WTVC
Chattanooga, Tennessee
Martin Theatres of
Georgia Stns.

KTVE
Monroe, Louisiana
Gray Communications Stns.

KATV
Little Rock, Arkansas
Griffin-Leake Stns.

WUSN
Charleston, South Carolina
Reeves Bcstg.

WTTV
Indianapolis, Indiana
Sarkes Tarzian Stns.

WPTA
Ft. Wayne, Indiana
Sarkes Tarzian Stns.

WTVM
Columbus, Georgia
Martin Theatres of
Georgia Stns.

WTOK
Meridian, Mississippi
Southern TV Corp.

KBMT
Beaumont, Texas
Liberty Corp.

KFYR
Bismark, North Dakota
Meyer Bcstg. Stns.

ABS-CBN
Manila, Philippines
Alto Bcstg. System

WPRI
Providence, Rhode Island
John B. Poole Stns.

**NHK-NIPPON HOSO
KYOKAI**
Tokyo, Japan
Japan National Network
J. OSAWA & CO., LTD.
Tokyo, Japan

Do they know something about Jamieson's Mark IV color processor you should know?

Jamieson's low-cost Mark IV 30 FPM color processor is the easiest of all machines to operate. It is fully instrumented. Automatically controlled. It has a warm-up time of just 10 minutes. A put-through time of just 23 minutes. And the Jamieson Mark IV delivers processed film at a rate twice that of other machines of its size.

Write us for complete information on the Mark IV and our other processors.



Jamieson Film Company

EQUIPMENT DIVISION
2817 CANTON ST., DALLAS, TEXAS 75226
A/C (214) 747-5634

Circle Number 30 on Reader Reply Card

New Products

(Continued from page 63)

signed to aid in the distribution and insertion of spot commercials.

The ACR-25 uses two tape transports. While one is playing a cas-

sette, the second cassette is automatically loaded and cued on the second transport. Each transport can rewind a finished program and cue-up a new program in less than 10 seconds. This permits the system to continuously play a series of

10-second commercials, each recorded on a separate cassette, without a roll interruption between cassettes.

Run-up time between activation of the play mode and the appearance of a color synchronous picture is two-tenths of a second.

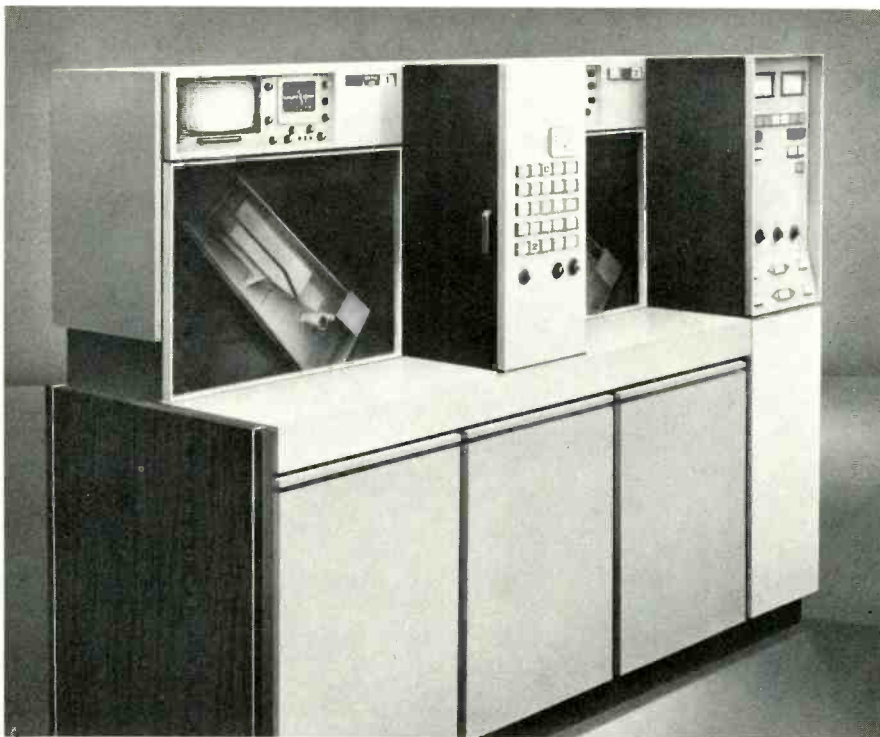
The ACR-25 is a quadraplex system designed to record and play back conventional transverse-scan, two-inch-wide tape in all broadcast formats including high band, low band, monochrome, color, and 525 or 625 line standards.

Circle Number 64 on Reader Reply Card

Educational Production Center Video Engineering Company, Inc.

of Riker Information Systems, Inc., Riker-Maxson Corp., announces a new TV Educator Production Center which contains all of the pertinent components generally found in TV stations and required for educational and training television productions for schools, hospitals, industry and CATV systems.

The TV Educator Model 945 consists of: Video Tape Recorder, Two Viewfinder Cameras, Two Zoom Lenses, Two Tripods, Two Cam-Link TV Pan Heads, Two Camera Dollies, Three five-inch Preview



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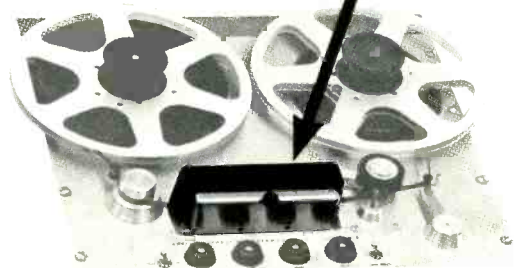
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Circle Number 31 on Reader Reply Card

Monitors, a Line Receiver Monitor, Switcher Fader Special Effects Control Center, EIA Sync Generator, Intercom System, Audio Mixer, Two High quality low impedance, hum reducing lavalier type microphones, Patch Panel with an input-output system, AC Power Center, RF Modulator, Lighting Kit, Video Tape, Head Cleaning Kit and Console.

Among the added features of the TVEducator Model 945 are an intercom jack and easy view tally light with the solid state viewfinder cameras; an intercom system with three headset-boom microphones; an audio mixer capable of mixing up to four microphones and one line level input audio source; and a patch-panel system that accepts up to three cameras and audio source; and a patch-panel system that accepts up to three cameras and audio input jacks for four microphones.

Circle Number 65 on Reader Reply Card

TV Automated Programming

One of the most advanced computer-controlled systems for automating television station operations—capable of controlling the entire day's programming has been announced by **General Electric**.

Called GE/BAC, this General Electric broadcast automation control system will automatically control the selection and timing of all elements in the day's programming, with flexibility to handle unsche-

duled changes.

Computer control of a station's technical operations is a logical step toward complete station automation, according to Harry E. Smith, manager-marketing of the GE Visual Communication Products Department.

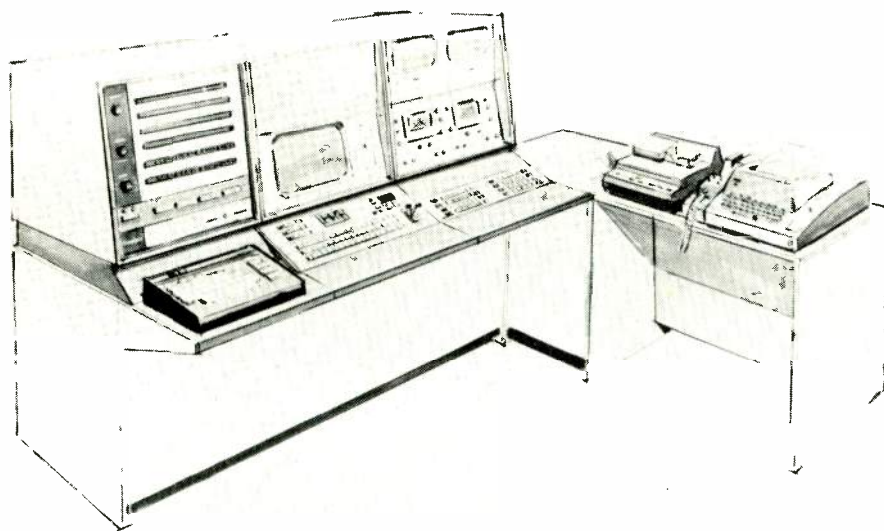
Control of technical operations by the GE/BAC system involves the computer's sensing of upcoming events, alerting the correct equipment, rolling it at the precise second, and doing all on-air switching, and printing out the "as run" log. Manual override is provided for last-minute changes such as news bulletins.

"Computer control will take over the critical, fast-paced switching during station breaks, for example," Smith said, "relieving video controllers of this manual operation and allowing them to concentrate on maintaining the best picture quality possible".

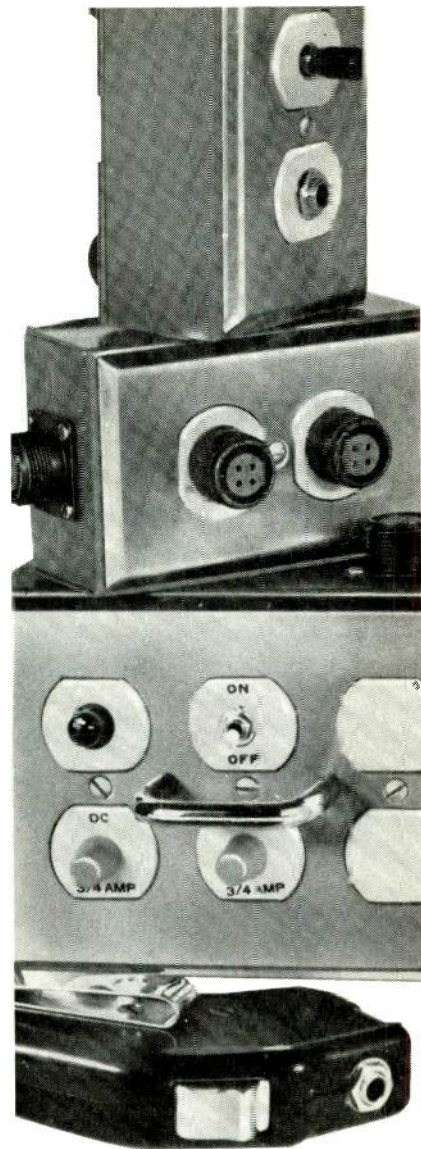
The GE/BAC system uses both a GE computer and GE broadcast switching equipment. It is designed in building-block, modular configuration for installation either as a complete system or as a step-by-step process to complete technical control.

Circle Number 66 on Reader Reply Card

Special Effects Generator
DYNAIR ELECTRONICS, INC. has added a new special effects generator/switcher to its line



Automation Control System



creative modules

Many separate intercom modules—including power supplies, headset stations, amplifiers and a belt station with an extension cord—which are standard items, can be used in various combinations to set up a customized inter-communication system to fit your need. These modules are designed to integrate with Wiremold and standard electrical outlet boxes.

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Circle Number 32 on Reader Reply Card



NEW RUSSCO STUDIO-PRO

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Circle Number 33 on Reader Reply Card

New Products

(Continued from page 65)

of quality television equipment. The SE-6X3-RS is a completely solid-state unit designed to complement the DYNAIR VS-121B-RS Switcher-Fader or similar units of other manufacturers, providing all of the basic effects necessary for professional-quality studio programming.

The special effects unit produces a single electronically combined signal from any two of six input sources, with capabilities for inserts from each of four corners, internal and external key, full horizontal and vertical wipes, and matting. Signal selection in the unit is accomplished by mechanical pushbuttons which activate solid-state crosspoints which perform the video switching.

The control panel is connected to a remote electronics unit with a 50-conductor DC control cable. Distance between the two units can be as great as 150 feet. The control panel chassis is only three inches deep, allowing for ease of installation in low, shallow console arms.

Circle Number 67 on Reader Reply Card

Portable TV Production Center

A complete mobile television production unit has been revealed by **Telenetics Division of Recording Center, Inc.**, San Diego, California for remote CCTV origination applications.

Known as the Mark-II Portable Production System, the console contains a slide-away control bay housing: a four-input audio mixer and monitor, intercom amplifier, industrial sync generator, and video

switcher/special effects generator. Three 9-inch video monitors complete the Mark-II console. A rear connector panel allows full audio and video input and output to the console. Besides video switching and fading, the "effects" mode permits a large combination of special effects. Camera and monitor tally lights are operational during all effects. A preview "buss" is provided for preset of effects.

Circle Number 68 on Reader Reply Card

Cable Trencher

Davis Manufacturing now offers its P-60 direct-burial Line-Layer as an attachment for its new 37 hp Fleetline 40 + 4 trencher along with an optional hydraulically controlled dozer. This combination provides a machine with exceptional lugging ability that will trench, plow or backfill at the instant command of the operator.

No mechanical changeover is required so that the machine can be used for plowing in cable, wire or tubing whenever possible, or without any delay, used for trenching then backfilling. The controls for the basic machine and attachments are all within easy reach of the bucket swivel seat.

The hydraulically articulated Fleetline 40 + 4 is controlled by the exclusive Davis Mono-Stick which lets the operator have one-hand coordination of speed, turns, direction and braking. It can easily maneuver in and around cramped quarters and the pivot-mounted P-60 Line-Layer follows close behind to permit tight turns in and around trees or shrubs and other obstacles.

Circle Number 87 on Reader Reply Card



Production Center

New Products Begins On Page 62

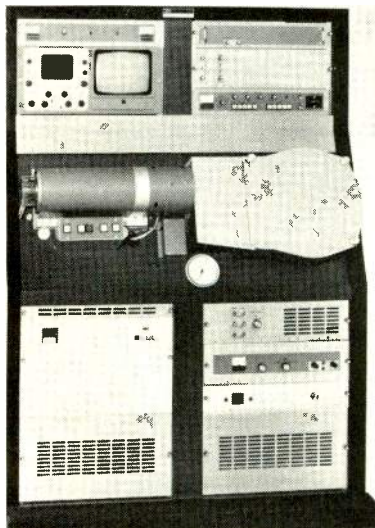
Color Film Process

The **3M Company** has developed a new process to transfer broadcast color television images to high quality 16mm motion picture film.

Called the Chromabeam system, the new process can produce a low-noise picture with color registration and reproduction comparable to the taped or live original. The system permits the television producer to combine the advantages of doing the original on video tape and then producing film copies for mass distribution.

The chromabeam recorder is a total electronic process (even tape scanning and advance) which permits the use of slow-speed, fine grain economical film stock. Color registration is controlled by having all images recorded by the same electron beam on the same film.

Circle Number 69 on Reader Reply Card



3M Chromabeam Recorder and Printer

UHF Dummy Loads

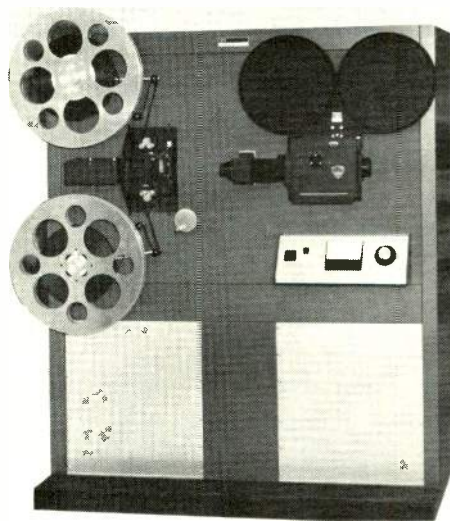
Three new loads designed specially for UHF and higher frequency transmitters were introduced at the IEEE show by **Bird Electronic Corporation**. Models 8542, 8552 and 8562 with 15kW, 25kW and 50kW continuous power rating respectively, operate with a very low VSWR of 1.1 from 450 to 1300 MHz. They are usable at either side of this band with a slowly rising VSWR characteristic to 1.2 max. at 300 MHz and 1.25 max. at 1500 MHz.

In addition to the 50 ohms RF Input Impedance from 300 to 1500 MHz, the three models also exhibit 50 ohms resistance from DC to 1000 Hz. This permits ohmmeter continuity checks, as well as 60 Hz transfer calorimetry for precision power measurement. Most other loads designed for a specific RF frequency spectrum are not operative at DC and power line frequencies.

Circle Number 70 on Reader Reply Card

Remote Amplifier

RCA Commercial Electronic Systems has introduced a new portable



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We're betting our Automatic Programmer for Television (APT) is equal to any challenge you can throw at it. And more.

Years ago, we got the jump on the industry with a television first. A computer controlled automation system that works. Experience has widened the gap. And today, nobody can touch Tarzian competence in television automation.

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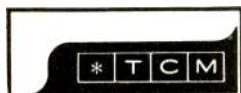


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SOLID

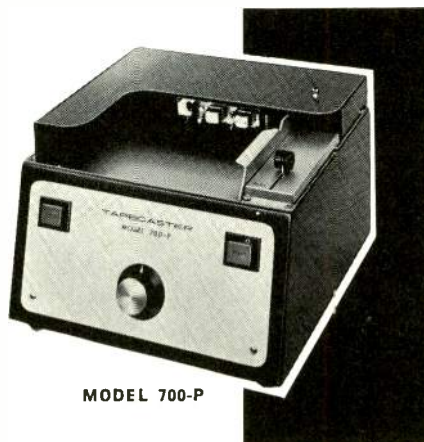
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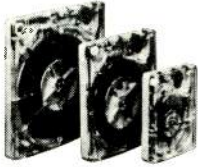
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MODEL 700-P

Spotmaster

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All lengths and sizes stocked — fast service — highest quality

| Series Type | Time at 7½ ips | Unit Price |
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| 300 | 70 sec. (44') | 2.10 |
| 300 | 100 sec. (63') | 2.25 |
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| 300 | 5½ min. (207') | 2.90 |
| 300 | 8½ min. (320') | 3.70 |
| 300 | 10½ min. (394') | 3.90 |
| 300 | empty cart. | 1.60 |
| 600 | 16 min. (600') | 6.25 |
| 600 | empty cart. | 2.80 |
| 1200 | 31 min. (1163') | 10.45 |

Also: DL cartridges (for Spotmaster delay machines), bulk tape, tape-tags and other accessories.

ANY ASSORTMENT—NO MINIMUM ORDER

BROADCAST ELECTRONICS, INC.

A Filmways Company

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remote amplifier, the BN-17A, that is designed for remote broadcast use but because of its small size and low power dissipation also can be used for additional or auxiliary mixing facilities.

The BN-174 employs 16 single-type silicon transistors which contribute to its dependability and performance. Four separate balanced input channels and two high level inputs are provided, plus cueing,

monitoring, test oscillator and mixer facilities. Because of these capabilities, the BN-17A can also be used as a control room mixing console.

The amplifier is completely self-contained for 115 or 230-volt, 50 or 60-hertz power line or battery operation. Other features include microphone input transformers for all channels, earphone monitoring, line cueing facilities and PA gain control.

Circle Number 71 on Reader Reply Card



Color Camera

A name well known to European television but relatively unknown in the U.S. made its debut at the 1970 NAB show on a feature-packed color television camera so light-weight and compact it can be used interchangeably for both studio and remote operations.

Fernseh GmbH of Darmstadt, Germany, chose the annual gathering of broadcasters to introduce its transistorized KC U 40 universal color camera to the U.S. Market after it had been proved by more than two years of actual operation by European TV stations.

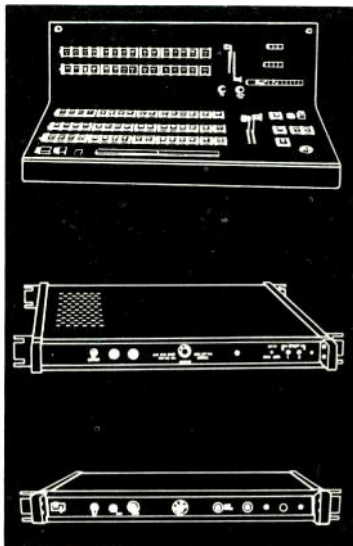
Fernseh's KC U 40 camera has a long list of advanced features of interest to the TV industry, resulting not only in simplified operation but also in an improved picture transmitted to television receivers.

The most visible advances in Fernseh's revolutionary design of of the KCU are its compact size (nearly half that of the average studio camera in use in this country) and a tiltable viewer which enables the cameraman to keep the picture within convenient eye-level no matter what angle (up or down).

Circle Number 72 on Reader Reply Card

ATTENTION OWNERS-TECHNICAL MANAGERS-ENGINEERS

We have acquired substantial excess inventory of RIKER VIDEO INDUSTRIES SWITCHERS, PRINTED CIRCUIT PLUG-IN MODULES, RACKS AND CHASSIS FRAMES, CONSOLES AND OTHER COMPATIBLE SYSTEM PARTS . . . Originally manufactured for Color Video Control and Special Effects.



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Circle Number 36 on Reader Reply Card

Zoom Lens Control

The availability of Monital zoom lenses with Denard Controls has been announced by **Rank Precision Industries, Inc.**

These provide manual control for both zoom and focus and a motorized iris which can be controlled by the operator of the camera by means of a push button switch, the switch being an integral part of the focus control.

Remote operation of the iris is done via a plug-in unit, which involves no additional modification, and are designed specifically for self-contained cameras which require an AC power cable and a co-ax for video output.

Circle Number 73 on Reader Reply Card

Turntable

Gotham Audio is offering a turntable that features, according to the manufacturer, virtually trouble-free operation over extended periods of operation. Identified as the EMT-930st, this unit features $\pm 0.035\%$ RMS flutter, and can be remote controlled.

Also, the EMT-930st has a low rumble reading and can be cued to any beat or syllable with a wow-free start. This turntable should be able to withstand the beatings turntables take from DJ's in all types of programming.

Circle Number 74 on Reader Reply Card

Borderline

A newly developed **Anderson Labs** model of Borderline is designed for application in PAL broadcasting. As with the NTSC version, the equipment produces dark borders around light colored lettering and characters to increase their contrast and visibility against light backgrounds. Greater contrast significantly increases recognition and speed of readability. The equipment is suitable for use with any standard inset keyer or any artwork. Applications include program titling, sports news and commercials.

The insert is digitized while the program material is processed in the normal video manner. Adjustment provisions on the front panel allow the border to be varied, and letters to be centered in black and grey level of the border. It will also operate either composite or non composite through a selector switcher, and allow lettering to be colorized.

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Video Tape Printer

Among the new Panasonic visual communications systems to be shown during the Institute of Electrical and Electronic Engineers Show at the New York Coliseum March 23-26 was a prototype high speed video tape printer that reduces the time for tape duplication while maintaining a good quality picture.

The system, for use with 2-inch tape, is especially designed for high reliability color tape duplications and is expected to meet broadcast industry standards in the near future.

Until the development of this equipment, mass produced video

tapes were not economically feasible. A dramatic breakthrough in the time required to duplicate video tapes was achieved by Panasonic after developing "the bifilar tape winding system" for contact printing.

Black and white, and color tapes may be mass duplicated quickly from one magnetic tape. Video tape recording, which has become increasingly popular in the industrial educational, and commercial broadcasting fields, will one day soon become a practical home activity with pre-recorded video tapes being marketed economically because of VTP's.

Circle Number 76 on Reader Reply Card



Audio Console

The new Ward Electronics dual channel audio console, the AC-650, features 24 inputs to 12 mixing channel, and all signal switching can be DC remote controlled.

In this unit, any mixer may be fed to any one, or all, mixing busses simultaneously while retaining good crosstalk isolation between busses. And since the output is obtained from sub-masters at line level, four-channel output is available if necessary.

Easing operation with slide switches and momentary contact illuminated push buttons engraved to station needs, the AC-650 uses silicon transistors throughout and offers high or low levels at all inputs. Three 10 watt monitoring amplifiers are supplied.

Circle Number 77 on Reader Reply Card

Limiting Amplifier

United Recording Electronic Industries (UREI) has announced a significant improvement in their well known 1176 limiting amplifier. Through the use of advanced circuitry and techniques, they have reduced the signal to noise ratio by 6 dB, from -75 dBm to -81 dBm. Control room listening tests have shown that with the improved 1176, now designated the 1176LN, the limiting amplifier noise at the threshold of limiting is below the level of audibility.

Owners of older 1176 limiting amplifiers will be happy to know that the company is making low noise kits available for most of the 1176's now in use. The retrofit kit, designated 1176RFK, will sell for \$40.00. Factory installation will be available.

Circle Number 78 on Reader Reply Card

EXTRA SPECIAL COMBINATION

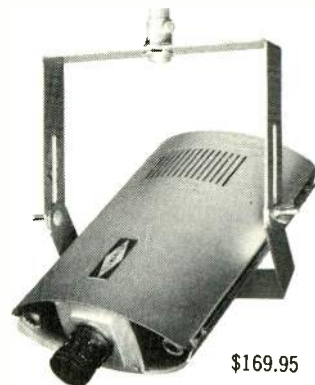
Complete V.T.R. Recording System ALL BRAND NEW

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CCTV CAMERA

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Circle Number 40 on Reader Reply Card

CATV Solid-State Field Strength Meter

A new solid state portable field strength meter for CATV (Cable TV) and MATV (Master Antenna TV) systems has been introduced by **JFD Electronics Corporation**.

The JFD Model 1720 is said to be ideal for CATV and MATV field use because it is light, accurate and easy to use. It works from four 9 volt batteries.

Unlike most other field strength meters, which measure only VHF signals, the 1720 provides direct readings on all UHF and VHF picture and sound carriers. Carriers are clearly marked for each channel.

The new meter measures inputs from 10 microvolts to 2 volts. It is accurate within ± 1.5 dB. To conserve batteries, the 1720 automatically turns itself off when the cover is closed.

It includes a special phone-scope jack, providing a detected signal output which can be used to drive a high impedance crystal earphone, a tape recorder or an oscilloscope.

Circle Number 79 on Reader Reply Card

Broadband RF Amplifier **American Electronic Laboratories, Inc.,** Colmar, Pa. announces its Model DA-2356 Broadband RF Amplifier.

This unique broadband amplifier provides the means for obtaining high level signals over a broad frequency band without the necessity for tuning or level adjustments. The amplifier will accept signals from any standard laboratory signal generator, CW or FM at a 2 MW level and deliver 20 watts of average power into a 50 ohm load with a bandwidth of 1 MHz to 250 MHz.

Circle Number 80 on Reader Reply Card

16mm Camera

Century Precision Cine/Optics of North Hollywood, California announces the availability of their new 6.5mm f/1.8 Super Wide Angle Lens for 16mm motion picture cameras. The lens covers an angle of 90 degrees, four times greater than the normal lens. Covering an entire room is possible without moving the camera.

Made with the latest optical glass for sharp resolution, full color correction and saturation, the manufacturer points out that this is not a fish-eye lens that renders only a

circular field. It covers a full 16mm frame without vignetting. Depth-of-field is enormous. Available in 16mm "C" or Bolex RX fixed focus mounts. Objects two feet to infinity remain in sharp focus with only a moderate 8 percent edge distortion.

Circle Number 81 on Reader Reply Card

Receiver-Monitor

A new **RCA** color TV receiver—Model JM-897W—is designed to serve as a general purpose utility monitor for numerous studio applications including direct off-air monitoring functions. It's especially suitable for non-critical viewing spots in the studio—backstage, audience and the like—that don't need the critical efficiency of technical, high cost monitor sets.

Sturdy, vinyl-covered metal cabinet houses a big 23" diagonal, 295 square-inch rectangular picture tube for comfortable viewing, even in large areas. This receiver is equipped to accept RF or bridged direct TV video and audio line feed without the costly adaptors required when entertainment-type TV sets are used for monitoring functions.

It includes a separate 75-ohm video input for direct off-air recording. In addition, the receiver provides for audio tape and phono input, as well as two external speaker outlets for sound reinforcement. Latest color advancements include: automatic fine tuning (A. F. T.), automatic chroma control, RCA's Super Bright Hi-Lite color kinescope, automatic color purifier, solid state color demodulator, powerful 25,000-volt New Vista chassis and easy-to-use color-keyed front controls that enable studio personnel to make quick, accurate "tint" and "color" adjustments.

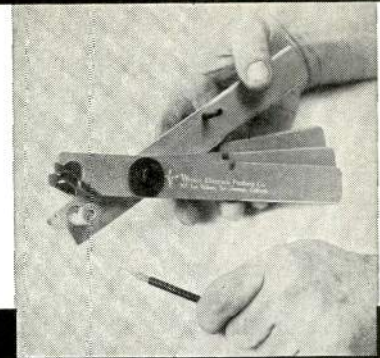
Circle Number 82 on Reader Reply Card

ETV, CATV Switchers

Fung Engineering Co. Belmont, Calif. 94002, announces the availability of a passive video switcher specially designed for CATV or ETV system use. Model PVS-8 or PVS-10 for 8 or 10 video inputs. The unit also includes an extra set of contacts for audio switching, and is available with 1, 2, or 3 switched program line output. All inputs are terminated 75 ohm.

Circle Number 83 on Reader Reply Card

**New Products Begins
on Page 62**



NEW MODEL CX-1

COAXIAL CABLE STRIPPER

Developed and used by NASA ■ Prepares cable for connectors in 10 seconds ■ Adjusts for stripping requirements of all standard co-ax connectors ■ Close-tolerance adjustment prevents nicked conductors ■ With removable inserts, accepts cable from .075" to .435" OD.

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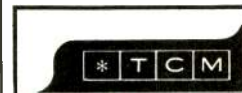
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MODEL 700-RP

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However, looks don't tell everything...only **TIME** will prove the **TAPECASTER CARTRIDGE MACHINE**. Exclusive in all **TAPECASTER CARTRIDGE MACHINES** is the new **SUPER-TORQUE** hysteresis synchronous motor plus a design that promises far better performance with years of trouble-free operation. **LOOK THEN SHOP** for the best machine, **THE TAPECASTER**.



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TECHNICAL DATA

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100. AEL SERVICE CORP.—a subsidiary of American Electronic Laboratories, Inc. A brochure on AEL EMI/EMC and Tempest Services is now available. A complete EMI test consists of determining sources of EMI, measurement of interference levels and documentation of results. Beginning with specifications and proceeding through design and assembly techniques to final equipment, EMI specialists can detect potential problem areas before test and recommend changes for their elimination.

101. ALDEN ELECTRONIC & IMPULSE RECORDING EQUIPMENT CO., INC.—A new 16-page catalog describing the Alden "Flying Spot" Component Recorders for Pattern, Plot or Picture is now available. The recorder reproduces electrical phenomena as permanent records in pattern, plot or picture form

rather than transient oscilloscope or CRT displays. When used with Al-fax Type A electrosensitive paper, it produces permanent graphic images of repetitive or sequential signals with detail and information content not approached by other display or recording techniques. The catalog contains complete specifications and information. Featured applications contained in the catalog include frequency spectrum analysis. Recordings of "whistlers" i.e. low frequency emanations from lighting and other electromagnetic phenomena of interest in communications studies are clearly illustrated along with recordings of ionospheric back scatter made during long range communications studies by radar in real time.

102. AMERICAN PAMCOR, INC.—An expanded series of crimp-type gas line fittings is fully

described in the new Catalog No. L-91c. The full-color, 16-page catalog includes completely updated specifications, plus application and dimensional data for over 60 different items of the AMP-FIT gas tube fitting family for gaslights, outdoor grills, service and distribution lines.

103. AMPEX CORP.—Composition and magnetic properties of Ampex ferrites for microwave applications are described in a series of new data sheets. The ferrites are designed for use in such devices as circulators, isolators, phase shifters and switches for low and high power requirements. Four classes of ferrite materials are described: lithium, nickel, magnesium and garnets.

104. AUDIOTRONICS CORP.—A colorful, 16-page 1970 Record Player and Accessories Catalog is now available. The catalog provides complete information regarding features and specifications of Audio-tronics monaural and stereophonic record players and transcription players, extension speaker systems, AM radios, headsets, headset listening systems, microphones, and other accessories.



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105. BIRD ELECTRONIC CORP.—How experimenters, inventors and microwave engineers got closer to this ideal from the days of actually using hundreds of feet of coiled cable, to the present miniature designs with space-age materials and departure from classic coaxial theory, is the subject of an illustrated engineering essay. This six-page application-oriented note also includes information and specifications on a new medium- and high-power Termaline® RF Load Resistors built around these advanced design concepts.

106. COMPUTER PRODUCTS—A four-page bulletin covers Computer Products' complete AD300 Series (14 separate models) Analog-to-Digital Converters. This series offers, on plug-in printed circuit boards, 8, 10, and 12-bit binary and 12-bit BCD A/D's with full range inputs of $\pm 4V$ or 0 to $-4V$. Speed is 10,000 conversions/second with up to 20,000 conversions/second available. Accuracy achieved is $\pm 0.025\% \pm \frac{1}{2}LSB$. Included in this bulletin are complete electrical and mechanical specifications on the A/D's plus information on the com-

panion mounting cases.

107. DAVIS MFG.—The full line of Davis underground excavating equipment is presented in a new, 20-page, full-color brochure entitled "Take A Trip Through Davis Country". The brochure describes all 11 Davis track-mounted and rubber-tire mounted trenchers from 6 to 65 hp, along with all the different combinations of direct burial line-layers, Davis Backhoes, dozer blades, Hydra-Borer attachments and tilt-bed trailers applicable to each unit. A foldout trencher selection guide gives comparative characteristics of each model.

108. ELCO—A revised 16-page guide describes and illustrates a complete line of economical aluminum p.c. card enclosures which, equipped with Elco connectors and wirewrapped interconnections, can also be supplied in the form of complete packaging systems. The enclosures are available in 32 standard models, but their efficient modular design accommodates special packaging requirements at little or no tooling cost.

109. ESC ELECTRONICS—a division of General Laboratory

Assoc. A new brochure describing their Electromagnetic Delay Lines for critical air traffic control applications is now available. ESC delay lines are used in transponders, beacon decoding networks, airborne computers, DME, IFF coding and decoding, and radar. The brochure illustrates and gives specifications for eight delay lines, which are typical of the hundreds that ESC designs for air traffic control applications. Characteristics featured are fast rise time, low distortion and attenuation, precision taps, and high density packaging.

110. FAIRCHILD—A new 100-page reference source, "MSI Pocket Guide", is now available. The guide provides easy-to-find data on MSI circuit functions, pin-out and loading rules, eliminating the time-consuming task of extracting this information from data sheets. The guide also gives a basic description of many simple bipolar integrated circuits commonly used with devices in the MSI family. The index lists 56 devices covering Fairchild's entire range of MSI building blocks in the 9300 series and MSI support functions in the 9000 and 9600

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series. Included in this total are a number of products not yet introduced.

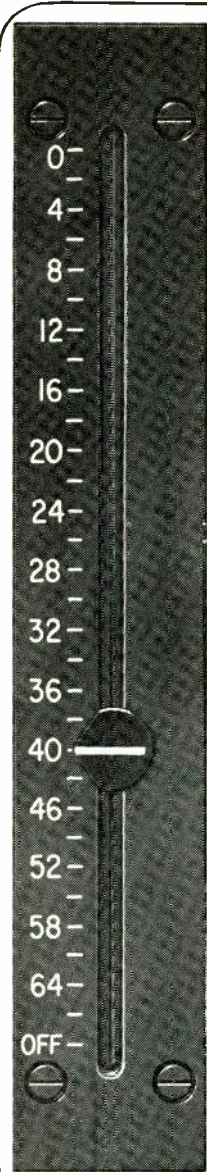
111. JEWELL ELECTRICAL INSTRUMENTS—A new 50-page catalog describing and illustrating the various designs of Jewell panel instruments is now available. The catalog contains engineering specifications and dimensions on each Jewell (formerly Honeywell) meter line, which includes elapsed time indicators, taut band panel meters and null indicators. The meters are available in round, square, rectangular, wing and edgewise styles to fit various equipment designs. Also included in this catalog is pricing information and a "Where to Buy" listing of Sales Representatives and Distributors.

112. LINDBERG HEVI-DUTY DIVISION,—Division of Sola Basic Industries. A radio frequency generator that has 20 millisecond response, with ± 20 percent change in power input, is described in a bulletin. The RF generator is discussed in terms of ratings and specifications chart showing output and input in the 5 and 7.5 KW range. Dimensional data are also included.

113. ODETICS, INC.—A new 4-page brochure on the new family of video tape recorders capable of compressing or "capsuling" time is now available. Discussed in the brochure is the product's many diverse applications in traffic control, time and motion study, bank, liquor store, and department store surveillance, plus machinery, construction, and medical/psychiatric observation. It also describes how a video tape recorder is modified to record pictures at staggered rate, then play them back at a faster rate.

114. MAST DEVELOPMENT COMPANY—A new four-page brochure describing Series 137/138 Random Access Projector Accessories is now available. Random Access Multiple Control and Dual Projection Systems, a Panel Mounting Kit, and a Rear Projection Theatre are among the adaptations of Kodak RA-950 and RA-960 Carousel Projectors which are discussed.

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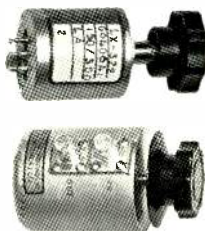
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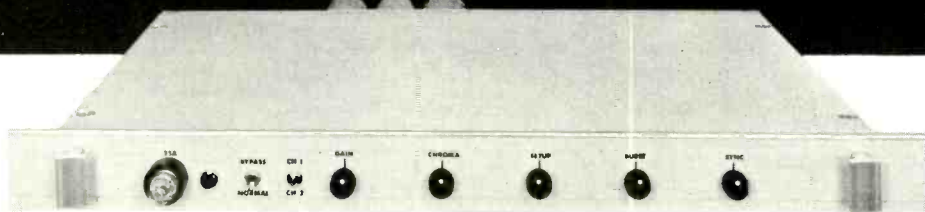
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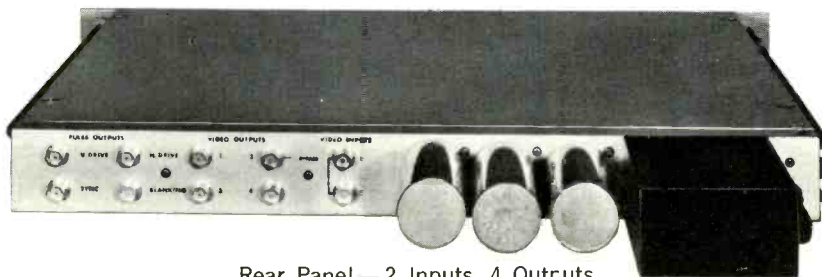
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