BROADCAST NEWS

RCA Vol. No. 122 AUG. 1964

RCA NEW LOOK

TV Film Projector

A deluxe model with every feature your program people could ask for

This new equipment does what you would expect from the world's most advanced television film projector. It has deluxe features, like instant start, reversible operation and automatic cue. These assure the finest quality and versatility. Completely transistorized and automated, the TP-66 is specially designed for TV film programming's faster pace.

INSTANTANEOUS START—Start and show buttons can be pushed at the same time, since projector sound is stabilized within 0.3 second. A pre-roll period, prior to switching projector "on air," is not necessary. Start is instantaneous, allowing preview of upcoming film when desired.

STILL-FRAME PROJECTION—Single frames can be shown at full light level for extended periods, permitting preview of first frame at start, or for special effects. Film is always completely protected by a filter that automatically moves into light path during still-frame use.

FILM REVERSING—Film motion can be reversed—a time-saving feature when rehearsing live or tape shows with film inserts . . . or as an imaginative production device.

AUTOMATIC CUEING—For full or partial automation, films can be stopped and cued up automatically. This eliminates the need for manually threading and cueing individual films, eliminating human error.

AUTOMATIC LAMP CHANGE—Both projection and exciter lamps are automatically switched in place, when burnout occurs. These time-saving features assure continuous operation and avoid costly delays.

AUTOMATIC LOOP RESTORER—Unique fail-proof feature eliminates need for human intervention, makes unattended operation practical.

TRANSISTORIZED SOUND—The TP-66 can be equipped for both magnetic and optical sound systems. Fully transistorized for finest quality and reliability.

NOW BEING DELIVERED

For full particulars, write RCA Broadcast and Television Equipment, Building 15-5, Camden, N.J. Or see your RCA Broadcast Representative.

RCA®

The Most Trusted Name in Television

New 16mm Television Film Projector, Type TP-66

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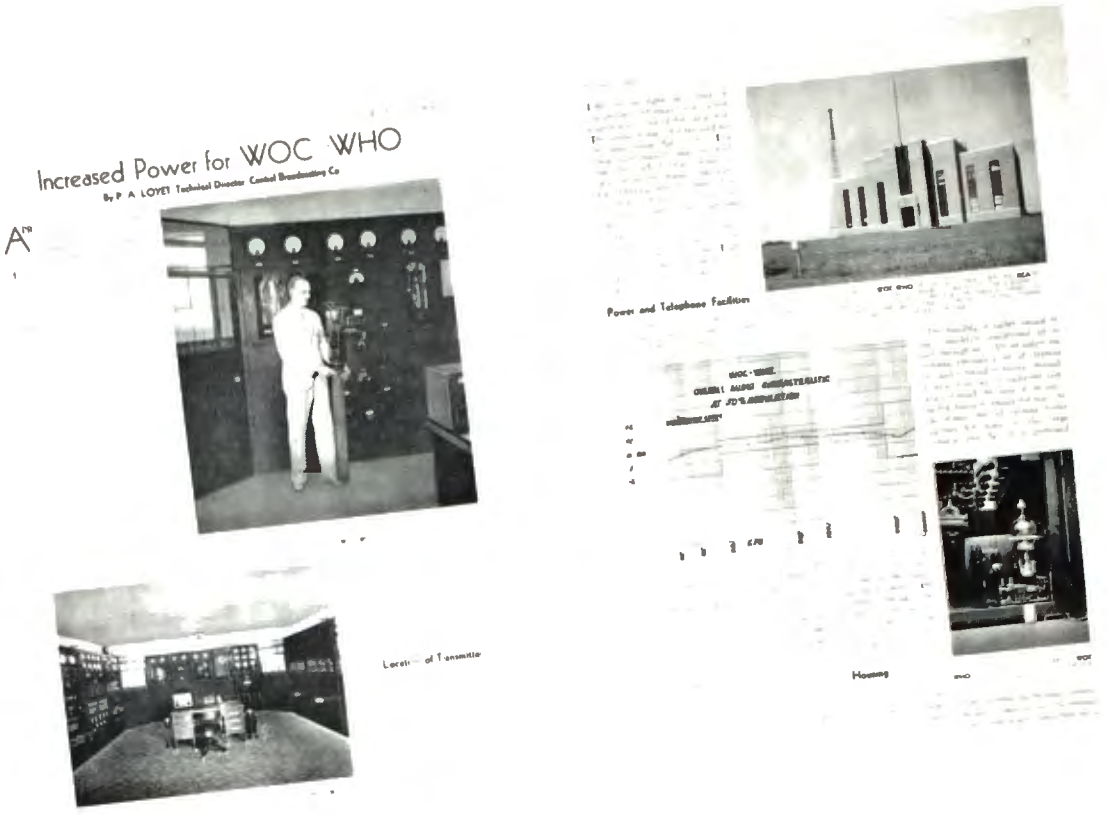
CONTENTS

As We Were Saying

ANOTHER "OLD FRIEND" is featured in this issue. On the cover is an architect's sketch of WOC's new studio building—and starting on page 10 is a detailed description of their new facilities. As anyone can see WOC is a thing of beauty and an engineer's dream. This is not an accident. As Dave Hauser, chief engineer, says, "We wanted the latest and the best." And they got it—TK-60 Cameras, TR-22 Recorders, TS-40 Switchers, etc. Of course, wanting the best (and getting it) is not new at WOC. Our close association with the Palmer stations (WOC and WHO) started that way—more than thirty years ago.

THAT WAS THE YEAR (1932) the Federal Radio Commission granted 22 AM stations CP's for 50 KW. One of these was WOC-WHO. For this jump to "super-power" they wanted the best. They looked and looked—finally decided on RCA. So did 14 others of the 22. Possibly more would have—but we were sold out. It was the first year in which we could say "most of the best stations use mostly RCA equipment." We have been able to say it every year since.

WOC-WHO's super-power installation was duly chronicled in BROADCAST NEWS for August



As We Were Saying

1933. (See above.) Author of the article was Paul Loyet, long-time technical director of the stations and now manager of WHO. It was only the eighth issue of BROADCAST NEWS and we were still feeling our way toward a format. However, it is interesting how much this early story resembles our present practice.

THAT WAS THE ISSUE, incidentally, of BROADCAST NEWS that carried the very first article on the Iconoscope. Dr. Zworykin had written the paper for the IRE Proceedings, but also gave us a copy. The IRE was slow and we "hit the street," as the newspaper boys say, a full month ahead of them. The world's first story on the first electronic eye was probably the greatest scoop in BROADCAST NEWS' history—but we didn't fully recognize the importance at that time.

FROM LINEARS TO AMPLIPHASE could be the title of a history of high-power AM transmitters —as the WOC story, above, reminds us. The RCA 50-B transmitter which WOC-WHO installed in 1933 used a linear amplifier output stage. For its day, the 50-B was a good transmitter, and for nearly a decade it was the standard of the industry. In fact, the last one in a U.S. station was retired just last year—after more than 30 years of service. In 1935 we brought out the 50-C, which incorporated many improvements—but was still the same basic linear design. And the trouble with the linear was that its output efficiency was very low (25-30%). In 1938 we announced our 50-D which was based on the then fashionable "Doherty" circuit. The "Doherty" had better plate efficiency (60%) but the carrier tube, taking most of the load, had relatively poor life —and the high feed-back ratio employed made it sensitive to changes in antenna load.

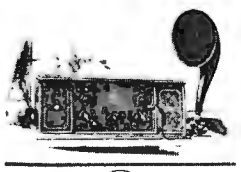
We learned the hard way—and not many 50-D's were made. In 1940 we announced the 50-E, the first high-level modulated 50 KW. After the war came the 50-F, also high-level, but with an updated tube complement. High-level modulated amplifiers have good plate efficiency (75-80%) but the modulators have low efficiency (25% at average modulation) so that the overall efficiency is not as good as it seems. Also, high power, high-level transmitters are less adaptable to remote control.

Thus the search for something better went on. RCA engineers found it in the "Ampliphase" circuit—an adaptation of an idea proposed 20 years earlier by Chireaux. The RCA 50-G introduced in 1955 was the first U.S. manufactured 50 KW transmitter to incorporate this circuit. The 50-H, our present model, is an advanced design which has high efficiency (75-80%), immunity to antenna load changes, superior interruptibility and high modulation capability. Its success is attested by the blue-ribbon list of stations that have installed it—24 in the U.S. alone.

Reproduction of an RCA ad which appeared in the Literary Digest of Oct. 25, 1924.

The family takes to politics

Radiola Regenoflex
Non radiating! It cannot interfere with your neighbor's reception. With four Radiotrons WD-11 and Radiola Loudspeaker. With compartments for the batteries. Complete except batteries . $191.00



Was a time when we voted Pa's ticket 'cause he did and his Pa did. When most of us couldn't get much closer to a candidate and his ideas than the soap box orator on the corner. When bonfires and torchlight parades were as exciting a part of election day as the candidates and issues. Politics was no place for ladies, and what little the women knew about it they gleaned from scraps of the men folks' talk.

Radio has changed it all. Every farm—every city living room—every corner radio store will be a gathering place for the people, listening in. There'll be a Radiola Regenoflex on the farm, where distance demands a sensitive receiver. There'll be a Radiola Regenoflex in the city home, where selectivity is most important—to tune out conflicting stations. You'll find one wherever good, clear, dependable loud-speaker reception is bringing the candidates and the issues right into the home—building America into a real democracy.

This symbol of quality RCA is your protection

"There's a **Radiola** *for every purse"*

Radio Corporation of America
Sales Offices
233 Broadway, New York 10 So. La Salle Street, Chicago, Ill.
433 California Street, San Francisco, Cal.

Radiola

As We Were Saying

FORTY YEARS AFTER the cacophony of "Alabama casts 34 votes for Oscar Underwood" we find ourselves living again the curious drama of a political convention—and with Alabama once more the focus of early attention. For some of us that 1924 Democratic Convention doesn't seem so long ago. We listened to it—through fifteen days and more than 100 ballots—in an isolated valley of the Pennsylvania mountains. It was the third or fourth receiver we had built—but the first one that worked well. We had built an amplifier and somehow managed one of the big Magnavox metal horns. To turn it on and have the convention proceedings come booming in was a thrill we'll never forget. In 1924 it was almost unbelievable! In 1964 it would be almost unbelievable if the convention were not on TV—and in every living room.

Of all this we are reminded by the 1924 ad (above) which was sent to us by Helen Davidson of Huntington, West Virginia. This ad heralded the arrival of radio in politics and pictured the effect of a whole nation listening. The copy would be considered good—even by today's standards. The writer gave flight to his imagination—as admen are wont to do. But there is no hint in his copy that he even imagined a day when a nation would watch as well as listen.

The interesting thing, to us, is that radio and television have grown faster and bigger—have become more all-pervading—than even the most optimistic "visionaries" of the twenties predicted. But some of them came close, and one of these was David Sarnoff. And in that context we keep thinking of his prediction (in the May issue of FORTUNE) that "Science and Industry will advance more in the next 36 years than in all the millenniums since man's creation."

As We Were Saying is continued on pg. 52

FIRST HALF: "NEW LOOK" COMES ON STRONG

[illegible]

Business in the Election Year of 1964 could be a whizbang or it could come after a visit with our accountant. Orders for RCA television broadcast equipment were up 34 per cent for the first half over the same period in 1963. And both optimism and orders were running high as the second half began.

There could be no cheering at many broadcasters who were in a mood to buy. Overall the industry's continuing prosperity had helped put more jingle in their pockets and an improved depreciation allowance on new items of capital equipment had helped too.

It was a happy if managed coincidence RCA chose this period to introduce its "New Look" line of broadcast equipment. It was a propitious move. The debut was nothing short of a smash hit both at the 1964 NAB convention and later when the man with the order book trolled in.

It's somewhat like Caesar: they came, saw and bought. It was because the "New Look" had voted heavily with advance features that had broadcaster appeal. The transistor was in, and the diode and all the others were old all the way.

The "New Look" had taken the broadcaster not just into tomorrow but years ahead. Soon the whole face of the TV technical facility will be drastically changed when in fact it probably won't even be recognizable by today's standards.

The new line had been three years in the making for it was but three years ago that RCA design engineers were satisfied that the solid-state components then available and foreseeable were suitable for broadcast gear. More funds were pumped into product development and the word went out to scrap the old idea of reworking and rebuilding what we have, start from scratch, come up with completely new design that take full advantage of solid state construction.

The result was on show in Chicago last April: an awesome display of 'New Look' equipment that at once was compact, more reliable, cooler operating, high in performance, more automatic and required much less maintenance. Some of the products, such as the TR-22 TV tape recorder, the TK-22 film camera, the TP-66 projector and the TTU-30A are rolling off the production floor now. Others will be later this year, some in 1965. Their trim line, cool blue and sheer finish and superior performance peak of the broadcasters' future, the future that already has arrived.

NEW CAMERA TO SEARCH IN OUTER SPACE FOR GAS CLOUD REGIONS

An ultra-sensitive TV camera with a unique mission to hunt "invisible" lights believed to mark gaseous regions in space is being developed by RCA's Astro-Electronics Division for the National Aeronautics and Space Administration under Project TIGRIS (Televised Image of Gaseous Regions in Interplanetary Space). A prototype of the space camera will be field tested later this year at an astronomical observatory in the Southwest.

Existence of these gaseous regions is the theory of Dr. Thomas Gold, Director and Chairman of Cornell's Astronomy Department and Director of Cornell's Center for Radiophysics and Space Research. Dr. Gold believes the gaseous clouds come from gas and magnetic fields that ring the sun and are pushed adrift by magnetic bulges billowing out from the solar surface. Magnetohydrodynamical shockwaves associated with this phenomenon, he theorizes, could be responsible for the suddenness of magnetic storms on earth.

The TIGRIS experiment was conceived by Dr. Gold and he will serve as the scientific advisor for the project. The TIGRIS television camera is the first image orthicon type ever designed for space exploration, and one of the most rugged ever built. On its mission the camera will be looking for gaseous clouds with a luminosity of only .0000005 foot candle or less than one millionth of the brightness of a normally lighted room. These clouds are believed to be harbingers of magnetic storms, cosmic ray disturbances and other phenomena that mushroom into space from the sun with sudden velocity and savage force. Detection of the clouds may make it possible to chart their size, shape and direction.

The RCA camera has been designed to operate on the same TV standards as the TIROS weather satellite system, also designed and built by RCA. Development of the camera represents the solution of imposing design and engineering problems in achieving an ultra-sensitive space TV camera that is:

1. Capable of detecting extremely faint light or radiation. This was solved by the successful application of an ultra-sensitive, highly ruggedized, three-inch image orthicon. For possible compatibility with the TIROS ground stations, the system provides 500 scanning lines and a frame time of two seconds, operates with a horizontal scanning rate of 250 lines per second, a video bandwidth of 65 KC, and an aspect ratio of 1:1.

2. Sufficiently compact and lightweight for possible future space flight. Advanced miniaturization techniques have produced an image orthicon camera that weighs only 35 pounds, compared with more than 100 pounds for the standard broadcast image orthicon TV cameras used in TV studios.

3. Ruggedized to withstand the shock and vibration of a rocket launch, and to remain operational during a suborbital flight. The camera design represents a major achievement in obtaining optimum ruggedness without sacrificing sensitivity, compactness and light weight.

RANGER CAMERAS THAT SNAPPED THE MOON ARE DESCRIBED BY THEIR RCA DESIGNERS

TV cameras peered at moon from this aluminum shroud, shown by Ernest Toth, RCA technician.

One of the most perfect space missions in history was completed on July 31, with the successful transmission of thousands of pictures of the moon's surface by the six-camera RCA television system aboard the Ranger 7 Spacecraft before it impacted on the moon.

The Ranger and its television system, designed as the first step in seeking a landing site for the Apollo lunar mission, began taking pictures about 1,250 miles from the lunar surface. The last shot was sent back to the giant antenna at the Goldstone Deep Space Instrumentation Facility in California's Mojave Desert from about 1,760 feet from the moon.

Space scientists at the Jet Propulsion Laboratory, in charge of the Ranger project for the National Aeronautics and Space Administration, indicated that all parts of the television system operated perfectly. The TV system was built by RCA's Astro-Electronics Division, Princeton, N. J.

Bernard P. Miller, RCA's Project Manager of the Ranger TV system, explained how the TV complex performed its mission:

"The cameras were arranged in two separate chains, each with its own power supply and controls, thus producing a redundancy to enhance the possibility of successful operation in case one chain malfunctioned.

"One of the chains had two cameras with a picture readout time of two and a half seconds. The other chain had four cameras sending back a sequence of five pictures a second.

"All six cameras were designed to provide 800 resolution lines, compared with the 525 lines of home television. However, to conserve power and bandwidth, Ranger transmitted one picture every two-tenths of a second as opposed to home TV's 30 pictures per second. In the cameras used in the four-camera chain, the central 200 resolution lines out of the 800 lines were scanned for readout in two-tenths of a second. An additional six-tenths of a second were required for preparation of the camera for its next exposure. Thus five exposures were obtained in one second providing a continuous flow of video data over the transmitters associated with the cameras.

"The cameras used in the two-camera chain took longer but saw more of the moon, trading the number of pictures taken for area coverage. They scanned the entire 800 lines in 2.5 seconds. As a result, the area they photographed was about 16 times that of a 200-line camera from an equivalent altitude. In this manner, the two fully-scanned cameras covered the desired area and at the same time provided indexing information by which the pictures from the four partially scanned cameras were oriented."

Since the exact lighting conditions on the moon were unknown, the cameras allowed varying amounts of light to enter the vidicon tubes to provide as broad a range of lighting as possible—from 30 foot lamberts to 2,600 foot lamberts. (A lambert is a unit of brightness of a given surface.) This range accommodated brightness comparable to light conditions on

(Continued on next page)

Close-up view of RCA camera system aboard Ranger.

(Continued from previous page)

earth between 3 p.m. to dusk on an average day.

The six cameras, the eyes of the spacecraft, weighed 88 pounds and were housed in a truncated cone structure 59 inches high, 27 inches across at the base and 16 inches at the top. The structure was covered by a shield of polished aluminum and mounted on the hexagonal base of the Ranger spacecraft "bus." It was circled by four one-inch-wide fins to supply proper thermal balance by absorbing the sun's rays during flight.

At impact minus about 16 minutes, when the spacecraft was about 1,250 miles from the moon's surface, the television system was commanded to full power. From then on, until Ranger 7 crashed on the moon's surface at a speed of 5,850 miles an hour, the six cameras sent thousands of pictures back to the earth-based receiving station.

Two separate cameras chains were utilized in the 375-pound TV system. They employed three 25-mm, or one-inch, lens cameras and three 75-mm, or three-inch, lens cameras, peering through a porthole near the top of the payload. The system was placed in a warm-up mode about 18 minutes before impact on the moon, and an 80 second warm-up period elapsed before automatic transmission of the pictures. Sixty-watt transmitters linked to the cameras flashed the pictures back to earth.

The Ranger Spacecraft was on a near-vertical lunar-impact trajectory, traveling at approximately 5,850 miles an hour, when the final pictures were snapped.

During its operational mission, the Ranger TV subsystem was supported by special ground-station equipment designed and built by RCA and installed at the JPL Deep Space Instrumentation Facility at Goldstone, California. This equipment received, stored, and reconstituted the video data transmitted from the TV subsystem.

Mr. Miller called the success of the mission possibly the most outstanding of any extra-orbital space venture.

Key RCA personnel participating in the Ranger project, besides Mr. Miller, included: C. P. Asch, Deputy Project Manager; J. J. Corr, Leader Test and Integration; J. R. Staniszewski, Leader Project Engineering; C. S. Peterson, Administrator Product Assurance.

TINY RADIO'S SIGNAL SPANS A CONTINENT

The newest thing in emergency communications gear is an "under-arm radio" that uses body heat for frequency control. The solid-state unit weighs a mere 10 ounces but is capable of sending signals across the North American continent, according to its developers at RCA's Tucson, Arizona facility.

The transmitter's crystals are housed in a small metal container which is linked by cable to the transmitter. The container is placed under the user's upper arm where the temperature is highly stable.

The unit's long-range transmission characteristics are based on using the stable high frequency skywave medium for an extremely narrow bandwidth reception. RCA engineers point out that if the receiver bandwidth is reduced to one-half on a given transmission path, the required transmitter power can be halved, and consequently a much smaller transmitter used.

Beyond emergency uses such as those by downed pilots and shipwreck survivors, the little transmitter could fill communications needs of U.S. Peace Corps members, missionaries, explorers, surveyors and others whose activities require distant and solo travel. Tests have demonstrated its capability to send specially keyed signals to a receiver site at Tucson from points of varying distances, including those in New York State, Alabama, Maryland, North Carolina and Virginia.

The little transmitter that goes a long, long way.

The transmitter broadcasts three bits of information per minute which in terms of the code, could represent far more intelligence than indicated. For instance groupings of a few signals could, by prearrangement, represent a message of vital concern to the sender and recipient.

Signal pickup requires a special receiver such as RCA has developed and built at its Tucson facility.

RADIO GIVES TV VIEWERS A "TALK-BACK"

Broadcast television and two-way radio are combined in a unique "see-hear-talk back" communications system which enables physicians in five Utah cities to participate in post-graduate medical conferences originating in Salt Lake City. The system was designed by RCA in conjunction with the University of Utah's Division of Postgraduate Medical Education. The Division has broadcast educational TV programs for some 1,800 participating physicians for several years.

The two-way radio facilities, which represent an extension of the service, permit doctors gathered in the ten hospitals interconnected in the system to ask questions and make comments during the discussion period that follows a TV presentation.

The radio system relays questions to the conference leader in the campus studios of KUED, the University's VHF television station, in Salt Lake City. Still another communications medium, the University's FM radio station, KUER, may be used to broadcast the discussion period if the subject matter is regarded as having sufficient general interest.

Two-way radio transmitter-receiver units are located at the University's radio-TV station in Salt Lake City and at hospitals in Ogden, Logan, Provo and Brigham City. Remote control units are used to tie in other hospitals in a given city with the transmitter sites. The system, which operates in the 450 megacycle band, also makes use of a repeater station to increase its range. The station is located at an elevation 9,000 feet on Mount Vision, about eight miles from Salt Lake City.

RCA-BUILT SPACECRAFT TESTS ROCKET ENGINE PROPELLED BY ELECTRICAL PARTICLES

A rocket engine propelled by electrical particles instead of hot gases was tested during July in space for the first time aboard a National Aeronautics and Space Administration spacecraft built by RCA. The spacecraft, called "SERT I" for Space Electric Rocket Test, was launched into a suborbital 48-minute flight from NASA's Wallops Station, Va., launch facility by a four-stage, solid propellant "Scout" launch vehicle.

SERT served as a platform in space to test two types of electric engines—called ion engines. The engines were supplied by Lewis Research Center. One of them is called an electron-bombardment type, using vaporized ions of mercury as its fuel. NASA reported that this engine operated for 30 minutes of the 48-minute flight. The second engine is a contact-ionization type using cesium as fuel. It was developed by Hughes Research Laboratories for the Lewis Center. This engine failed to produce thrust and NASA indicated the failure probably was due to a high voltage breakdown. All other systems of the spacecraft operated normally.

Such engines are of much interest to scientists because of their potential to power spacecraft for long periods of time, possibly to the edges of the solar system. The thrust of the engine was tested by its effect on the spin of the spacecraft during the 2,500-mile-high flight. RCA was responsible for the design of the basic spacecraft structure. The company also developed the capsule's power switching and distribution system, data-conditioning and telemetering system, spin-rate sensing equipment, command subsystem, antenna subsystems and special ground equipment which was used during test and capsule checkout at the launch site.

The SERT capsule, approximately 30 inches in diameter and 28 inches in over-all height, was characterized by several notable features in spacecraft design and performance, according to Lawrence E. Golden, RCA SERT project manager.

1. Extremely high payload to structural weight ratio. Some 370 pounds of equipment were packaged in a compact capsule that is only 30 inches in diameter and 28 inches high over-all.

2. Unique magnesium baseplate. "Keel" of the SERT capsule is a new type of baseplate machined from a magnesium forging.

This departure from conventional riveted sheetmetal construction points the way to weight-and-space-saving design for many other types of spacecraft. Thirty inches in diameter and weighing only 9 pounds, the magnesium baseplate supports more than 300 pounds of capsule weight and equals sheet metal baseplates in vibration characteristics.

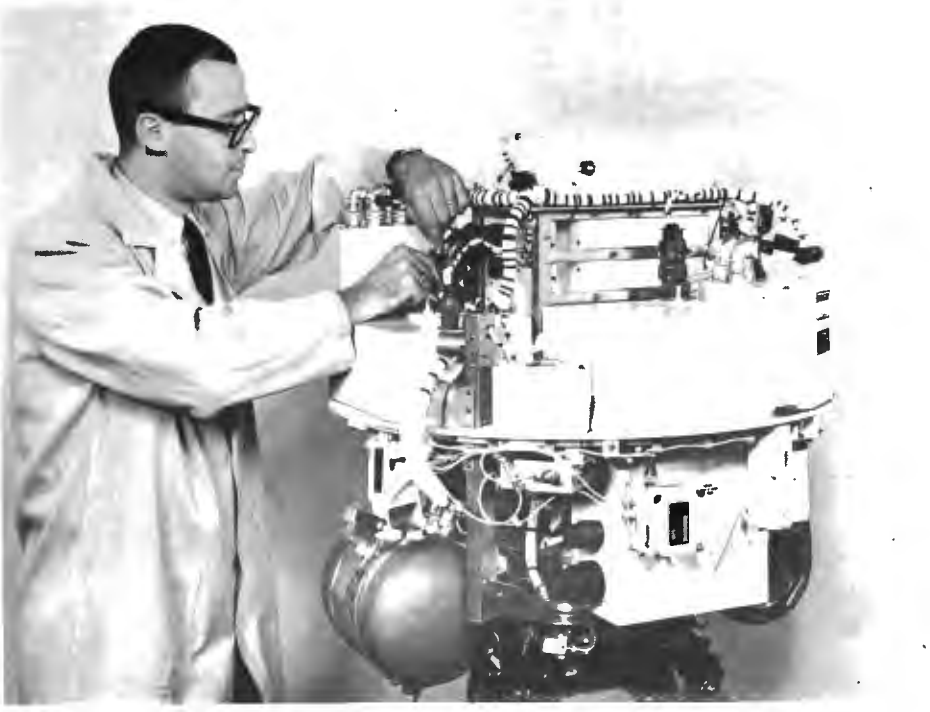
3. Highest power ever sent into space. To provide the 1500-watt power requirements of the ion engines, SERT carried aloft a main power supply consisting of two 30 ampere, 28-volt silver-zinc primary one-shot batteries. NASA's power conversion equipment generated from the low-voltage, on-board power supply the various high potentials and special levels required to operate the ion engines. Some of these potentials were in excess of 5,000 volts.

4. Another notable feature is the hydraulically-damped engine extension system. This provides for storage of the engines within the 30-inch limitation imposed by the Scout rocket's heat shield and deployment of the engines to outboard operating positions after separation from the rocket's fourth stage.

Following deployment, the two test engines were to have been activated alternately to exert tangential thrusts on the spacecraft. Thrusting of the ion engine created torgues around SERT's spin axis and altered its spin rate. The thrust of the engine was measured by monitoring the change in SERT's spin rate using TIROS-type sun sensors and a NASA high-accuracy accelerometer. This information was telemetered to earth for analysis.

NASA supplied SERT's primary control —a programmer unit which was turned on just prior to lift off. It directed the complete flight sequence. Additionally, RCA developed a backup control system embracing a command subsystem and an auxiliary command unit. They provided virtually independent command of flight operations from the ground. The RCA command subsystem is unaffected by noise and functions in the high-noise field generated by the ion engines. It can receive in-flight commands amid noise 47 db above thermal noise levels.

Lawrence Golden, RCA Project Manager for SERT, inspects spacecraft before its initial flight.



Pioneer Station Creates Dynamic New Broadcasting Facility in Davenport, Iowa to Better Serve Its Clients and the Quad-City Community

FIG. 1. Two story lobby establishes atmosphere of achievement and drama in new WOC Broadcast Centre.

FIG. 2. Dr. David D. Palmer, president Palmer Broadcasting Co., at special metal sculpture in lobby, which indicates communication to eyes and ears of man.

FIG. 3. Studio A, 2 stories high, more than 5000 sq. ft. in area, with 18-ft. turntable and newest RCA studio cameras is typical of modern facilities afforded by new WOC Broadcast Centre.

WOC AM FM TV is an example of a progressive pioneer one that is still leading the way in modern-day broadcasting. The forward thinking reflected here makes it ideal for others to emulate. Total-facility layout and advanced technical equipment lend themselves to efficient production of programs and commercials. Unusual public service efforts in a multi-city market lend continuing stature to the operation. Image building local programs and commercials have the distinct touch of the professional.

Altogether New

This new Broadcast Centre is designed from the inside out. Use has been made of modern transistorized technical equipment. Television cameras and tape recorders reflect the latest advances in electronic engineering. Studios and control rooms are equipped for fast, smooth, expert production of programs and commercials.

Nothing has been neglected to make the station a modern concept of efficiency and capability — with ample provision for growth in size and full-color operation.

Fully Staffed

The WOC stations are completely new. Office furnishings and equipment, technical apparatus and accessories: everything is new. Some used equipment has been put into remote service. Only people were moved into Broadcast Centre from previous quarters.

WOC's Broadcast Centre comprises the largest staff in the Quad-City area. Some one hundred people contribute to the success of the operation. This includes a technical staff of 30 and a production staff of 42. Station personalities are well known and are familiar with the area, deftly able to minister to the needs of a complex multi-city community.

Building Description

The modern exterior of the building is indicative of the newest, most recent broadcasting equipment installed throughout WOC Broadcast Centre.

Plans for the Centre were carefully made to meet present and future requirements of broadcast operations. A team of architects and decorators provided the elegance and professional appearance, structural and mechanical proficiency of the building. The WOC staff, however, designed the functional aspects, the working areas of the Centre.

As a result, business and production offices are separated, yet all areas are arranged to contribute maximum efficiency to the overall operation.

The building includes an area designed and available for public meetings of non-profit community organizations.

Leaders in the broadcast industry have termed the WOC Broadcast Centre one of the finest in the country.

Modern Equipment

According to Dr. David D. Palmer, President of Palmer Broadcasting Company, WOC's new Broadcast Centre accommodates the finest, most modern equipment.

Technical equipment allows telecasting of local film in color, as well as network color-casting. Full studio color capacity is provided in contemplated expansion with, in the near future, and lighting provision are already complete.

WOC-TV has installed two transistorized TV tape recorders. These, the finest in the RCA line, turn out tape programs and commercials. Material commercials can then be previewed, recorded for repeat telecasting.

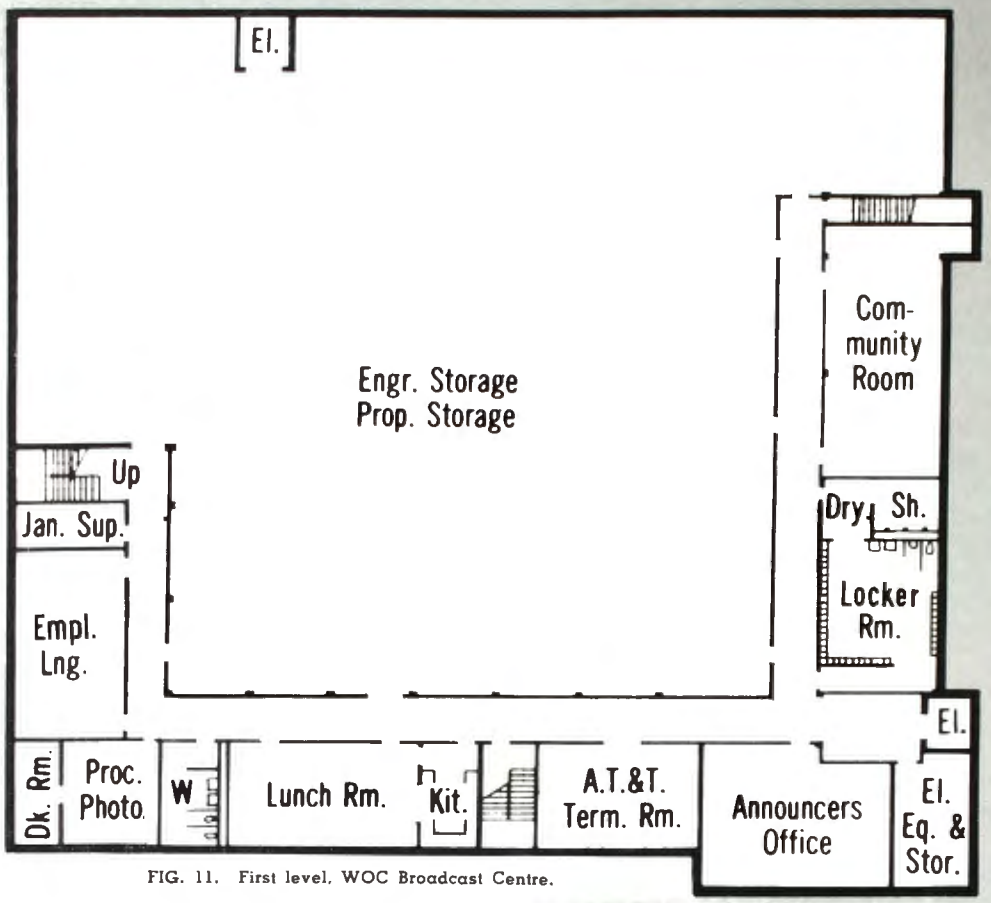


FIG. 11. First level, WOC Broadcast Centre.

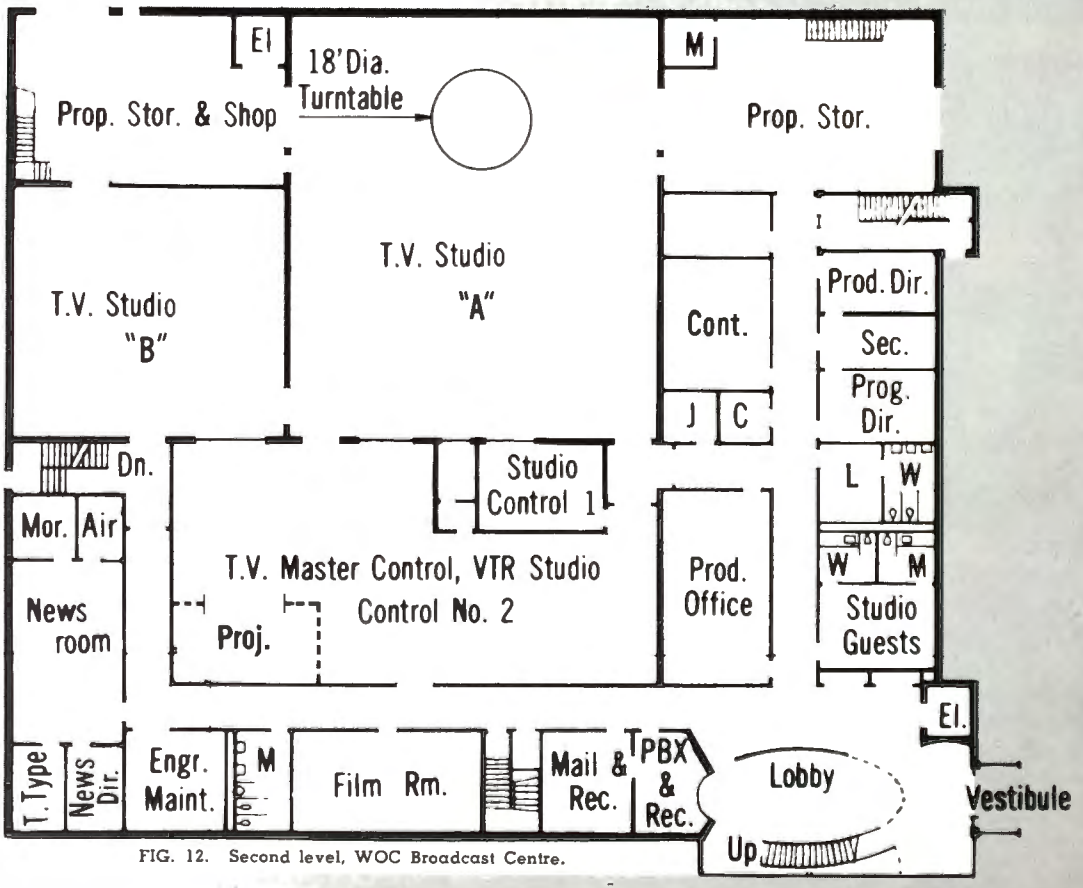


FIG. 12. Second level, WOC Broadcast Centre.

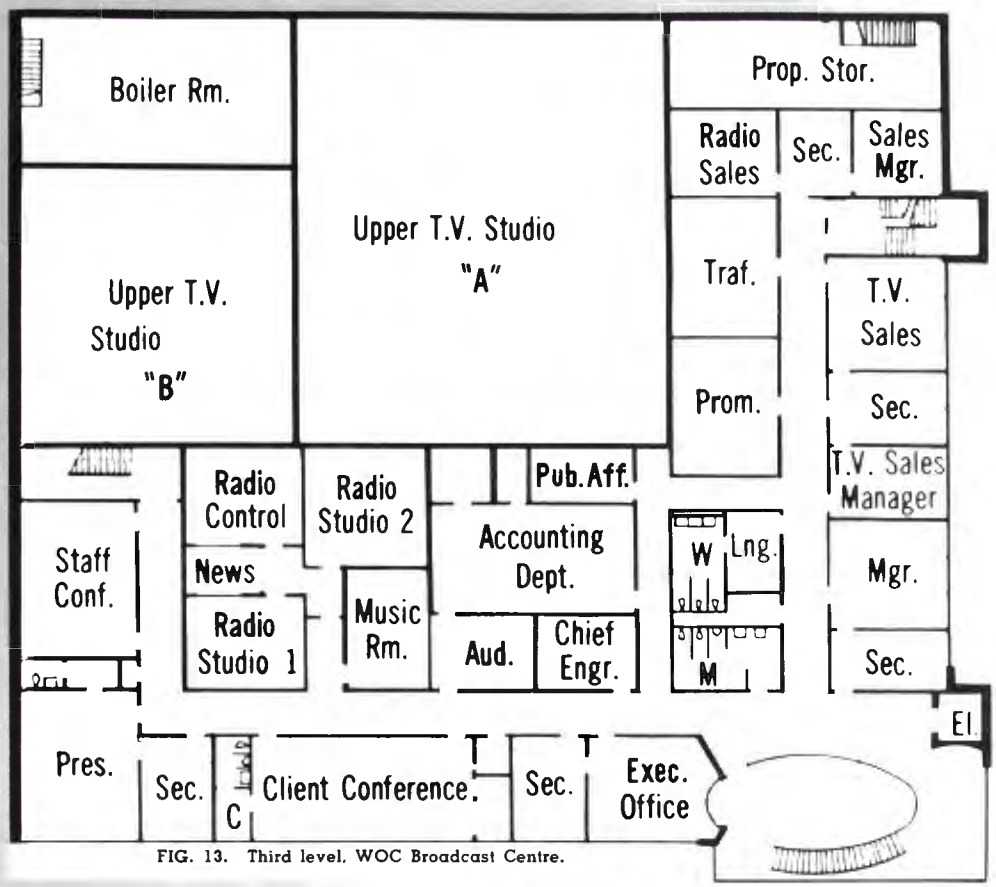


FIG. 13. Third level, WOC Broadcast Centre.

How the New WOC Broadcast Centre Aids in Production of Programs and Commercials

by VERN GIELOW, *Production Manager*

Our new WOC Broadcast Centre at 805 Brady Street, Davenport, Iowa is a dream come true for the staff of the AM-FM-TV operation. The structure is designed and tailored to handle production and programming efforts in proper sequence. Offices and operational areas are so situated they are in immediate proximity to each other This affords a traffic and operational flow for maximum communication.

Good planning places film and art departments across the corridor from TV master control The film director, also responsible for the TV tapes, uses roll carts to bring film and tapes to projection, just about twenty steps away from where they are prepared for use. And down the corridor from the film room the news department is conveniently located.

Largest Studio

Studio "A", measuring 70 by 75 feet, serves as the studio for most guest appearances. Here is located the permanent set for our homemaker's program, *"Especially for You,"* now in its 13th year. Inasmuch as this program has a variety of segments from exercises to music, much of this large studio is used for limbo settings to complement the various parts making up the half-hour Monday-through-Friday show.

This studio also serves as "home base" for most of our special programs such as *"Kaleidoscope,"* a weekly public service program; *"Our Wonderful World,"* a half-hour programmed each week on behalf of the Davenport Public School System; plus other programs scheduled on a regular or one-time basis.

Turntable for Auto Accounts

The vast expanse of Studio "A" serves an even more useful purpose in the development of commercials. This is particularly true in the case of automobile spot announcements. We have had a substantial increase in the number of automotive accounts since moving into Broadcast Centre last fall.

An 18-foot turntable situated in this studio provides a tool for creation of unique effects. Coupling effective lighting techniques with the revolving turntable produces a totally different commercial Needless to say, no other television station in our area can boast such equipment to create selling commercials.

Distinctive Image for Advertisers

We have found our "special effects" amplifiers particularly useful in positioning prices on a portion of the screen while products are being shown. While we have no hard and fast rule regarding the use of special effects, we do attempt to reserve a given technique to one account. This gives the client a look all his own, something identifiable with his business image.

Studio "B" in Daily Use

We use studio B for regular fixed programs. This includes weather, news, and sports, as well as a youngster's program, *"Cap'n Vern's Cartoon Showboat."* While Studio "B" is the smaller, it can rightfully be termed the workhorse studio because of its constant daily use. Sets here are permanent, allowing for rear screen projection in sports and news programs, outsized weather maps to show maximum information at a glance, as well as interview areas for sports. Smaller commercial sets are also maintained.

In this studio, microphones are permanently assigned, lighting is fixed, and formats governing production rigidly plotted. We feel this lends a continuity of presentation welcomed by viewers who look forward to basic programming each day. Special silicon-dimmed lighting boards are customized in each studio.

Convenient Prop Areas

Important to a retail department store operation is a warehouse; equally, to a television station, prop storage areas serve much the same function of having at hand immediately the countless items needed for daily and special programs. We have individual prop storage areas immediately adjacent to each studio, as well as a second floor prop storage area. A freight elevator serves to transport larger props to a basement area where there is more than sufficient storage area to accomodate items that might only be used once or twice a year. The WOC-TV prop areas are about twice the size of the studios, allowing for plentiful storage.

Two Complete TV Systems

From the production standpoint, the most versatile feature is the duplicate control facility. Each studio has its own matching control area including individual special effects amplifiers, audio boards, remote projection/VTR controls and switching gear, fully transistorized. It is possible to be on the air with a complete crew from one studio, while taping a separate program in another studio. By using the master switcher, it is conceivable we could tape two completely different TV programs at the same time, while airing yet a third.

An example of how well the duplicate operation functions is shown in a recent election returns presentation handled by WOC-TV. Election boards, election reporter, and the staff needed to compile the returns were situated in Studio "A". The returns were aired from this Election Centre by a crew from director to floormen completely removed from the regular staff on shift this evening. By using the flexible switching control in the master control area, the two directors were able to smoothly make the transition from one mode of programming to the other.

A typical instance was in our 10 p.m. news. The regular director on duty directed the customary newsman through his appointed ten-minute period. However, during the newscast, control switches were made so that the election crew could present its own individual report.

We have found this to be particularly useful inasmuch as we feel the normal director on duty has his work cut out for him through the usual flow of programming, without having to worry about special inserts for election reports. Conversely, to efficiently present election reports, the director and his group, in keeping information precise and fluid, had to keep their collective fingers on the pulse at all times.

TV Tape Efficiencies

Of any given RCA equipment installed in Broadcast Centre, the new transistorized TV tape machines have effected the greatest operational change. These two TR-22 machines are used for recording every afternoon, Monday through Friday, and three evenings during the same period for taping of weekend programs. By taping programs during the week, we save manhours for use at times other than weekends.

Another area of economy introduces itself in the production of commercials. We tape these commercials at our own convenience, for playback at times when we normally do not have cameras "hot." This helps cut down overtime and scheduling problems for the production and engineering staffs.

Through the use of the TV tape machines we are handling announcements in a way that takes all guesswork out of them. It is interesting to report that the staff is stimulated to try the more difficult or unusual in effects and techniques, with the knowledge they are backed-up by two TV tape machines.

FIG. 14. Production Manager Vern Gielow in announce booth, which looks into both studio controls.

TV Film Economies

The film projection room, with its two projection "islands," indirectly has created money-saving situations, too. We regularly produce promotion announcements on behalf of our daily motion pictures. When promotion slides are available to us, we use them. But should they not be readily at hand, we still-frame projectors to opening credits, using them in lieu of special one-time art pieces. The saving in art is considerable and we use this type of promotion almost daily.

As any newsroom should be, ours is busy almost twenty-four hours a day. With the largest staff in our market bringing in film, readying news in the fastest manner possible, technical aids are of great help to the newsmen. One of the handiest is stop-cue leader in motion picture footage used in newscasts. This simple application of foil to the film permits automatic stopping of motion picture footage at precisely the frame desired by the newsman. This permits placing of all newsfilm for any given show on one reel. By using blank leader and stop-cue technique, newscasts are more foolproof, plus giving valuable time to the projectionist and directors who ordinarily would have to concern themselves with not only starting a film on cue, but ending it, too.

FIG. 15. Studio "A", 70 by 75 feet, contains permanent set for homemaker's program, which has variety of segments requiring many limbo settings.

FIG. 16. New transistorized TV tape machines produce new and more efficient operational procedures in production of programs and commercials.

FIG. 17. Control for Studio "A" (shown) is identical with Studio "B". Both feature TS-40 custom-built switchers with special effects. Note transistorized audio control at right.

FIG. 18. Typical on-the-spot area news coverage by WOC team. This mobile unit—one of seven—is equipped with 2-way radio and monitors for emergency frequencies. It includes inverters for operation of sound cameras.

FIG. 19. Spot news recording center, which permits recording off telephones, 2-way radio, or from News Booth control. Equipment includes RT-7 Cartridge Tape machines and NBC Hot-Line alert receiver.

FIG. 20. News Broadcast Booth. Here the seven mobile units can be contacted and reports may either be put on-air "live" or recorded. (Newsmen use hand-carried 2-way radio units for places not accessible to regular mobile units.)

WOC News Operation

In the area of public service, WOC endeavors to act as a contributive citizen of the community. Its local news activity is a major effort in this direction. This is spearheaded by a 12-man news team, rendering more than 30 live newscasts a week on TV, and more than 70 per week on radio.

News Organization

The WOC news staff covers one of the most complex market areas in the United States, spanning five major cities and numerous suburban towns in three counties and two states. Twelve full-time, professional newsmen are complemented by a large staff of correspondents throughout Eastern Iowa and Western Illinois. In addition to their news-gathering and airing activities, WOC newsmen provide in-person newscasts to a large number of civic club meetings each week. Other clubs, as well as key buildings and gathering spots throughout the area, are provided with a WOC Noon Newsletter each weekday

FIG. 21. Houston Fearless 16mm reversal film processor is part of News Dept. facilities. Dark room adjoins the processing room.

TV News Department

The WOC News Room is conveniently located on the second level of the WOC Broadcast Centre. It is adjacent to television studio "B" from which newscasts are made. The news set is equipped with rear screen projection.

The news department has a complete broadcast booth within its operating area. Equipment includes control consolette, 2 microphones, 6 tape machines, on-air "interview" telephone, portable tape recorder, and 2-way radio contact with 7 mobile units. In addition, the news department also has a recording center for taping interviews and news programs.

FIG. 22. Nerve center of WOC news room. Microphones on desk provide contact with mobile units. Twelve receivers on wall shelf monitor area emergency frequencies. (Spot news recording is at right. This rack is duplicated in the studio, and tapes in both racks are remotely controlled from the studio consolette.)

Technical Facilities Feature Solid-State Equipment and Make Provision for Color

by DAVID HAUSER
Chief Engineer

When new AM and TV facilities were being planned, WOC wanted more than just improvement. We had been a pioneer in television, having built studio facilities prior to telecasting in October, 1949. Now we wanted what RCA calls the New Look. We wanted the latest and best for our new WOC operation.

"New Look" Planning

The engineering staff decided at the outset to get as much solid-state equipment as possible, from the TS-40 vertical interval switching to our 108-kw lighting boards. Our belief that this equipment would be relatively maintenance-free has been borne out by the fact that after nine months on the air we have replaced only three transistors in the two TR-22 tape recorders.

To avoid the cluttered look common to control rooms, and to make a room attractive as well as efficient, we gave a great deal of time and effort to planning the layout of the controls, procuring housings to blend with the equipment. This is shown clearly in the delegate housing for the TV tape machines and the delegate housing for the film projectors. All speaker enclosures, tables, and desks in the control room are walnut, or walnut-grain Formica to add the decorator touch.

All monitoring speakers in both AM and TV are identical. While a minor point, this does avoid the necessity for getting accustomed to a different sound when going from one operation to another.

Thermopane doors separate the projection room from TV master control. These provide a sound barrier when closed, yet permit full view of the master control room.

Planning For Color

Along with our solid-state equipment we decided to start our basic color system with the TK-26C. Sponsor interest in color films and spots has justified our decision. We have a complete color island for programming movies and slides.

We have provided outlets for color cameras in the studios. Draperies, lighting and the rubber tile floor were selected with live color programming in mind.

We have also left rack and console space in TV control for additional color equipment. Our switching system is designed for color.

FIG. 23. Newest RCA 4½-inch TV camera is symbol of the good picture on WOC—produced by a combination of modern equipment and capable staff.

FIG. 24. Master Control in foreground, Studio "A" control in rear. Station breaks are handled at MC when "A" and "B" sub-controls are unmanned. All operations and switching can be done at MC when no live programming is going on.

FIG. 26. Close up of Studio A Control showing custom built TS-40 vertical interval transistorized switching and effects panel. Control desks are walnut grain Formica to give added touch of prestige. Each sub-control contains 14 monitors.

Film Facilities

We also have a TK-21 Film Camera on our color island, and another TK-21 on the black and white island. Both black and white and color cameras have 16-inch monitors which permit the projectionist to see what is being fed into the cameras at all times. We have a fourth 16-inch monitor that permits the projectionist to view the output of sub-control A, B, master switcher, network, or any one of 15 other sources.

Our delegate system in the projection room permits us to delegate control of all projectors and slide projectors to either sub-control A or B, or Master Control. This allows us to make station breaks from the master switcher when both sub-controls are off.

Duplicate Sub-controls

Except during periods of live programming, both sub-controls are shut down and all operation and switching is done from the master video control console with our custom-built TS-40 one-step, pre-set audio-video switcher. One man can easily handle the entire operation.

FIG. 25. Chief engineer David Hauser at custom-built delegate control in projection room. Top switches operate intercom. Upper large switch delegates film projectors and slide projector on TP-11 island to "A", "B", or Master Control. Lower large switch delegates projectors and slide projector on TP-15 (color) island to studio controls. Bottom row of push buttons is WOC house monitoring system, to punch up any of 15 video sources with matching audio.

FIG. 27. Transistorized TR-22 TV Tape machines are symbol of WOC plan to procure as much solid-state equipment as possible in new Centre.

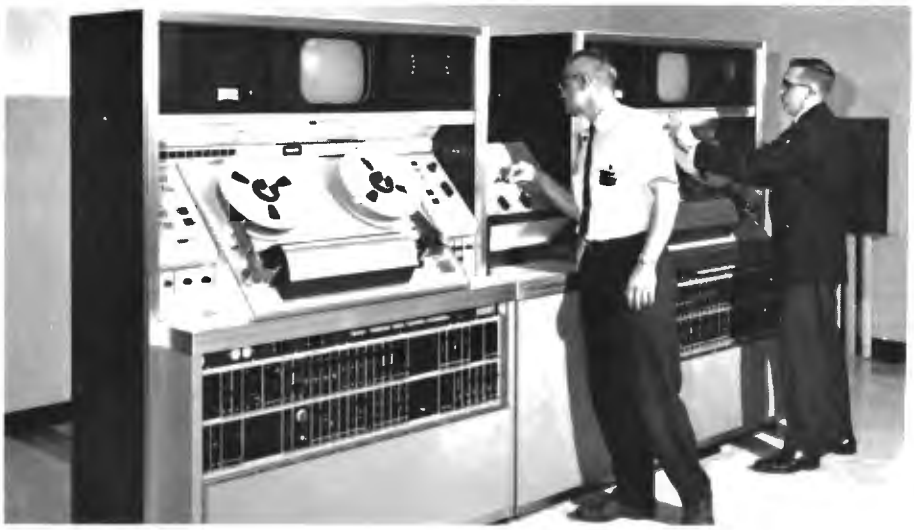


FIG. 28. Special TV tape delegate control was designed and built for WOC. Note that housing blends with RCA tape recorders.

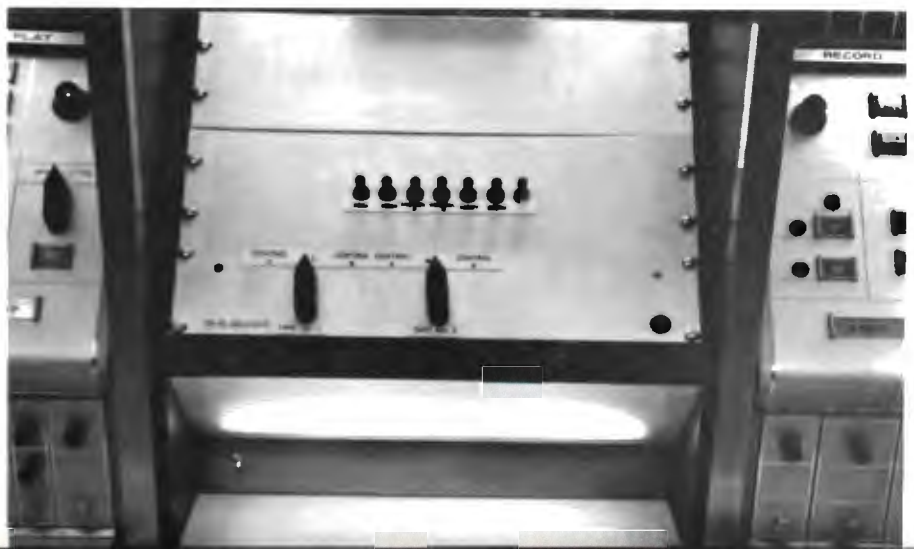


FIG. 29. Studio "A" includes 18-foot turntable with two mikes and a-c outlets. It will run up to 2½ rpm in either direction.

Both sub-controls have identical TS-40 custom-built switchers with special effects. Any camera or tape machine can be switched up on either, or both switchers. The TR-22's are fed both composite and non-composite so that they can be operated in a pix-lock mode. We also feed non-composite network so we can gen-lock with network.

Solid State Audio

The heart of the audio system of the sub-controls is the BC-7 solid-state console. Sub-control A also has the BCM which gives us a greater number of mike channels. Both studios can be controlled from either sub-control.

Of our 15 cartridge machines, TV control has six: Two each in master control, sub-control A, and sub-control B. These have proved to be a great aid to smooth production, being fast and simple to operate and extremely reliable.

Features of Studio Facilities

Studio A is 75 by 70 and 28 feet high. The lighting grid is 15 feet from the floor. We have 72 kw of power available from the lighting board. By swapping non-dim and dim circuits from the other studio we can have 72 kw of dimming. We are presently using 100 foot-candles of light, but plan to cut this down because of the high sensitivity of the RCA 7295-B used in the TK-60's.

We have an 18-foot turntable in Studio A which will run up to 2½ rpm in either direction. The turntable has two mike outlets and two a-c outlets in the center. The mike outlets are fed thru pools of mercury and the a-c outlets by slip-rings.

On either side of Studio A electrically-operated roll-up doors open to the prop storage areas which also serve as sound locks for auto drive-throughs. These areas, in turn, have large doors to the outside, enabling us to drive cars thru the studio. One prop storage area has a freight elevator to the basement, giving additional storage space.

FIG. 30. One of three BC-7 transistorized audio consolettes in new WOC. This is sub-control B. Included are two cartridge tape units and turntable.

FIG. 31. Rack equipment in control room includes BA-33 Transistorized Audio System and three TS-40 Transistorized Switching Systems. (Provision has been made in switchers to accommodate 4 live color cameras, color film chain, and another TR-22.)

FIG. 32. WOC-built house monitoring system distributes 15 video sources to 15 offices and special areas. At left, are new RCA TA-24 Transistorized DA's (Pulse and video distribution system are completely solid-state.)

Both studios have double wall construction.

Studio B is 45 by 45 with 28 foot ceiling. A 36-kw lighting board is used for weather, news, sports and cartoon shows. Both studios are connected to the custom-built house monitoring switcher, permitting studio personnel to punch up, from the studio, whatever video source they wish. This has proved to be a great convenience.

There are sufficient outlets in both studios to operate all four TK-60's in either studio.

Modern Installation

All video wiring was done with the latest type of double shielded video cable and solderless connectors except for the center conductor. The audio blocks are of the latest solderless type, giving a neat, trouble-free connection. Audio distribution amplifiers are the BA-33, of which we have 35 in our Broadcast Centre. TV audio is solid-state throughout.

The pulse and video distribution are completely solid-state, using 24 of the new TA-24 Pulse Distribution Amplifiers and 80 TA-23 Video Distribution Amplifiers. The control room now has 28 racks with space for an additional 14.

FIG. 33. Two islands of film equipment at WOC. Each is equipped with two film projectors and a slide projector. Island at left handles black and white. Island at right handles color as well as black and white.

▲ FIG. 34. WOC Radio Master Control. Equipment includes turntables, disc-cutting units, reel-to-reel tape and cartridge tape. Entire radio operation is transistorized.

FIG. 35. WOC custom built combo console in radio studio No. 1. RCA transistorized audio tape machines and control console are employed. ▼

Complete Radio Centre

WOC Broadcast Centre is a production facility for all aspects of broadcasting including AM and FM radio. The staff-planned layout includes one large radio studio, a combo studio, and master control. There are also an announce booth and a news room. This complete radio production area, together with accompanying offices and conference room, is located on the third level. The radio operation, as the TV audio, is completely solid-state.

WOC was granted its call letters on Feb. 18, 1922, and then began, under Col. B. J. Palmer an enviable record in the new industry.

Many ideas in programming were pioneered by WOC.

In 1924, WOC took its first program from WEAF in New York City. This was the beginning of network broadcasting. Later, in the same year, WOC joined the newly formed National Broadcasting Co., as the first affiliate west of the Mississippi.

WOC's radio personalities program 19 hours of information, news, good music and special events daily.

FIG. 36. AM and FM Radio and TV transmitter installation. Radiating 100 KW on Channel 6, WOC produces highest signal strength in the area.

FIG. 37. WOC Director of Engineering Paul Arvidson who planned and installed the new WOC transmitter facilities.

Transmitter Installation

In 1961, WOC installed new transmitter facilities as part of the master plan of providing maximum service to the Quad-City area.

The site of the WOC transmitter plant is Pleasant Valley Township, northeast of Davenport on ground owned by the Palmer Broadcasting Co. Here a 3-tower array propagates radio signals, while a fourth tower 1200 feet above average terrain propagates the TV signals.

At the time this new TV tower was completed in October 1961 a building was also constructed to house all new RCA transmitting equipment installations.

In the accompanying photograph (Fig. 36) are shown the three transmitters (at left) 5,000 watt AM radio transmitter (at right) 10,000 watt FM radio transmitter. In the center is the 25,000 watt TV transmitter installation which, together with the gain of the antenna, radiates 100,000 watts on Channel 6.

With the completion of the new Broadcast Centre, as well as the new transmitter facilities, WOC has completed the final step to provide the finest possible service

FIG. 38. In 1961 the new transmitter building was completed. New equipment, all RCA, was installed. Foreground tower radiates TV signal. Three tower array in rear radiates AM signal.

Creation of a WOC Local Commercial

"WOC Broadcast Centre allows closer liaison between agencies, marketing people and our sales staff," stated Harold Heath, Television Sales Manager. "The ultimate goal of our efforts is sales results for the advertiser. Therefore, the most modern equipment, operated by knowledgeable technicians and production personnel, is of vital importance to our sales effort."

The WOC-TV sales approach is one of enthusiasm for the television broadcast industry it helped to pioneer in 1949. Nationally represented by Peters, Griffin, Woodward, Inc., the WOC sales staff concentrates on local and regional clients. Through past years there has been a steady increase in the number of area clients using WOC-TV as a sales medium.

FIG. 39. WOC-TV account executive Ran Jensen discusses ideas with client Bob Neal, Rock Island, one of the nation's top nine Ford dealers.

FIG. 40. WOC-TV writer gets copy points, checks approach to best strengthen client image, create sales.

FIG. 41. Production conference: director, copywriter, film director, account executive, floor manager and technical director discuss video-taping.

FIG. 42. On camera! Bob Neal and seven cars are featured in a commercial shown during the Sunday night color movie sponsored by Sumption Ford Sales.

FIG. 43. Two minutes after taping, commercials are reviewed on one of the two RCA Deluxe TR-22 tape installations in the WOC-TV control room.

Client Promotion

Following no cut and dried formula for merchandising, the Promotion Department evaluates the needs of the client in getting the best results from a WOC Radio or Television schedule. Sales letters on WOC letterhead or 4-color printed stationery, jumbo post card mailings, telegrams, wrappers and window banners, etc., are some of the materials prepared to merchandise a client schedule. Each month more than 2000 key market people in the area are alerted to the products and promotions featured on the WOC stations through a merchandising publication called the "Tele-Log."

FIG. 44. Each week the color film feature gets extra promotion in the dealers show-room. Poster displays photos, holds film calendars prepared by WOC-TV Promotion Department, under Dorothy Boyd.

FIG. 1. Deluxe RCA recorder, TR-22, equipped for high-band operation, is shown at right in this 1964 NAB Convention photo. More than 20 RCA recorders, high-band equipped, have been delivered to international customers.

HIGH-BAND TELEVISION TAPE RECORDING

A New Method of Operation Which May Become One of Tomorrow's TV Taping Standards

by H. H. KLERX, *Mgr., Electronic Recording Products Merchandising*

At the 1964 NAB Convention, RCA demonstrated a TR-22 deluxe recorder equipped for high-band operation. Since that time, a considerable amount of interest has been expressed in high band as a new method of producing color and monochrome tapes of particularly high quality.

The term "high band" refers to a television tape recording system with capabilities for superior technical performance. The high-band system is a quadruplex recording system, similar in principle to the present quadruplex system. However, because it uses a higher carrier frequency than the present standard, tapes made on high-band machines can be played back *only* on high-band machines using a common high-band standard.

High-Band Operation of RCA Recorders

The technical innovations in the TR-22 deluxe recorder and new TR-3, TR-4 and TR-5 equipments today offer a significant improvement in picture quality, and at the same time permit all of these to be readily adaptable to high-band operation.

Many of the new circuit techniques needed for high band are already a part of the TR-22 RCA is delivering today. These circuits are also designed into the TR-3, TR-4 and TR-5. Conversion equipment will be made available for all earlier model TR-22s in operation. This means that every transistorized recorder that RCA has ever built can be adapted for high band. For TR-22s, high band takes the form of a third mode of operation which is added to monochrome and color modes already built-in. For the TR-3, TR-4 and TR-5 the high-band mode can be selected as a second mode of operation.

Benefits of High Band

1. Reduction of the moire pattern (beats inherent in current color tape recordings made to existing color standards).

TR-4 Compact Recorder

TR-3 Playback Special

FIG. 2. All of these transistorized TV tape recorders include new circuits needed for high-band operation. For TR-22's, high band is a third mode of operation which can be added to monochrome and color modes already built-in. For the TR-3, TR-4, and TR-5 the high-band mode can be selected as a second mode of operation.

TR-5 Mobile Recorder

TR-22C Deluxe Recorder

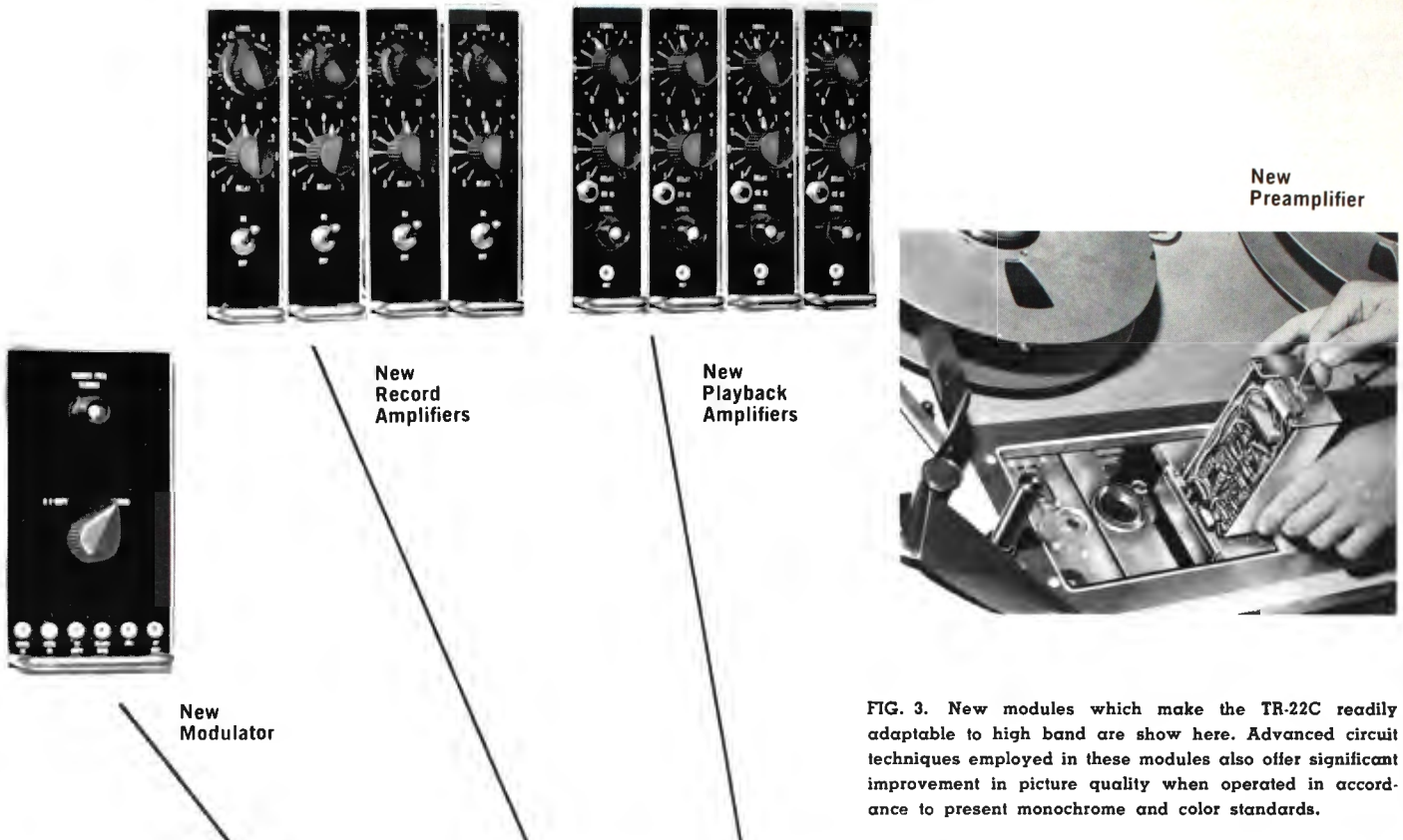


FIG. 3. New modules which make the TR-22C readily adaptable to high band are show here. Advanced circuit techniques employed in these modules also offer significant improvement in picture quality when operated in accordance to present monochrome and color standards.

2. Reduction in intermodulation components (with resulting picture quality almost indistinguishable from the original signal).
3. A significant improvement in signal-to-noise ratio.
4. Increased bandwidth capability.
5. Improvement in differential phase and gain characteristics.
6. Improved "K" rating (transient response).
7. Possible standardization on a single mode of operation for both color and monochrome recording.

All of these benefits are not directly related to the selection of new carrier and deviation standards. Recent advances in the state of the art offer significant improvements in the areas of the record and playback amplifiers, headwheel preamplifier, modulator and demodulator, as well as in basic headwheel panel design. These factors make important contribution to the overall system performance capability that high band has to offer.

Applications of High Band

High-band recording is today being seriously considered in operations where:

1. Finest quality tape reproduction is mandatory for in-house recording and compatibility is not a factor.
2. High-band masters may be made to achieve second generation video dubs (with as good quality as masters made by conventional methods).
3. Tape to film transfers are made.

Origin of High Band

The origin of RCA high-band operation may be traced back to early efforts between RCA and BBC to develop a universal international recording standard, which would provide the best possible monochrome and color recording capability. After much engineering effort, such a system was achieved using new techniques now called high band. More than 20 of these RCA systems have been delivered to international customers to date. Because in the international market, color standards are not yet established, high band is now being considered as a universal mode of operation for both color and monochrome recording.

A High-Band Standard for the Future

The possibility of establishing high-band operation as a standard may be viewed as a long term objective, since both color and monochrome standards are already in use. However, it is an attractive possibility because high band offers a significant improvement in overall tape operations with essentially no compromises made in color and monochrome reproduction.

To date there are over three hundred transistorized RCA Television Tape Recorders in use throughout the world. Every major network, both in this country and abroad, plus many leading independent organizations now have basic facilities which can be readily expanded to high-band operation. Today's RCA transistorized recorders have built-in high-band capability. However, only when all tv tape facilities in existence are capable of recording and playing back to a common high-band standard, will tape interchangeability exist.

Technical Notes

To achieve the design objective of the RCA high-band system, careful consideration was given to all system operating parameters. Carrier frequency and deviation were selected to obtain the best balance between signal-to-noise, moire and video bandwidth.

The principal areas in the TV tape system affected by high-band operation are (1) the FM system and (2) the headwheel panel assembly.

The FM system of RCA transistorized recorders is converted to permit the use of more favorable carrier and deviation frequencies (domestic 6.1 to 7.9 mc; international 7.2 to 9.3 mc). The main purpose of this conversion is to reduce moire inherent with the current color deviation standard. In addition, circuit improvements reduce beats due to intermodulation distortions. Increased deviation, plus better pre-emphasis characteristics provide an additional improvement in signal to noise (the order of 6 db).

The choice of international and domestic proposed high band deviation standards were dictated primarily by the 4.43 color sub-carrier (international) and 3.58 color sub-carrier (domestic). Related effects on differential phase, gain, video bandwidth, and minimum moire (beats) were also factors.

In addition to changes made to the FM system, further design improvements are made to the headwheel assembly in order to achieve a universal headwheel directly interchangeable with all RCA recorders in use today. Notable improvements in this area are increased sensitivity, and significantly reduced cross-talk.

Specific changes in electronics needed for high-band operation include:

1. extended FM bandwidth
2. raised head resonance frequency
3. extended discriminator frequency range
4. new playback equalization
5. new reference crystals
6. new pre- and post-emphasis
7. improved intermodulation performance in amplifiers.

To meet the above requirements the following modules have been completely redesigned: (see Fig. 3)

1. new recording amplifiers
2. new pre-amplifier
3. new playback amplifiers.

These new modules are already a part of the RCA TR-22C, TR-3, TR-4 and TR-5.

PERFORMANCE OBJECTIVES OF THE RCA HIGH BAND SYSTEM

Description	Domestic	International
Signal-to-Noise	46 db	43 db
Moire	3%	3%
Differential Gain	5%	5%
Differential Phase Note: IEEE Test Signal off Tape	5 degrees	5 degrees
"K" Factor Note: Using .25 microseconds sine squared pulse	2%	2%
Video Bandwidth	5 megacycles ±1½ db	5½ megacycles ±1½ db

HOW THE TK-22 GETS THE BEST FROM MONOCHROME FILMS— EFFORTLESSLY

"New Look" Transistorized Film Camera Features 1½-Inch Electrostatic Focus Vidicon Tube, Interchangeable Modules and New Automatic Control System

by NORMAN P. KELLAWAY
Broadcast Camera Engineering
and JOHN C. ADISON
Broadcast Studio Merchandising

The TK-22 Monochrome Film Camera is the first of a series of cameras to utilize interchangeable plug-in modules and to provide the benefits of advanced transistor circuitry. Entirely new in concept, it incorporates many important technical advances and operational features to meet the demands of today's fast paced film programming. A highly developed automatic control system simplifies operation without compromise in picture quality. The TK-22 sets new standards in performance and stability to provide the very best in film and slide reproduction.

Transistorization Advantages

The new TK-22 Camera uses semiconductors throughout; the only vacuum tube is the vidicon. This exclusive use of transistors provides a high degree of reliability and significantly reduces maintenance requirements. It also provides freedom from microphonics and high stability. Heat generated by transistors is negligible and power consumption is reduced to a new low. In total performance, the result is dependable operation over extended periods of time with a minimum of technical attention.

Smaller size and reduced power consumption permits concentration of circuitry at the "camera-head" position,

FIG. 1. Small size and low power consumption allows concentration of circuits at the camera head position.

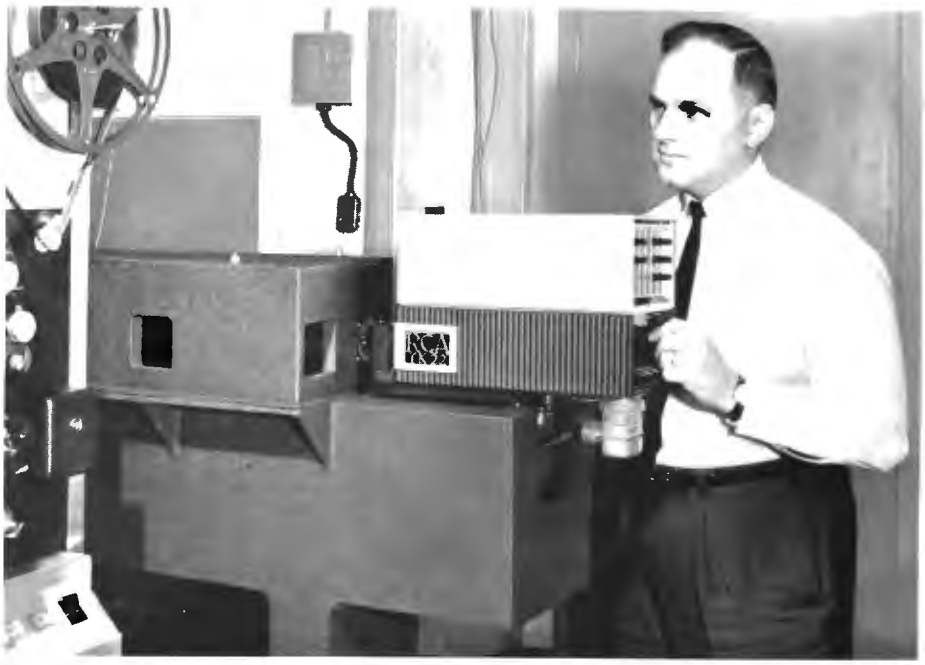


FIG. 2. TK-22 Camera installed on a TP-11 Multiplexer. Complete set-up adjustments can be made from this location.

allowing the remaining circuitry required at the rack and console positions to be kept to a minimum. Operating controls are restricted to passive circuits which are unaffected by time delay, frequency response, insertion loss and other transmission line characteristics. Use of only passive components here increases the reliability of the equipment at the control position.

The TK-22 camera may be set up completely at the camera head independently of the control position, see Fig. 2. The grouping of functions and circuitry into one equipment unit not only saves time for the technician, but permits him to do a consistently better job of equipment maintenance.

One of the major design goals was to improve the stability of the system to the point where basic setup and adjustment becomes a routine maintenance procedure practiced monthly instead of daily. For the setup to be independent of the control location, circuits were developed to operate from d-c controls. Motor driven controls have always been available, but require an inordinate amount of equipment to do the job. However, as discussed in detail later, a video processing system using pulses is employed. This system is based on the application of the transistor as a d-c control device. The d-c controls in the TK-22 produce changes in both amplitude and polarity of the control pulse. Cable lengths are no longer critical when using d-c transmission.

FIG. 3. Camera modules are of the standard plug-in type and interchangeable with many of those used in new live and film color cameras.

FIG. 4. Closeup of the rear of the camera head. The plug-in module bank is located at top and a set-up control panel at the bottom.

FIG. 5. TK-22 camera mounted on a TP-15 multiplexer shelf. Note that auxiliary electronic equipment can be mounted in the base.

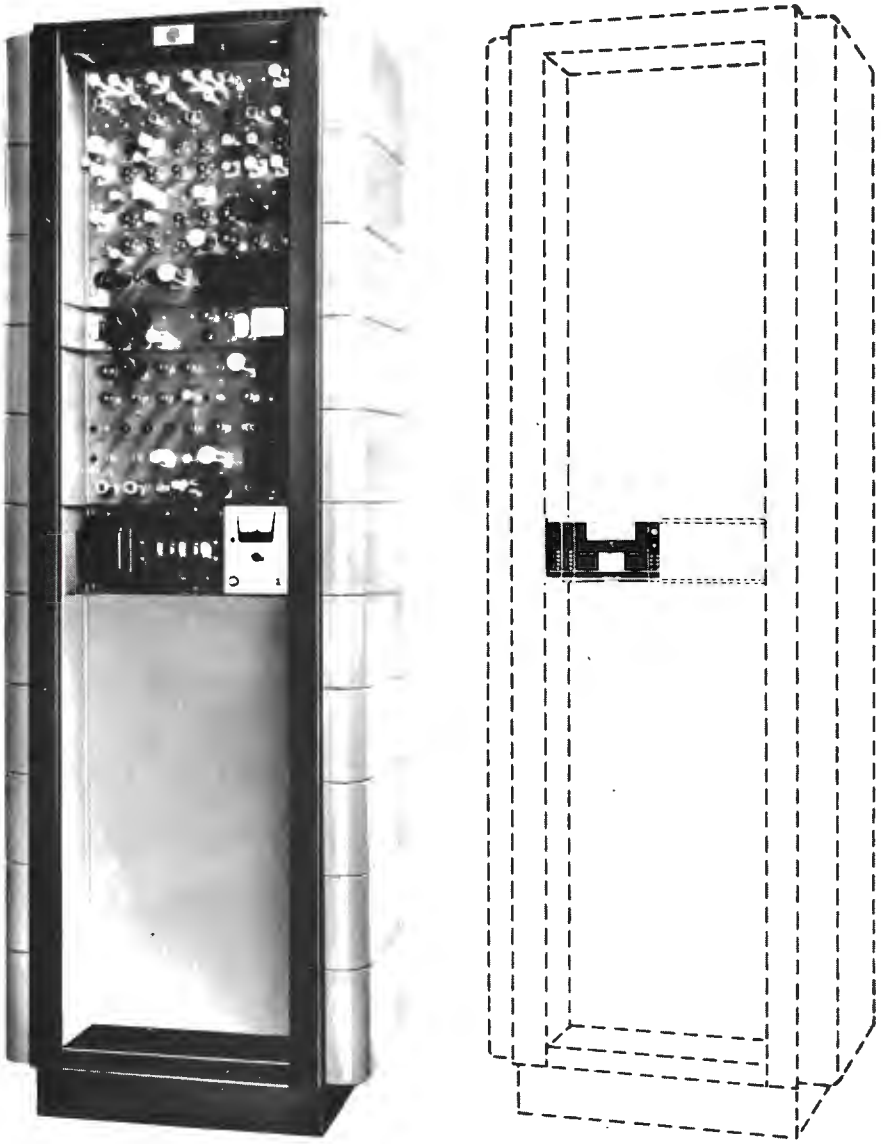


FIG. 6. The auxiliary equipment for the TK-22 (right) now occupies only 5½ inches rack height (one half standard rack width). Cabinet at left shows rack space required before transistorization. Deflection and processing circuits included here are now in the camera head.

New 1½-Inch Electrostatic-Focus, Magnetic Deflection Vidicon

The new RCA 8480 vidicon is designed specifically for the TK-22 film camera and is a major factor in its performance. Focus stability is achieved simply by operating the elements of the electron optical system from a common voltage source (proportionality of voltages between elements is therefore held constant). This is considerably more simple than the all-magnetic system formerly used. Eliminating the focus coil and its regulated current supply drastically reduce the power consumed and space required by the vidicon. The flatness of electrical focus and shading, excellent geometry, and reduced deflection power are other features of this new tube.

Film Camera Stabilizing Techniques

From the broadcaster's viewpoint, one of the most important features is stability of the camera equipment. This feature depends not only upon the basic design of the film camera itself, but on the operation of film projection equipment and the exact operating characteristics of the vidicon tube and other components. Therefore, in the design of the TK-22 film camera, circuits are included to account for the operation of associated equipment.

Looking at the overall film camera system, possible sources of instability can be classified into these parts: 1) film characteristics, 2) vidicon characteristics, and 3) the basic electronic circuitry of the film camera (stability in this part of the system must be inherent in the basic design).

The video system of the TK-22 has been designed to deal with all categories effectively. The following presents technical descriptions of stabilizing systems such as automatic sensitivity, automatic black level and automatic white level controls provided in the TK-22 design, as well as a description of the basic camera circuitry.

FIG. 7. Closeup of the auxiliary equipment used with the TK-22 Camera. A remote control panel is located at this position.

Film and Projector Considerations

The vagaries in characteristics of all types of films such as average density, gamma, contrast range, grain size and limiting resolution are the most difficult variables to be handled.

Vidicon Characteristics to be Considered

The second part of the system, the vidicon, is a thermionic device having its own variable characteristics that must be taken into account. These include the short and long time variations of beam current, focus drift, dark current changes with temperature, target voltage and shading.

Automatic Control Circuits

Three automatic control circuits have been added to overcome stability problems in both the basic film and vidicon areas:

1) *Automatic Sensitivity Control (ASC)*
Adjusts for the variations in highlights of film and the variation of sensitivity of the vidicon with temperature and age. Control of sensitivity may be accomplished by maintaining constant light into the system and fixing the operation of the vidicon or by allowing the light to vary and raising or lowering the vidicon target voltage to maintain a constant output.

2) *Automatic Black Level (ABL)*
Takes the darkest part of the scene and sets it at a predetermined black level. This is the first step in the process of handling the variable contrast range of films. Automatic Black Level eliminates the effect of "dark current," a peculiarity of the vidicon as target voltage is adjusted or as temperature changes. These changes produce corresponding undesirable changes in the background of the picture.

3) *Automatic White Level (AWL)*
Samples the highlight in the picture and adjusts the gain of the camera's video system to provide the proper peak white level.

The ASC is a closed loop that maintains a constant peak level into the processing module. The combination of the ABL and AWL establishes peak black and white levels and with the introduction of gamma correction matches the contrast range of the film to the contrast range of the television system.

Design of a Stable Video Gain Stage

Fundamental to the overall stability of any system is the stability of each stage required within the system. Thus, the video amplifier configuration must produce a stable, predictable gain relative to the design goal established for total system stability. In the video amplifier for the TK-22, gain stability and predictability have been achieved in a variety of ways. Wherever possible, the individual amplifying stages make use of the feedback pair shown in Fig. 8; also, the video amplifier incorporates a series of gain stages whose individual gains and bandwidths are both predictable and stable.

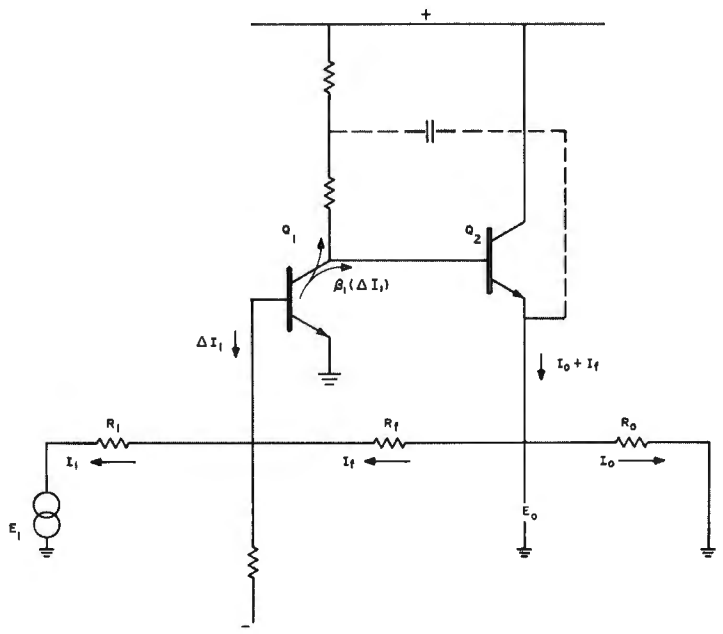


FIG. 8. Video feedback amplifier used extensively in the TR-22 Tape Recorder has been adapted in the camera design. Some variations have been added to enhance performance.

The effect of the video amplifier current feedback from the emitter of the second transistor to the base of the first transistor lowers the input impedance to a fraction of an ohm. The input current I, is then determined by the input voltage divided by R_i. If the betas of the transistors are high, only a very small amount of signal current, I_i, flows into the base of the first transistor.

The product of this base current and the current gain of the pair, (I_1) (B_1) (B_2) supports the sum of the currents I_f and I_o. (Emitter current of Q_2).

If the betas of the transistors were infinite, the voltage gain would be:

$$\frac{I_f}{E_i} = \frac{I_i}{R_f} = \frac{E_o}{R_i}$$

Further, the current gain would be:

$$\frac{I_o}{I_i} = \frac{I_o}{I_f} - \frac{R_f}{R_i}$$

For practical betas, as the current gain is raised, the loading is reflected back through the transistors to cause an increase in the base current of Q_1. This subtracts from I_i and the voltage gain reduces.

For low-level stages, gain-bandwidths of 100 mc are possible; for higher level stages, the collector resistance of Q_1 must be lowered to raise the quiescent currents and voltages. Signal current at the collector of Q_1 should, if possible, flow only to and from the base circuit of Q_2. To offset the loss of signal current to the collector resistor of Q_1, "bootstrapping" is utilized which raises the impedance of the collector and restores the original gain expressions.

Other factors which determine the choice of transistor types include, but are not limited to beta vs frequency effects, staggering of cutoff points within the feedback loop, and distributed capacitance effects.

TK-22 VIDEO SYSTEM

Preamplifier

Figures 9 and 10 illustrate the video system operations performed in the TK-22 monochrome film camera. Briefly, the preamplifier has an overall current gain of 10; this takes into account a current gain of 1000 ahead of the high peaker. The peak current out of the vidicon, which corresponds to peak white, produces a peak negative signal; zero signal current (neglecting dark current) represents black. A single inversion within the pre-

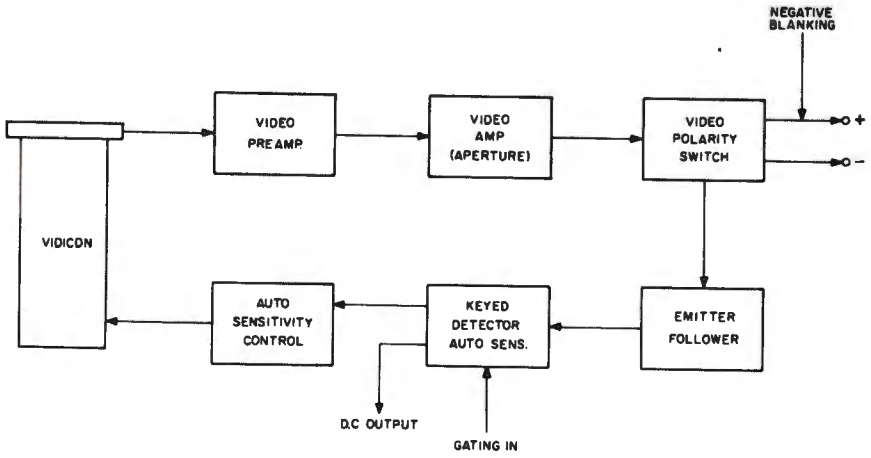


FIG. 9. The automatic sensitivity control (ASC) in a closed loop, the operation of which relies on phased video gain from the vidicon output to the keyed detector input. Any variation in peak vidicon output is offset automatically by the ASC.

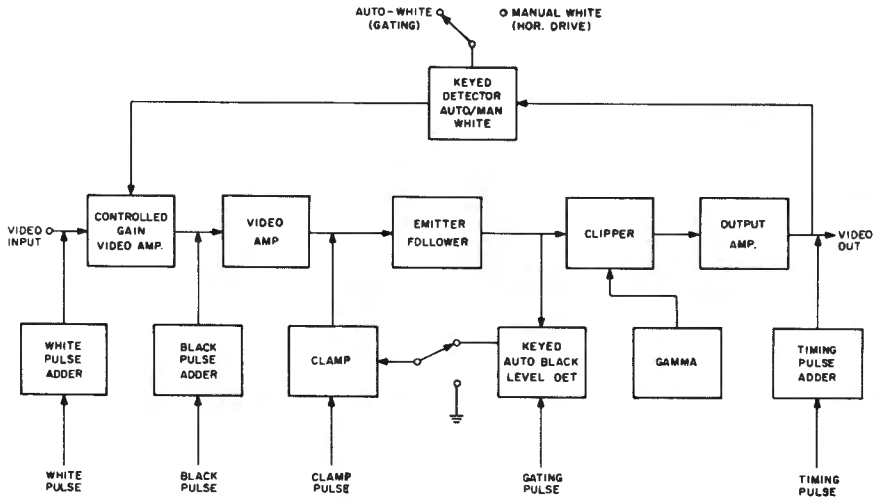


FIG. 10. TK-22 video processing diagram. Video white level is held constant by the primary keyed gain control loop (top). Video black level is held constant by secondary gain control loop (bottom center).

amplifier, combined with the overall gain described above, delivers to the video amplifier module a signal that corresponds with the output of the least sensitive image orthicon.

Input-Stage-Video Amplifier

The low-input impedance (only a fraction of an ohm) provides a convenient means of physically separating the video preamplifier from the video amplifier. Because both positive and negative films are used, a polarity switch, which can serve as a special effects device, is provided.

The video amplifier is also used with the TK-42 Color Studio Camera's image orthicon pickup tube. The low-input impedance serves as an excellent current sink and eliminates the need of a high peaker.

Gated Detector

The gated detector samples the peak-to-peak video signal level with a pulse that ignores the edge effect encountered in scanning the vidicon. With light falling over an area exceeding the scanned portion, the unscanned photosensitive surface of the vidicon becomes a very low impedance; thus peak target currents exceeding peak white develop at the boundaries of the scanned area. Without gating, spikes occurring at the edges of the video signal (both horizontally and vertically) instead of the scene content of the film would operate the system. The detector is followed by a d-c amplifier which amplifies small deviations from the nominal 0.7 volts output.

Gain Stabilization

Although gain is required in the video processing system (see Fig. 10), the term "processing" is applied because the following electrical modifications are made to the video signal to enhance its reproduction:

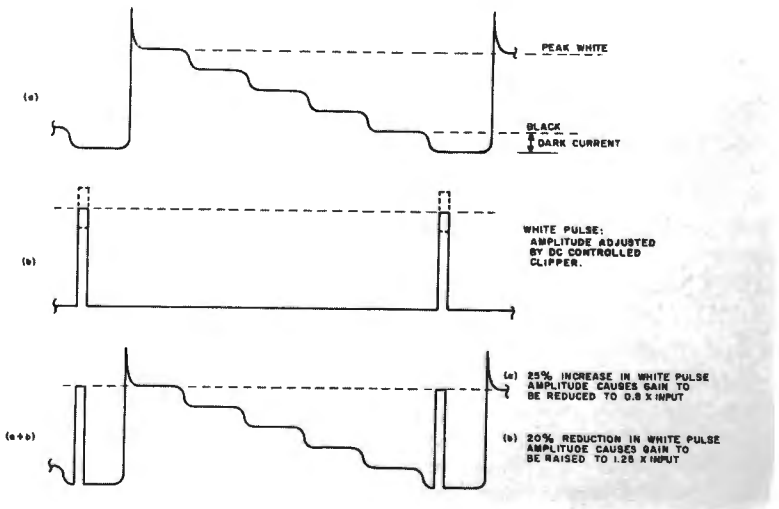
1) Gamma (film) Correction
2) Automatic Manual Black Level
3) Black Pulse Insertion
4) White Pulse Insertion
5) Automatic Manual White Level

To stabilize the overall gain of this part of the system, it is necessary to consider the stability of the individual blocks of the system.

White Level Control

The gain control device used in the white-level adjustment circuit is a photo-

FIG. 11. Waveforms showing addition of a white pulse for manual operation of the white level control loop.



voltaic cell packaged with a lamp in a TO-5 transistor case; the resistance element and lamp leads are brought out individually. A pair of these devices is used as the feedback element (Fig. 8) of the controlled gain video amplifier stage. Speed of response of the lamps is a few milliseconds, and the frequency characteristics of the resistive elements are excellent. To offset any temperature instability, the control device is included within a feedback loop.

The white-level feedback-loop waveform shown in Fig. 11a is a grey scale of five steps. (For convenience it is shown here to be five equal steps.) The negative portion of the signal is the horizontal blanking interval (it is during this time that horizontal retrace takes place and the vidicon target is electrically turned off). This interval is just less than 10 microseconds. White spikes that may develop at the edges of the picture are cropped when wider system blanking is added in the auxiliary equipment.

Figure 11b illustrates the white pulse to be added to the video waveform during the blanking interval and fed to the keyed detector. Figure 11(a + b) illustrates the addition. When the nominal value of the pulse is 0.7 volt, and the overall gain of the processing system is unity, the keyed detector samples only the white pulse, notes, and maintains the gain control setting in the controlled gain amplifier. By adjusting the d-c voltage applied to the collector of a transistor, the amplitude of the pulse may be reduced or increased. The detector circuit senses this deviation from the normal 0.7 volt level, generates a correction voltage and changes gain to offset the error.

To control the white level of the picture automatically (AWL), the gain of the system must be adjusted so that the peak white of the video signal is sampled and corresponds to 0.7 volts. Figure 12 shows the two keying or gating waveforms that are used to provide the two modes of operation. The first keying signal samples the white pulse level irrespective of the video information. The second keying signal samples the complementary interval, except the "off" time is widened to ignore spikes that exceed white.

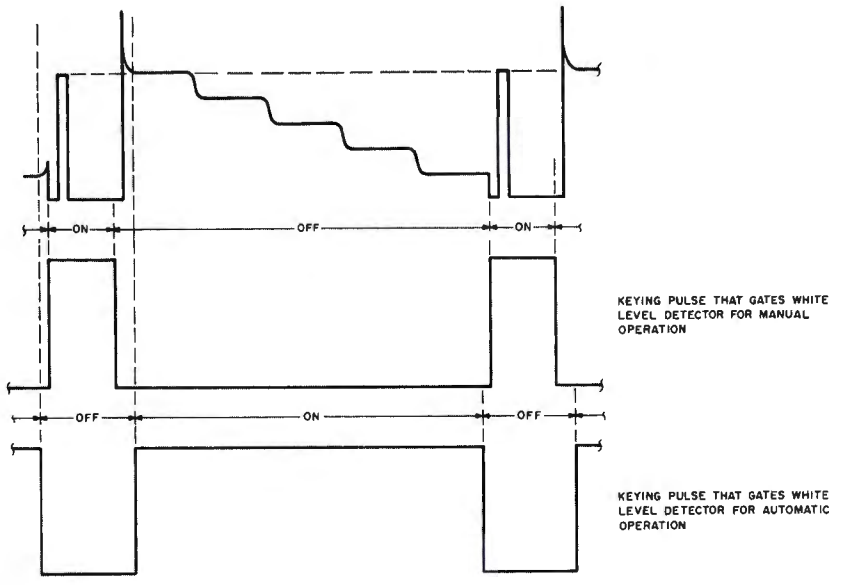


FIG. 12. The keyed detector used with the white level control may be switched between two keying pulses.

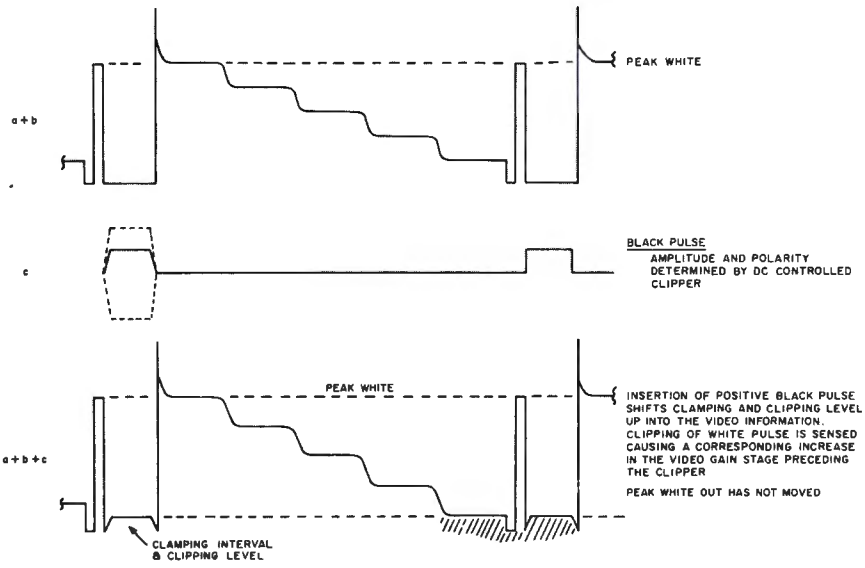


FIG. 13. Waveform (a + b) has an adjustable black pulse (c) added to produce waveform (a + b + c). This sum represents simultaneous operation of the two control loops (black and white levels); automatic or manual operation of either loop is optional.

Black Level Control

Located within the processing system, and in particular inside the keyed automatic gain-controlled loop, is the means of altering or adjusting the black level of the video signal. Figure 10 shows a black pulse adder, video amplifier, a clamp, an emitter follower for isolation of clipping stages and another keyed detector used for automatic black level. Figure 13 illustrates how manual black level adjustments are accomplished. The waveform of Fig. 13(a + b) is the same video signal with white pulse. In Fig. 13(c) a black pulse, whose amplitude and polarity are adjusted around zero volts or ground, is added immediately after the white pulse, but within the blanking interval. The clamp sets this pulse to ground, which allows the clipper that follows to remove any desired amount of the video or to introduce a pedestal of as much as 50 per cent peak white. It is important to note that this adjustment of black level is inside the keyed automatic gain controlled loop. As black level adjustments (either automatic or manual) attempt to alter the amplitude of the white pulse, the *auto or manual white level con-*

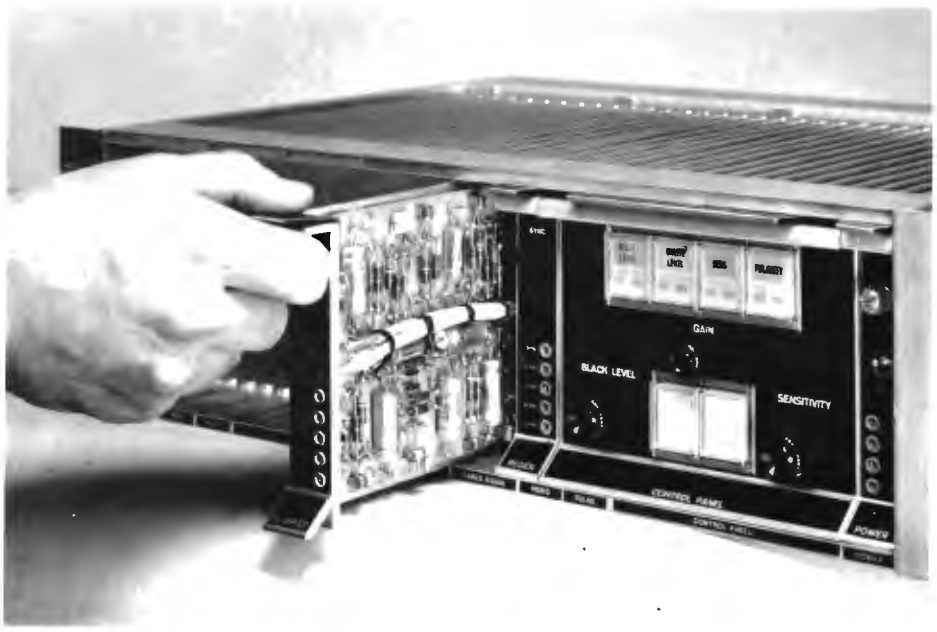


FIG. 14. In this application, the control panel is mounted with the auxiliary equipment (blanker, regenerator and power supply).

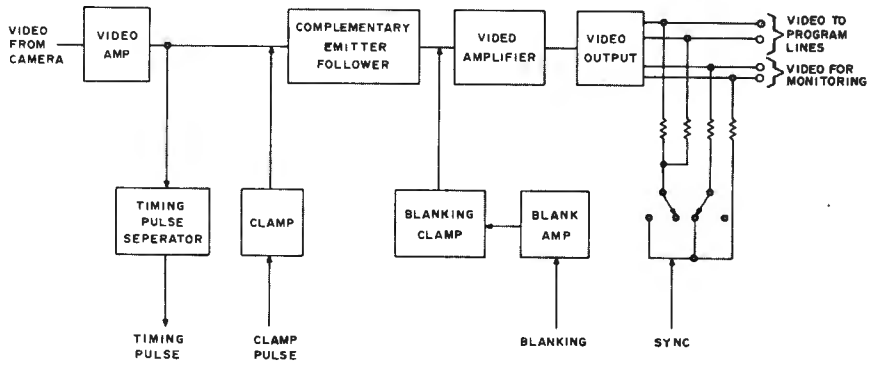


FIG. 15. Block diagram of the blanker, final video module of the camera chain.

trol introduces the needed compensation to maintain peak white.

Operationally, the system white level remains fixed and independent of black level adjustments. Also, the system black level remains fixed and independent of white level adjustments.

Final Signal Processing (Blanking and Sync)

In the total camera video system (camera, auxiliary and control panel), there remains only the addition of system blanking and sync at the auxiliary. In multiple camera systems where lap-dissolve and mixing techniques are used, many video signals are added together. The coincidence of the blanking pulses of such signals is mandatory to prevent lateral shifts in pictures at the home receiver.

To achieve such coincidence, time delay is made negligible by locating the auxiliary units of several camera systems in one rack where the coaxial cable lengths (blanking feeds) between units are kept short. Program lines connecting these same auxiliaries to the switching system will be of equal lengths, thus keeping differential delays negligible and preserving the coincidence achieved.

As shown in Fig. 15, the last module of the video system, the blanker, includes two clamping circuits. One removes hum, while the other removes the pulses previously added to process the video, and the waveform spikes or edge effects shown in Figs. 11, 12 and 13.

Although the voltage gain between the input and output stages (Fig. 15) is 2, power gain is required to drive the four-low-impedance output lines simultaneously. It is fitting in summing up the operation of the video system, to note that the same feedback pair circuit configuration (Fig. 8) with its two transistors performs this key function admirably.

SUPPORTING SYSTEMS WITHIN THE CAMERA CHAIN

Pulse System

While the preceding descriptions have dealt primarily with the overall video system within the film camera, it is apparent from the waveforms and block diagrams that a separate pulse and timing system that supplies the various signals is in itself rather extensive. The transistor has provided the means of generating precise pulse amplitudes and widths that are a vital need in a stable video processing system. This critical and complex array of pulses is produced without adjustment, alignment or special selection of components.

Deflection System

The TK-22 deflection system used in conjunction with the new vidicon includes a module having two current feedback amplifiers with loops including respective yoke windings. The combination of the deflection circuit, yoke and vidicon results in excellent linearity and a geometric fidelity with less than 1 per cent distortion. No linearity controls are required to achieve or maintain this performance.

Power Supply System

The low-voltage supply for the TK-22 Film Camera is located in the auxiliary (Fig. 14). To assure a constant voltage at the film camera head, power supply voltage is sensed at this point and fed back to the source where it is changed to offset the variable voltage drop resulting from different camera cable lengths. Short-circuit protection avoids possible damage from power surges and transients. The power supply requires no adjustment.

Conclusion

The initial step in a program for a new line of ultra-stable television cameras has been taken with the production of the TK-22 film camera. This and other camera designs (a TK-27 color film camera and a TK-42 color studio camera) are the forerunners of a complete line of "New Look" equipment that promise the broadcaster immediate and substantial economies in maintenance and operating costs, reduce his overall space requirement, and provide finest television pictures with minimum effort.

NEW MEDIUM-GAIN ANTENNA IS IDEAL CHOICE FOR MOST UHF-TV STATIONS

New Antenna Combines Pylon Ruggedness And Reliability With Moderate Cost

by A. J. GALINUS
UHF-Antenna Product Analyst

UHF-Pylon antennas, introduced by RCA during 1952 have earned an excellent reputation for ruggedness, reliability and performance.

The TFU-30J is a new model of the RCA UHF Pylon which combines moderate price with excellent pattern circularity, long-term reliability, outstanding picture quality and low wind-load inherent in the pylon-type of antenna design. A portion of this new antenna is shown in Fig. 1.

Megawatt ERP Capability

The TFU-30J UHF-Pylon Antenna is a medium-gain antenna offering a power gain of 30 and a power-handling capability of 65 to 50 kilowatts, depending on the operating channel 65 kw for Ch 14; 50 kw at Ch 83 Thus, a TFU-30J antenna (with a power input of only 35 kw) is capable of delivering an ERP in excess of one *megawatt* (1000 kw)

118 Pylons Built to Date

RCA has built more than 11[illegible] UHF-Pylon antennas and dozens more are planned Many of the[illegible] stations have replaced low power low gain RCA antenn[illegible]

FIG. 1 The TFU-30J UHF Pylon Antenna combines radiating surfaces and supporting structure into one slender silhouette. This minimizes windload, reduces maintenance and retards ice formation.

with higher-power/higher-gain pylons. This, in itself, is an excellent indication of the widespread satisfaction with the performance of UHF-Pylon antennas. In all, some 21 stations are "repeat customers."

Immune to Lightning

As are all RCA UHF-Pylon antennas, the TFU-30J is self-protecting against lightning damage. The reason for this is that the entire electrical system of the antenna is enclosed within the structural-steel pole. In the event of a lightning hit, the high conductivity of the steel carries the discharge to the tower which, in turn, passes it harmlessly to ground. Of all the UHF-Pylon antennas now in daily use, not one has suffered lightning damage save, possibly, for some scarred paint at the point of contact.

Simplest of All UHF Antennas

Figure 2 is a simplified cross-section drawing of the TFU-30J antenna. Note that the only external components are the pole steps which, of course, are not part of the antenna's electrical system.

The antenna's electrical system consists of the copper inner conductor and the slots cut into the supporting pole. The transmitter power enters the antenna at the lower end of the inner conductor and is distributed to each of the radiating slots in definite amounts. This simplicity is an important factor in the UHF-Pylon antenna's outstanding record of reliability.

Virtually No Maintenance

Complete freedom from antenna maintenance is still an engineer's dream but, the UHF-Pylon antenna comes as close to being maintenance-free as modern technology allows. Such devices as stainless-steel bolts and nuts, heavy-duty galvanize on all steel parts, polyethylene-plastic materials, cast aluminum fittings contribute much to the anti-corrosion quality of UHF-Pylon antennas. Usually, the only maintenance a TFU-30J antenna really requires is an occasional coat of paint to comply with air-hazard regulations.

Low Wind Resistance

An important consideration in selecting a suitable antenna is how much area it presents to the wind. The TFU-30J, like other UHF-Pylon antennas, contains its electrical system within the supporting structure. The circular cross-section is, in a manner of speaking, "streamlined" in all radial planes. A further advantage is that the TFU-30J antenna collects less ice during sleet storms. This, of course, reduces tower load under icing conditions.

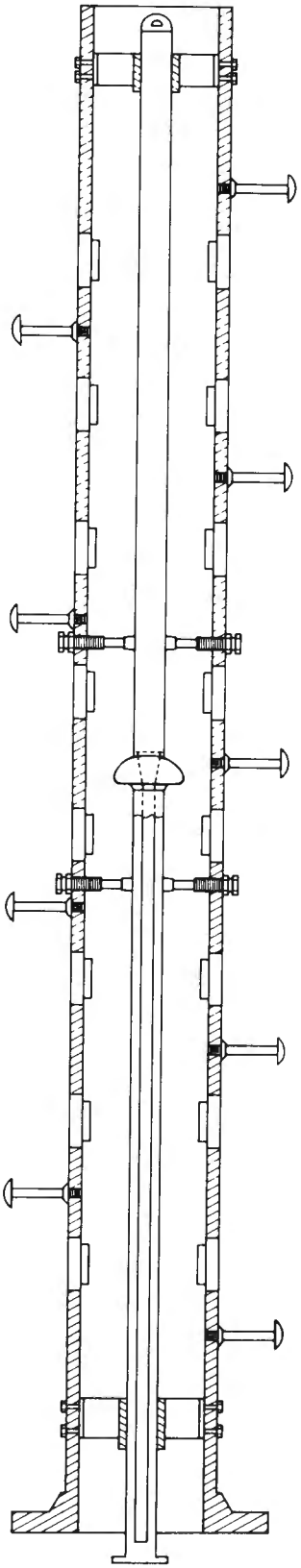


FIG. 2. This abbreviated cross-sectional drawing illustrates the unusual simplicity of the TFU-30J antenna (see text).

Each Antenna Fully Tested Prior to Shipment

RCA operates a fully-equipped antenna-test site on a 40-acre tract of ideally-contoured land some 18 miles from Camden (N.J.). Here, every UHF-Pylon antenna—including the TFU-30J—is performance tested for vertical pattern, gain, beam tilt, impedance match and so on. All antenna testing is supervised by the engineering personnel responsible for the antenna type under test thus adding an extra measure of perfection to every antenna.

"Computer-ized" Design

Television-antenna design demands vast amounts of mathematical calculation that would be prohibitive were it not for modern electronic computers. In addition to making the calculations economical, the use of computers greatly improves accuracy. The result is a superior design at a lower-than-expected cost.

Suitable for Multiple-Antenna Installations

The TFU-30J antenna, as a result of its excellent design, is ideally suited to multiple-antenna installations such as the "candelabra" towers now operating in Dallas, Baltimore and Stockton/Sacramento, California. Indications are that the excellent circularity of the TFU-30J antenna is essentially unaffected by the presence of another antenna which is located beyond a reasonable distance. Further, TFU-30J antennas may be side-mounted on many existing towers with some sacrifice in pattern circularity, depending on the distance between the antenna and the tower.

Electrical Beam Tilt Optional at No Extra Cost

The TFU-30J is available with or without electrical beam tilt at no extra cost. Beam tilt is often necessary to make the main beam of the antenna intersect the ground at the horizon. The TFU-30J offers four "standard" values of beam tilt: ¼-; ½-; ¾- and 1-degree. The proper value of beam tilt for a given situation should be determined by a TV-consulting engineer or other qualified person after careful consideration of terrain conditions, antenna height, coverage area, etc.

The incorporation of beam tilt, although it reduces the antenna's power gain, gen-

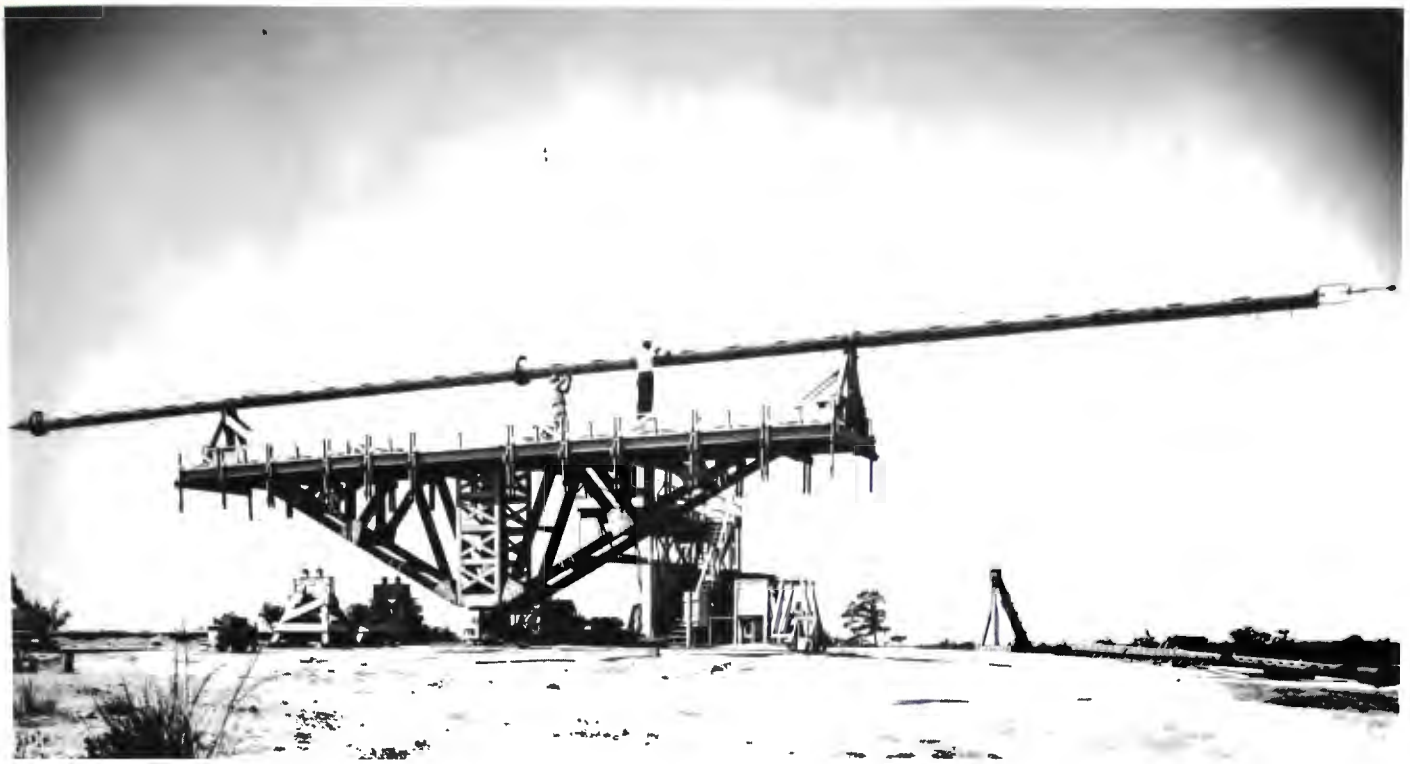


FIG. 3. Every UHF-Pylon antenna is tested on a "turntable" such as this at RCA's 40-acre antenna-test site near Camden (N.J.). The turntable permits precision movement of the antenna both axially and radially (see text).

erally improves local coverage markedly. To illustrate, a TFU-30J equipped with ½-degree beam tilt offers a power gain of 27 . . . a reduction of only 10 percent or 0.22 db.

A Truly "Universal" UHF-TV Antenna

The TFU-30J antenna, because of its power gain and power-handling capability, is the ideal choice for virtually any UHF-TV station. The power gain increases the operating economy of the station by reducing the requirement for transmitter capacity while the high power-handling capability permits future expansion of the low-power station without the usual antenna change.

The built-in ruggedness and long life, combined with virtually no maintenance expense, go a long way to increase the operating economy of any station using a TFU-30J antenna.

FIG. 4. Cutting the radiating slots in the structural-steel pole. Oxy-acetylene cutting torches, under precision control, burn away unneeded steel to form the dozens of radiating slots in each UHF-Pylon antenna.

RCA "NEW LOOK" TV TRANSMITTERS SIGNAL UHF BREAKTHROUGH

New High-Gain Power Tubes Simplify 2-, 10-, 30-, and 50-kw Models Provide Basic Design for Economical Ultra High Power

RCA New Look UHF transmitters represent a major advance in UHF technology. Incorporating all the benefits of reliable solid state devices, of new broad-band amplifier tubes with much higher gain and greater power capability, and video modulation at fractional watt levels, these transmitters achieve simplicity and small size, yet pack more power per cubic foot than any predecessor.

For example, the TTU-50B is a 50-kilowatt transmitter designed for two million watts ERP. Aural and visual power amplifiers each use a new vapor-cooled klystron with a gain of 35 db and requiring only ten watts of drive. The entire TTU-50B occupies only 400 sq. ft. floor space.

The TTU-30A is a 30-kilowatt transmitter designed for one million watts ERP. This uses a lower power version of the vapor-cooled klystrons used in the TTU-50B. A TTU-30A can be modified to a TTU-50B in the field. Both transmitters require about the same floor space area.

The TTU-10A is an air-cooled 10-kilowatt transmitter that delivers 250,000 watts ERP with a suitable antenna, and takes less than half the floor space of previous water-cooled 12-kw versions. The visual output stage utilizes diplexed 8501 coaxial tetrodes driven by a traveling wave tube amplifier and by an 8501 IPA. Thus for 10-kw output there are only three r-f stages following the exciter.

The TTU-2A is a 2-kilowatt transmitter designed for the minimum power station with plans for expansion to higher power. For 2-kw output there are just two r-f stages following the exciter: a TWT amplifier driving an 8501 tetrode PA. In going from 2- to 10-kw, a matching cabinet containing diplexed 8501 output tubes is added.

All four transmitters utilize the well known RCA BTE-10C *direct FM* aural exciter and a simplified, single-unit exciter/modulator which generates the modulated visual carrier at a level of only a few watts eliminating the need for a high power video modulator.

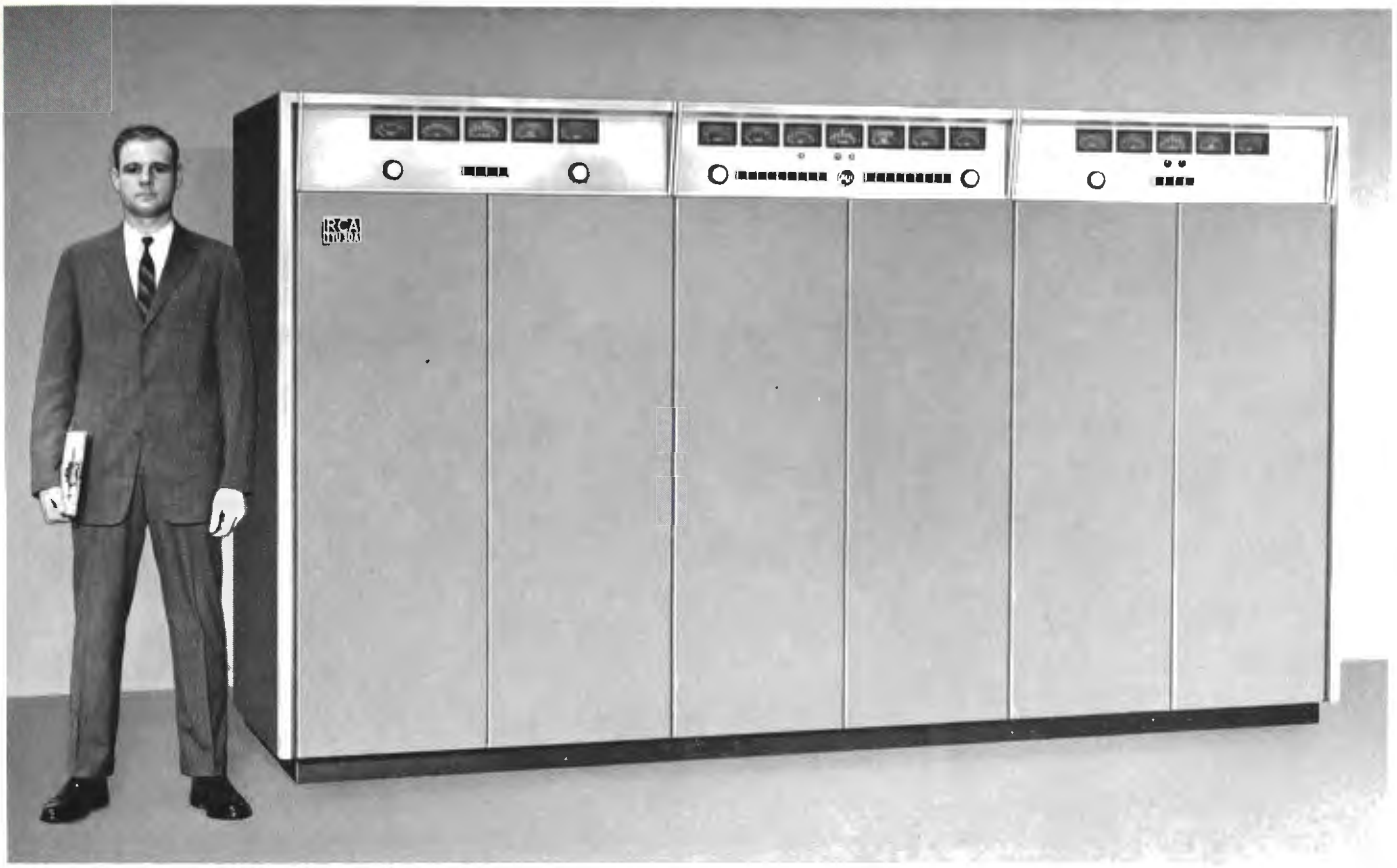


FIG. 1. New 30-kw and 50-kw UHF Television Transmitters. Both have same appearance and cabinet size. Designations are: Type TTU-30 and TTU-50.

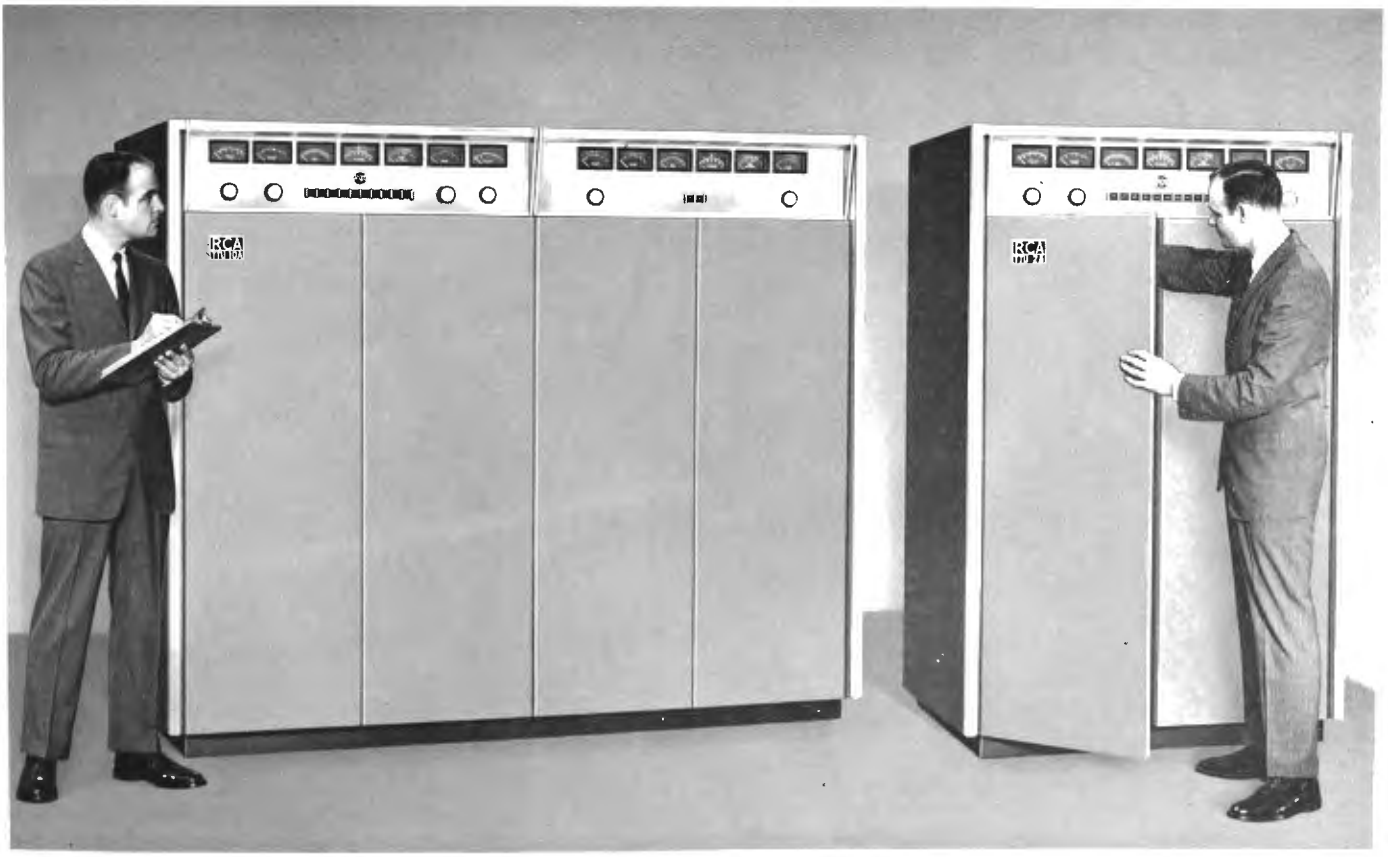


FIG. 2. New 10-kw UHF TV Transmitter, Type TTU-10A.

FIG. 3. New 2-kw UHF TV Transmitter, Type TTU-2A.

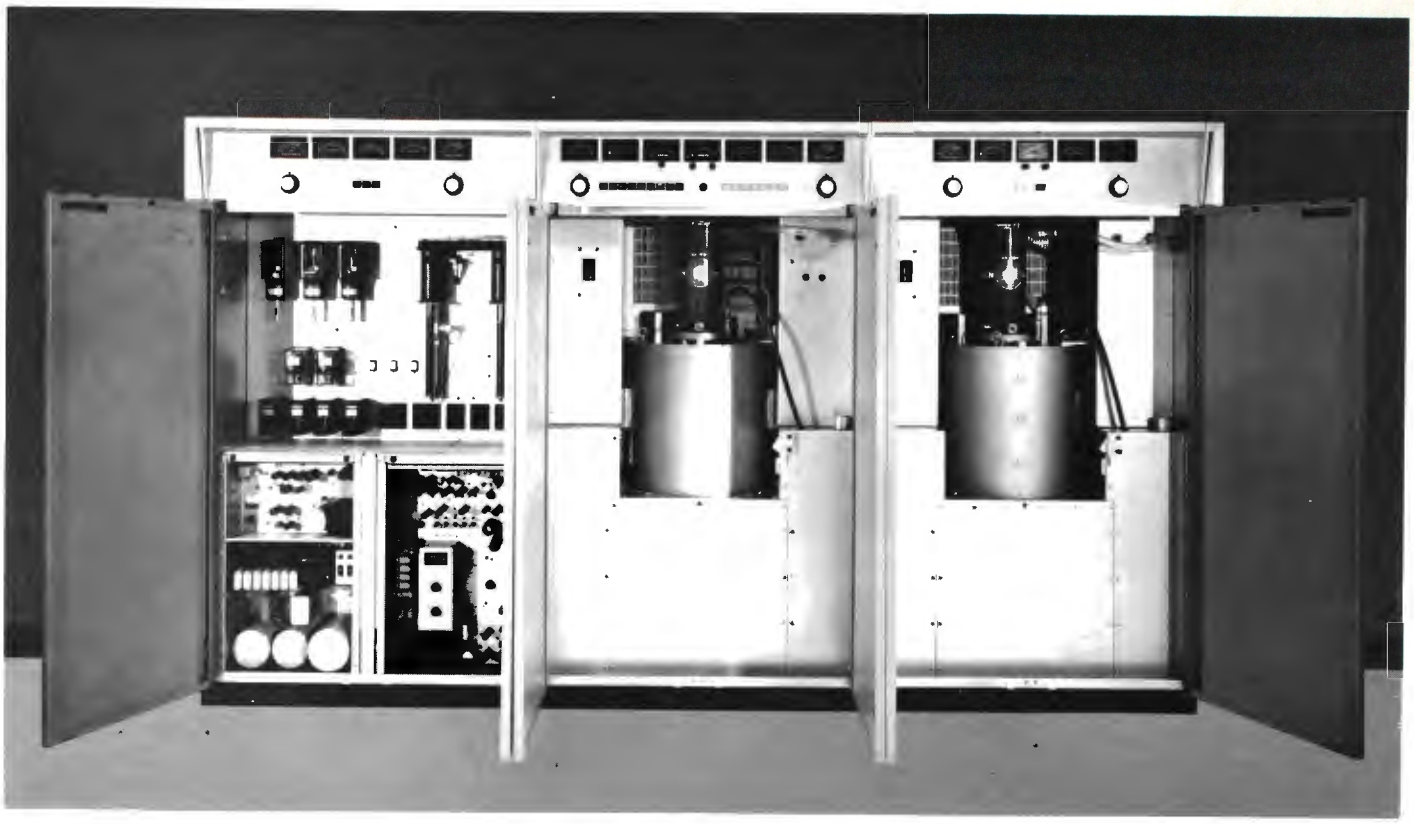


FIG. 4. TTU-30A and TTU-50B transmitters both utilize three front line cabinets containing aural and visual exciters and IPA's, visual klystron PA (center) and aural klystron PA (right).

FIG. 5. Identical ceramic 7289 tetrodes and tuned cavities serve as IPA's for aural and visual channels of 30-kw and 50-kw transmitters. Stages occupy upper half of left-hand cabinet.

New Klystron Ideal for High Power UHF

Availability of a vapor cooled, integral cavity klystron for the power amplifier stages of the 30 and 50 kw transmitters is one important reason why these transmitters require relatively little floor space compared to other designs. Vapor cooled klystrons contribute considerably to size reduction since steam is the heat transfer medium and steam condensers are smaller than water condensers of equal cooling capacity. Only one-tenth as much water is needed. The vapor system also results in a primary power saving of some 10 kilowatts, means lower installation costs and less maintenance. It should be noted that the klystron is of the integral cavity type. Making the cavities part of the tube itself permits factory pretuning, and eliminates the tedious preparation required at the station site by external cavity types.

Klystron Evaluation

The vapor cooled, integral cavity klystron was selected after RCA engineers made a careful and lengthy evaluation of several klystrons to determine their practicality for future UHF transmitters. In 1950, RCA's evaluation of klystrons versus tetrodes resulted in the decision to employ tetrodes in the TTU-12A/25B UHF transmitter design. The wisdom of this choice is a matter of industry record. Since 1952 when RCA shipped the first UHF transmitter, more UHF stations selected these RCA transmitters than those of all other manufacturers combined.

But, high power klystrons in the last decade have shown many improvements. One advance in particular is better differential phase and gain performance, so essential to good color transmission. New UHF receiver developments had come to the fore, and more applications were being received for the high bands, where in contrast to the tetrode, klystron efficiency is higher. Lastly, high power klystrons (those with integral cavities) had established enviable records for long and reliable service in the BMEWS installations. Performance later verified klystrons as the logical choice for high power UHF, and they pointed the way to economical ultra high power UHF transmitters based on the design of the new RCA 30- and 50-kw transmitters.

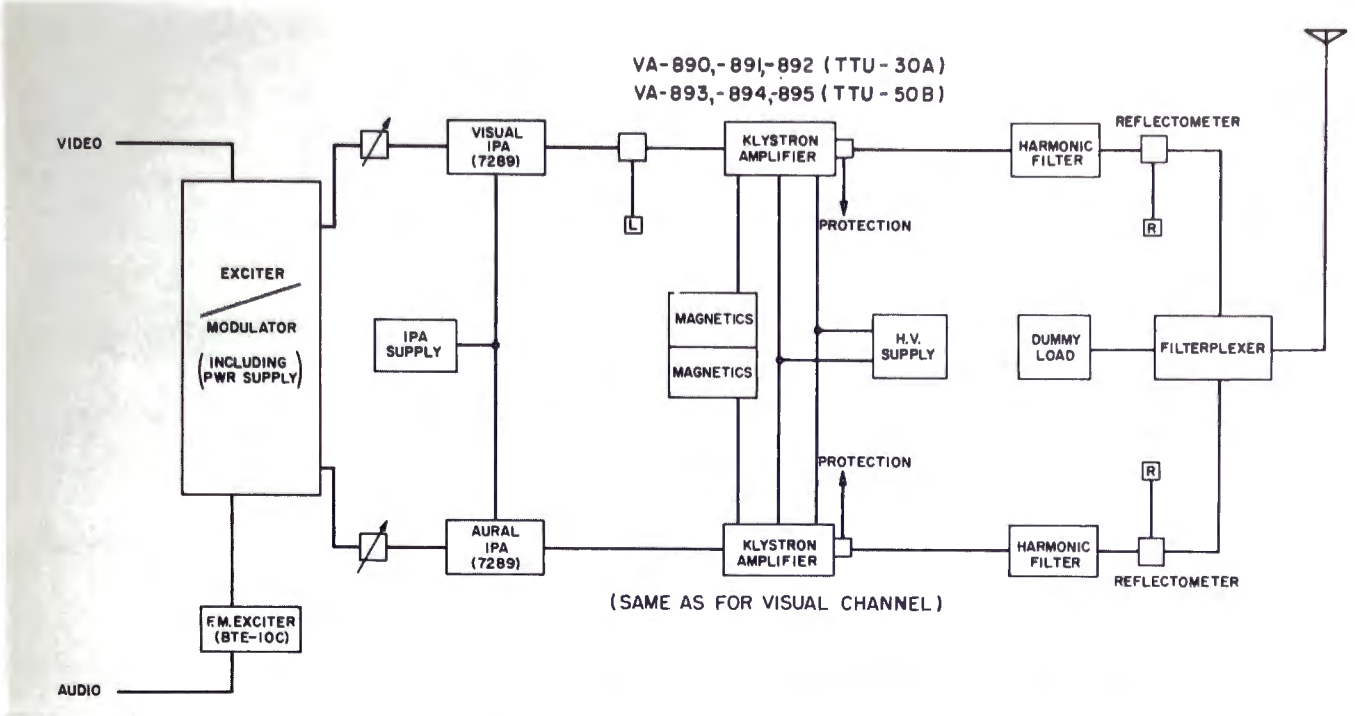


FIG. 6. Block diagram of TTU-30A and TTU-50B UHF transmitters. Aural and visual channels are identical, and tubes and cavities are interchangeable.

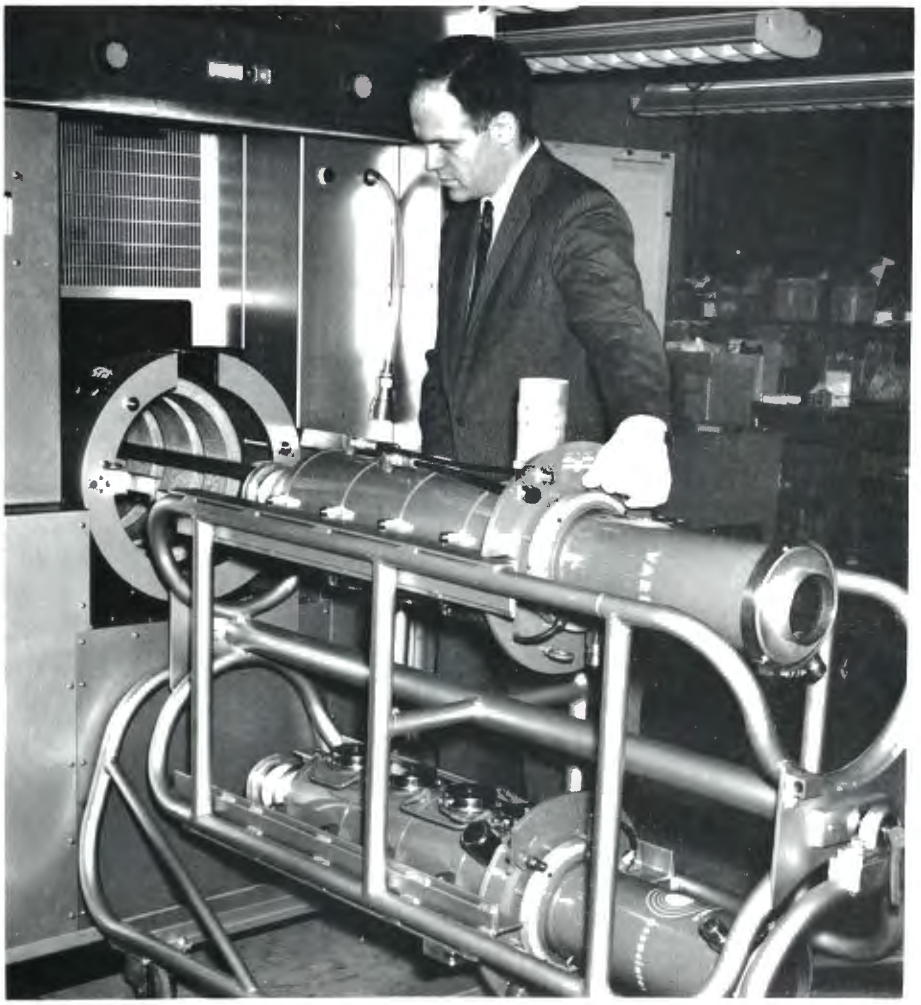


FIG. 7. One operator can easily change klystrons in either 30-kw or 50-kw transmitters by tilting tube to horizontal position, sliding it out of transmitter onto special klystron carriage, rotating carriage, then sliding replacement klystron into transmitter.

Longer Tube Warranty

The TTU-30A and TTU-50B employ klystrons engineered and manufactured by the Varian Associates. Depending on frequency, these tubes are designated as VA-890, -891, and -892 (for the TTU-30A), and VA-893, -894, and -895 (for the TTU-50B). Klystrons for the TTU-30A have an estimated life of 10,000 hours, and are warranted for 8,000 hours in aural service and 4,000 hours in visual service. Leasing plans are also available.

Compact 30- and 50-kw Transmitters

The TTU-30A and TTU-50B UHF transmitters are each housed in three new, low profile 77-inch cabinets with eye level meters and convenient finger-tip controls. They both feature simplicity and beauty in styling, single, unified control areas, fewer stages and small size. Every effort has been made to incorporate mechanical and electrical devices to permit one-man operation of these high power transmitters either locally or from a remote point.

Exciter Plus Only Two R-F Stages

The aural and visual carriers are generated and modulated within small chassis

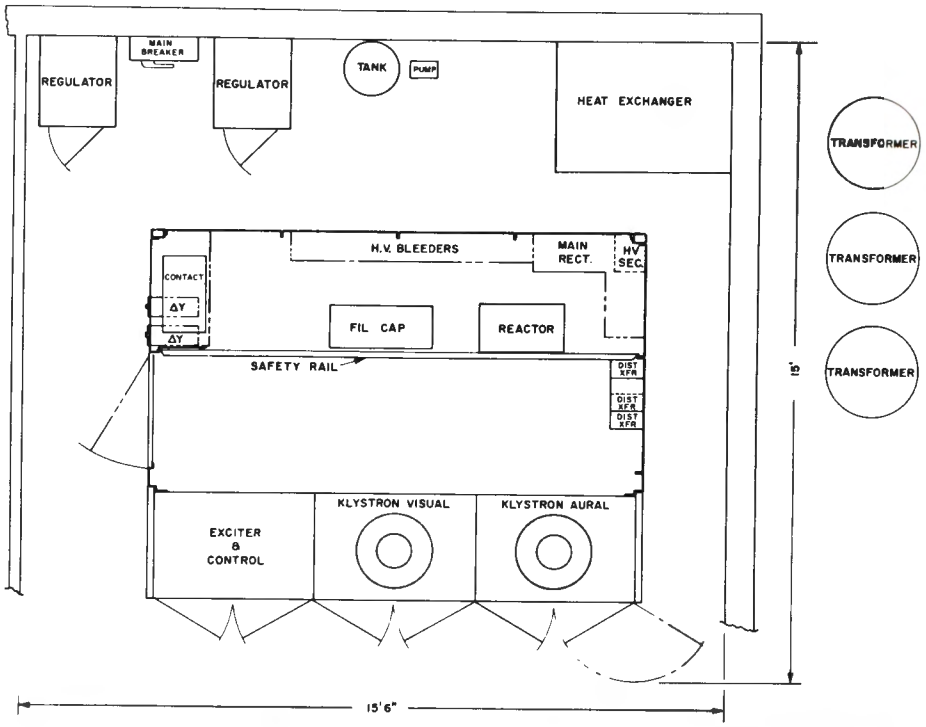


FIG. 8. Floor plan showing approximate space requirements of TTU-30A and TTU-50B transmitters.

mounted units at levels of only a few watts. Aural modulation is applied via the *direct-FM* method using the new RCA type BTE-10C Exciter which is the heart of all RCA full fidelity FM transmitters. Video modulation takes place in a new and simplified Exciter/Modulator which produces a video modulated peak output of two watts, eliminating the need for a high power video modulator and setting a new high standard of reliability.

Following these exciter units are two identical r-f stages in each channel consisting of a cavity tuned 7289 tetrode IPA and the klystron power amplifier. These tubes and cavities are identical and therefore interchangeable between the aural and visual channels.

Long Life Solid State Power Supplies

Silicon rectifiers are used throughout. These and other power supply components are mounted on vertical panels which form the transmitter enclosure. Solid state devices greatly improve power supply efficiency and increase reliability.

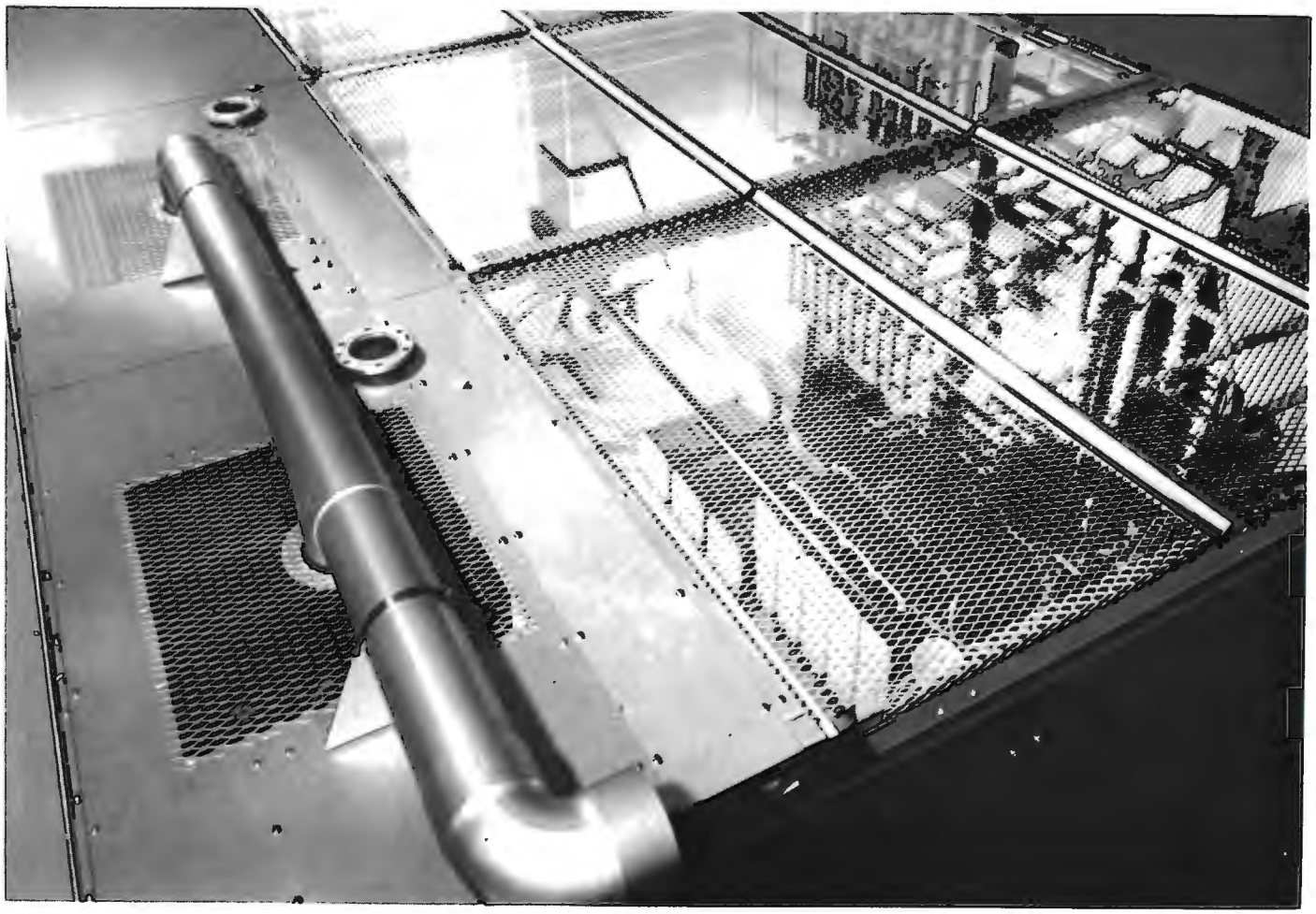


FIG. 9. Top view of TTU-30/50 Transmitter. Walk-in cabinet design requires only a fraction of the floor space of cubicle design. Components are more accessible and more effectively cooled resulting in longer life.

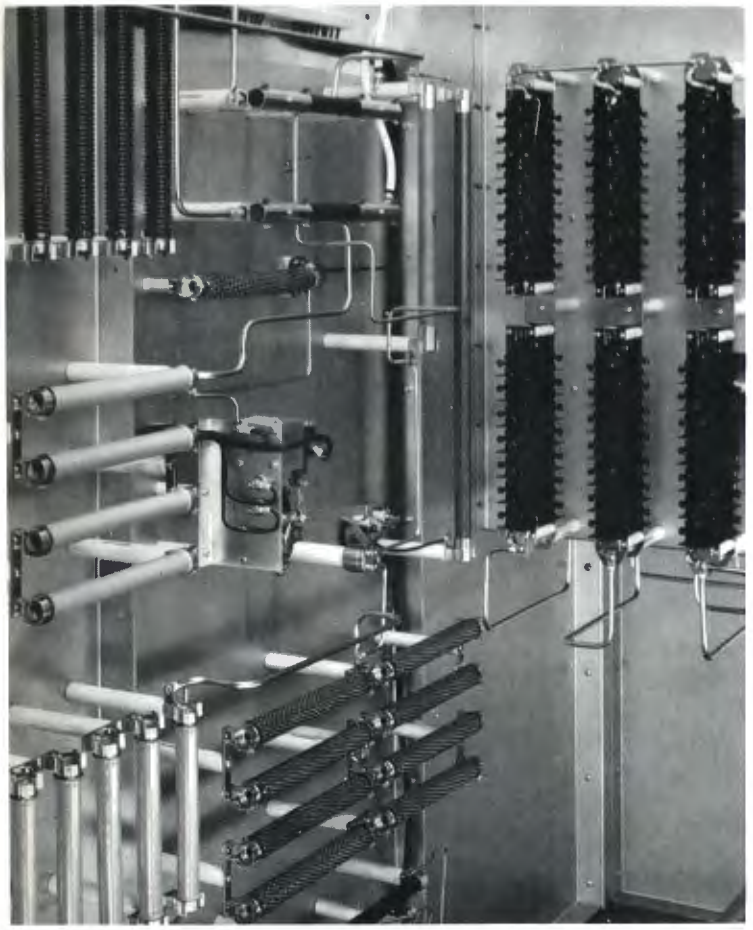


FIG. 10. Long life silicon rectifiers (right) are "modularized" for easy and quick replacement if ever necessary. Other components shown are high voltage bleeder resistors. High voltage rectifiers are in a separate enclosure (See floor plan).

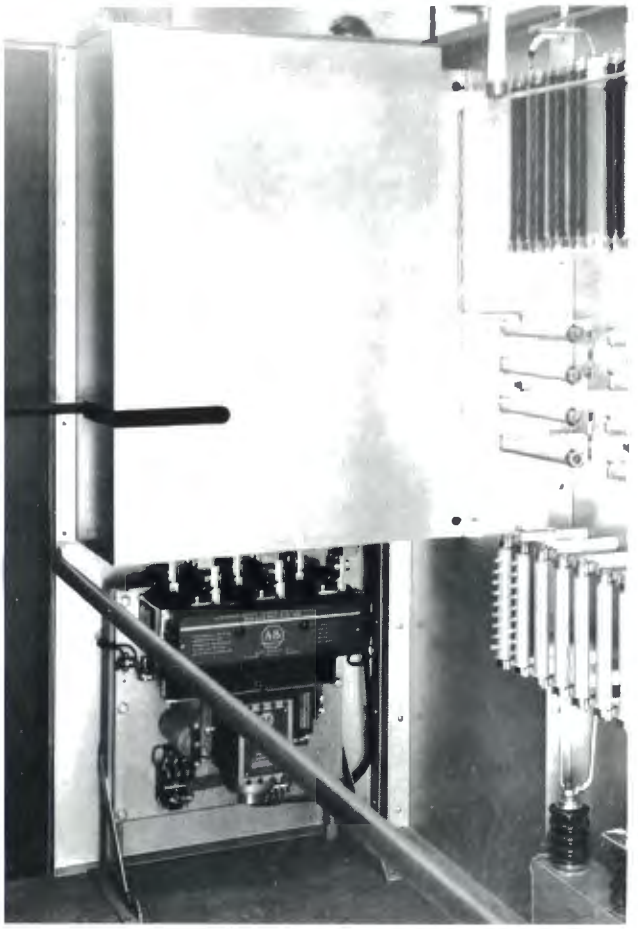


FIG. 11. Main contactor of TTU-30A and TTU-50B transmitters. Handle across doorway activates main switch for power removal for safety.

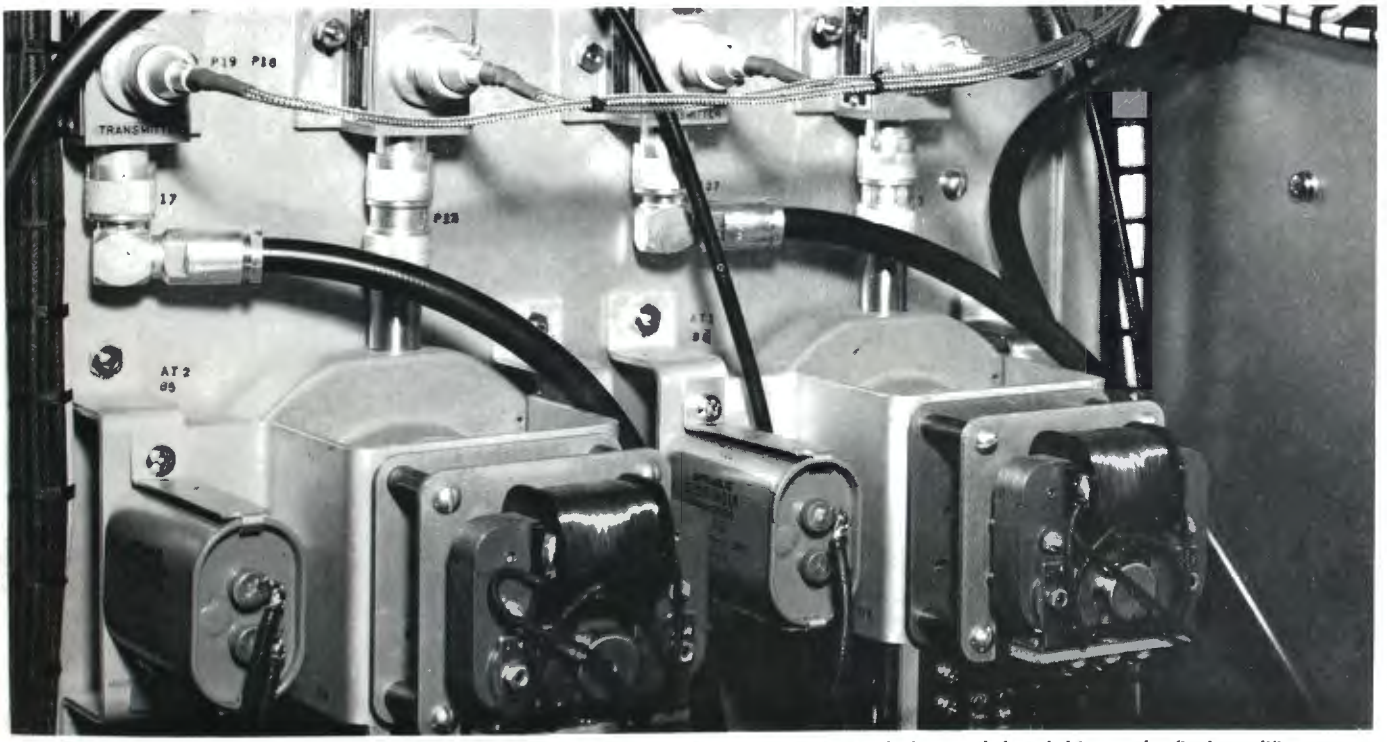


FIG. 12. Remotely operated power level controls consist of motorized r-f attenuators which control the r-f drive to the final amplifiers.

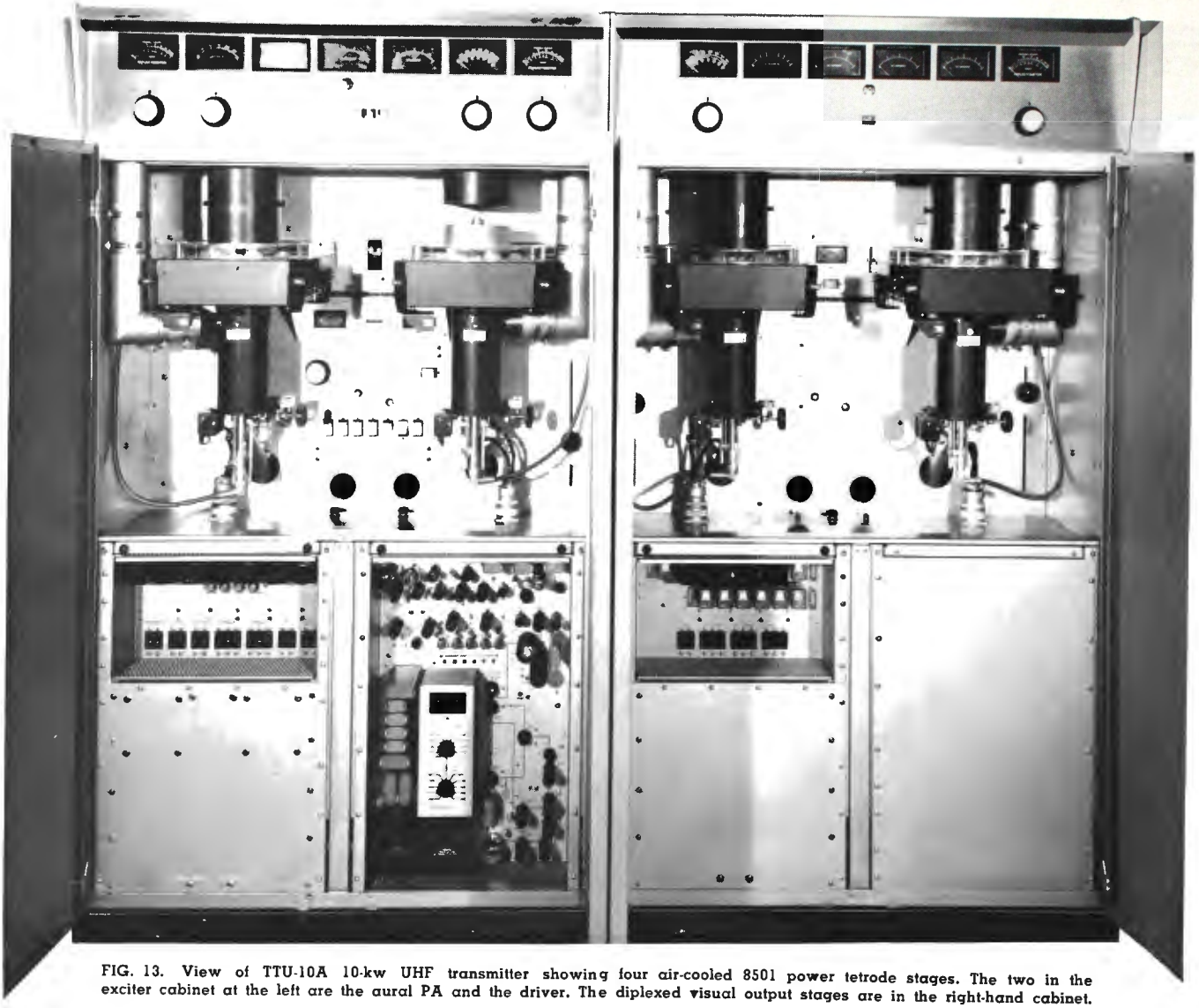


FIG. 13. View of TTU-10A 10-kw UHF transmitter showing four air-cooled 8501 power tetrode stages. The two in the exciter cabinet at the left are the aural PA and the driver. The diplexed visual output stages are in the right-hand cabinet.

Space-Saving, Air-Cooled 10-Kilowatt UHF Television Transmitter

The RCA TTU-10A is a completely new, 10 kilowatt UHF transmitter designed for operation on any specified channel, 14 through 83. Requiring less floor space than older transmitters with only a fraction of the power output, the new transmitter is completely air-cooled which eliminates the bulky and power-consuming water cooling equipment of earlier transmitters.

The TTU-10A utilizes as a driver the new RCA TTU-2A 2 kw transmitter which occupies one of the two matching, low-profile 77-inch cabinets. These transmitters are the first commercial TV broadcast transmitters to employ traveling wave tubes with their history of long life in microwave equipment. Use of the TWT makes possible fewer and simpler stages. It is a broadband tube requiring no tuning devices. Power gain provides an amplification from one watt to 250 watts in a single stage.

Aural and visual power amplifiers of the TTU-10A employ the air-cooled 8501 UHF power tetrode which features a thoriated-tungsten mesh filament and coaxial cermolox construction. The cavities of all these high power stages are identical.

Diplexed Visual Output

Visual amplifier output makes use of the diplexing circuitry proven so reliable in latest RCA VHF-TV transmitter designs. Diplexing permits continued operation on one amplifier tube at reduced power without loss of air time, should the other amplifier tube fail. It also permits use of identical tubes — and cavities — in the driver and output stages, reducing spare tube inventory requirements.

Unitized Power Supplies

Power for the TTU-10A is furnished by two compact units employing solid state rectifier plug-in modules. These power supplies can be located near the transmitter, or in a separate location, even in unheated areas if necessary.

Remote Control

Designed for remote control, metering points are provided for monitoring several operating parameters. Many functions are motor driven and therefore can be operated remotely. The TTU-10A has aural and visual reflectometers.

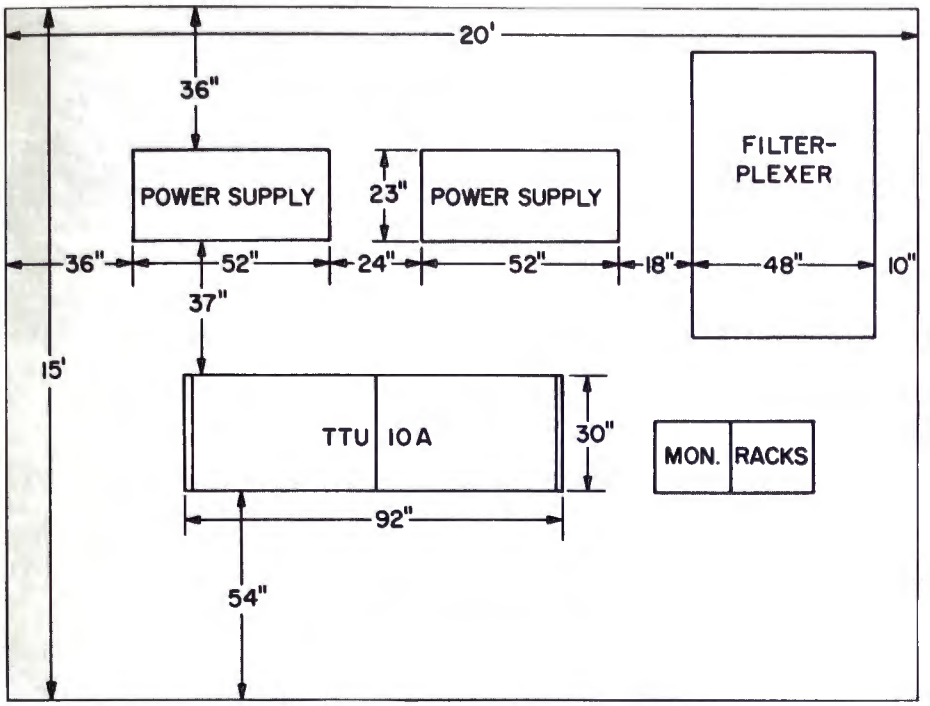


FIG. 14. Typical floor plan layout of TTU-10A transmitter. Unitized power supplies can be located at any remote area.

FIG. 16. High gain TWT (traveling wave tube) used in driver stages of new RCA 10- and 2-kilowatt UHF transmitters.

FIG. 17. Air-cooled Type 8501 power tetrode tube and cavity with covers removed to show cavity tuning mechanism.

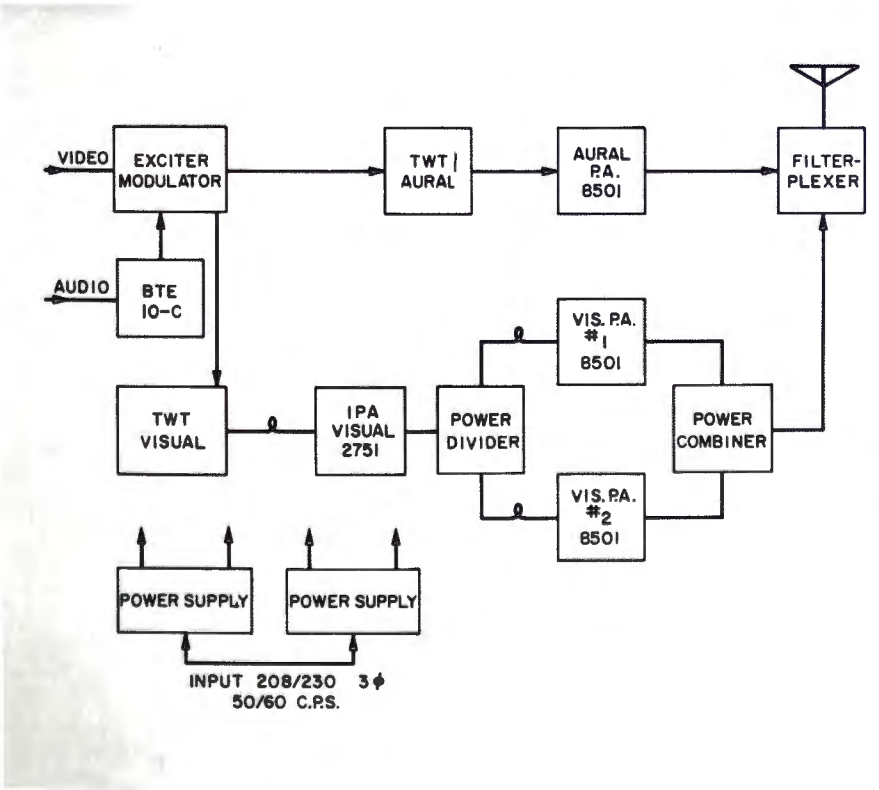


FIG. 15. TTU-10A block diagram. Diplexed amplifiers with their better impedance matching and other advantages are used in the visual channel. In this transmitter, there are only two different tube types above two watt level.

New, Compact 2-kw UHF TV Transmitter for "Just Starting" UHF Stations

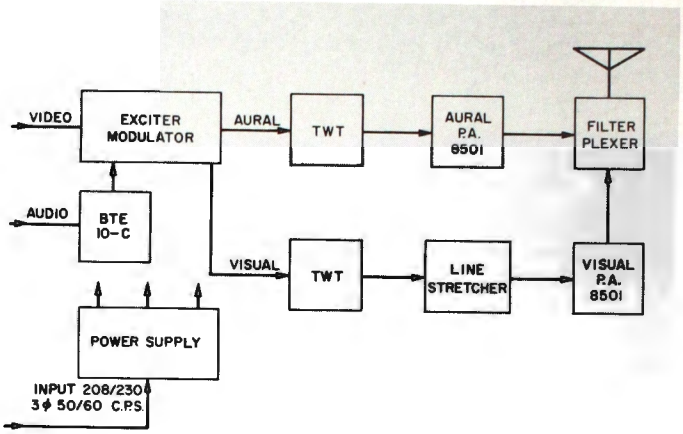


FIG. 19. TTU-2A block diagram. Drivers for tetrode 8501 PA stages are high gain traveling wave tubes.

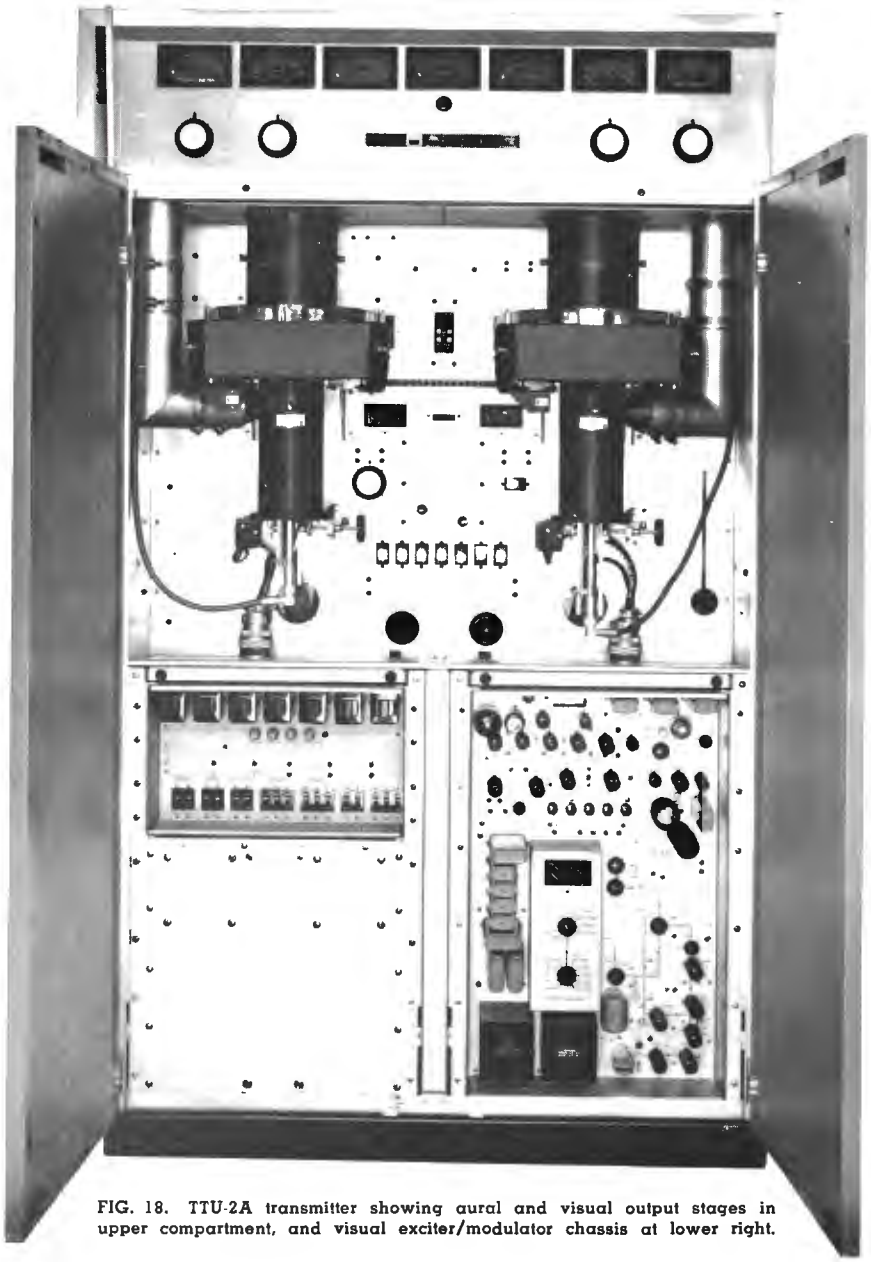


FIG. 18. TTU-2A transmitter showing aural and visual output stages in upper compartment, and visual exciter/modulator chassis at lower right.

The TTU-2A is a 2 kw UHF transmitter designed for the station that seeks to keep transmitter investment and operating cost at a minimum, but with an eye to future expansion. The TTU-2A is capable of delivering up to 50-kw ERP, with a suitable antenna and it offers the possibility for future expansion to 10 kilowatt output by a matching add-on cabinet containing an amplifier using the same type PA tubes. The original transmitter remains substantially intact. In fact, the TTU-10A 10 kilowatt transmitter utilizes the TTU-2A as a driver.

The TTU-2A features unusual simplicity and long trouble free service. There are only two r-f stages following the exciter in each channel. A forced air cooled 8501, driven by a traveling wave tube, serves as the PA in both the aural and visual chains. The FM aural signal is derived from the RCA BTE-10C, *direct FM* exciter, and the visual signal from another newly designed unit, a visual exciter/modulator, that applies video modulation at a level of only a fraction of a watt. The 2 kilowatt output of the transmitter is indeed conservative duty for the 8501 UHF power tetrode which is capable of delivering 5.5 kilowatts output in Class B TV service to 900 mc.

One man operation of the transmitter or even remote unattended operation is possible with the TTU-2A as with the higher power RCA UHF transmitters. Metering points for remotely monitoring power output, plate voltage and plate current are provided. Several operating functions such as video gain, pedestal level, excitation and overload reset are motorized and thus can be operated remotely by electrical controls.

FIG. 20. A full complement of easy-to-read meters, illuminated push-button indicator/controls and large multimeter selector knobs are at convenient level.

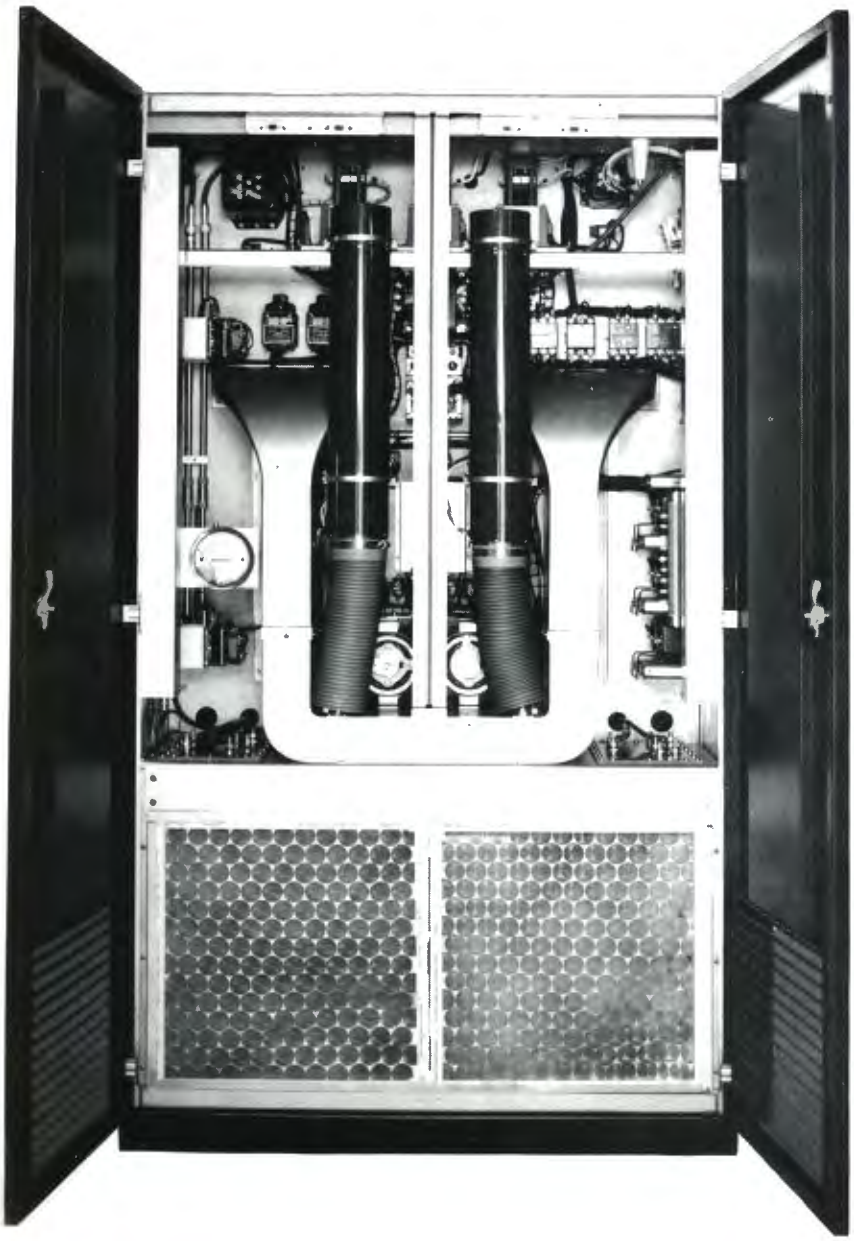
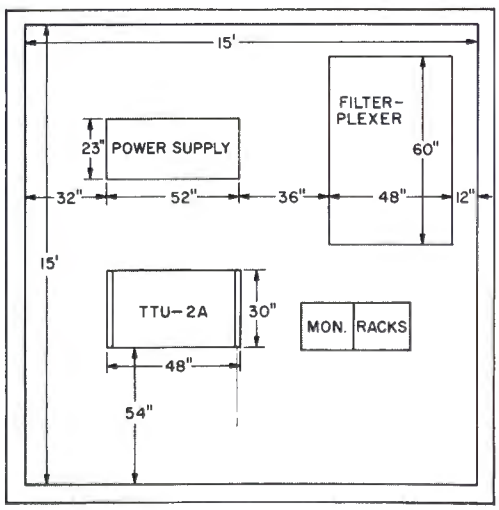


FIG. 21. Rear view of TTU-2A showing traveling-wave tube aural and visual drivers. TWT's require no tuning adjustments.

FIG. 22. Typical floor plan layout of TTU-2A transmitter. Siliconized power supply can be located in separate area if desired.



New UHF Transmitters Use Full Fidelity FM Exciter and Simplified Visual Exciter/Modulator

Aural and visual signals for the new UHF transmitters emanate from the BTE-10C FM Exciter which generates the full fidelity FM signal for RCA's new line of FM transmitters, and from a new and simplified Visual Exciter/Modulator.

The FM exciter is entirely new in design but retains the effective "direct FM" principle that has been a feature of RCA FM for many years. The oscillator is modulated by capacitive diodes. There are no cascaded modulators, and there are only four r-f tubes. A new AFC employing a magnetic amplifier precisely controls frequency without use of tuned circuits. The exciter is the simplest ever devised.

The visual exciter/modulator develops a highly stable, crystal controlled frequency which is heterodyned with the modulated video and with the aural signal from the FM exciter, producing aural and visual output carriers separated by 4.5 mc (5.5 mc for CCIR Standards).

Visual modulation takes place at the grid of a pencil triode, Type 4055. All r-f stages preceding this are operated Class C and are simply tuned for maximum output by observing indications on the built-in meter. Aural and visual carrier outputs operate separately, so should the aural carrier fail, the transmitter still retains a picture signal.

These advanced aural and visual exciter units contribute significantly to the success of the RCA New Look UHF transmitter designs. These transmitters are simple, easy and convenient to operate. Adequate tally-light indication, metering and control arrangements simplify transmitter operation to little more than turning it on and off. This, together with the excellent reliability built into these transmitters assures the owner the highest degree of satisfaction with any of the RCA New Look transmitters.

FIG. 23. Simplicity of the FM exciter is shown by block diagram. Total of only nine tubes are employed.

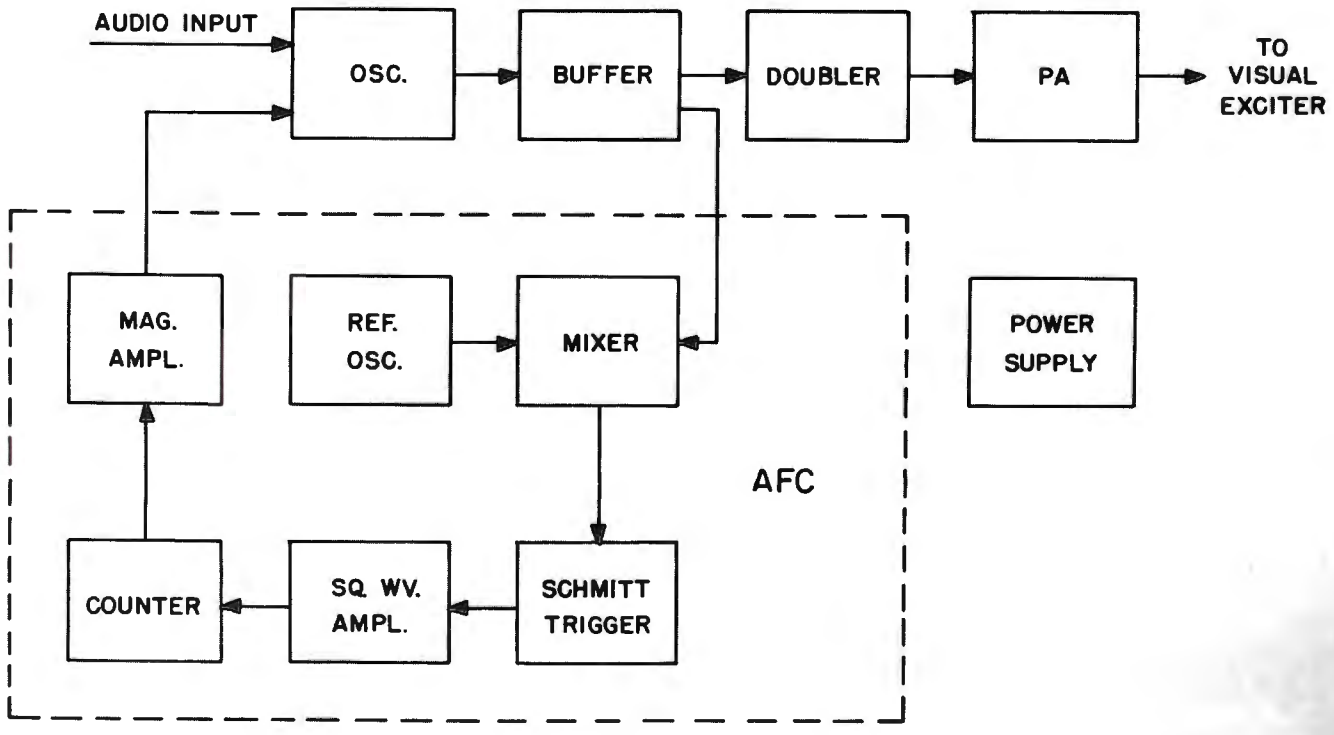


FIG. 24. BTE-10C Direct FM exciter used in all RCA UHF-TV and RCA high fidelity FM transmitters.

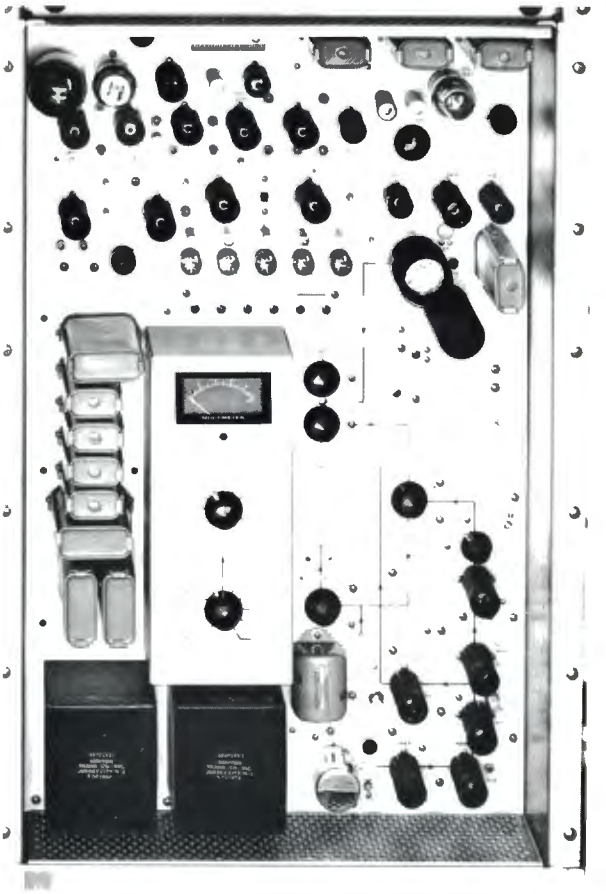
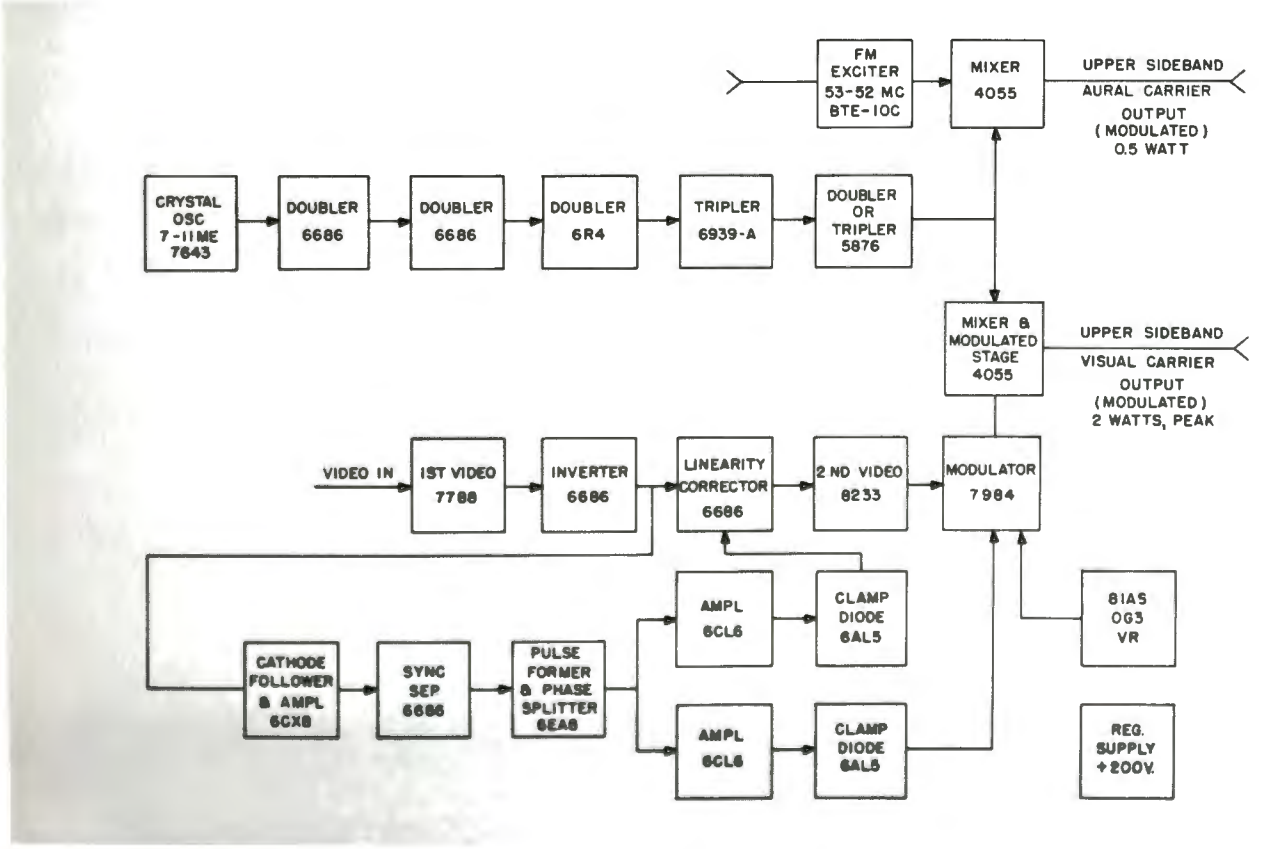


FIG. 25. Visual exciter/modulator produces video modulated signal of two watts peak. Features reliability, compactness, has built-in multimeter and power supply.

FIG. 26. Block diagram of visual exciter/modulator. Mixer and modulator stages use pencil triodes.

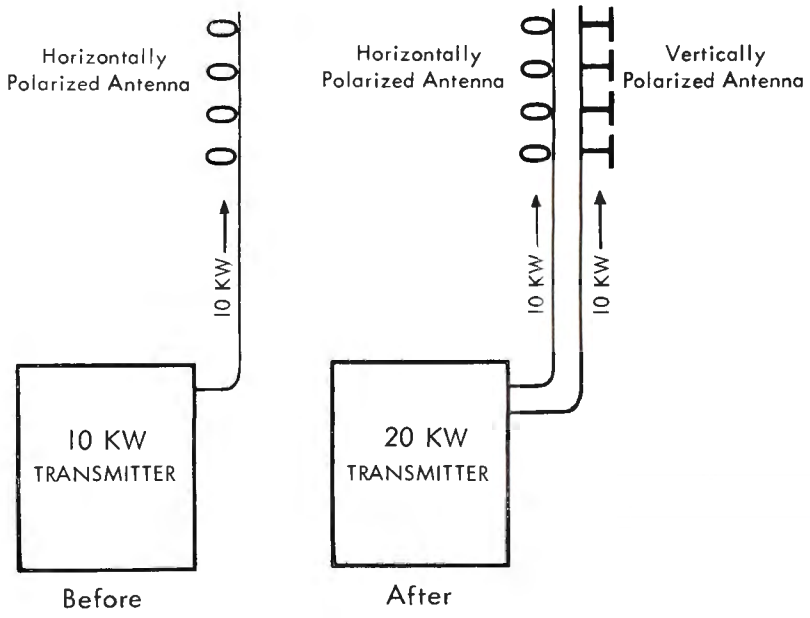


As We Were Saying

FIRST VICTIM of "the ratings"—or, more correctly, the misinterpretation of them—was the LITERARY DIGEST, wherein the above-mentioned ad (pg. 3) appeared in October 1924. Young ops may never have heard of it—but the LITERARY DIGEST was the leading news magazine of its day, highly respected, an authority (sic) on political trends. During the 1936 presidential campaign it made a poll, and based on the poll predicted that Landon would beat FDR. As it turned out Landon carried just two states. And the LITERARY DIGEST literally (!) died of the ridicule that followed. It is now recognized that the LITERARY DIGEST went wrong because it did not use a scientific sample. Modern polls do not make this mistake. But, as someone has said, experience is that which enables us to make new mistakes, instead of making the same ones over again.

SITTING OR GOING you get 'em both when you add vertical polarization to your FM radiating system—or so goes the theory. Horizontal polarization, they say, is fine for the home audience, but for FM car radios you do better with vertical polarization. Nice part is, Commission allows you to have same ERP for vertical as for present horizontal. Vis., using 10 KW now with horizontally polarized antenna—put another 10 KW into new vertically polarized job. One 20 KW transmitter can feed both. Our new BTF-20E transmitter plus a BFA horizontally polarized antenna and a 300-V vertically polarized antenna makes a beautiful combination. Users say it gives better signal in homes, as well as reaching mobiles. And think how good it looks on the rate card!

WE KEEP SELLING, because it's our job—but we keep hoping that you will still like us. And if we press a little now and then—that you will forgive us. Not incidentally, have you ever considered how our advertising helps you. Not the old bromide of "keeping you informed"—but rather in the positive sense of helping you sell. A case in point is what we call our "prestige" campaign. Ads in this campaign don't talk about decibels, or distortion, or gamma range, or lines of resolution. Rather they stress the quality which the RCA name denotes. You might call it the Cadillac approach. And, as you can judge people by the Cadillacs they drive, so you can judge stations by the RCA equipment they use. Our ad, "When the VIP's are on TV, Look for the TK-60 Camera" (inside back cover of this issue) is an example. Also featured in this series is our TR-22 Tape Recorder (back cover). Both the TK-60 and the TR-22 are deluxe, high-performance equipments. It seems obvious to us that their use by a station is a strong indication of the station's intent to do the best possible job for its advertisers. We want the advertisers to recognize this. And to make sure they do we run these "prestige" ads not only in the industry's trade magazines, but also in ADVERTISING AGE, a magazine which is to the advertising business what BROAD-

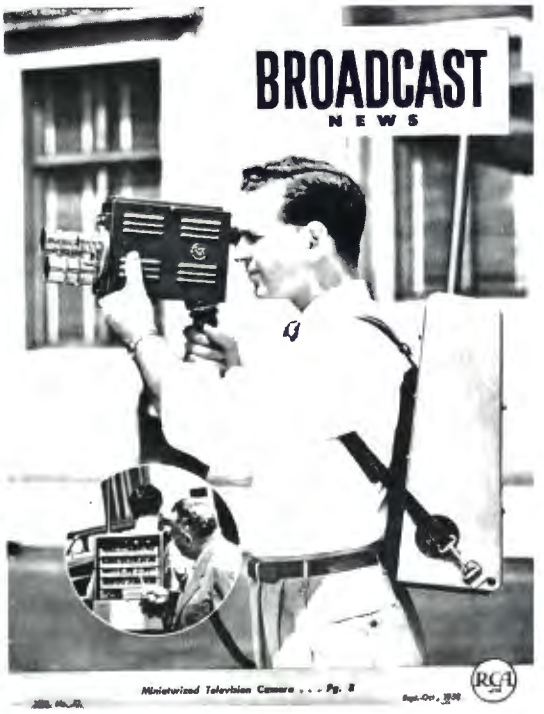


FCC now allows FM stations to add vertically radiated emission to present horizontal component. See story above.

As We Were Saying

CASTING is to ours. In this way, these ads reach not just station people but also advertisers, agencies, and media people. We think it helps the users of our equipment even as it helps us. In fact, we are surprised that more stations don't identify themselves as "RCA Equipped." What better evidence is there that you can do the best job for the advertiser.

PURE NOSTALGIA of the kind we shouldn't indulge is aroused by other pictures in the 1933 issue of BROADCAST NEWS shown on pg. 2. In particular the pictures of RCA's exhibit at the 1933 Century of Progress. We remember it well —because the IRE Convention in Chicago that year was the first time we personally had the responsibility for our Convention exhibit and hospitality suite. It was August, it was hot, and it was prohibition days. The center of interest in our "Exhibit" was a bathtub full of cracked ice (sic). But don't mistake, we did have several small pieces pieces of equipment. One, we remember, was our TMV-21 Field Intensity Meter—the first piece of broadcast equipment to be manufactured in RCA's Camden Plant. We were (at the time) very proud of it.



WALKIE-PEEPIE'S got a lot of publicity at this year's political conventions. All three networks had their own versions, and the competition for attention was considerable. Nothing wrong with that. But what irked us a little was the inference that this was a new idea or a "first." Fact is we built walkie-peepie's for NBC to use at the 1952 conventions. And we pictured it on the cover of our September 1952 issue (see above).

50% less fiddling

Why string along with old-fashioned drawing board techniques? Now you can change your tune, and cut fiddling time in half with the Chart Pak tape method of drafting and visual communication.

Chart Pak pre-printed, pressure-sensitive tapes and symbols pick up the tempo of such slow-moving projects as cross-hatching, filling in, and repetitive drawing.

A complete repertoire of pressure-sensitive, heat-resistant tapes, templates, letters, numerals and symbols — in a variety of finishes, a gamut of sizes, and a symphony of 16 colors — converts the draftsman into a virtuoso of the drawing board.

There are scores of uses for the Chart Pak tape method PERT charts, bar charts, statistical charts, printed circuit masters. Write for the full story. We'll send our 1964 Chart-Pak general catalog and a sample swatch of precision-slit, pressure-sensitive tape will accompany it. No strings attached.

CHART-PAK, INC.
ORIGINATOR OF THE TAPE METHOD OF DRAFTING
280 River Road Leeds Massachusetts
Dealers in principal cities in U.S. and Canada
Your CHART-PAK dealer's name is listed in the Yellow Pages.

Bravo! We're ready to change our tune. Send your new Chart-Pak general catalog and a sample swatch of tape.

Name
Title Dept
Company
Address
City Zone State
Application

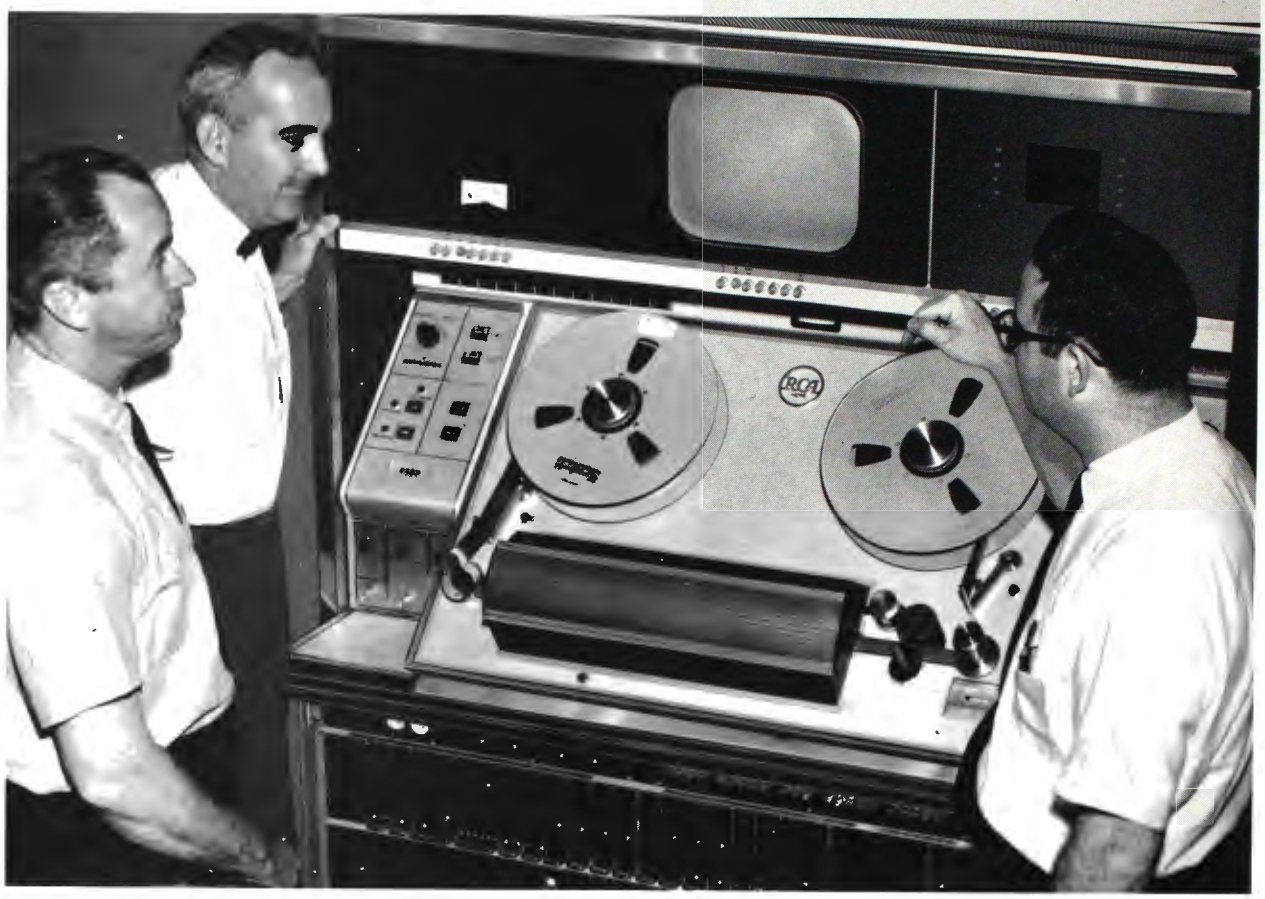
50% LESS FIDDLING, and no strings pulled. Since we've established a reputation as a clip and paste columnist, we suffer all kinds of slings and arrows. The above landed in our mailbox—anonymously. We assume the sender referred to the cover of our last issue. And we assume he meant 50% less fiddling with the new FM transmitters. Or was he thinking of stereo? Tell us why in 25 words or more.

APOLOGIES TO DEAF SMITH, and more specifically, to KPAN, Hereford, Texas (deep in Deaf Smith County). In our last issue, speaking of letters, we made a meant-to-be-humorous reference to "the finest station in this part of Deaf Smith County." We were living in the past. When we covered that territory as a salesman (was it really 25 years ago!) there wasn't a radio station within miles of Deaf Smith County. It's the only station in the county—any part of it. Talk about a one-station market!

READERS RIGHT US, about everything, but mostly our mistakes they like us. Last issue noted, we said wiley, pic said riley, must by misprint pointed, John Harris, Yazoo, he and others gleefully giving us the loud bazoo. No, no misprint Johnny, just shows never count on newsprint. So take our word for the absurd, it's not really riley, it's weally wiley.

—The Armchair Engineer

RCA SERVICE KEEPS ALL YOUR AM, FM, TV EQUIPMENT IN TOP CONDITION



TR-22

TAKE ADVANTAGE OF THE FOLLOWING SERVICES OFFERED BY RCA:

Video Tape Recorder Service • TV Camera Overhaul • TV Transmitter Overhaul • Installation Supervision • Microphone and Pick-Up Repairs • Transmitter Performance Measurements • Antenna Inspection Measurements • Console Repairs • Microwave Service • TV Projector Service • Custom Fabrication • Teletypewriter Maintenance

Your audience demands a superior signal which requires top performance from all your station equipment. RCA Broadcast Service is planned to assure you of meeting this objective. More than 30 years in the broadcast industry have provided a background of solid service experience. This is the type of protection broadcasters have relied on for years, the kind of protection you can count on . . . contract or per-call . . . from the experts in the service business, RCA Service Company. To guard performance of all your equipment . . . simply telephone one of the following field offices: Atlanta (phone 355-6110), Chicago (WE 9-6117), Phila. (HO 7-3300), Hollywood (OL 4-0880). Or contact Technical Products Service, RCA Service Company, A Division of Radio Corporation of America, Bldg. 203-1, Camden, N.J. 08101.

The Most Trusted Name in Electronics

Living color with only black-and-white studio lighting

With this 3-tube set in the TV camera, the studio lighting you now use for B&W pickup is all you need to transmit superior color pictures. At the same time, you air high resolution pictures having normal tone rendition for B&W receivers. You avoid many of the lighting costs normally associated with high-quality studio color pickup...as well as the high scene-lighting temperatures and need for extra air-conditioning.

Precision construction, field mesh, and closely matched tube characteristics assure excellent registration and color uniformity over the entire scanned area.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics

High signal-to-noise ratio and signal output, and excellent life expectancy are additional features of the RCA-4415 and -4416.

This factory-matched set consists of two RCA-4415's and one RCA-4416 with a high blue sensitivity which increases over-all camera sensitivity by as much as a factor of two. For quick identification, each image orthicon is marked for its particular color channel.

Write or call your local distributor of RCA broadcast tubes for information on these orthicons that enable you to air living color with only B&W studio lighting.

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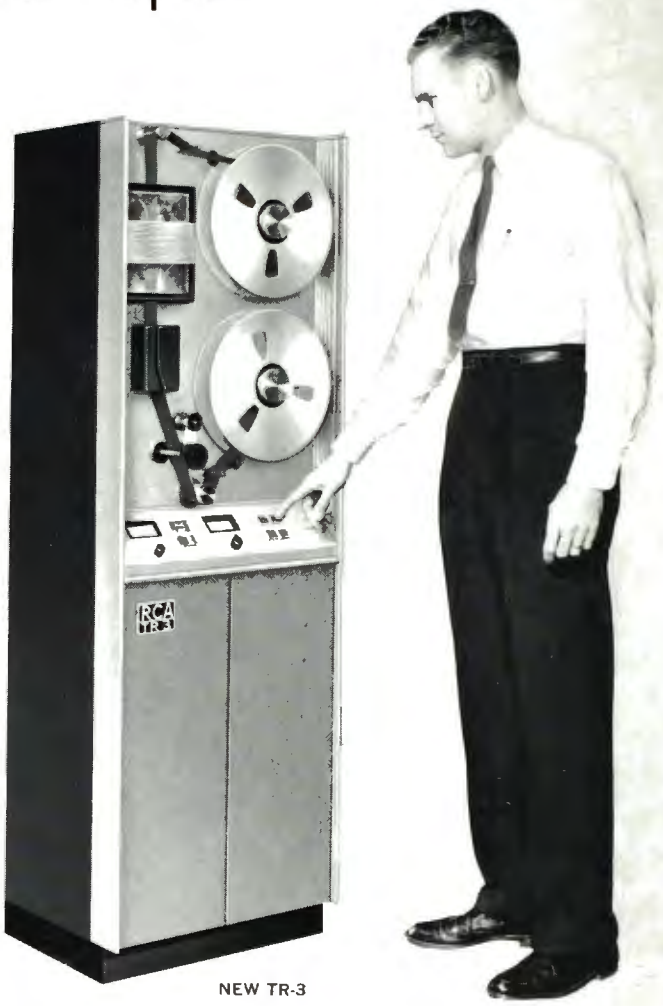

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