TELE-VISION ENGINEERING

MARCH, 1952

The News-Engineering Journal of VHF-UHF TV, Radar and Allied Industries

Industrial TV audio-video monitor station.

Are you missing any of these IRON CORE ENGINEERING POSSIBILITIES?

✓ Smaller tuning units
✓ Less critical materials

By providing electrostatic and electromagnetic protection over that supplied by the can, *Stackpole sleeve cores* permit use of a smaller can and enable it to be made from less critical and costly materials.

✓ Higher Q
✓ Smaller assemblies
✓ Simplified tuning

Stackpole threaded type iron cores eliminate the usual brass core screw from the field of the coil, thus greatly increasing efficiency.

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✓ High Q in small space

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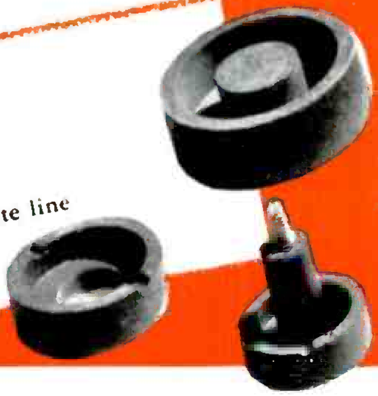

There's no substitute for molded iron cores in a long list of applications—electrically, mechanically or economically!

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This is the Hallmark of the Ideal Insulation

SINCE 1919

MYCALEX

THE INSULATOR

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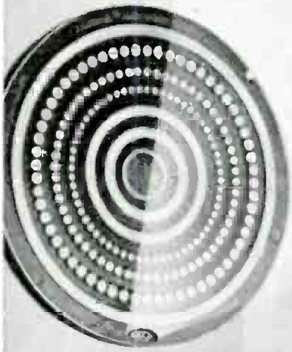

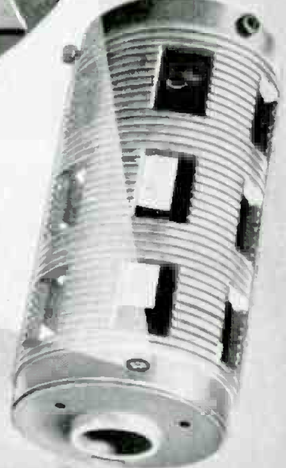

FOR ALL FREQUENCIES

Mycalex, the ideal insulation, offers low loss and high dielectric strength. It is impervious to oil or water, free from carbonization, withstands high temperature and humidity. Mycalex remains dimensionally stable permanently and possesses excellent mechanical characteristics. In its present high state of development, Mycalex combines every important insulating advantage — including economy. Mycalex is available in sheets and rods, can be injection or compression molded to close tolerance, is readily machineable, can be tapped, drilled, threaded and ground.

INJECTION MOLDED GRADES

MYCALEX 410

Mycalex 410 is approved fully as Grade L-4B under National Military Establishment Specification JAN-1-10 "Insulating Materials, Ceramics, Radio, Class L."

Power Factor, 1 megacycle	0.0015
Dielectric Constant, 1 megacycle	9.2
Loss Factor, 1 megacycle	0.014
Dielectric Strength, volts/mil	400
Volume Resistivity, ohm-cm	1×10^{15}
Max. Safe Operating Temp., °C	350
Water Absorption, % in 24 hours	nil
Tensile Strength, psi	6000

MYCALEX 410X

Mycalex 410X can be injection molded, with or without metal inserts, to extremely close tolerances.

Power Factor, 1 megacycle	0.012
Dielectric Constant, 1 megacycle	6.9
Loss factor, 1 megacycle	0.084
Dielectric Strength, volts/mil	400
Volume Resistivity, ohm-cm	5×10^{14}
Max. Safe Operating Temp., °C	350
Water Absorption, % in 24 hours	nil
Tensile Strength, psi	6000

MACHINEABLE GRADES

MYCALEX 400

Mycalex 400 is approved fully as Grade L-4A under National Military Establishment Specification JAN-1-10 "Insulating Materials, Ceramics, Radio, Class L."

Power Factor, 1 megacycle	0.0018
Dielectric Constant, 1 megacycle	7.4
Loss Factor, 1 megacycle	0.013
Dielectric Strength, volts/mil	500
Volume Resistivity, ohm-cm	2×10^{15}
Arc Resistance, seconds	300
Max. Safe Operating Temp., °C	370
Water Absorption, % in 24 hours	nil
Tensile Strength, psi	6000

MYCALEX K-10

Mycalex K-10 conforms fully to Grade HIC5H4 under National Military Establishment Specification JAN-1-12.

Dielectric Constant, 1 megacycle	10.6
Q Factor, 1 megacycle	300
Loss Factor, 1 megacycle	0.034
Dielectric Strength, volts/mil (0.10 in. thickness)	270
Fractional Decrease of Capacitance with Temperature Change	0.0056
Fractional Increase of Capacitance with Temperature Change	0.0076

LOW-LOSS MINIATURE TUBE SOCKETS

ECONOMICAL — Comparative in cost to ordinary phenolic sockets, but far superior electrically. Dimensional accuracy unexcelled.

AVAILABLE IN TWO GRADES — Mycalex 410 fully approved as Grade L-4B under N.M.E.S. JAN-1-10 "Insulating Materials, Ceramics, Radio, Class L." Mycalex 410X offers lower cost with insulating properties exceeding those of general purpose phenolics. Both Mycalex 410 and 410X Tube Sockets are supplied in 7 pin, 9 pin and subminiature. All are precision molded for highest accuracy.

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MYCALEX K

embraces an entire series of capacitor dielectrics, each with specific characteristics. These can be supplied on special order in sheets 14"x18" in area and from ⅛" to 1" in thickness, also available in rods. MYCALEX K can be machined to close tolerance or molded.

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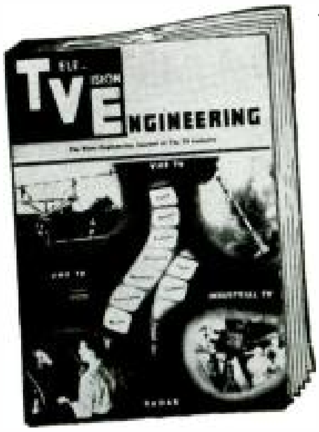
MONTHLY FEATURES

Cover Illustration

Industrial TV monitor station setup used during closed-circuit stockholders meeting at Foote Mineral Co., Exton, Penna.

Editor: LEWIS WINNER



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TELEVISION ENGINEERING

LEWIS WINNER, Editor

March, 1952

The Sterling Record of NTSC—A dozen years ago when TV was just beginning to attract attention, particularly in Washington, industry was told by the FCC, through the offices of the then chairman, Lawrence Fly, that full commercialization of TV would be authorized by the Commission . . . "as soon as the engineering opinion of the industry is prepared to approve any one of the present competing TV systems."

That was quite a challenge. Fourteen months later, industry had an answer to that challenge, thanks to the resourceful efforts of the first NTSC. In that short time, the plan for the committee had been formulated, committees assembled, meetings held, minutes recorded, technical reports compiled, and a final report delivered to Washington.

Commenting on this historic achievement at the recent IRE national convention, Doc Baker said . . . "The NTSC standards resulted from a thorough reexamination of every phase of the TV art relating to public service. The front displayed by the engineers and industry at the conclusion of the NTSC work was, if not wholly solid, as uniform as any that can be expected to result from a democratic process. When the committee's recommendations were made to the Commission, the complexion of the industry had changed from a discord of counterclaims to a concord of expert opinion, which persuaded the Commission to acknowledge its value and to proclaim the art open to the public."

Today, there is another NTSC in action, and again it is meeting a robust challenge through the concerted efforts of all members of industry. Its task today is more complex, covering three thorny issues: allocation problems on the ultrahigh band; procedures enabling the FCC to lift the freeze; and particularly, basic standards for the development of a commercially practicable system for color TV. And again the results have been commendable. On all three fronts there have appeared plausible, practical formulas for successful solutions to the problems. In the field of color, the committee, through its nine panels and host of subcommittees, has contributed striking answers to every phase of the involved subject. As in the forties, the discord of counterclaims has rapidly disappeared, and industry has combined its talents to produce a plan which it is felt will convince and impress the Commission, and warrant approval.

Recently, the Department of Justice implied, in an inquiry into industry behavior, that coordinated efforts through industry associations and committees set up to find base solutions to common problems might be considered an act of collusion, contrary to public interest. If the evolution of an extremely efficient and government-approved monochrome system, and attempts to provide a practical color system, through the efforts of a sincere group of industry committees, can be called collusion, dictionaries should begin redefining the word and enter the adjective *friendly* before the noun *cooperation*. For no friendlier group than these NTSC panels have ever convened in a room or on a field to pull together and attempt to find equitable answers. And no broader requirements for committee entry were ever written. Anyone could join; the only requirement has been recognized skill, interest and ability in the assigned project.

The NTSC has been an exemplary body and a tribute to the sincerity of an industry, seeking to provide the ultimate in engineering, research, design and production, so that the public might enjoy the best in sight and sound, not only today, but for many years to come.

The Solid-State Age—With the increased interest in magnetic amplifiers, transistors and dielectric amplifiers, as substitutes for vacuum and gas-filled electronic tubes, it appears as if the solid-state age has really arrived. The unique transistor, featuring two hair-thin wires touching a pinhead of a solid semiconductive material soldered to a metal base, has been found to be even more impressive in its possibilities than originally predicted. Tests made in commercial and military labs have revealed that the tube substitute, which can serve as an amplifier or oscillator, has made it possible to construct a host of miniaturized, highly-efficient devices, heretofore considered mere drawing-board ideas. Some tests have shown that the transistor will amplify over 100 times. The transistor seems to have answered a question scientists have been pondering for many years: how to make semi-conductors amplify and thus provide a simpler, more rugged, smaller device that might perform the functions of a vacuum tube.

Magnetic amplifiers have also blazed a path on the radio and TV front. Although somewhat slower to respond than vacuum tubes, they have been found highly effective as amplifiers in servomechanisms and other types of automatic control and instrument work. Even the slow response is being minimized through the use of improved cores, and many look to the amplifier as an ideal substitute for the tube in a variety of applications where it is necessary to have complete isolation between input and output, signals mixed at different voltage levels, and extremely high power gains.

The dielectric amplifiers, featuring the use of capacitors which might be made with barium titanate, strontium titanate, or lead zirconate, are also rapidly coming to the front as an effective means of amplification. These amplifiers bear many interesting operational similarities to the magnetic type. In the magnetic amplifier, the incoming signals control current flow by magnetic means, whereas in a dielectric amplifier the signals change the effective resistance to current flow of the titanate-type capacitors.

These new revolutionary devices will not completely replace the vacuum tube; rather they will complement them, and make it possible to evolve and produce equipment with trail-blazing features. A toast to these three ingenious developments, creators of a truly new age.

—L.W.

TVE-grams . . .

UHF Developments Highlight IRE Convention: That bright new homeland for sightcasters, the ultrahighs, which will become a beaming fact as soon as the Commission releases that historic 600-odd page allocation document, will be the scene of a bustling arena of developments, according to the parade of experts who appeared at the IRE national meeting a few weesk ago.

It was disclosed that a striking variety of tubes will be available for upstairs TV. One family will feature plane, parallel electrodes, which will allow very close spacing required for extremely short transit time. Anode and grid-contacting pins have been replaced by copper discs, fused into and protruding beyond the wall of the glass bulb. The tube, a disc-sealed triode, will be usable as an oscillator in coax-line circuits; with an anode input of 10 watts it will provide about 2.8 watts at 1000 mc and .5 watt at 3000 mc. In receivers, it will be possible to use the tube as a high-frequency amplifier and local oscillator, while in transmitters its main service will be as a self-excited, controlled and impulse-modulated transmitting tube.

Also discussed was the long-awaited klystron capable of poviding 5 kw of output power, which with high-gain antennas might supply up to 100-kw *erp*, a power it was believed a short while ago would be impossible to produce.

Displayed, too, was an air-cooled 1-kw *uhf* tube, featuring the use of ceramic in the envelope. It was pointed out that the tube could be used in class-*B* service as a grounded-grid broadband amplifier having a power-gain factor of 10, or in narrow-band class-*C* service as an amplifier or oscillator.

On still another tube front, there appeared news that an extremely small power triode, a forced-air-cooled grounded-grid type, was available. Featuring a coax-electrode structure, the tube was described as having a maximum plate dissipation of 250 watts, which could be operated at full plate voltage (*rf* power amplifier class-*B* TV service) of 1500.

A variety of *uhf* receiving tubes, and germanium and silicone diodes were also exhibited. Among the tubes shown were a planar-grid triode, silicon mixer diode, germanium diodes for harmonic generation, oscillator-mixer double triode, double triode for the first *if* stages, and direct-coupled video-amplifier beam tetrodes.

A new type of transmitting antenna also appeared on the scene. Featuring a slotted construction, the antenna was said to have a *vswr* of less than 1:1 over an operating channel, and a controllable horizontal radiation pattern circular within 1 db. Curved radiating elements featured in the antenna were claimed to create an essentially cylindrical surface on which flows a uniform cylindrical current.

An extremely interesting assortment of receiving antennas were also exhibited. Among those shown were the popular single and stacked fan dipoles, a stacked V antenna, corner and parabolic reflectors, as well as a yagi.

Converters, tuners, and even complete *uhf* receivers, were also prominently on view during the conclave. During a press meeting, newsmen saw, for the first time in New York City, reception from channel 54 (708-714 mc), with the signals coming from the DuMont ultrahigh station in New York City.

Particularly impressive were the assortment of tuners and converters provided for single and dual-station pickup, as well as complete ultrahigh coverage, plus both *uhf* and *vhf* reception. The latter, an 82-channel turret-type tuner, featured incremental tuning, with tuning accomplished by means of lumped constants. Another tuner, covering channels 14-83, featured a tuned transmission line as a basic tuning device, the latter being formed as a curved line. This design was said to provide a mechanical layout which made it possible to simplify the location of the oscillator as well as connections between the preselector, mixer and oscillator circuits.

Still another tuner featured the application of the sliding-contact method of variable inductance. It was also pointed out that tests have been made with printed-circuit *rf* plates, featuring the use of silver powder, with a basic pattern printed on 270° of a surface, allowing 360° rotation of a contactor which could serve both the high and low bands, or channels 2-13 and 14-83.

The possibilities of antenna distribution systems were also probed. It was pointed out that with the types of commercial tubes presently available, single-channel types of amplifier distribution systems will probably be used initially. It was predicted that new tubes, such as low-noise travelling-wave types with large gain-bandwidth factors, may eventually result in the design of broadband amplifier distribution systems.

The comprehensive review of practically every facet of the ultrahigh art which emphasized the thorough planning of industry was praised by everyone, for it was felt that extremely practical solutions to many of the key stumbling blocks had been evolved, and Mr. and Mrs. Consumer would reap the benefits of these developments, assuring foolproof gear when the ultrahighs do appear on the commercial horizon.

AUDIO FREQUENCY measurement standards, developed at Bureau of Standards, featuring a highly accurate electro-thermic transfer standard for the measurement of voltage and current.

ONE OF THE ULTRAHIGH EHXIBITS at the recent IRE convention, which featured a display of a microwave generator, tuning strips for turret tuners, transmission line *uhf* tuner, air-cooled 1-kw tube, diplexer and an assortment of miniature *uhf* tubes for receiving and transmitting. A complete report on these developments will appear in April, TELEVISION ENGINEERING.

TVE-grams . . . — *Personals*

New Posts: *S. Wyman Rolph*, president of the Electrical Storage Battery Co., has been elected president of The Franklin Institute. *Richard T. Nalle*, president of the Midvale Co., was appointed to the board of managers to fill Rolph's unexpired term. *Morton Gibbons-Neff* has been elected vice president of the Institute, and *E. G. Budd, Jr.*, was named to the board. *C. M. Waterbury* was elected assistant treasurer. . . . *Paul Gaynor*, formerly vice president of Buchanan and Co., Inc., has been appointed vice president in charge of merchandising of CBS-Columbia Inc. . . . *Kenneth C. Towe* has been elected president of American Cyanamid Co. . . . *Colonel Edmund C. Stoner*, Federal Telephone and Radio Corp., has received the Order of the British Empire, for his work in the development of the allied air force communications system in Italy during World War II. . . . *Thomas S. Bills* has been named manager of the new Los Angeles engineering offices of the Sprague Electric Co. Other members of the staff include: *George S. Kariotis*, *Fred S. Nichols*, *Paul M. Kuefler*, *Lloyd West*, *John J. Fiske* and *Dana Grindy*. . . . *Stanley L. Abrams* has been named director of purchasing, and *Irwin M. Koenigsberg* has been named manager of the purchasing division of Emerson.

Frank R. Edgarton, formerly a senior mechanical engineer with Stromberg Carlson, has joined the staff of the Ordnance Development Division of the National Bureau of Standards, where he will assist in the development of fuses for guided missiles. . . . *Dr. Murray Gerstenhaber*, Harvard University; *Ernest Mark Henley*, University of California; *Dr. Emin Turan Onat*, Brown University; *Dr. Henry Helson*, Yale; and *Paul Namon Schatz*, Brown University, have been named to receive the $4500 Frank B. Jewett post-doctoral fellowships for '52-'53. . . . *Hugo Sundberg*, vice president and general manager of Oxford Electric Corp., has assumed the duties of directing future sales policies of the organization. . . . *B. Clark Boeckeler* has been appointed treasurer of Taylor Tubes, Inc. . . . *George K. Otis* has been elected vice president of Lear, Inc. . . . *Raymond W. Saxon*, formerly staff assistant to J. B. Elliott, vice president in charge of consumer products, has been appointed general sales manager of the RCA home instrument department. . . . *Cyrus W. Haller* has become president of Victoreen, succeeding *Winfield S. Kendrick*, who has retired due to illness. *John A. Victoreen* is chairman of the board. *Bruce A. Coffin*, president of Hytron, is on the Victoreen board.


Walter A. Weiss


Cyrus W. Haller


Charles P. Cushway


Morton Lee

Vice president *C. H. Haines* has been appointed to serve as director of facilities planning for Sylvania. . . . *Matthew D. Burns* has been named general manager of the radio tube division of Sylvania, headquartering at Emporium, Pa. . . . *John H. Harley* has joined the radio interference filter group at the Culver City, Calif., application engineering laboratory of Sprague Electric Co. . . . *William B. Mooza* and *George Davis* have been appointed sales reps for Tricraft Products Co. . . . *Leslie E. Woods*, director of industrial relations at Raytheon, has been appointed a member of the New England Regional Labor-Management Committee for Defense Manpower. . . . *Dana K. Bailey*, of the National Bureau of Standards Central Radio Propagation Lab. has received the Arthur S. Fleming award as the outstanding government man of the year. . . . *Donald Morse* has been named sales manager of the tape recorder division of Eicor, Inc. . . . *Roy W. Augustine*, research engineer for the Muter Co., has been presented a certificate of appreciation for his European electronic research conducted during the last year of World War II. . . . *Fritz P. Rice* has been named manager of the picture-tube division of DuMont. . . . *C. K. Krause* has been named manager of the electronic products division of Air Associates Inc. . . . *W. H. Pitkin*, formerly general attorney, is now counsel for the International Telephone and Telegraph Corp. Others appointed were: *Charles D. Hilles, Jr.* vice president and general attorney; *Geoffrey A. Ogilvie*, vice president and secretary; *Paul F. Swantee*, comptroller; and *M. Richard Mitchell*, general solicitor.

Walter A. Weiss has been appointed general manufacturing manager of the radio tube division of Sylvania. . . . *Dr. P. S. Christaldi*, formerly engineering manager, has been named assistant division manager of the instrument section of DuMont. Other appointments in this division include: *G. Robert Mezger*, engineering manager; *Emil G. Nichols*, technical sales manager; and *Melvin B. Kline* and *William G. Fockler*, assistant engineering managers. . . . *Prof. Malcolm S. McIlroy* has been appointed assistant dean of the college of engineering at Cornell University. . . . *Russell C. C. Dubois, Jr.*, has been appointed sales manager for RCA mobile and microwave communications equipment, succeeding *Dana Pratt*, who has been named product manager for broadcast transmitters. . . . *Morton Lee* has joined the staff of British Industries Corp. as a sales engineer. . . . *Fred J. Hartman* has been appointed assistant controller; *Norman Hamlin*, credit manager; and *L. H. Kline*, materials control supervisor, of The Gabriel Co. . . . *Major General Kenneth D. Nichols*, deputy director of guided missiles within the Office of the Secretary of Defense, has been named Army service member of the Department of Defense Research and Development Board. . . . *Charles P. Cushway* is now vice president and chairman of the advisory board of Crescent Industries, Inc. . . . *Herbert Bloomberg*, central district sales manager for the TV transmitter division, Allen B. Du Mont Laboratories, Inc., has been named to supervise the division's sales activities in its newly realigned central sales territories.

C. A. Haines

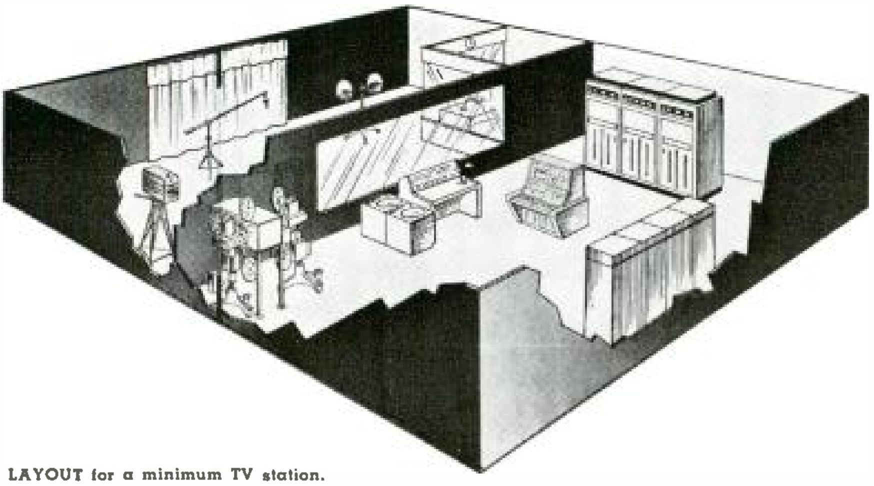
Fritz P. Rice

Norman Hamlin

Fred J. Hartman

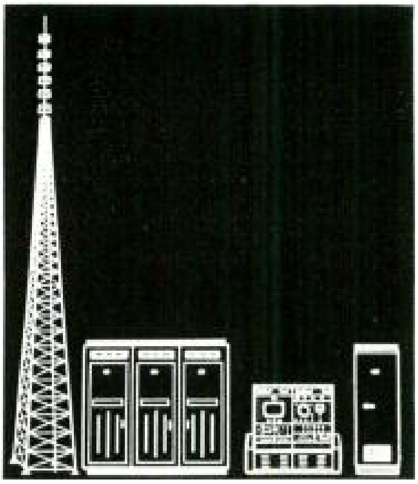
Matthew D. Burns

Grow-As-You-Earn TV



LAYOUT for a minimum TV station.

TRANSMITTER-ANTENNA setup: Transmitter, transmitter control, frequency monitors, modulation and video monitors, spare tubes, wattmeter, audio, antenna and transmission line.



THE ECONOMICS of television-station operation requires a well-planned arrangement and selection of equipment that will allow for future expansion with a minimum, if any, obsolescence of equipment. At the same time the equipment must offer the potential station management a chance to go on the air with a minimum investment.

There have been evolved *grow-as-you-earn* programs which meet these economic requirements of today's telecasting business. Through the arrangement of equipment into a few functional groups which fit together to form a complete, well integrated TV station, cost, operational manpower requirements, and flexibility are assured.

The power allocation of the station can be used to determine the transmitter complement of transmitter group which will be required. For instance, transmitters offer a potential station a choice of powers from 500 watts to 100/200 kw *erp* through the use of amplifier units added to a basic three-cabinet transmitter unit. The antenna best suited for the particular transmitter can be selected to provide the coverage required to serve the market area best competitively.

If the location of the studios and transmitters are some distance apart, it will be necessary to plan for a microwave link, or telephone company service, for which a special group of equipment is available for this link.

Central control equipment is comprised of a monochrome scanner; terminal facilities for setting up and monitoring incoming network and remote signals; nine channel video switching and mixing equipment complete with line and preview monitors; patching facilities; consoles; and rack cabinets. To this central control equipment all other studio and field equipment can be added, in quantities, depending on the size of the station being planned.

In the *grow-as-you-earn* program, studio and field equipment have been broken down into seven basic complements. Any of these groups can be added to, as requirements of programming must be carefully considered in order to fill fully the needs of the station's operations from the time it first goes on the air.

Also available is a complement of gear consisting of two studio cameras with regular, wide-angle and telescopic lenses, dollies, cables, and necessary accessories. This group makes up the necessary video pickup equipment for *live* shows in the studio.

For audio pickup in the studio, as well as recording reproduction there is another complement which contains all the necessary equipment for a two-camera studio.

The need for suitable lighting can be filled with still another package which provides basic lighting for a 40 x 60 studio.

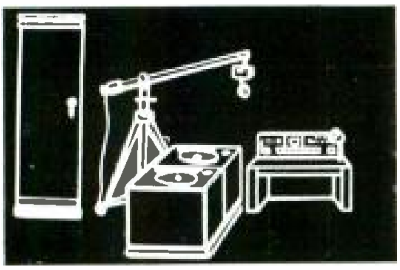
Certain test equipment is needed to trouble shoot and for regular maintenance work. A group of equipment is also available for this job.

To fit the needs of a minimum station, there has been provided a package of equipment which includes a film/studio camera, two 16-mm projectors, a multiplexer and accessories.

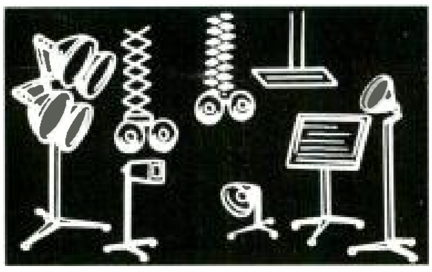
For field pickup of programs there are available a dual field camera chain complete with sync generator, video mixer, and accessories. For more complete field programming, a triple camera chain is available.

To transport and house the field equipment, there is a package which includes a telecruiser with self-contained power plant, portable relay,

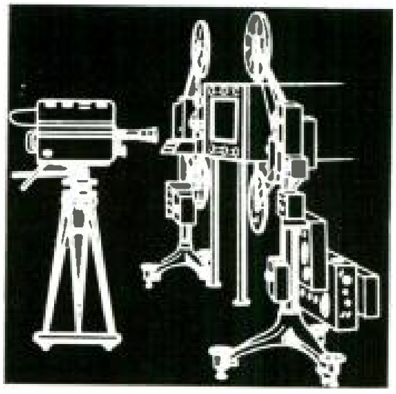
AUDIO COMPLEMENT for typical two-camera studio.



LIGHTING COMPLEMENT for basic lighting of 40 x 60 studio.



FILM-STUDIO CAMERA with two 16-mm projectors, multiplexer and accessories.



STATION PLANNING

by FRANK NEWMAN

Transmitter Division
Allen B. DuMont Laboratories, Inc.

Going on the Air with Minimum of Equipment . . . Preparing for the Future

monitoring and distribution facilities equipment for power, audio and video.

The foregoing complements illustrate the groups which go to make up a television station. However, this does not mean that all of them are necessary to start a TV station. They are the basic groups with which an operation may be built up, and may be added to existing equipment at any time. For example, any number of cameras may be added for studio use as the need arises, or perhaps events to be televised require a second complete field camera setup. All these pickup complements, field camera chains, studio cameras and film cameras, plus the network programs received via wire or microwave feed into the nerve center of the station. This complement itself may be added to as required by means of additional console cabinets housing monitors and control equipment. Each studio camera is provided with its control and monitoring equipment housed in a universal console section that fits into a central control group.

To go on the air with a minimum investment, the antenna and transmitter selected (complying with the individual allocation and permit) should give maximum coverage of the best market areas within coverage range. This is necessary to make the operation economically sound. To the actual transmitting equipment should be added

(*Continued on page* 25)

Scope.
Voltohmmeter.
Audio oscillator (20 cps to 20 kc).
Video sweep generator.
Tube tester.
1,000′ RG59/U coax cable.
Coax cable connector.

Test equipment complement: cost about $2,900.

Dramaspot, 6″ Fresnel medium prefocus with pipe clamp (20).
500-watt longlife lamp.
Dramaspot, 8″ Fresnel mogul prefocus, with pipe clamp (12).
1,000-watt longlife lamp.
Barn doors for 6″ Dramaspot (20).
Barn doors for 8″ Dramaspot (12).
Skyhook (10).
Videolite (12).
1,000-watt long life, clear, mogul screw lamp (18).

BASIC LIGHTING for 40′x60′ studio; cost about $3,400.

Sync generator, including timing generator; sync shaping unit; blanking driving unit; *lv* supply, *hv* supply; power control panel, and cabinet assembly.

Monochrome scanner, including *lv* supply; picture generator; control panel; scanning generator; *hv* supply and cabinet assembly.

Basic image orthicon chain, including control and monitor; *lv* supply; pickup auxiliary; pickup head (less pickup tube), and viewfinder.

Image orthicon.
Lens, 99 mm f/35, 3½″.
Iris control, 90 mm lens.
Power cord, 15′.
Cable, 9½′ w/connectors.
Cable, 100′ w/connectors.
Cable, 15′ w/connectors.
Cable, 10′ w/connectors.
Telephone headset (2).
Balanced head w/ball bearing pan.
Tripod.
Dolly (tracking).
Universal console section.
17″ receiver-monitor.
1¾″ blank panel.
Console mounting kit.
16 mm superspeed film projector (2).
Multiplexer for *i. o.* pickup.
Field-to-studio sync adapter.
Stabilizing amplifier.

Audio equipment, including seven-position studio audio console, complete with power supply, relay unit and tubes; transcription turntables (2); booster amplifier (2); polydirectional microphone; microphone desk stand; cord connector; wall receptacle; coax speaker; line matching transformer; 15″ speaker cabinet; 24 pair jack panel; 24″ patch cords (6).

MINIMUM studio complement whose total cost is about $36,000.

500-watt aircooled transmitter, including aural transmitter driver and visual transmitter driver (plus set of spare tubes).

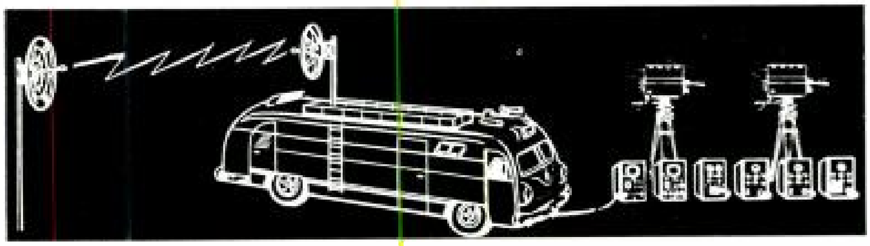
Transmitter control console, including picture monitor; *lv* power supply; cable; waveform monitor; power supply cable; stabilizing amplifier; stabilizing remote control; video switch unit; switch auxiliary; audio switch unit; transmitter power control; remote meter panel; universal console (2).

Frequency monitoring equipment, including visual frequency monitor; aural frequency and modulation monitor; aural monitor power supply plus spare tubes.

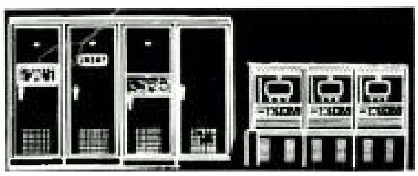
RF waveform monitor.
Monitor receiver (channels 2-6).
Air-cooled load and wattmeter.
Limiting amplifier.
Monitor amplifier.
Coax speaker.
Line matching transformer.
15″ speaker cabinet.
3-section superturnstile, including diplexer; tower mounting antenna.
Sleet melting equipment.
3⅛″ transmission line, 200′.

TRANSMITTER/ANTENNA complement whose total cost will vary from about $69,000 to $72,000 depending on channel.

MOBILE FIELD UNIT and dual field camera chain. In the mobile unit are portable relay, monitoring and distribution equipment for power, audio and video. The camera chain contains sync generator, video mixer and accessories.



CENTRAL CONTROL COMPLEMENT: Sync equipment, test pattern and slide video gear, video switching and mixing equipment.



LOW-VOLTAGE

Research Project, Involving Voltage-Stability Problems, Provides Interesting Answer in Form of an Electronically-Regulated LV Supply Which Can Be Used as a Bias Source in Current-Carrying Loop. Unit May Be Used with a Regulated or Unregulated DC Source. Terminal Voltage Is Adjustable ±5 Per Cent. Tests Over 72-Hour Period Have Indicated an Output Voltage Constancy of Better Than .2 Per Cent for an Output Voltage of 12.5 V.

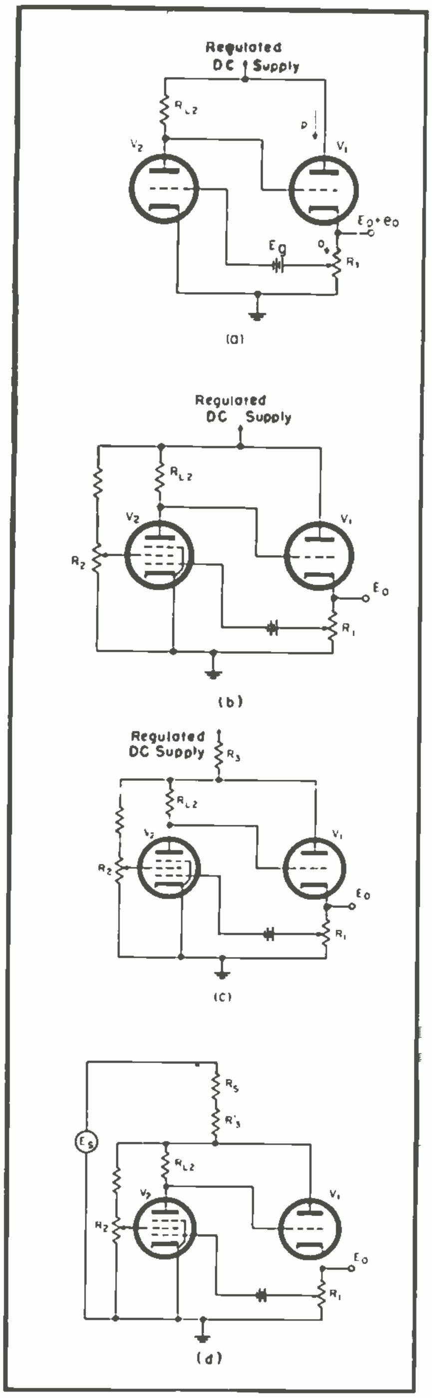


Figure 1

REGULATOR CIRCUITRY. In a appears a simplified lv regulator circuit. The use of a pentode, which provides an essentially constant screen potential is shown in b. In c we have a circuit with a resistor in the B+ supply of V_1, which results in changes in the load current causing changes in screen potential; this tends to counteract originating changes. The substitution of internal resistance of the rectifier-filter arrangement for part of the series tube plate-load resistor is shown in d.

Many forms of degenerative-type electronic voltage regulators tend to become complex when designed for operation at voltages as low as ten or twenty volts.

The major obstacle in the design of a low-voltage regulator, retaining circuit simplicity, is the restricted range of control-grid excursion. It will be noted, in the simplified low-voltage regulator circuit of Figure 1 *a*, that the grid of V_1 must be lower in potential than its cathode, to prevent the flow of grid current. The plate of V_2 is at the same potential as the grid of V_1. The cathode of V_2 is at ground potential. The minimum plate voltage of V_2 must be approximately two volts positive, if grid current flow in V_2 is to be prevented. An additional bias supply would be necessary were the cathode of V_2 to be made negative in potential. The maximum grid swing of V_1 is therefore restricted to a value approximately 3 volts less than the constant output voltage E_o of the regulator.

The battery indicated in *a* of Figure 1 is a mercury-type cell. Tests[1] have shown good shelf life over a wide range of temperatures. Since the voltage regulator shown, in common with most degenerative electronic voltage regulators, can be no more stable than its standard of comparison, batteries of the mercury-cell type were chosen for this unit. In addition, the battery is necessary in order that the plate-to-cathode voltage range of V_2 shall be a maximum. Gaseous voltage regulator tubes have been found to be subject to variations in output potential of as much as two per cent under conditions of changing load, temperature, and life.[2]

The regulator was designed to function as a stable source of bias voltage. It may be well to deviate at this point to explain why a battery, although it is used as a part of the regulator, could not be used in place of the regulator.

The bias source is used in a current-carrying loop. Such battery usage results in changed battery output potential with time. In the case of a negative-bias battery in a current-carrying loop, the battery potential may increase as much as ten per cent after several hours of use. This *charged* potential drops rapidly with removal of applied voltage and provides an erratic bias source. In some cases, a low resistance generator or supply is required. In addition, the ability to vary the applied bias potential, while maintaining a low source resistance so as to yield voltages other than the terminal potential of the batteries, may be required. Under such circumstances, the usual battery-potentiometer arrangement will not suffice. For these reasons, an electronically regulated supply having a very low internal resistance and stable output is desirable.

The circuit in *a* of Figure 1 may be discussed in general terms as follows: If the output voltage increases by an amount of E_o, this voltage is reduced by the voltage-divider ratio of the potentiometer R_1, and is applied to the grid of V_2. The plate-load resistor R_{L2} is 15 megohms, and the tube V_2 is operating with about ten microamperes of plate current.[3] The reduced incremental voltage is amplified by V_2 and is applied to the grid of V_1. Since there is phase reversal between grid and plate of V_2,

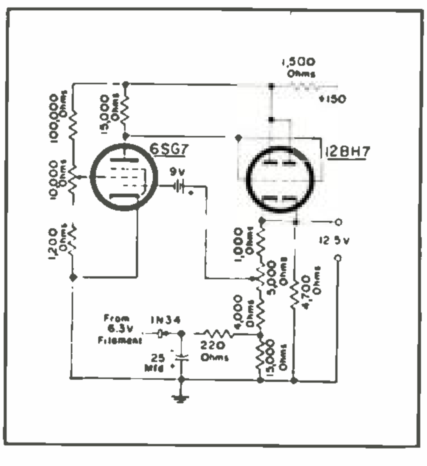


Figure 2

COMPLETE UNIT designed for use with an ac line-voltage regulator.

Regulator

by SHERWIN RUBIN
Central Radio Propagation Lab.
National Bureau of Standards

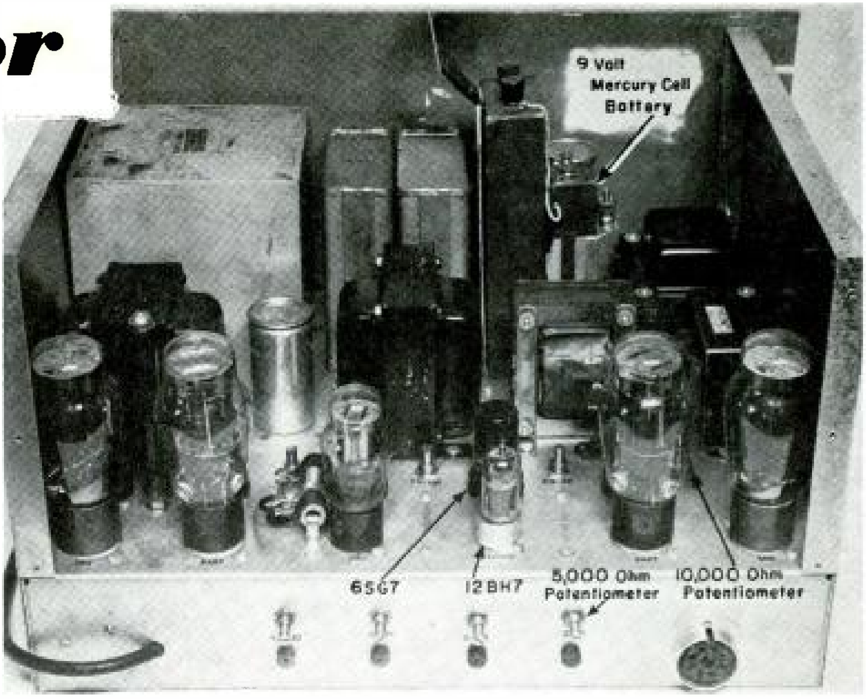


Figure 3

MULTIVOLTAGE SUPPLY incorporating the 12.5-volt regulator. The pin jack directly beneath the 5000-ohm potentiometer on the rear of the chassis is used for monitoring output voltage when adjusting the regulator.

the amplified voltage acts on V_1, to counteract the change in E_o.

If a pentode is used for V_2, as shown in Figure 1*b*, an essentially constant screen potential will be maintained, since the screen current is less than five microamperes. For example, with a screen-supply bleeder current of one milliampere, a variation of two to one in screen current will change the screen potential by less than one per cent. Increased amplification in the control circuit may be obtained in this manner, but a finite internal resistance will remain in the regulator. It may be noted that the circuits of *a* and *b* in Figure 1 require an *error* signal to cause corrective action.

Experimental data were taken using a 6SG7 pentode in the circuit of Figure 1*b*. The screen potentiometer, R_2, was adjusted to give various mean values between 2 and 7 volts. R_2 was then varied to yield screen potentials in a range of one volt about the mean value, and the output voltages for no-load and full-load external currents were noted. In this instance, full-load external current was 25 milliamperes, and no-load external current was zero. From the results obtained, it was found that the output terminal potential of the regulator is an approximately linear inverse function of the screen potential, between mean screen values of 2 to 7 volts.

If, therefore, the screen potential is adjusted to be the proper fraction of the supply voltage, then changes in supply potential may be counteracted by changes in screen potential. If we now insert a resistor in the B+ supply of V_1 (as shown in Figure 1*c*), changes in load current will cause changes in screen potential, which will tend to counteract the originating changes. We can go further and adjust the screen potentiometer so as to cause output voltage to increase with load, and vice versa. It can be seen that it is now possible to achieve zero or even negative internal resistances in the regulated supply.

We can go one step further, and substitute the internal resistance of a rectifier-filter arrangement for part of the series tube plate load resistor, as shown in Figure 1*d*. (The results tabulated in *appendix 2* show regulation and internal resistance of the supply under such conditions to be essentially similar to those of Figure 1*c*, where a regulated voltage supply is used to feed the low-voltage regulator.)

Heater-voltage variation will affect the output potential of the regulator because of initial velocity changes.[4] In Figure 2 appears a circuit of a complete unit designed for use with an *ac* line-voltage regulator. The germanium diode and associated filter may be used to compensate for changes in heater voltage and allow operation without a line voltage stabilizer. (Data on stability are shown in *appendix 1*.) The unit was run continuously for a period

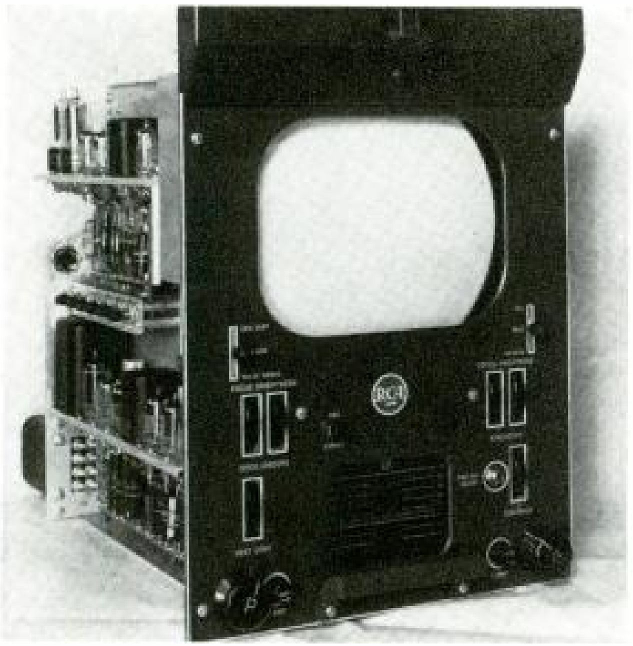
(*Continued on page* 26)

Heater Voltage Stability			Supply Voltage Stability			External Load Stability	
E_H	$E_{N.L.}$	$E_{F.L.}$	E_S	$E_{N.L.}$	$E_{F.L.}$	Ext. Load (ma)	E_{out} (volts)
7.0	12.56	12.56	120	12.50	10.70	0.0	12.51
6.3	12.51	12.51	130	12.50	12.50	3.0	12.51
6.0	12.51	12.51	150	12.50	12.40	6.3	12.51
5.5	12.50	12.50	180	12.48	12.47	13.0	12.51
5.0	12.50	12.51	200	12.49	12.43	28.0	12.51
4.5	12.50	12.50	210	12.60	12.43	34.0	12.42
4.0	12.51	12.52					

Appendix I
Regulator stability with regulated source

Heater Voltage Stability			Supply Voltage Stability			External Load Stability	
E_H	$E_{N.L.}$	$E_{F.L.}$	E_S	$E_{N.L.}$	$E_{F.L.}$	Ext. Load (ma)	E_{out} (volts)
7.0	12.50	12.52	120	12.55	12.32	0.0	12.50
6.3	12.50	12.51	130	12.52	12.53	3.0	12.50
6.0	12.49	12.51	150	12.50	12.52	6.3	12.50
5.5	12.50	12.51	180	12.46	12.49	13.0	12.50
5.0	12.50	12.52	200	12.44	12.45	28.0	12.50
4.5	12.51	12.52				34.0	12.32
4.0	12.51	12.53					

Appendix II
Regulator stability with unregulated source



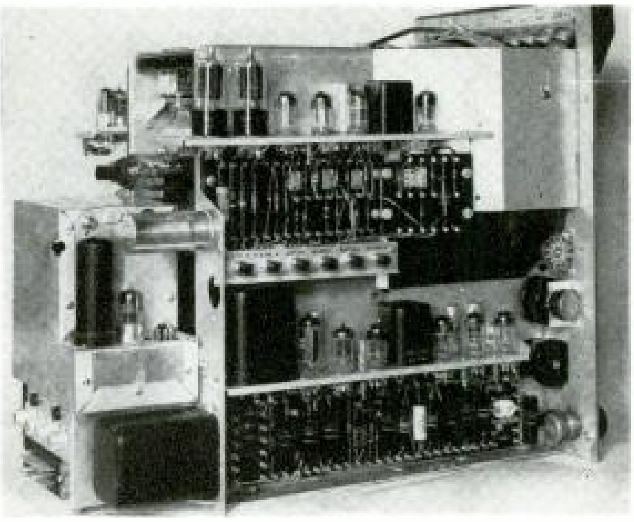


Figure 1 (left) — Figure 2 (above)

MASTER MONITOR front view. DEFLECTION SIDE of master monitor.

Master Monitor For

Instrument, Designed for Critical Video Monitoring, Features Such Developments as CRO Time-Base Expansion Permitting Detailed Observation of Blanking and Sync Intervals, Delay Circuit to Produce Pulse-Cross Display on Picture Tube, and Deflection Circuits for Greater Linearity.

OVER THE PAST FEW YEARS the need for more critical video monitoring and for greater accessibility of monitor controls and operating adjustments has become vital in the successful handling of modern TV programming.

To fulfill these needs, there has developed a master monitor‡ with many features. The new equipment, for instance, employs new *cro* time-base expansion, which permits the detailed observation of blanking and sync intervals, and provides the necessary circuits and calibrated scales to comply exactly with recommended IRE standards of measuring video levels.

For simultaneous examination of the composite sync signal, a delay circuit has been incorporated to produce a *pulse-cross* display on the picture tube. Overall circuit design permits a uniform control of video signal levels, a closer observation of deflection linearity, and an accurate check of picture resolution. To facilitate operation, all circuit and adjustment controls have been brought out on the front panel except those alignment controls purposely located behind the front panel to avoid accidental misadjustment.

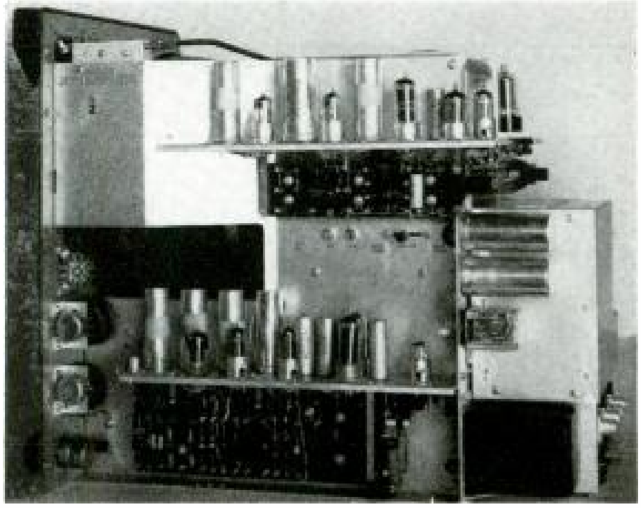


Figure 3

VIDEO SIDE of the master monitor.

Deflection Circuits

Particular emphasis has been placed on improving the deflection circuits. The vertical deflection employs negative feedback with a shaping network introduced ahead of the output stage to make the feedback more effective. The schematic of the horizontal deflection circuit (Figure 4) is very similar to a push-pull output stage of audio practice; it differs in that the damper winding returns to ground. As in the *Schade* circuit, the damper controls the energy supplied by the driver tube and thus requires no plate current directly from the power supply. It is advantageous, however, to use the same tube types for both driving and damping functions, since better waveform symmetry is achieved when this is done.

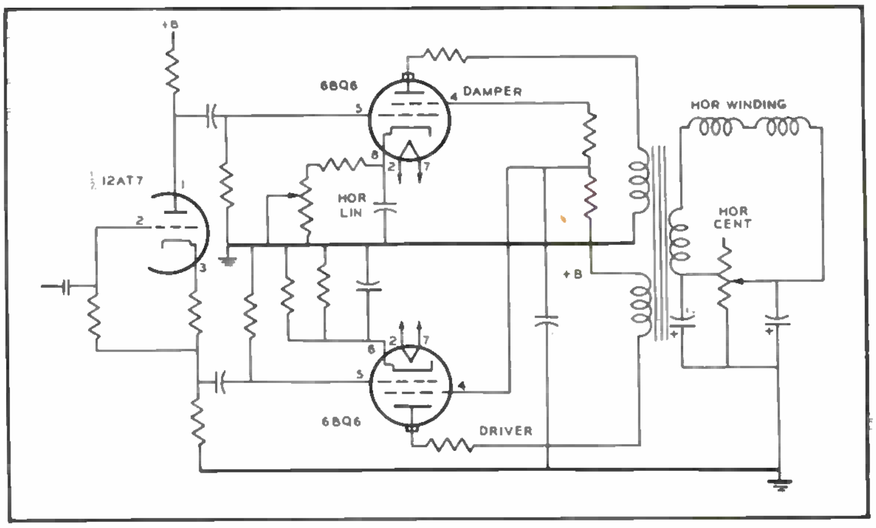
‡RCA TM-6A; sucessor to and interchaneable with the TM-5A.

Figure 4 (right)

HOIZONTAL DEFLECTION circuit.

Figure 5 (below)

HALF-FREQUENCY circuit for the cro time base: V_1 is at right and V_2 at left.



VIDEO MONITORING

by N. P. KELLAWAY

TV Terminal Equipment Engineering
RCA Engineering Products Department

and linearity is essentially independent of reasonable width variations.

CRO Frequency Stability

Figure 5 depicts the half-frequency circuit for the *cro* time base and illustrates how tubes required for frequency division and sawtooth generation functions have been reduced to one dual triode. The change in sweep frequency from 7825 to 30 cycles has been accomplished by changing the capacitance across the grid of the second tube. To explain the operation of this circuit, let us assume that V_2 is cut off and the grid and cathode of V_1 are at 60 volts. At the same time, the grid of V_2 is rising as its grid capacitor charges through a high resistance towards $+B$. When this tube starts to conduct, the feedback from the plate of V_2 to the grid of V_1 biases V_1 beyond cutoff and the grid of V_2 conducts. The grid capacitor of V_2 discharges rapidly through a 5600-ohm cathode resistor in series with the *cathode-to-grid* resistance of V_2, while V_1 is cut off. As the cathode voltage drops, the point is reached when V_1 again conducts and the charging cycle repeats. This circuit has exhibited a much more stable frequency characteristic than the previous *frequency division* circuits investigated.

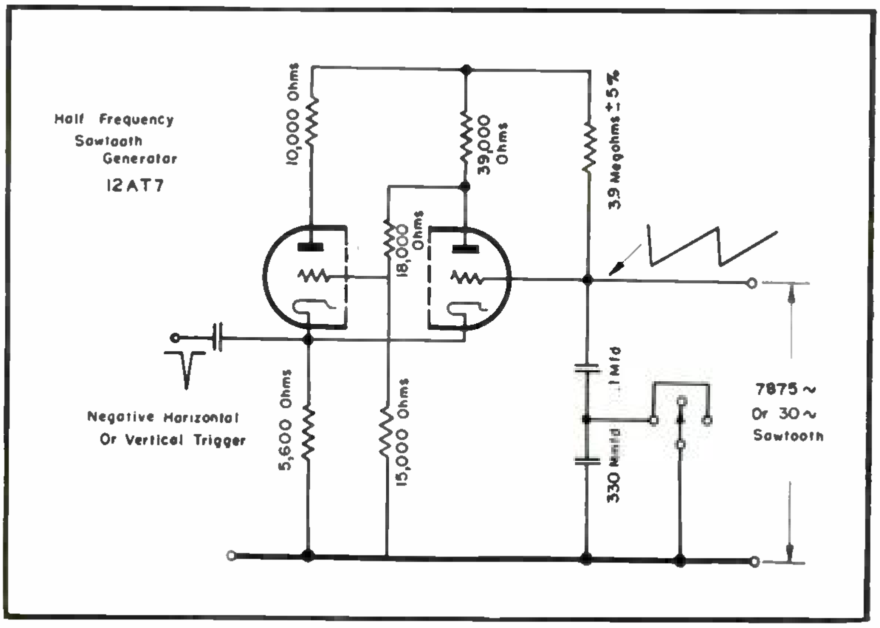
Sweep-Expansion Circuit

Another circuit feature has been the addition of a *cro* expansion circuit, Figure 6, which gives an eight-to-one expansion of the center of the sweep, allowing a close inspection of either the horizontal or the vertical sync and blanking intervals in a composite signal. The circuit used is a cathode-coupled clipper which clips most of the lower, then most of the upperhalf of the sawtooth. With sweep expansion, the time base trace on the *cro* is increased about 20% to permit the fast, linear portion of the trace to occupy the usable area of the screen.

Accurate CRO Calibration

To minimize circuit drift and to make adjustment simple and rapid, the calibration circuit has been revised; Figure 7. The plug-in meter* has a 1.5 milliampere current sensitivity and measures 940 ohms within 2%. When 1.4-ma flow through the 940 and the 60-ohm resistors, 1.4 volts are developed across the series combination. Interruption of current by the pulses which cause crystal *1* to conduct and crystal *2* to be cut off causes the voltage across the 940 and 60-ohm combination to

*RCA MI-21200-C now in use with RCA TV terminal equipment for current and voltage measurement.



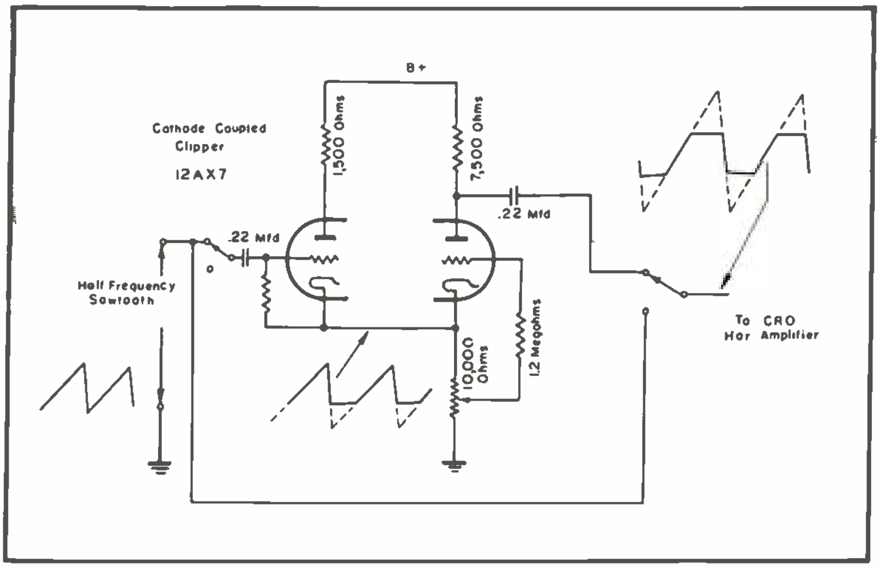


Figure 6
CRO EXPANSION circuit, which affords an eight-to-one expansion of the center of the sweep.

alternately change from 1.4 volts to zero. The insertion of the meter plug interrupts the gating process and the current flowing is then direct-current. The multiplying resistors are 2% wire wound units to insure accuracy, and use of the same meter to calibrate all monitors provides the additional advantage of insuring consistent metering by all monitors so calibrated: aging of the diodes over long period of time will introduce no errors. To simplify the calibration process, both the *cro* amplifier gain and calibration adjustment controls have been placed on the front panel.

Simplified Sync Arrangement

The monitor has been made to operate on externally supplied sync, in addition to the previous arrangements of operating on drive pulses or separated sync information; the switching arrangement is illustrated in Figure 8. This setup has been found to eliminate the necessity of providing supplementary equipment to add sync to the video signal in order to drive the master monitor. Supplementary equipment consisting of either a mixing amplifier or two sections of a distribution amplifier, together with their required power supplies has not been found to be necessary.

Miniaturization of Components

Some broadcasters have indicated a reluctance to change from octal to miniature tubes, since poor quality tube sockets made it difficult to keep tubes in their sockets and introduced electrical contact trouble. The use of silver-plated, beryllium copper contacts have overcome all possible objections to miniature tubes, and the use of miniature tubes has resulted in an efficient equipment layout.

Wide usage has been made of high quality miniaturized oil capacitors which give additional assurance of trouble-free operation as well as reducing space requirements. Consistent with previous broadcast equipment design practice, resistors and potentiometers are operated below 50% of wattage rating. Capacitors are operated below 75% of voltage rating.

Additional Electrical Features

Other design features included in this new monitor are:

(1) Improved *cro* vertical amplifier in which the filament and plate requirement have been reduced by 50%.

(2) Both IRE roll-off* and 4.5-mc response of the same amplifier.

(3) Regulated high voltage supply, which it has been found has virtually eliminated regulation problems in the high-voltage supply.

(4) New electrostatically focused picture tube designed especially for the monitor.

(5) A 20% reduction in overall power requirements resulting in more efficient cooler operation, and a lighter unit.

(6) Extended frequency response

**Standardizing and Measuring Video Levels in a TV Station,* J. H. Roe, Broadcast News; No. 65.

Figure 7
CALIBRATION circuit, designed to minimize drift and make adjustment simple and rapid.

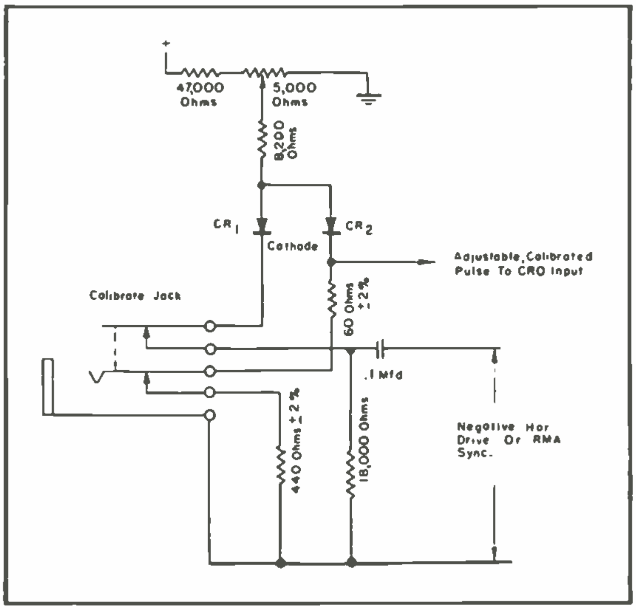
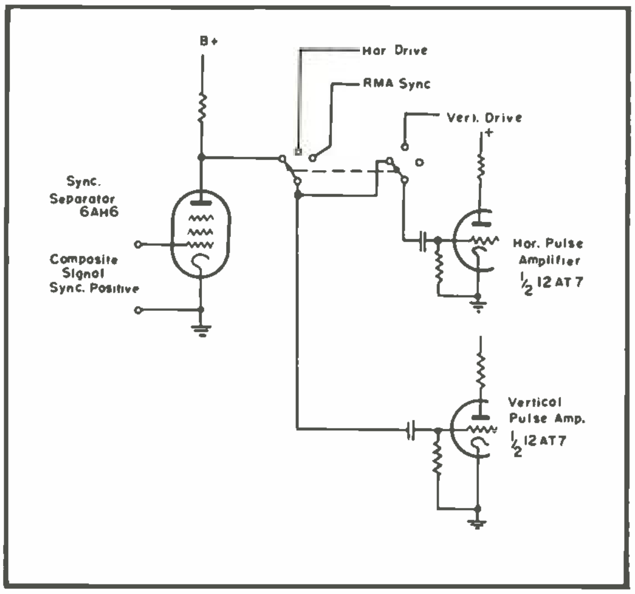


Figure 8
SYNC SWITCHING system: Monitor operates on externally supplied sync as well as on drive pulses or separated sync information.



and increased sensitivity of the picture-tube video amplifier.

(7) Balanced centering arrangement for *cro* centering combined with an astigmatism control.

(8) Addition of a pulse-cross display.

Mechanical Features

The mechanical redesign has been carefully worked out to take full advantage of the space gained in using miniaturized components. By positioning the lower shelves so that they extend close to the front panel, it has been possible to switch video and the half-frequency *cro* sweep circuits directly without requiring relays. A high-quality lever switch with wiping contacts of coin silver performs this function. These front-panel switches are unaffected by dust.

To facilitate manufacture, a video amplifier shelf and its associated terminal board comprises a complete sub-assembly which is tested and aligned before final assembly. The video peaking coil construction has been arranged so that peaking adjustments can be more easily made. Distributed capacity in the video circuits has been materially reduced by keeping wiring and component capacities to a minimum.

Improved Cooling and Greater Accessibility

To prevent any tendency to trap heat, the space between the vertical panels contains a minimum of components, and filament transformers have been placed at the extreme rear of the unit on a sub-chassis in such a manner that they are essentially in the open. The placement of the filament transformers and *cro* tubes has resulted in an improved non-synchronous operation of the unit.

The same open construction of the center compartment plus a plug-in-yoke assembly has made it possible to remove easily the picture tube from the top and the *cro* from the bottom. In addition, yoke adjustments are readily accessible and easily performed.

Maximum ventilation was accomplished by locating the horizontal driver and damper tubes at the rear of the upper left shelf. Console housings and field cases have ventilating louvres directly over this area so that heat is carried away without passing over components and chassis. The video output tubes were also placed at the rear of their respective shelves for the same reason. By reducing distributed capacity in the output stage, two less output tubes

(Continued on page 26)

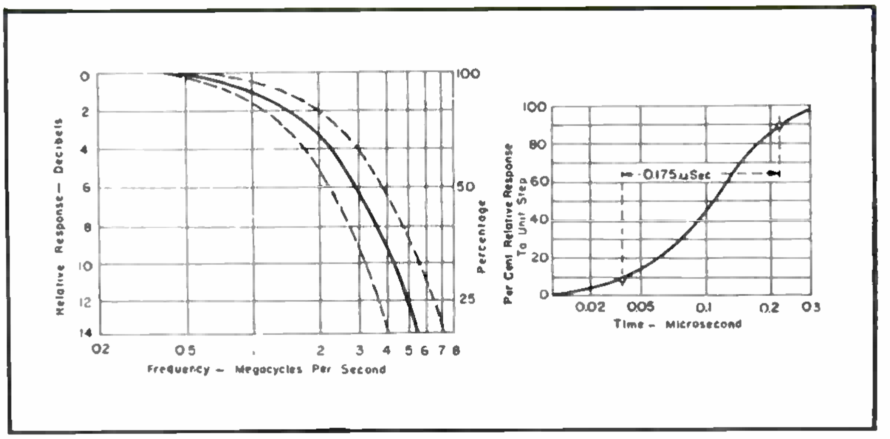


Figure 9

CRO CIRCUITRY in monitor has been found to provide a response which is flat out to 4 mc, making it possible to observe transient effects on blanking and sync pulses. Also provided is a response with the IRE recommended roll-off characteristic. Choice of either response can be made with a switch on the front panel.

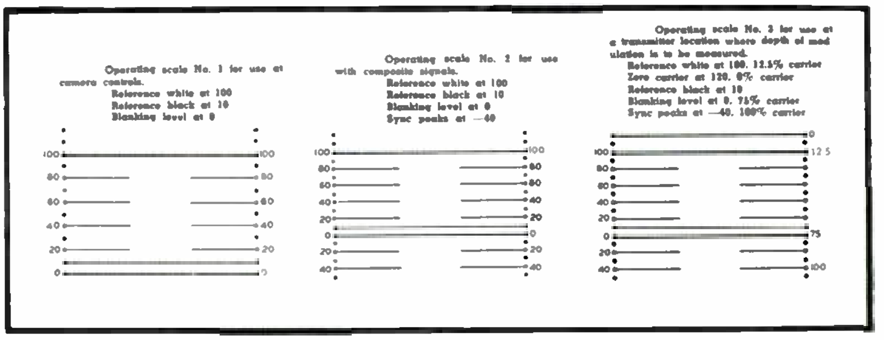


Figure 10

Three different scales supplied for measurement of video levels.

Figure 11

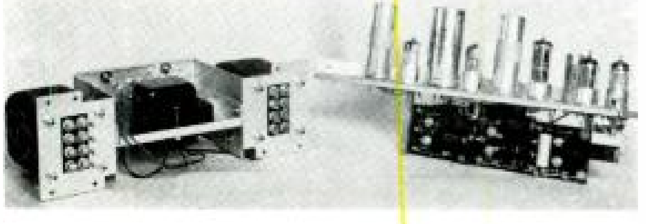
VIEW OF MASTER MONITOR showing sub-panel controls at top of unit.

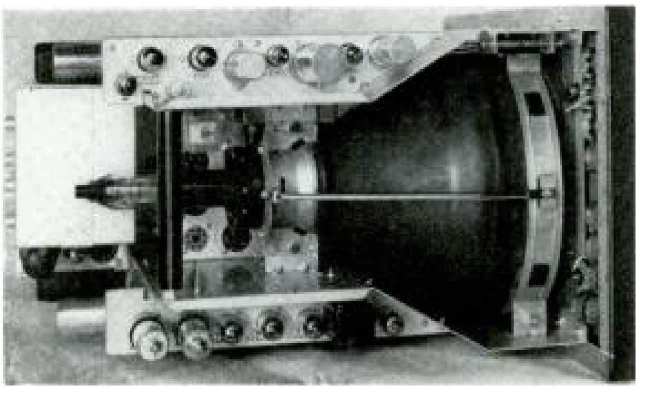
Figure 12 (below)

SUB-CHASSIS assemblies illustrating improved mechanical construction.

Figure 13 (right)

GENERAL VIEW of master monitor showing accessibility and open construction for cooler operation.





Part II . . . Receiver Circuitry . . . Limiter-Decoder-Trigger Circuits . . . Modulator-Transmitter Design . . . Coax-Hybrid Duplexer Characteristics . . . Features of Power Supply and Remote Switching, Circularly Polarized Turnstile Antenna and Test Methods.

MINIATURE TRANSPONDER

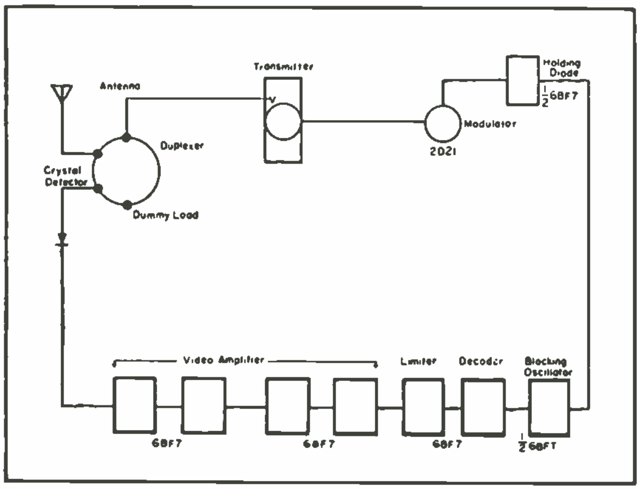
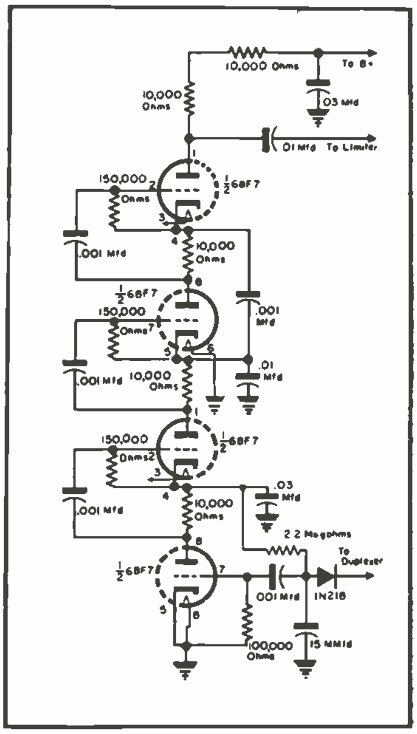


Figure 1 (left)

BEACON CIRCUITS block diagram.

Figure 2 (right)

COMPLETE RECEIVER schematic.



In designing the beacon, it was necessary to consider one key requirement: replacement of a larger transponder beacon measuring 6″ in diameter by 10″ long, and weighing 13 pounds, including power supply, with a smaller unit which would fit into the confines of missiles 5″ in diameter, and yet retain similar electrical characteristics. Secondary requirements called for a separate power supply, a single antenna system for transmission and reception, and naturally, less weight.

The original beacon was extremely compact and ruggedly constructed, but used conventional sized components and batteries, which obviously could be scaled down through the use of subminiature components. However, it was imperative that three basic features of the beacon be altered if true miniaturization was to be achieved. These were: the battery power supply, made up of conventional *B* batteries and a lead-acid *A* battery; the 2C40 lighthouse transmitter tube and associated cavity; and the relatively large ¾ wavelength *rf* filter cavity, which was used as a means of minimizing adjacent channel radar interference.

New developments in the field of batteries looked promising and battery engineers agreed to make up special miniature packages of a zinc-silver-peroxide type of battery and certain new *B* cells to power the beacon. Power engineers also believed new high-frequency vibrator techniques to be applicable and proceeded to develop an ultra-compact vibrator power supply.

A new pencil triode* was investigated and found to be particularly well suited to the beacon application; a program was thus set up to develop a miniature pulsed-oscillator cavity for the tube.

It was decided to eliminate the filter cavity and use instead pulse-coding techniques, rather than frequency discrimination, to avoid interference, which would eliminate a tuning control and add to both the reliability and compactness. The problem of choosing a coding system was already solved since the instrumentation radars were equipped to use two-pulse interrogation; two one-microsecond pulses, spaced three microseconds.

It was also decided, in the interests of further compactness and simplicity of operation, that a coax *rat-race* duplexer would be an ideal means of operating from a common antenna system, since it would require no adjustment in the field.

With these ideas frozen and the electrical characteristics of the original beacon in mind, the development of the new beacon got under way.

Receiver Circuits

An extremely simple crystal-video receiver was designed for the beacon with several novel features. In the video amplifier portion of the receiver were placed four triode sections of two 6BF7s, all connected in series. Voltage division is approximately equal and each tube operates with about 35 plate volts. The tubes are operated in the high-gain region, since operating bias is only that due to contact potential. The resulting current drain is only one milliampere for the entire receiver, and gain is comparable to the gain achieved in a conventional cascade arrangement where each tube would be permitted to draw one or two milliamperes. Video compensation techniques were purposely avoided to keep the number of components to a minimum, as was the usual crystal-video receiver technique of employing fast *rc* coupling time constants to minimize microphonics. This latter feature was achieved in the limiter-decoder circuit. The bandwidth of the receiver is only 300 kc, yet it is capable of reproducing the required pair of one-microsecond pulses, spaced three microseconds apart with approximately 0.3 microsecond risetime and with no serious overshoots.

A 1N21B crystal was chosen as the detector for two basic reasons. It is

*RCA 2317.

BEACON For Guided Missiles

by B. H. SINCLAIR

Electronics Engineer
SCEL, Evans Signal Laboratories

comparatively inexpensive and readily available in radar spare part kits or in supply depots since it is commonly used in radar mixers, and test equipment. During preliminary design it was anticipated that considerable selection of crystals would have to be made, which was not felt to be particularly objectionable due to the cost-availibility consideration. However, after some investigation it was discovered that forward *dc* bias applied to the crystals, in the order of 5 to 15 microamperes, would raise the sensitivity of poor crystals to that of good crystals. Crystals that were good, including special video-crystals, were unaffected by the bias. Further investigation showed that both match and rectification efficiency were affected by the forward bias, but the improvement appeared to be due to the resulting greater efficiency rather than match. In general the results were comparable to the video type crystals, yielding triggering sensitivities of at least −70 dbw, and one-to-one signal-to-noise ratios better than −80 dbw, even with duplexer losses and a relatively inefficient crystal holder. The crystal was physically located on the duplexer, the lowest temperature region of the beacon, and provided with one tuning stub for matching purposes. The forward bias was extracted from the cathode of the second video stage through a two-megohm resistor. Some crystal selection is still necessary but this is largely due to the inability of the simple holder to match all crystals.

Limiter-Decoder-Trigger Circuits

The output of the receiver is fed into a ½ 6BF7, which functions as a limiter providing pulses of fairly constant amplitude over the receiver input range of 0 to −35 dbm. This, in turn, is fed into a second ½ 6BF7 amplifier, biased beyond cut-off, which, together with a short-circuited delay line in the grid circuit, provides decoding, pulse width discrimination and anti-microphonic functions.

In the case of two-pulse decoding, the second reflection of the first pulse from the delay line is coincident and additive with the second pulse which overcomes the bias on the amplifier, causing one pulse to be emitted from the plate to trigger a one-shot blocking oscillator, another ½ 6BF7. The bias control in the decoder is adjusted so that response is made only to the second pulse under high level receiver input conditions (O dbm).

In the case of single-pulse operation, a portion of the limiter plate resistor is shorted out by the single-pulse/two-pulse switch, bringing the level of all pulses up to the same amplitude level as the added pulses in two-pulse operation. The bias control in this case is adjusted at low level receiver inputs for optimum sensitivity; thus the blocking oscillator is not triggered by noise. In practice the bias control can be left at the same point. However, with careful adjustment, triggering sensitivity is about three db better in single-pulse operation.

In both cases, the delay line serves to break up wide received pulses and microphonics, thus preventing excessive triggering by microphonic transients due to vibration, or interrogation by single wide pulses in two-pulse operation. The bias pot and operational switch can be adjusted from the side of the beacon container. Automatic bias is used in both the decoder and blocking oscillator at the expense of two milliamperes current drain from the plate supply. But the end result is well worth it, since the circuits function properly with no further adjustment between 100 to 200 plate volts. Even so, the total drain of the receiver, limiter, decoder, blocking oscillator, and bias nets is only 5 ma, at 140 volts.

Modulator-Transmitter

A 2D21 thyratron and the last ½ 6BF7 are used in a resonant-charging, line-controlled modulator circuit. The charging choke and capacity of the

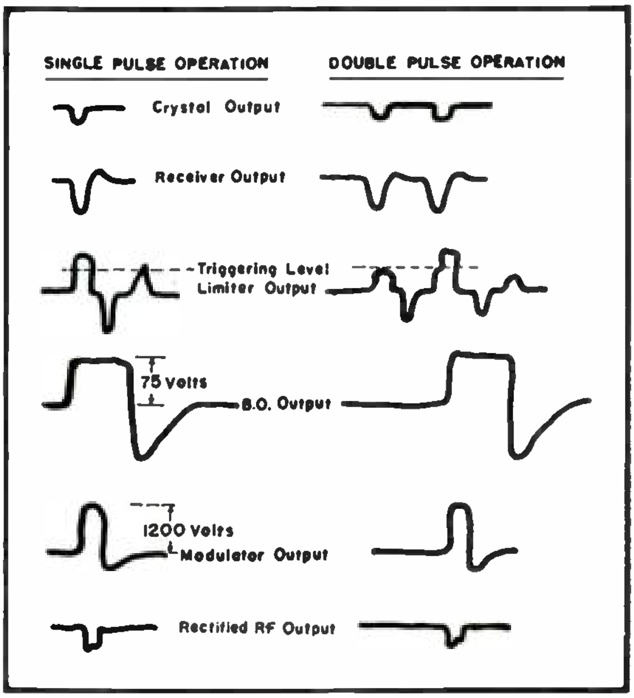


Figure 3
WAVEFORMS illustrating two pulse decoding.

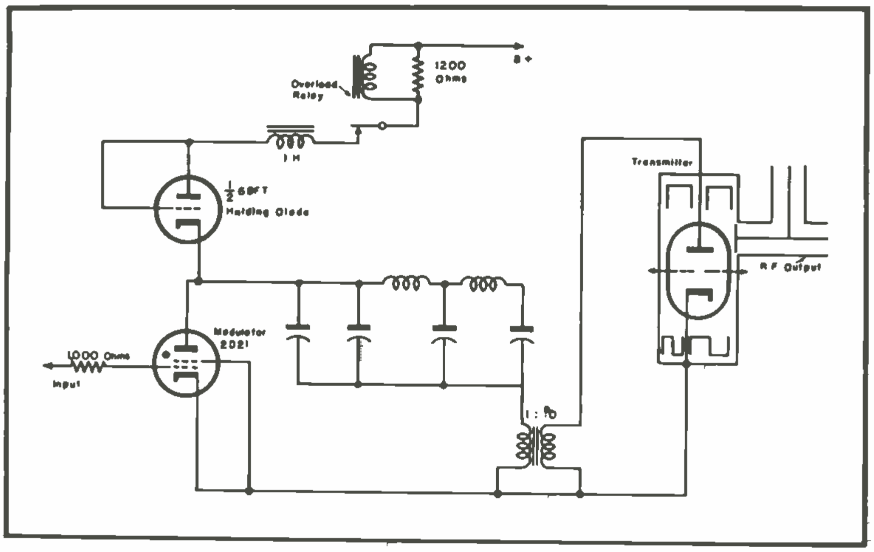


Figure 4
MODULATOR and TRANSMITTER circuitry. The 2D21 and ½ of the 6BF7 are used in a resonant charging line-controlled modulator system.

pulse-forming network are resonant to a *prf* of approximately 1.500 pps. The line impedance is in the order of 10 ohms, and the pulse transformer has a 1:10 step-up ratio, providing one-microsecond pulses of 1,200 volts to the plate of the transmitter. The ½ 6BF7 is used as a holding diode to maintain constant plate voltage from one trigger pulse to the next over a wide range of interrogating pulse rates or when pulses are occasionally missed. An overload relay is used in the plate circuit of the 2B21 to disconnect plate voltage in the event of a *dc* arc within the tube at turn-in, or in the case of over-interrogation. Output of the modulator is made available through the side of the container to facilitate tuning.

The transmitter is a specially developed reentrant cavity using a pencil triode.* The approximate dimensions of the cavity are 1" in diameter by 5" long. Tuning is effected from the side by a coax-capacitor arrangement, and output is obtained from a capacitor-type probe brought out in a right-angled output connector with a ⅛ wavelength stub extension, through which the probe can be adjusted by a screw mechanism. These adjustments can also be made from the side of the beacon container.

The transmitter operates over the frequency range of 2,875 to 2,925 mc, with a frequency stability of approximately 2 mc, throughout an ambient temperature range of 0° *C* to 70° *C*; *rf* pulses of 0.75-microsecond duration and 100 peak watts output are obtained with 140 volts applied to the modulator. The current drain is approximately 12 ma. at 1,000 pps interrogation rate.

Duplexer

A coax-hybrid duplexer, commonly known as a *rat-race* is used to permit operation of both receiver and transmitter from a common antenna. The duplexer is a coax-ring arrangement of critical line lengths which result in cancellation of transmitter energy at the receiver junction. A main objection to this form of duplexer is that transmitter energy is divided between the dummy load and the antenna, resulting in the loss of one-half of the transmitted power. This was no objection in the beacon design since half power or 50 watts was adequate for the purpose intended. The receiver is not as badly affected, since the transmitter impedance changes in the quiescent period, resulting in only one or two db loss between antenna and receiver.

Two novel features have been incorporated in the race; one improves the performance considerably, and one is a safety feature. As may be noted in the schematic of the duplexer, it is quite similar to an *ac* bridge circuit which requires for maximum attenuation between transmitter and receiver junctions, a very precise balance in amplitude as well as phase. Therefore, an adjustable stub has been shunted directly across the dummy load resistor to simulate the reactance of the antenna. This adjustment is made by connecting a microammeter and a large capacitor across the crystal, and, with the transmitter triggered from an external source, tuning the stub for minimum meter deflection. By both select-

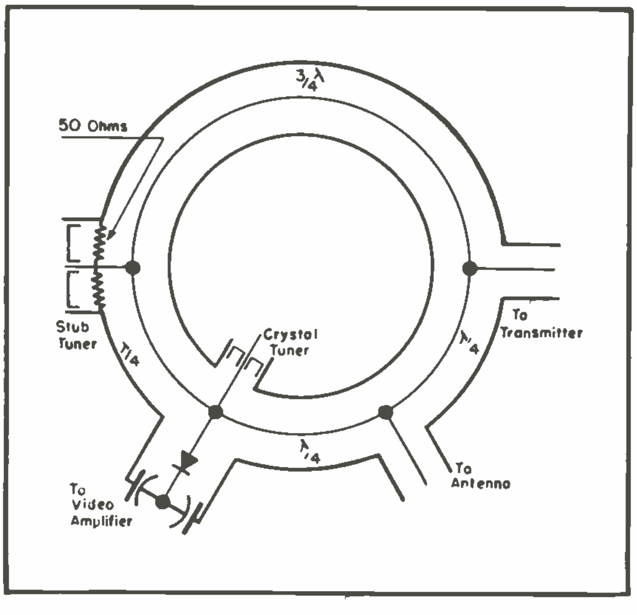


Figure 5
RAT-RACE DUPLEXER schematic.

ing the value of resistor and tuning the stub, attenuation in excess of 40 db has been obtained, but a minimum of 26 db has always been achieved without resistor selection, which is adequate to protect the crystal. The second feature is a switch at the antenna junction of the race which renders the transmitter inoperative in the event that the antenna is not connected to the race. For, should the transmitter be operated without the antenna, approximately 25% of its power would reach the crystal, resulting in burn-out or impairment.

Power Supply and Remote Switching

The power supply features a specially constructed, compact, 400-cycle synchronous vibrator, plus transformer and associated filters, in a hermetically sealed container 2¼" in diameter by 2" high, which delivers 140 volts at the 1,500 pps interrogation-rate load (22 ma). Since *rc* filtering is used, regulation is poor, approximately 25%; this subjects receiver, decoding, and trigger circuits to 180 volts when not interrogated. This is the reason for the use of automatic bias in the decoder and blocking oscillator circuits. A 22½-volt hearing aid type of *B* battery is used for modulator bias, and a special one shot zinc-silver-peroxide battery which requires no charging, merely the injection of a solution of potassium-hydroxide electrolyte to be made ready for use, is used as the primary source of power. The latter is one of a series of one-shot batteries developed by Signal Corps engineers expressly for use in guided missiles. The discharge characteristics are extremely flat, starting at 6.5 volts under load, and rapidly dropping off at end of life. In this application, 2½ amperes total drain 20 to 30 minutes of operation are obtained to an end voltage of 6 volts.

The heart of the remotely controlled switching assembly is a rotary-solenoid device which cam-drives a pair of uncased microswitches to connect the beacon to either the internal batteries or to an external source of power. Leads feed back to the point of control-light pilot lamps to identify positively switch position. By this means the beacon can be warmed up or operated for long periods of time from an external source of power and just prior to flight, switched over to internal batteries. Monitoring leads are also provided so that the actual operating voltages at the beacon can be checked.

Antenna

A circularly polarized antenna is used with the beacon. It is a version of the familiar turnstile, scaled down to the microwave frequency range, with similar broadband characteristics. Phasing is achieved by the slots between the elements which have rounded contours for aerodynamic purposes. A matching transformer is contained in the cylindrical support tube providing a match better than 1.5 *vswr* to a miniature 50-ohm coaxial cable. In use, it is mounted on the trailing edge of one of the missile tail fins, providing radiation both forward and aft.

Mechanical Features

The mechanical construction of the beacon and power supply is quite novel, particularly in its simplicity. Three stainless steel stringers, spaced 120° apart, provide the backbone of the units. When slipped into the container, only one screw at the bottom is necessary to secure the unit in the container, which when tightened draws up on the stringers placing them in tension, and automatically sealing the plastic gasket between the edges of the duplexer and container, thus pressurizing the unit. When open, the stringers readily snap away, permitting the components to be serviced. The two semi-circular chassis are merely held in slots in the transmitter cavity when the stringers are removed, and may be slipped out for servicing of components. The entire equipment lends itself to fabrication by sub-assemblies, rather than as a unit, which is more economical production-wise, as well as making servicing easier.

All metal components, with the exception of the stringers and transmitter cavity, are made of aluminum, and those which require blackening are done by black anodizing rather than by painting.

To check pressurization, one of the side plugs are removed and a special valve is screwed in its place.

The four 6BF7s are held in place by two specially-shaped shields, each requiring only removal of one screw. The transmitter tube is held in place by two screws at the bottom of the cavity.

Test Methods

During design, all major components and tubes were subjected to constant acceleration, shock and vibration in excess of the basic requirements, to determine suitability. During evaluation tests on the first models, similar tests, plus temperature, humidity, and actual flight tests, were conducted on the entire equipments. Of these the only one worthy of mention, because it required a facility not in common use, was the constant-acceleration tests. This required the construction of a large centrifuge with a three-foot radius arm, on one end of which the beacon was mounted, the power supply on the other. The antenna was mounted in the center and voltages were monitored through slip rings. By this means the beacon could be interrogated, while being subjected to actual flight conditions, and thoroughly tested for response, frequency shift and voltage variations.

In production, components and sub-assemblies are pre-tested 100% before fabrication. Each finished unit is also tested on electrical test jigs which com-

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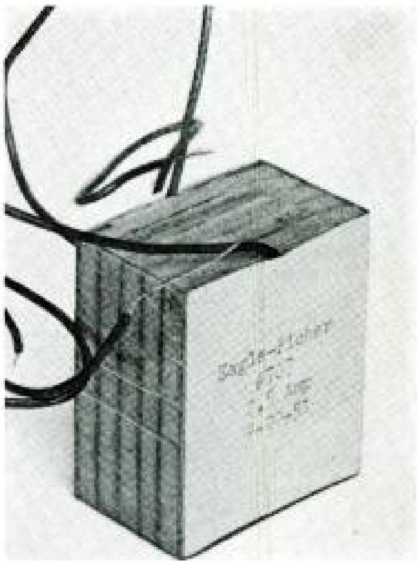
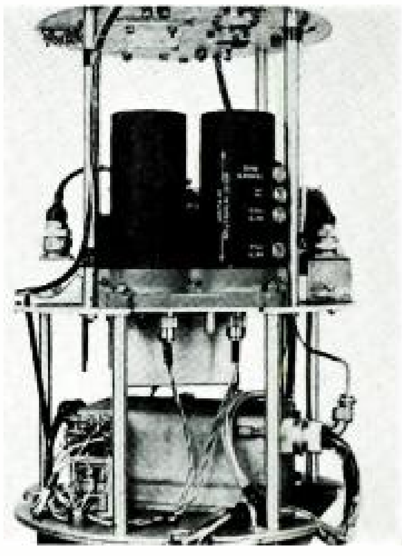


Figure 6

ZINC-SILVER-PEROXIDE battery used to power beacon, which is 1 13/16" high x 1 9/16" wide x 31/32" deep.

Figure 7

BEACON in Signal Corps Aerobee missile, used in upper atmosphere research.



Underwater RADAR System

by RALPH G. PETERS

Development Affords a Radar Type Display of Underwater Conditions Over 360° Surrounding a Vessel; Only Stern Wake of Vessel Under Way Eliminates That Portion of Scan.

RADAR, which has been widely acclaimed as a marine navigational aid, serving to chart accurately sand bars, deep channels and detect obstacles, has recently been adapted to a unique nautical detection system‡ which provides a display of underwater conditions over 360° surrounding the vessel.

The method of indication used in the gear has been described as its major virtue. The basic indicator used is a *ppi* (plan position indicator) *crt* common to radar systems. As in radar, the beam deflection of the picture tube (a long persistence type) is rotated synchronously with an ultrasonic transducer.

Over a moderate distance (approximately ½ mile), the scanning rate of the equipment has been found to be sufficiently high to maintain a trace on the *crt*.

A second indicator is also provided: a linear type of *crt*: *A* 'scope with a short or medium persistence screen. The medium persistence green (P2) screen coating was found to be most desirable where operation under fairly high external light conditions without a viewing hood is desired. The use of the *A* 'scope appeared to provide considerable intelligence of the reflecting object or objects which may not be readily apparent on the *ppi*. Also featured in the system is a loudspeaker, with a volume control, which reproduces the sound of the returning echo signal. The returning signal is, in effect, modulated by the amplitude of reflection. The sounds produced by the loudspeaker serve to help an operator to appraise the nature of any beach landing or shoal water he may be approaching. Since the operator might not be continuously watching the *crt*, these sounds can warn him that echo signals are being received. Incidentally, during the tests, it was found that the sound of an echo being reflected from a single solid object was of short duration, with a hard, solid, sound. The sound of echo signals being received from a beach or hidden sand bar, if either is relatively smooth, was drawn out with a *whishy* effect. When the beach or sand bar

(Continued on page 27)

‡*Intervox Fishfinder, developed by Wayne M. Ross.*

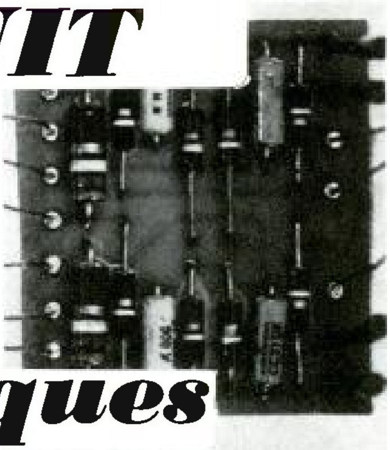
(Above)

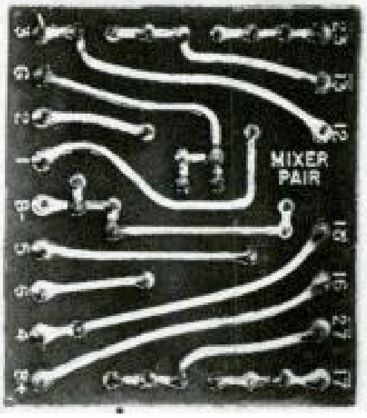
Wayne M. Ross, inventor of the underwater radar instrument, explaining its operation to a Navy sonar representative.

(Left)

UNDERWATER radar transmitter.

PRINTED CIRCUIT Design and Assembly Techniques

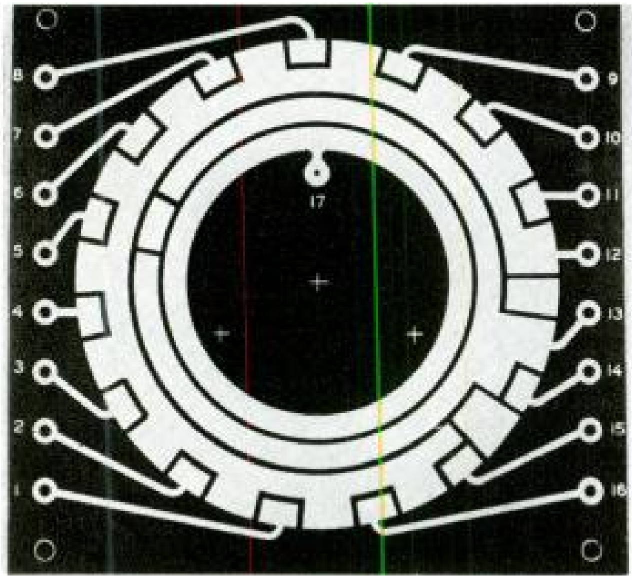




by **WILLIAM TEWELL**
Photocircuits Corporation

Part II . . . PC Components . . . Electrical Characteristics of Assemblies . . . Cost Estimates . . . Recent Developments . . . The Future of the PC Art

ANALYZING THE POSSIBILITIES of *pc* TV chassis fabrication, last month, it was pointed out that in certain applications, the *if* strip has been constructed as a separate unit, and connections to the main chassis made by the use of pin connectors, conventional wiring methods or possibly the use of flexible foil wiring harness, produced by etching foil on a flexible support. In an adaptation of a present assembly technique, as applied to dip soldering large printed-circuit chassis where warpage is to be prevented, tinned eyelets have been inserted as receptacles for component leads. The leads are formed and cut so, that upon insertion, their length will protrude through the eyelet barrel. The preforming and cutting of leads and their insertion is a semi-automatic process to speed assembly and reduce inspection time. After the foregoing step, the assembly is dipped in a fluxing solution. Then the chassis is dipped to the depth of the bottom surface of the plastic base for a matter of seconds in a molten solder bath. The chassis is then grasped by the arms of a vibrator and vibrated vigorously for several seconds to insure that all solder joints were made securely. To provide a solid electrical connection between the flange of the eyelet and the foil termination, when the conductor pattern is on two sides of the chassis, the pattern is tinned or solder plated; this deposits a thin film of solder over the entire conductor pattern. When the chassis is immersed in the solder bath, the heat transferred through the eyelet to the metal conductor surface melts the film of solder under and surrounding the eyelet flange, and a good joint between each is realized. The solder film also serves as a protective conductor coating to prevent the formation of oxides.



(Above)
COMPLETED DIP-SOLDERED assembly.

(Left)
FLUSH etched foil disc-type commutator.

Printed Components

By the use of proper conductor pattern design and chassis layout, printed circuit assemblies can simulate any operating characteristics achieved by conventional wiring systems. The stage of the art has not progressed to the point where resistors, capacitors and coils can be printed with sufficiently reduced tolerances and with high-dielectric-constant plastic materials, to make their general application feasible at this time. However, resistor printing is being developed. There is now in progress an extensive research program to determine the possibilties of printing large numbers of low tolerance resistors simultaneously for operation over the entire resistance range. Ca-

(Continued on page 29)

TV Audio Facilities

by W. W. DEAN

Broadcast Studio Engineering
Electronics Division, General Electric

Part II . . . Magnetic Sound Track Recording Possibilities . . . Optical Techniques and Equipment Currently Employed for Film Sound . . . Trends in Audio Components

TV STATIONS, today, rely heavily on film, with both 16 and 35-mm film being used. At present sound is mainly recorded by the optical system for very practical reasons. Many feel that it will not be long before superior quality magnetic sound track will take over.

Unfortunately, it has been found costly to add magnetic sound tracks to film, since each print must be prepared individually. Until comparable high-speed magnetic printing methods are perfected, film sound will remain largely optical.

Separate magnetic tape recordings have been used for film sound. The quality is, of course, excellent, but complicated synchronization schemes must be employed. Broadcasters have also balked at the red-tape problem involved in bringing two reels together at just the right time to put on the program. This is a very practical problem in view of transportation delays frequently encountered.

Pickup of the optical sound track, whether variable area or variable density, is accomplished by the familiar exciter lamp, photocell and amplifier combination. It is very important to have the best quality optical slit so that a very narrow, intense, uniform light beam illuminates the sound track. It is also most important to have low-hum modulation of the exciter lamp filament supply. The input stages of the *pe* cell preamp must be carefully shock-mounted to prevent pickup of machine vibration. Electrical shielding of all critical circuits is important, to keep external interfering fields out of the preamplifier.

Response shaping is employed, in accordance with SMPTE and RTMA recommended practices. Generally, the roll-off is adjusted for normal film, but can be changed to compensate for poor quality sound tracks. Film-sound preamps for TV must provide sufficient output to feed projection room distribution and switching systems. The latest suggested standards provide for +14 dbm output at low distortion so that +4 *vu* program level can be obtained. This relatively high output provides for direct *vu* meter monitoring to check levels and to facilitate maintenance.

High-quality TV motion-picture sound is based on good equipment plus proper maintenance. Good equipment involves heavy commercial projectors with the best optical and mechanical parts. Proper maintenance requires servicing by experienced motion picture service organizations thoroughly familiar with all the details of this special type of equipment.

**G.E. BC-11-A.

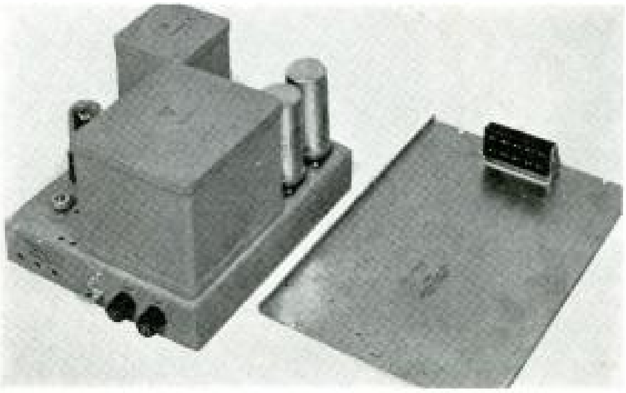
Trends in Audio Components

Currently available is an audio-control consolette** especially designed for TV.

While the console is designed to accommodate up to eleven standard plugin amplifiers, it may be actually equipped with whatever complement one desires or the console can be used with external amplifiers of various types. Space is provided for two plugin relay chassis but these may be located externally and the space used for more amplifiers.

Mixing Controls

Nine mixing controls are provided with mikes on the left side and projector, turntable, remote and network controls on the right side. At the top of the panel are telephone type key switches that control the inputs to the mixers. Each mixer can feed either of two mixer buses for program or monitor use, or for dual channel operation.



PLUG-IN POWER SUPPLY AND TRAY[1] which powers the plug-in amplifiers and audio console.

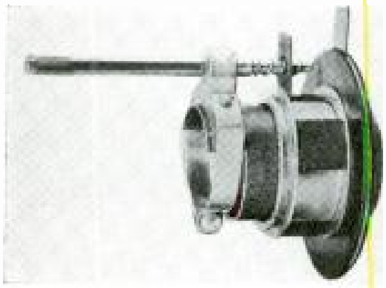
[1]G.E. BP-10-B

TV Parts & Accessory Review

Picture Tube Focusing Device

A PM FOCUSING DEVICE, which is installed by slipping over the tube's neck and tightening the clamp, has been announced. No brackets or special mounting contrivances of any kind are required.

Device weighs five ounces, including a 1¼-ounce Alnico permanent magnet. Two turns of the adjusting screw are said to be sufficient to cover the entire focus range. Other features include a builtin picture positioning device and the fact that there is no interference magnetically or mechanically with other components.—*Heppner Manufacturing Co., Round Lake, Ill.*

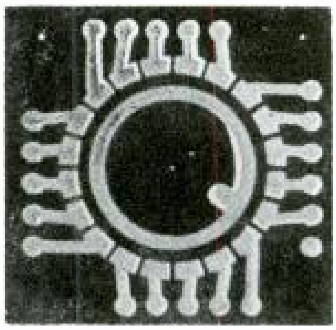


Heppner PM Focusing Device

Printed Circuit Switch Plate

A PRINTED CIRCUIT SWITCH PLATE, that has its contacts flush with the surface of the plastic in which they have been embedded, has been introduced. Metallic contacts are .008" in thickness, and are of copper base with hard silver surface.

Switch plate is said to withstand more than one million revolutions. Varying sizes and shapes are available, from 1" x 1" up to 10" x 15".—*Emeloid Co., 1239 Central Ave., Hillside 5, N. J.*



Emeloid PC Switch Plate

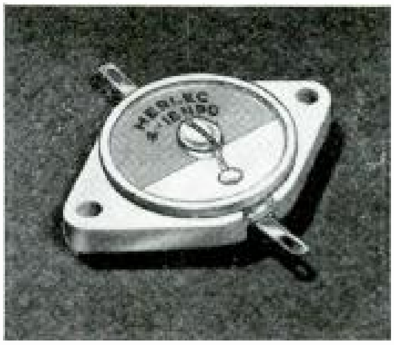
RF Choke Coils

RADIO FREQUENCY CHOKE COILS, featuring smaller size and extremely wide range of inductance, are now available.

Made with insulated copper wire, coils have a molded jacket made of a mineral filled thermosetting compound which is said to permit use under the most severe service conditions. Coils have no shorted end turns and the windings are soldered to the leads.—*101, 102 and 104; Jeffers Electronics, Inc., Dubois, Pa.*

Trimmer Capacitors

CERAMIC TRIMMER CAPACITORS for use in circuit applications where maximum stability of capacitor characteristics is important, have been announced.—*Type 408, Engineering Bulletin 604; Herlec Corp., Milwaukee, Wis., or Sprague Electric Co., North Adams, Mass.*



Herlec Trimmers

Control Knobs

CONTROL KNOBS, for use in the manufacture of both commercial and government electronic equipments, have been developed.

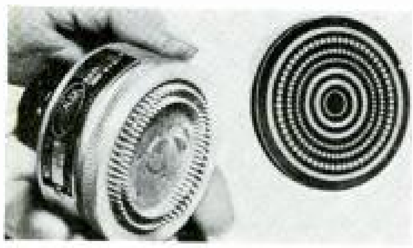
Available are six types: round, skirted-round, dial-skirted-round, pointer, skirted-pointer and crank knobs . . . ranging in size from 7/10" to 2¼" in diameter; in a variety of colors and high-gloss finishes. Knobs are made of black injection molded cellulose acetate butyrate, incorporating anodized aluminum inserts with two plated hex socket set screws.—*Raytheon Manufacturing Co., Department 6170 P, Waltham 54, Mass.*

Miniature Telemetering Switch and Commutator Plate

A MINIATURE TELEMETERING SWITCH AND COMMUTATOR PLATE, featuring Mycalex 410 injection-molded glass-bonded mica, has been produced.

Commutator is said to have logged over 1000 hours of maintenance-free performance. It has 180 contacts and three slip rings of coin silver integrally molded. Plate, providing 30 synchronizing pulses, samples 60 channels of information.

Telemetering switch incorporates a commutator that has 120 contacts and two slip rings of coin silver. Switch is supplied for either 28-volt *dc* power or 8-volt 400 cycle *ac* power.—*Mycalex Corp. of America, 30 Rockefeller Plaza, New York 20, N. Y.*

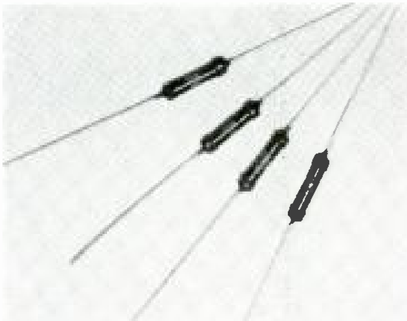


Mycalex Miniature Telemetering Switch

Deposited Carbon-Boron Carbon Resistors

DEPOSITED CARBON AND BORON CARBON RESISTORS, that are said to provide higher resistance values in less space at a lower cost than wire-wound precisions, have been produced.

Boron-carbon resistor is claimed to provide a greater degree of temperature stability. Two types available; both rated at ½ watt. Body length, 9/16". Diameter of outside caps, 5/32".—*BOC, DCC; International Resistance Co., 401 North Broad St., Philadelphia 8, Pa.*



IRC Carbon-Boron Resistors

High-Temperature Capacitor

A CAPACITOR, with 125° C performance characteristics, has been announced.

Case size is ¾" x 1" x 1¾". Weighs 1¼ ounces. Capacitor is rated at 0.5 mfd and 400 volts *dc* working with no derating up to 125° C. Insulation resistance is 6,000 megohms at 125° C.—*Unicon type D; United Condenser Corp., 337 East 139th St., N. Y. 54.*

United Condenser High-Temperature Unit

Magnetic Tape-Recording Head

A MAGNETIC TAPE RECORDING HEAD is now available.

Featured are compactness (.765" wide by .845" long by .609" thick); controlled track width which may be furnished with a track of from .025" to .100"; flexibility of mounting, using standard 2-56 mounting screws. May be adapted to specific mounting bracket or used with a mounting bracket which provides vertical and angularity adjustments.

May be used for multiple track applications.—*TR-16; Shure Brothers, Inc., 225 W. Huron, Chicago 10, Ill.*

Instrument News

Null Indicator

A HERMETICALLY-SEALED NULL INDICATOR has been announced.

Center-point sensitivity is microampere per mm or higher. Meter's shaded pole face and shielded core construction is said to give sharply logarithmic attenuation as it departs from null point, and to provide overload protection. Stated maximum safe current is ten times actual rated full scale value.—*HS2 (2½" size), HS3 (3½" size); Marion Electrical Instrument Co., Manchester, N. H.*

Marion Null Indicator

Differential Transformer Amplifier

A DIFFERENTIAL TRANSFORMER AMPLIFIER, that has been designed to measure statistically and dynamically, displacement, force, vibration, torque, acceleration, pressure, thickness, etc., has been announced.

Frequency response is from *dc* to 1000 cps, with a range of motion from ±.001" to ±0.1" of the transformer core. Output is phase sensitive and indication is given for positive or negative motion.—*Model 301; Sterling Instrument Corp., 13331 Linwood Ave., Detroit 6, Michigan.*

RF Marker and Crystal-Controlled Calibrator

A TV RF MARKER AND CRYSTAL-CONTROLLED CALIBRATOR, that is said to be accurate to .05 per cent, is now available.

Instrument features an *rf* signal generator in ranges of from 53-89 mc and 174-217 mc on fundamentals, and 868 mc on harmonics; a marker generator from 53-89 and 174-217 mc, in two bands; a crystal oscillator usable from 500 kc to 20 mc; a 2.5-mc crystal; a heterodyne frequency meter for calibrating other generators up to 900 mc; usable harmonics output on *vhf* and *uhf* bands; sound and picture frequencies for all 12 TV channels; tuning drive ratio of 11 to 1; and a built-in magic eye to provide a zero beat indicator.—*Model 680; The Hickok Electrical Instrument Co., 10528 Dupont Ave., Cleveland 8, Ohio.*

Stroboscope Unit

A STROBOSCOPE UNIT, giving 60 brief flashes of light per second when connected to a 60 cycle *ac* power line, has been introduced. Lamp is a standard neon bulb.

Power source, 115 volt, 60 cycle *ac* supply; power consumption, less than 1 watt; flashing rate, 60 cycles per second, determined by line frequency; and flash duration, approximately 100 microseconds, measured at 50% of peak intensity.—*Model 18. Berkshire Laboratories, 596 Beaver Pond, Lincoln, Mass.*

Dual-Beam 'Scope

A DUAL-BEAM OSCILLOGRAPH, with dual-beam presentation on either common or individual sweeps, amplitude calibration of either axis of both channels, has been announced.

Picture tube employed in 'scope is operated at an overall accelerating potential of 3000 volts. High gain *ac* and *dc* amplifiers are provided for both axes. Sinusoidal frequency response of the *X* and *Y* axes of both channels is said to be down not more than 10 per cent at 100,000 cps, and down not more than 50 per cent at 300,000 cps, with a deflection factor of 0.028 peak-to-peak volts per inch on the vertical axis and 0.28 peak-to-peak volts per inch on the horizonal axis.—*Type 322; Instrument Division, Allen B. Du Mont Labs., Inc., 1500 Main Ave., Clifton, N. J.*

DuMont Dual-Beam 'Scope

Power Frequency Amplifier

A POWER FREQUENCY AMPLIFIER, that is said to relieve a test circuit from supplying the usual power to the measuring voltmeter or wattmeter, has been developed.

Input is connected to a test circuit, and output is connected to a voltmeter or the voltage coil of a wattmeter. Amplifier's input impedance requires a maximum of 150 microamperes from the circuit being tested. Output provides 0.05 to 0.07 ampere.

Input connections for 15, 75, 150, 300, and 600 volt inputs are provided, and in each case the output is 150 volts. Overall accuracy is said to be such that less than 0.15% is added to measurements.—*Model 105 Meter Matcher; Keithley Instruments, 3868 Carnegie Ave., Cleveland 15, Ohio.*

Noise Generator

A RANDOM-NOISE GENERATOR, that utilizes a gas-discharge tube operated in a magnetic field as the noise source, has been developed.

Two stages of amplification and suitable filters provide an open-circuit output voltage of 1 volt on three frequency ranges, from 30 cycles to 20 kc, 500 kc, or 5 mc. Gaussian distribution of amplitudes is said to be good, with only moderate clipping on the 500-kc and 5-mc ranges.—*Type 1390-A; General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.*

G-R Noise Generator

Color TV Test Equipment

A LINE OF COLOR TV TEST EQUIPMENT is now available.

Basic picture-making equipment units available are: flying spot scanner, pickup head, monitor and synchronizing generator. May be had in several models for either monochrome, or one of the color systems.

Monochrome scanners provide black and white video signals from either positive or negative transparencies. Both monochrome and color scanners are available for either 35-mm slides or 3 x 4-inch film. All models will provide picture signals when operated without the use of a sync generator. —*Telechrome Inc., 88 Merrick Rd., Amityville, N. Y.*

High-Current Volt-Ammeter

A HIGH-CURRENT VOLT-AMMETER that measures up to 1200 amperes, and can be carried in the coat pocket, has been introduced.

A *snap-around* type, it measures current instantly without being connected to the conductor. The reading can therefore be taken without interrupting the circuit or shutting down equipment.

Uses a doughnut-type transformer which is claimed to eliminate for all practical purposes the factor of error due to position of conductor within the probe jaws. Incorporates six ammeter ranges and three voltmeter ranges: 0-15/60/150/300/600/1200 amperes *ac*, and 0-150/300/600 volts *ac*.

The voltage test leads are equipped with a safety-type plug which automatically insulates itself when removed from the meter.

Probe jaws are completely insulated down into the sockets.

Has a d'Arsonval jeweled movement with Alnico magnet, precision balanced and dust proofed.—*Amprobe model 1200; Pyramid Instrument Corp., Lynbrook, N. Y.*

Production Aids

Helical-Wire Thread Inserts

Stainless-steel helical-wire thread inserts, that are said to provide higher loading strengths and are more resistant to wear and corrosion than original threads, have been developed. Tapped threads are available in all types of industrial castings.

Inserts are available in 4-40 to 1½-6 sizes in the National and Unified Coarse thread series and 6-40 to 1½-12 in the National and Unified Fine thread series. Inserts are supplied in 1", 1½" and 2"-diameter lengths.

Because they are slightly larger than the hole into which they are installed, these thread inserts are claimed to be self-locking. They can be removed with a special tool.—Heli-Coil Corp., 1184 Shelter Rock Lane, Danbury, Conn.

High-Temperature Magnet Wire

High-Temperature Magnet Wire, that is said to be capable of operating up to 250° C, has been announced. Wire features inorganic ceramic insulation with a single outer coating of Teflon.—*Ceroc ST (data in bulletins 401B, 402G, 403C, and 404); Sprague Electric Co., North Adams, Mass.*

Rust Remover and Phosphatizer

A Chemical Treatment, that is said to remove rust, tarnish and light oil, chemically prepares metals for paint, and retards corrosion, has been introduced.

Treatment not only chemically cleans the surface of steel, iron, aluminum, zinc and cadmium, but also forms a phosphate coating which acts as a base for organic finishes. It is also claimed to be an effective tarnish remover for copper and its alloys.—*Rustclenn; Octagon Process Inc., 15 Bank St., Staten Island 1, N. Y.*

Anti-Static Compounds

Two Anti-Static Compounds, that are said to remove electrical charges from smooth surfaces, and charges on fabrics, have been introduced.

Compound may be wiped, sprayed or brushed on, and is said to be non-inflammable, fast drying and invisible when dried.—*79, 79-OL; Merix Chemical Co., 1021 E. 55th St., Chicago 15, Ill.*

Resistance Soldering Unit

A Resistance Soldering Unit, that features an adjustable heat control which is said to allow the electrodes to heat up to 1500° *F* rapidly, has been announced.

Power unit is enclosed in a 4" x 5" x 6" case. Electrode handle is 7" long and made of plastic.—*Model K-72; Sunrise Products Co., P.O. Box 173, Hawthorne, N. J.*

Fiber Glass Polyester Resin Sheets

Fiber-Glass Reinforced Polyester-Resin Sheets, for electrical insulation which is said to feature good physical strength have been developed.

Five grades of the polyester-glass plastic are available. Grades are made with glass fibers in mat or cloth form and polyester resins, and differ primarily according to flame resistance and physical properties.—*Imcor; Available through Insulation Manufacturers Corp., or Molded Resin Fiber Co., Ashtabula, Ohio.*

Vertical Molding Machine

A vertical molding machine that has four pre-plasticizing units to preheat the plastic material to give it greater flowing properties has been produced. Together with a 25% greater locking pressure on the dies, machine is said to permit the moulding of pieces in large sizes.—*Worcester Moulded Plastics Company, Worcester, Mass.*

Universal Motor

A Universal Motor, rated 1/40 to 1/12 hp, has been announced.

Featured are porous bronze-sleeve bearing with a felt oil reservoir, standard internal fan, and no load speed 15,000 rpm, full load speed 7500 rpm, continuous duty 1/30 hp.—*EMC 1120; Howard Industries, Inc., Racine, Wisconsin.*

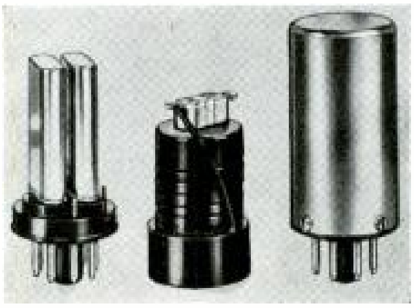
Solder Seal Terminal

A unit for hermetic sealing of electrical components and designed to meet hermetic sealing requirements of MIL-T-27, has been produced. It is a solder seal type terminal with a molded polytrifluoromonochloroethylene resin insulating the solder seal ring from the center terminal rod. The molded body, fabricated from Kellogg's Kel-F, is chemically inert to organic solvents, acids, alkalies, oils, fumes, etc. It is said to be unaffected by high humidity, has zero water absorption, and high resistance to thermal shock (—70° *C* to +190° *C*). Overall length 1 5/16"; dielectric strength, 500 *v (rms)* 60 cps; corona starting voltage is over 2000 *v (rms)* 60 cps.—*HS-1 Terminal; International Resistance Company, Special Products Division, 401 North Broad Street, Philadelphia 8, Penn.*

Crystal Temperature-Control Oven

A Crystal Temperature-Control Oven, for crystal units normally in the frequency range of 16 kc to 200 kc, is now available.

Unit provides temperature stabilization at 75° *C* ±2° for one or two J-K type H-17T (military type HC-13/U) crystal units in ambients from —55° to +70° *C*. Standard octal base; overall width, 1.28"; height, less pins, 2.41". Heater, 6.3 *v ac* or *dc* at approximately 1.40 *a*. Power consumption at +25° *C*, 3.3 watts; at —55° *C*, 6.8 watts.—*JKO-2T; The James Knights Co., Sandwich, Ill.*



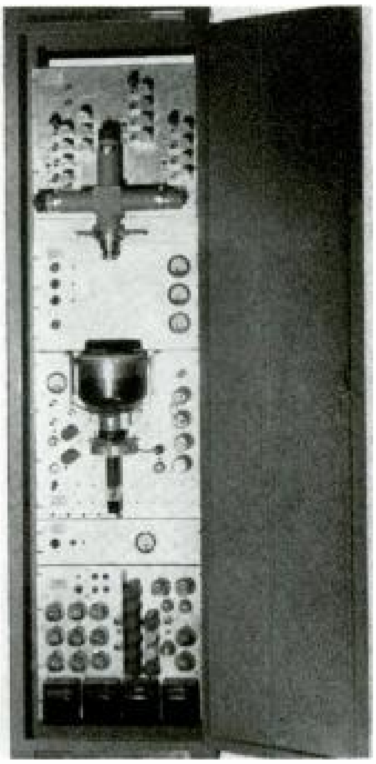
Assembly of JKO-2T crystal oven: (At left) two JK H-17T crystals mounted on octal base: (center) heater assembly before mounting; and (right) entire unit after assembly with outer shell.

Broadcast News

Universal Color Pix Generator

A Universal color picture generator using the flying-spot principle is now available as a video signal source for all color TV systems. Picture information may be derived from 2" x 2" slides, 35 mm film or 3" x 4" transparencies.

Scanning rates may be supplied preset at any two frequencies in the range of 60 to 144 fields per second and 15 to 32 kc line frequencies per second.—*Telechrome, Inc., 88 Merrick Road, Amityville, L. I.*



Telechrome Scanner

Mobil-Mount Dolly

A mobil-mount dolly which features a single one-hand steering lever to turn all four wheels simultaneously to set the direction for a *dolly shot* is now available. An indicator on the steering lever is graduated in degrees allowing predetermined settings for specific *shot* angles. For regular steering, with the rear wheels locked and the front wheels free, a foot pedal releases four-wheel steering mechanism. A safety catch prevents operator from releasing the front wheels to swiveling action except when the steering lever is set at 0° with the wheels aligned.

Dolly, which is 26" in width, is mounted on 6" aluminum wheels with silent roller bearings. A cable guard prevents it from riding over cables on the studio floor.—*Allen B. Du Mont Laboratories, Inc., 1500 Main Ave., Clifton, N. J.*

RF Attenuator

A radio frequency attenuator has been developed. With two units connected in series, these attenuators are available with losses up to 100 db in one db steps. Units are said to have a zero insertion loss, and a frequency range from *dc* to 225 mc.—*RF-550; Daven Company, 191 Central Ave., Newark, N. J.*

Industry Literature

Superior Electric Co., Bristol, Conn., has released a 12-page bulletin, *D851N*, featuring a line of noninterlocking types of dimmers. Detailed are circuit diagrams, outline dimensions, manually-operated and motor-driven assemblies in ratings from 1000 to 30,000 watts.

Tru-Ohm Products, Division of Model Engineering and Manufacturing, Inc., 2800 N. Milwaukee Ave., Chicago 18, Ill., have issued a catalog detailing power rheostats, fixed resistors, and adjustable resistors.

General Electric Co., Schenectady 5, N. Y., has published a bulletin, *GEC-717*, that describes the application and operation of equipment used for measuring magnetic properties. Detailed are a gauss meter, indicating fluxmeter, recording fluxmeter, and fluxmeter calibrating unit.

General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass., have made available a bulletin which describes a line of stroboscopes. Specific applications of the different instruments is also provided.

Rex Rheostat Co., 3 Foxhurst Rd., P. O. Box 232, Baldwin, N. Y., has issued a catalog, *No. 5*, describing standard tubular rheostats, potentiometers and resistors from 220 to 1000 watts. Also described are double rheostats and resistors up to 2000 watts.

N. V. Philips Gloeilampenfabrieken, Eindhoven, Netherlands, through *Elsevier Press*, Inc., 402 Lovett Blvd., Houston 6, Texas, has added two books to their technical library: *Application of the Electronic Tube in Radio Receivers and Amplifiers* ($7.75), and *Transmitting Tubes*, by P. J. Heyboer and P. Zijlstra ($6.25).

Keithley Instruments, 3868 Carnegie Ave., Cleveland 15, Ohio, has released a 2-page bulletin describing an electrometer shunt that is said to convert their electrometer to a micromicroammeter. Shunt is claimed to permit direct current readings from 10^{-6} to 10^{-13} ampere.

The Richardson Co., 2765 Lake St., Melrose Park, Ill., has published a 20-page catalog on laminated plastics and their applications in industry. Described are various grades of laminated plastics and data on the mechanical and electrical properties of each.

Chicago Telephone Supply Corp., Elkhart, Ind., has issued a 38-page catalog describing a line of military and civilian composition and wirewound variable resistors, ranging from ½ watt, ¾" diameter miniaturized variable to a 4 watt, 1 17/32" diameter wirewound variable resistor.

Detailed descriptions of both military and civilian resistors include electrical characteristics, mechanical characteristics, special features and constructions, and dimensional drawings of each resistor. A special information section on the military line includes data on *locking bushing, high torque feature*, and *mounting hardware, resistance tapers* for *variable composition resistors*, and *watersealed bearing and mounting*. Information section on the civilian line includes data on *dimensions of slotted and knurled shafts* and *lead covers for snap switches*. The switch section illustrates and describes a 1⅛" diameter, single pole, two, three and four-position tone switch.

General Electric Co., Schenectady 5, N. Y., has released the '52 edition of the instrument transformer buyer's guide, *GEA-4626E*, a 94-page book, containing information on their line of instrument transformers.

Insulation Manufacturers Corp., 565 W. Washington Blvd., Chicago 6, Ill., has prepared a 24-page catalog describing electrical insulation products.

Cinema Engineering Co., 1510 W. Verdugo Ave., Burbank, Calif., has issued a 16-page '52 catalog, *No. 18-A, Audio Attenuators*.

Heppner Manufacturing Company, Round Lake, Ill., has issued a catalog illustrating and describing a line of snap-on, slip-on and screw type ion traps, centering devices for electrostatic TV tubes of all sizes, Alnico *pm* speakers, adjustable focus magnets with picture positioning control, and flyback transformers. Described also are facilities for military orders, including engineering, tooling, punch press, screw machine, welding, milling, machining and silver plating.

The Instrument Division of Allen B. Du Mont Laboratories, Inc., 1500 Main Ave., Clifton, N. J., has prepared a reference of transducers for use with 'scopes. The compilation contains over 500 different types of analog transducers arranged alphabetically according to their functions. Through the use of the compilation users may find the model, manufacturer, and mechanical and electrical characteristics of the transducer required. For each transducer, the following pertinent information is given as available from the manufacturer: Function; principle of operation; accessories required; transfer characteristics; power required; amplitude range; sensitivity; output characteristics; bandwidth; resonant frequency; resolution or precision; linearity; weight; range; sturdiness; temperature limitations; mounting; size; remarks, and model designation. A transducer accessory listing has also been included, giving characteristics, remarks, uses, and manufacturer. Compilation is available for 50 cents a copy.

E. F. Johnson Co., Waseca, Minnesota, has issued a general products catalog, 972. Listed also are the Viking 1 transmitter, Viking *vfo*, shield for plugin links, rotary inductor, crystal socket and a knob and dial line.

E. I. Guthman Co., Inc., 15 S. Throop St., Chicago, Ill., has released a booklet describing the production facilities of their Chicago and Attica, Indiana, plants.

Thor Ceramics, Inc., 225 Belleville Avenue, Bloomfield, N. J., have published a catalog, No. 151, with data on standard steatite stand-off insulators.

The Palnut Company, 61 Cordier Street, Irvington, N. J., has issued 4-page folder describing fasteners for radio and TV coils and shield cans.

Station Planning

(Continued from page 7)

a sync generator; monochrome scanner for still slides and test patterns; a single image orthicon camera chain for live shows as well as film pickup; two 16-mm projectors; a stabilizing amplifier for local adjustment of network feed; and minimum audio facilities.

It is better economically, if the transmitting facilities as well as the pickup facilities can be housed in a compact, single building. In this manner operating personnel, as well as microwave or telephone wire service is held to a minimum. Experience has shown that a station may go on the air with as few as three operating personnel; one transmitter and video operator, one film operator, and one audio operator.

As income warrants, or as operations require, this minimum layout may be expanded through the addition of camera, field equipment, more studio lighting and audio equipment, and the necessary additions to the central control equipment.

For *uhf* the *earn-as-you-grow* pattern can also be applied. There will be available a minimum transmitter or 500-watter designed for use in small cities, as well as a driver unit for the higher-powered transmitters. Transmitters will range in power (under present plans) up to 12 *kw* visual and 6 *kw* aural. This output in connection with a high-gain *uhf* antenna (power gain of 20) will provide maximum allowed power on *uhf*.

Television relay equipment, including microwave transmitter; microwave receiver; transmitter (*hv* supply); transmitter (*lv* supply); receiver power supply.
6' solid spun aluminum dish (2).
6' dish dipole antenna (2).
Complete RG17/U assembly solid dielectric transmission line, including test hangers, connectors, etc. (100').
Rack cabinet (2).
Sound channel relay, operating with above equipment (optional).

MICROWAVE relay complement, costing about $20,000.

STUDIO CAMERAS with mobil-mount dolly, cables, lenses and accessories.

Video Monitoring

(Continued from page 13)

are used in the *cro* vertical amplifier than would otherwise be required.

New 'Scope Scales

The front panel construction has been simplified, and eight additional controls and one extra switch as well as a metering jack for the calibration circuit have been included. Engraved *cro* scales having adjustable intensity edge illumination have been provided and are supplied so that a suitable scale can be used for each application. A two-light system of monitor designation which employs an edge-lighted lucite block is located at the top of the front panel. A tally light relay switches the light from white to red as the monitor is switched from *stand-by* to *on-the-air*. The additional controls at the top are covered since they only require occasional adjustment.

Another important mechanical feature of the new monitor has been its weight reduction to 54 pounds.

Credits

The development of a unit of this type involves contributions from many people. The author wishes to acknowledge in particular the work done by J. D. Spradlin, A. H. Lind, N. S. Oman and S. L. Bendell and P. C. Harrison.

LV Regulator

(Continued from page 9)

of 72 hours, during which the output was monitored by a recording potentiometer. The excursion during this period was less than 0.2 per cent. Internal resistance, at the beginning of this period, was adjusted for 0 ohms within 0.2 ohm and measured zero within those limits at the conclusion of the test period.

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[1] *P. R. Mallory and Co., Inc., Form SA-11-20-50-2M; p. 3.*

[2] *George M. Kirkpatrick,* Characteristics of Certain Voltage-Regulator Tubes, *Proc. IRE, p. 485; May 1947.*

[3] *George E. Valley, Jr., and Henry Wallman,* Vacuum Tube Amplifiers, *pp. 414-418; McGraw-Hill, 1948.*

[4] *Karl R. Spangenberg,* Vacuum Tubes, *Chap. 8, p.190; McGraw-Hill, 1948.*

Underwater Radar

(*Continued from page* 18)

was round and rocky, the sound was drawn out and had a rough *rattly* sound.

The equipment employs a transducer which is normally directed horizontally and is rotatable over 360°. The transducer is driven, rotated mechanically, by a small motor. Provided is a selector switch which causes the transducer to rotate continuously over 360° or scan a sector approximately 50° either side the bow of the vessel. There is a third position of the switch which provides for manual control of the scanning motor. In this position a spring return, left-right switch is available. With this control the operator may direct the transducer in a given direction or at a specific target and hold on this target. In the matter of scanning, the equipment is comparable to a conventional radar system where these types of scanning are available.

The transducer is a crystal unit which operates at a resonant frequency of 50,000 cps. Its beamwidth is approximately 20°. In operation it is suspended next to the keel, near midship of the vessel, by a 1"-diameter monel tube, which passes up through a packing gland in the hull. The transducer itself is suspended inside a teardrop housing by an inner concentric shaft. Mounted inside the vessel, atop the larger monel shaft, are a scanning drive motor and selsyn motor which operates the *ppi crt* deflection system.

Experiments with transducers operating from 20,000 to 175,000 *cps* have been conducted. It has been found that, generally, the higher the operating frequency, the greater the definition (reflection from small objects). Above a certain point this has been found to be a disadvantage. Kelp, small objects floating on the surface of the water, etc., have been found to produce more reflection than desired. However, for detecting small objects, submerged cables, submarine nets, etc., these higher frequencies are of value. Tests have shown that with higher operating frequencies the beamwidth will be narrower for a given diameter of transducer face. It has been found desirable to have a narrow beamwidth, both from the standpoint of picture definition and greater power concentration in the narrower beam. Thus, from this aspect, the higher frequencies are more desirable. It is also necessary to consider the fact that the attenuation is greater at the higher frequencies. In addition accoustical noises from the vessel and from the sea are more predominant at the lower frequencies.

Tests have indicated that for navigation and fish locating, a frequency of 50,000 *cps* is about optimum.

In the depth sounding equipment used in this radar system the oscillator operates at a relatively low level. It is keyed by a square wave multivibrator which produces a controllable pulse width. The power amplifier consists of two 6L6 operating in push-pull, a method which gives rise to the least possible harmonic radiation.

The output of the superhet receiver used in this gear is rectified at a low level. This rectified signal is used to operate the meter and recorder marking.

The pulse width is controllable; the triggered, one-shot multivibrator is adaptable to any method of pulse-width control. In an experimental model, it was possible to vary the pulse width as the gain-control setting was changed. This system was found to have an advantage, permitting the production of a short pulse at low gain settings where

(*Continued on page* 28)

Underwater Radar

(*Continued from page 27*)

less power is required. providing narrow. well defined lines when recording shallow depths. As the depth increases. the gain control can be increased as required. producing greater pulse width. This method was also found to have desirable possibilities when used in the *underwater radar* equipment.

The pulsed power output of this unit is approximately 100 watts.

The bandwidth of the superhet receiver. using 175 kc iron-core *if* transformers. was found to be sufficient to pass pulses of the width and frequency used. For purposes of meter operation. after the signal has been rectified. the signal is integrated to discriminate against extraneous noise which may be present in the receiver. The pulse width has been found to be great enough to overcome this integration. The degree of integration can be changed with each position of the range switch. as is the pulse width. Following the integration circuit is a high grain triode pulse amplifier *reshaper tube*. which reproduces the sharp leading edges to the received signal pulse.

Miniature Transponder Beacon

(*Continued from page 17*)

pare each circuit to a standard. Transmitter cavities and tubes are pre-tested in a similar manner.

Test harnesses are furnishd with the beacons for field testing. requiring in addition only standard test equipment ordinarily used with field radar sets.

Conclusions

The new miniature beacon represents a weight reduction from 13 to 4 pounds and a reduction in volume from approximately 285 to 65 cubic inches. Although the beacon is a good example of what can be achieved through modern miniaturization techniques. the art is still young. Even now new developments of similar equipment are under way which are considerably smaller and lighter in weight.

The basic development of the beacon is accredited to Signal Corps engineers at Evans Signal Laboratories. Belmar. N. J.. where the writer had the privilege of being project engineer. To engineers of Squier Signal Laboratories. Ft. Monmouth. N. J.. full credit is due for development of many of the small components. especially the miniature batteries and vibrator supply, which represents a considerable advance in the state of the art. Also. credit is due to Signal Corps thermionic engineers who shudder at the unbelievable tortures to which their tubes are subjected. yet obligingly conduct extensive tests to determine the proper tube types for reliable operation under the strange environment. Certain of the foregoing developments have been made by engineers of private industry under government contract. who are not known to the writer. However. credit is due to engineers of the CGS Laboratories, Stamford. Conn.. for the transmitter cavity development. and to Jason Woodward. chief engineer. General Communications Co.. Boston. Mass.. for many of the refinements incorporated in the production beacon. The bulk of the circuitry is commonly known to the art. Even the series receiver. which was for a time considered to be original in design. was found to be in use by other laboratories. particularly in *if* amplifier designs. called *cascoding* or *casplating*.

PC Techniques

(Continued from page 19)

pacitors can be printed, but there is still a lack of a satisfactory high *K* material, stable over operating temperatures and frequency ranges, that could also serve as an inexpensive base material for the printed conductors. As mentioned previously, coils can be printed, but at low frequencies their size is not practical.

Electrical Characteristics

Design engineers need not be overly concerned with the electrical characteristics of printed-circuit forms. On phenolic surfaces, peak flash-over voltages, under normal conditions with no protective coating over a $\frac{1}{32}$″ pattern spacing, is about 1,800 volts. Current-carrying capacities are good for general applications. For example, a .00135″ thick copper foil conductor, $\frac{1}{16}$″ wide, will carry 10 amperes before a buckle is evidenced on the surface. In a study of *pc* circuit frequency response, it was found that since the response is determined by the shunt capacitances of the circuit, at audio levels the shunt capacitances are negligible; hence good frequency response is assured. At higher frequencies distributed capacities between the conductor line can become pronounced. In such cases, a low dielectric constant material should be used and care should be taken in the pattern design to use short conductors, wherever possible. Also ground lines may be run between critical lines to reduce the electrostatic coupling. Generally speaking, the pattern capacitance can be considered to be comparable in magnitude to that encountered in conventionally wired assemblies. There is the advantageous feature that capacitance will be identical from pattern to pattern.

Recent Developments

During the past year there have been rapid strides in the field of printed circuits. The new developments which can now be offered and utilized in quantity production are:

(*1*) Flush circuits, complex switches, contacts and commutators.

(*2*) Metal foils laminated to flexible supports including glass cloth, nylon and paper suitable for electrical circuits patterns.

(*3*) Lamination of foils to high temperature plastics, such as silicone fiberglass which will withstand temperatures of 200° *C* for four hours and longer.

(*4*) Efficient dip-soldering pin-assembly method.

(*5*) Spot-dip soldering where specific areas such as foil termination, rather than the entire pattern are soldered.

(*6*) Circuit patterns on post-formed plastics.

Cost Estimate

Unless the type of material, the size and thickness of the piece, intricacy of the printed circuit and quantities involved are known, it is usually difficult to provide a cost estimate for a *pc* project. However, costs in the neighborhood of one to five cents per square inch for a completely fabricated piece are indicative, depending on the aforementioned factors.

Conclusion

A minor revolution appears to be brewing in certain phases of the TV industry. Printed circuits are making a tremendous impression because of the

(*Continued on page* 30)

PC Techniques

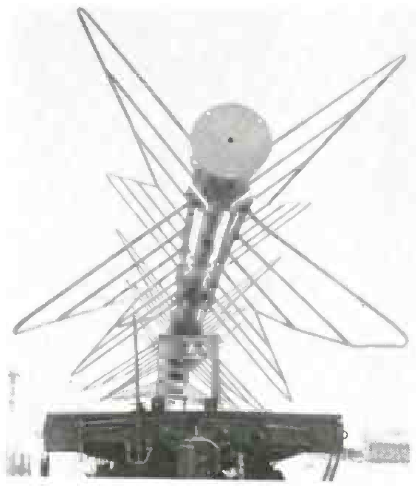
(Continued from page 29)

appreciable reductions in wiring and assembly costs, circuit reproduceability and miniaturization possibilities they offer. Their applications are limited only by the imagination of the design personnel anticipating their use. Extending the imagination will enable one to visualize complete encapsulated and potted *packaged* assemblies containing printed conductors and components on flexible supports; the supports to be rolled or wrapped around larger circuit elements into shapes requiring very little space. Heat dissipation will be a minor problem; in most instances, transistors which consume a negligible amount of power, will replace the standard vacuum tube. Since a large number of assemblies, either singularly or with a number of sub-assemblies, can be standardized and produced by mass production systems, costs can be reduced to a level heretofore considered impossible.

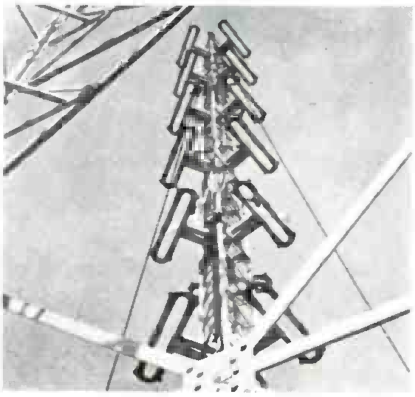
At Pacific Coast Exhibition

Above: George Curran, supervisor of special engineering for KFI, Los Angeles, and H. L. Blatterman, KFI chief engineer for the same station, who were among the more than 500 guests who attended the first annual Industrial Electronics Exhibition at the Los Angeles' Elks Club Temple which was arranged and financed by Richard V. Weatherford, Los Angeles distributor. Below: Charles Brokaw, RCA Western regional manager; Mrs. Ed Benham and Ed Benham, chief engineer of KTTV, Los Angeles.

Latin-American TV



Above: G.E. antenna for CMQ-TV, Santiago de Cuba. Below: FTL 8-bay antenna for LR3-TV, Buenos Aires.



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TELEVISION ENGINEERING

MARCH, 1952

Briefly Speaking . . .

Transistors, although officially announced several years ago, have during the past few months become quite a national item, with three manufacturers particularly active in the promotional campaign. All have predicted a golden future for the tiny bead. According to *Doc Engstrom* of *RCA* Labs . . . "This new tool will open vast new horizons in the electronic art." Fully refined transistors, RCA engineers have predicted, will be used in portable electronic computors, cigarette-package size receivers, and even combination receivers and transmitters that might be smaller than telephone handsets. *I. J. Kaar*, of *G. E.*, noted that it is really . . . "difficult to predict all of the effects germanium may have, to foresee the magnitude of growth it portends, or to conjure up all of the new products and techniques that may emerge and their effects on marketing and industry." . . . To prevent the failure of electronic equipment through the misuse of components in end items, the engineering department of *RTMA* has established an engineering committee which will serve as a central collecting agency to receive all reports and data from surveys relating to reliability of equipment in the field. The committee will also set up routines with various *RTMA* and *JETEC* committees so that data collected can be referred to proper groups for study and handling. Patterns, covering general needs that may be of interest to manufacturers, will also be probed by the group. . . . A *uhf* transmitter which can provide an erp of 100 kw, and which it is said can sell for the same price as a veryhigh 5-kw transmitter, was announced during the recent IRE show week by *DuMont*. The transmitter's design was described as revolving about the use of the recently announced *Eimac* klystron 5-kw tube. . . . *Radio Receptor Co., Inc.*, 84 N. Ninth St., Brooklyn, N. Y., has become the first licensee of Western Electric to manufacture germanium transistors and diodes. Germanium division at Radio Receptor is headed by *E. G. Shower*, formerly a member of the technical staff of Bell Telephone Labs. . . . *Standard Coil Products Co., Inc.*, has announced the acquisition of the *Sherold Crystal* division of Espey Manufacturing. . . . A dinner will be tendered to *Dr. Lee de Forest* at the Waldorf-Astoria on Tuesday, April 8, to celebrate the 50th anniversary of his entry into commercial wireless telegraphy. Speakers at the dinner will be former president *Herbert Hoover* and *Charles A. Edison*. *Rear Admiral Ellery W. Stone*, president of American Cable and Radio Corp., will preside at the dinner. Also present will be *Brigadier General David Sarnoff*, RCA; *Colonel Sosthenes Behn*, ITT; *Walter Marshall*, Western Union; *Dr. Mervin J. Kelley*, Bell Telephone Labs, and *Rear Admiral Stanford C. Hooper*, USN (Ret.). Dinner is being sponsored by The De Forest Pioneers, AIEE, ARRL, IRE, NARTB, RTMA, SMPTE and VWOA. . . . A delineation of the complexities inherent in TV broadcasting was given recently by *Rodney Chipp*, director of engineering for the DuMont TV Network, in an address before the IRE, Monmouth County Sub-Section. Chipp will also present a paper entitled *TV Control Room Layouts* at the NARTB show in Chicago, March 31-April 2, at the Conrad Hilton Hotel. *Robert Betts* of the TV transmitter division will also present a paper on *Methods of Controlling and Improving Video Signals*.

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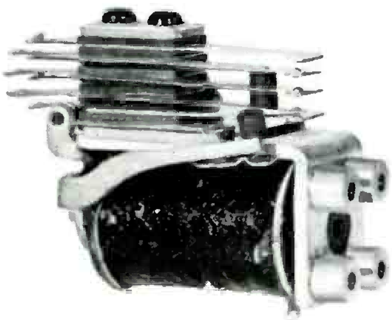
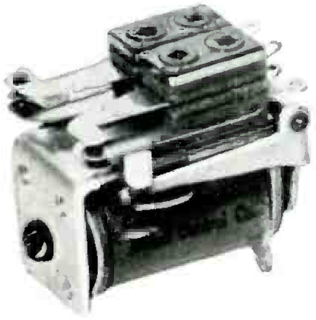




Midget Relays

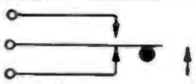
STK. NO.	VOLTAGE	OHMAGE	CONTACTS	MFG. & NO.	UNIT PRICE
R-416	4 VDC.	9	1C @ 1.5 AMP.	ADVANCE 1603S	$1.65
R-378	6 VDC.	100	1A @ 1.5 AMP.	ADVANCE 1601S	1.50
R-850	12 VDC.	450	1A @ 1.5 AMP.	ADVANCE 1601	1.50
R-379	19/27 VDC.	250	2A @ 1.5 AMP.	ADVANCE 1605	1.65
R-694	24 VDC.	300	1A @ 5 AMP.	ADVANCE 1601A	1.50
R-935	28 VDC.	1000	1C @ 1.5 AMP.	ADVANCE 1603S	1.65
R-572	24 VDC.	256	1C	AIRCRAFT RADIO CORP.	1.25
R-857	24 VDC.	260	1 MAKE BEFORE MAKE	AIRCRAFT RADIO CORP. 9453	1.75
R-912	4/5 VDC.	20	3A-1C CERAMIC	ALLIED TKX50	1.45
R-291	6 VDC.	5	1A	ALLIED 73A71	1.25
R-921	6.7 VDC.	18	1A Dbl. Brk. @ 10 amp.	ALLIED CRX-11	1.45
R-738	12 VDC.	60	3A	ALLIED TX3A	1.20
R-922	12 VDC.	75	1A Dbl. Brk. @ 10 amp.	ALLIED CRX-13	1.45
R-144	12 VDC.	228	1A	ALLIED D-283486	1.45
R-696	24 VDC.	230	1A @ 8 AMP.	ALLIED 55837	2.00
R-145	18/24 VDC.	250	2A CERAMIC	ALLIED 7252	1.45
R-723	24 VDC.	280	1C	ALLIED 7251	1.50
R-298	21 VDC.	300	1A	ALLIED CB-5	1.25
R-296	21 VDC.	300	1A	ALLIED CA-5	1.25
R-586	21 VDC.	300	1A & 1C	ALLIED 73A-69	1.25
R-142	24 VDC.	400	2C	ALLIED 73A50	1.50
R-785	24 VDC.	200	2C @ 10 AMPS.	AUTO. ELECT. ZH-37169-1	2.00
R-375	24 VDC.	200	2A heavy duty	AUTO. ELECT. H-87063-1	1.75
R-373	12/20 VDC.	225	1A split	AUTO. ELECT. SQA	2.50
R-370	12 VDC.	75	1C	AUTO. ELECT. MANKATO R-25	2.30
R-607	24 VAC.	INT.	1A	AUTO. ELECT. MANKATO R-45-D	1.20
R-606	24 VAC.	INT.	1A & 1B	AUTO. ELECT. MANKATO R-45-F	1.20
R-605	24 VAC.	INT.	3A	AUTO. ELECT. MANKATO R-45-G	1.20
R-374	24 VDC.	300	2A heavy duty	BETTS & BETTS RAC-15AS	1.75
R-728	6 VDC.	30	1A	CLARE........A-26690	1.25
R-149	6/8 VDC.	45	1B	CLARE........A-20545	1.50
R-732	12 VDC.	120	1A	CLARE........A-25454	1.45
R-281	12 VDC.	126	2A	CLARE........A-13415	1.25
R-347	18/24 VDC.	300	1A	CLARE........A-19469	1.10
R-376	24 VDC.	300	1A	CLARE........K	1.25
R-818	18/24 VDC.	300	1B	CLARE........A-8058	1.30
R-133	24 VDC.	300	NONE	CLARE........A-20388	.75
R-348	18/24 VDC.	300	2A	CLARE........A-16734	1.15
R-138	24 VDC.	300	4A	CLARE........A-16280	1.45
R-349	18/24 VDC.	300	1C	CLARE........B-16947	1.25
R-377	24 VDC.	300	1C	CLARE........B-22441	1.45
R-132	24 VDC.	300	2C	CLARE........	1.50
R-731	24 VDC.	300	2C	CLARE........A-16265	1.55
R-492	24 VDC.	300	4C 1A	CLARE........	1.95
R-626	24 VDC.	400	1A @ 5 AMPS.	CLARE........A-22717	1.55
R-786	60 VDC.	1300	2C	CLARE........A-12408	2.00
R-415	60/85 VDC.	1800	2A	CLARE........K	1.95
R-371	2 VDC.	30	1C Ceramic	COOK........418	1.75
R-755	24 VDC.	300	1A	COOK........55340	1.45
R-150	6 VDC.	30	1A	E-Z ELECTRIC	1.50
R-893	14 VDC.	150	1A, 1C	G. E.........55526	2.50
R-895	14 VDC.	150	2A, 1B, 1C	G. E.........55531	2.50
R-896	24 VDC.	260	2A	G. E.........55589	2.50
R-959	24 VDC.	747	2C	GUARDIAN....36761	1.50
R-693	2/6 VDC.	125	1C @ 3 AMP.	LEACH........P-501424	1.20
R-947	12/24 VDC.	320	1C @ 3 AMP.	LEACH........P-3	1.25
R-692	6/24 VDC.	1280	1C @ 3 AMP.	LEACH........P-3	1.35
R-856	18/24 VDC.	300	1B	PAUL HENRY 1010	1.45
R-913	6 VDC.	20	3A, 1C CERAMIC	PRICE BROS.	1.45
R-915	12 VDC.	70	1A Dbl. Brk. @ 10 amp.	PRICE BROS.	2.00
R-148	12 VDC.	100	2C & 1B	PRICE BROS.	1.85
R-222	12 VDC.	100	2A	POTT. & BRUM.	1.00
R-834	6 VDC.	20	3A, 1C	RBM	1.45

OTHER RELAY TYPES IN STOCK

- Keying Relays
- Rotary Relays
- Contactors
- telephone Relays
- Voltage Regulators
- Differential Relays
- Sealed Relays
- Special Relays

Form A—"Make" (Single Throw, Normally Open)

Form B—"Break" (Single Throw, Normally Closed)



Form C—"Break-Make" (Double-Throw)

Relay Sales

Manufacturers and Distributors: Write for the new Relay Sales Catalog.

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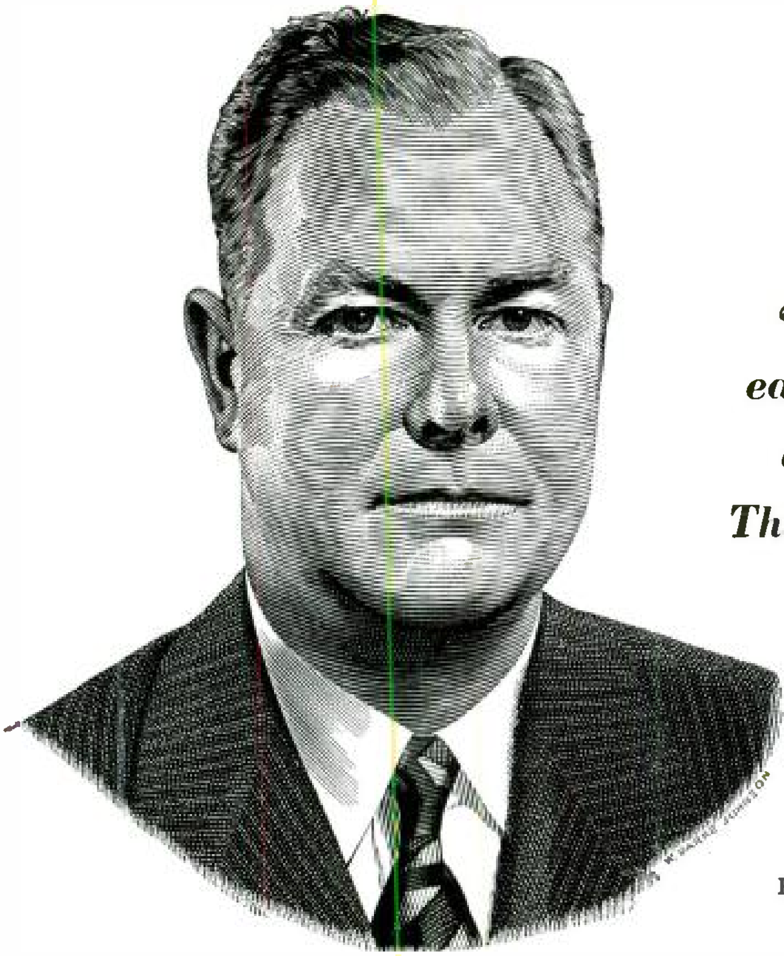

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