Including ELECTRONIC INDUSTRIES for Defense

See Page 33

TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

Ground Control Approach and Area Surveillance Radar at Los Angeles Airport, California

Selling to the Air Force • Radar in the Air • FCC's New TV Allocation Plan

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May • 1951 CALDWELL-CLEMENTS, INC.

Motorola microwave

Multiply your present communication facilities, realize new economies, and make sure of the greatest possibilities for future expansion, by insisting on a MOTOROLA, superior-engineered Microwave System.

With the most *private-owned* microwave mileage now in operation, Motorola offers you the benefit of EXPERIENCE, *plus* many immediate and practical advantages.

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Brazos River Electric Transmission Cooperative
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Motorola Microwave is the super communication "pack horse" of complete round-the-clock reliability. Cross-town or cross-country, office to plant—to branch—to mobile crews, it provides multi-channel facilities for voice circuits, supervisory control networks, telemeter, and teletype, 2-way radio tie-in, with innumerable additional combinations for automatically and simultaneously operating your entire system. Motorola Microwave means efficient, economical point-to-point communication.

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World leaders in FM 2-way radio communications • 2-way mobile • portable • microwave • carrier and control • supervisory control equipment

TELE-TECH

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Edited for the 15,000 top influential engineers in the Tele-communications and electronic industries, TELE-TECH each month brings clearly written, compact, and authoritative articles and summaries of the latest technological developments to the busy executive. Aside from its engineering articles dealing with manufacture and operation of new communications equipment, TELE-TECH is widely recognized for comprehensive analyses and statistical surveys of trends in the industry. Its timely reports and interpretations of governmental activity with regard to regulation, purchasing, research, and development are sought by the leaders in the many engineering fields listed below

Manufacturing

TELEVISION • FM • ELECTRONIC
LONG & SHORT WAVE RADIO
AUDIO AMPLIFYING EQUIPMENT
SOUND RECORDERS & REPRODUCERS
AUDIO ACCESSORIES

MOBILE • MARINE • COMMERCIAL GOVERNMENT
AMATEUR COMMUNICATION
CARRIER • RADAR • PULSE
MICROWAVE • CONTROL SYSTEMS

Research, design and production of special types
TUBES, AMPLIFIERS, OSCILLATORS, RECTIFIERS, TIMERS, COUNTERS, ETC. FOR
LABORATORY • INDUSTRIAL USE
ATOMIC CONTROL

Operation

Installation, operation and maintenance of telecommunications equipment in the fields of

BROADCASTING • RECORDING
AUDIO & SOUND • MUNICIPAL
MOBILE • AVIATION
COMMERCIAL • GOVERNMENT

MAY 1951

COVER: Interior of the CAA control tower at Los Angeles International Airport. Ground Control Approach (GCA), and Area Survey Radar screens are shown under actual night operating conditions. The screen on the right shows the movement of all aircraft within 60 miles, the left screens constitute the PAR, or Precision Approach Radar system. The photograph is provided by courtesy of Gilfillan Brothers, Inc., Los Angeles, California, and was taken by William Eccles, Los Angeles.

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BIG-PICTURE PROBLEM

"Our new deluxe TV set must show a king-size picture. So . . . what tube over 20 inches is now in production?"

G.E.'s 24-inch metal tube—24AP4—is coming off the line as you read this, Mr. TV-set Designer! No blue sky about this pace-setter—the promise stage was over long ago, performance of the tube has been amply demonstrated, production is here . . . now!

335 square inches of full-width picture area . . . you have real set appeal, sales appeal in the 24AP4's newspaper-size GIANT picture! And quality of image is tops, with a neutral-density faceplate giving maximum contrast—accenting lights, enriching shadows.

Compact TV cabinet? The 24-inch length of the 70-degree-deflection-angle 24AP4 helps you keep down receiver bulk. . . . Tube weight? Only 27½ pounds, substantially less than with a glass type of equal size.

Act fast—*today!* Telegraph or write for technical bulletin ETD-101, giving ratings and performance information on the 24AP4. Or, at your request, a G-E tube engineer will be glad to call on you. *Electronics Department, General Electric Company, Schenectady 5, New York.*

24AP4

Recommended operating conditions

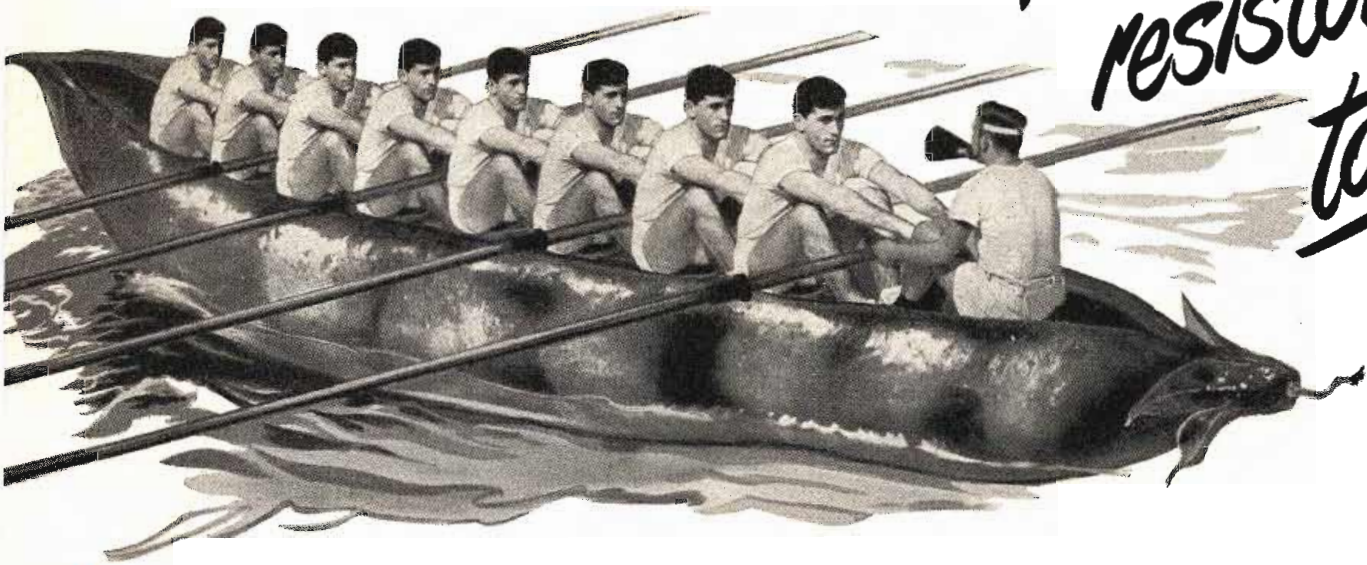
Anode voltage	15,000 v
Grid-No.-2 voltage	300 v
Grid-No.-1 voltage	—33 to —77 v
Focusing-coil current (RMA Coil No. 109 at 3½ inches)	114 ma
Ion-trap field intensity	36 gausses

GENERAL ELECTRIC

181-K2

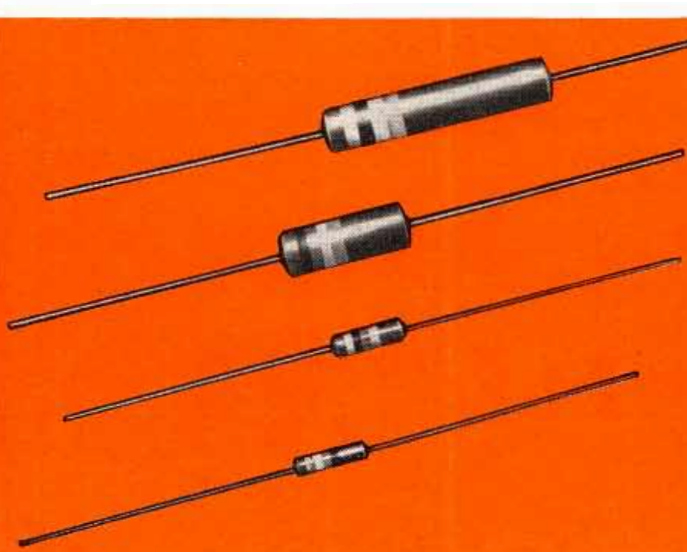
Uniformity is

for resistors too!



It isn't hard to make a resistor with specific characteristics. The trick is to make resistors by the million, fast and at low cost, and *still retain uniformity* in those characteristics. Specializing in resistors, IRC achieves this uniformity through mechanization of production, plus continuous inspection and rigid quality control. Result:—IRC customers are assured of identical resistance units—within prescribed limits—regardless of quantities or time of purchase.

Uniformity of IRC Advanced BT Resistors—which meet JAN-R-11 specifications—is the result of combining IRC's filament-type resistance elements with exclusive construction features. Resistance material is permanently cured and bonded to special glass. Leads extend into filament for rapid heat dissipation. Molded bakelite seals element against moisture and prevents grounding. In standard RMA Resistance Ranges, Advanced BT's possess extremely low operating temperature and excellent power dissipation at ⅓, ½, 1 and 2 watts. Full details of these compact, light-weight, fully insulated units are contained in 12-page technical data Bulletin B-1. Use coupon to send for your free copy.



Meet and beat JAN-R-11 Specifications.

Low noise level and temperature coefficient.

⅓, ½, 1 and 2 watts—Available in ±5%, ±10%, and ±20% tolerance.

Easily meets rigorous TV requirements.

IRC

INTERNATIONAL RESISTANCE COMPANY

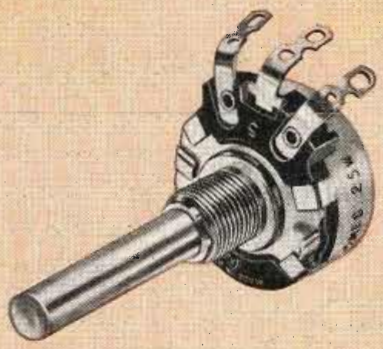
401 N. Broad Street, Philadelphia 8, Pa.

In Canada: International Resistance Co., Ltd., Toronto, Licen

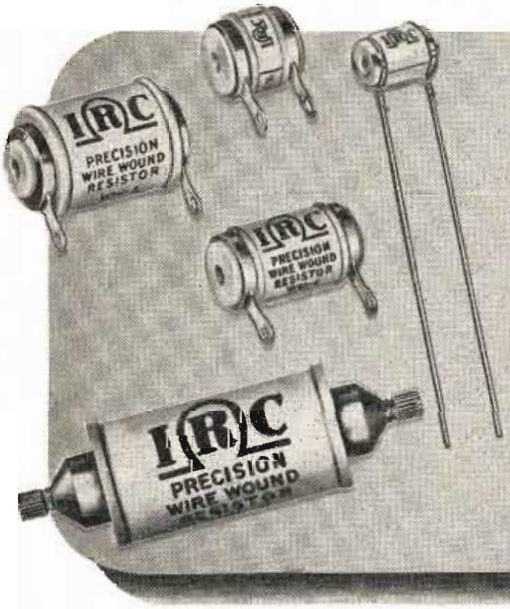
important

Unvarying balanced performance in every characteristic makes IRC Power Wire Wound Resistors ideal for exacting, heavy-duty applications. Uniformly wound with highest-grade alloy wire, and precisely coated with special moisture-proof cement, these fixed and adjustable resistors are unexcelled in essential electrical and mechanical characteristics. Leading industrial, aircraft, broadcast, maritime and commercial users have specified them for over 14 years. Catalog data Bulletin C-2 contains full details.

TEMPERATURE RISE AND DERATING CHART



Meticulous engineering and elimination of hand manufacturing operations assures maximum uniformity in these small 1 5/16" Type Q Controls. Resistance element is the best IRC has ever manufactured. Increased arc of rotation permits same resistance ratios proved successful in previous larger IRC controls. Electrical rotation is the same with or without new IRC Type "76" switch. Catalog data Bulletin A-4 gives complete information.



Uniformly accurate and dependable, IRC Precision Wire Wounds excel in every significant characteristic. Leading instrument makers use them extensively for close tolerance applications. Winding forms are non-hygroscopic ceramic with high insulation qualities, high mechanical strength, low coefficient of expansion. Special humidity-proof enamelled-wire windings receive particular attention to avoid strain or breakdown in insulation. Standard 1.0% tolerance. ½, ¼ and 1/10% are available. Full details in catalog data Bulletin D-1.

Power Resistors • Voltmeter Multipliers • Insulated Composition Resistors • Low Wattage Wire Wounds • Volume Controls • Voltage Dividers • Precision Wire Wounds • Deposited Carbon Precistors • Ultra-HF and High Voltage Resistors • Insulated Chokes

Wherever the Circuit Says

For prompt delivery of uniformly dependable standard resistors, in experimental or maintenance quantities, simply phone your local IRC Distributor. IRC's Industrial Service Plan keeps him fully stocked with the most wanted types and ranges—permits him to give you fast, round-the-corner delivery of small-order requirements. We'll be glad to send you his name and address.

INTERNATIONAL RESISTANCE COMPANY
407 N. BROAD ST., PHILADELPHIA 8, PA.

Please send me complete information on the items checked below:—

- ☐ Advanced BT Resistors (B-1)
- ☐ Type Q Control (A-4)
- ☐ Precision Wire Wounds (D-1)
- ☐ Power Wire Wounds (C-2)
- ☐ Name and Address of Nearest IRC Distributor

NAME_____

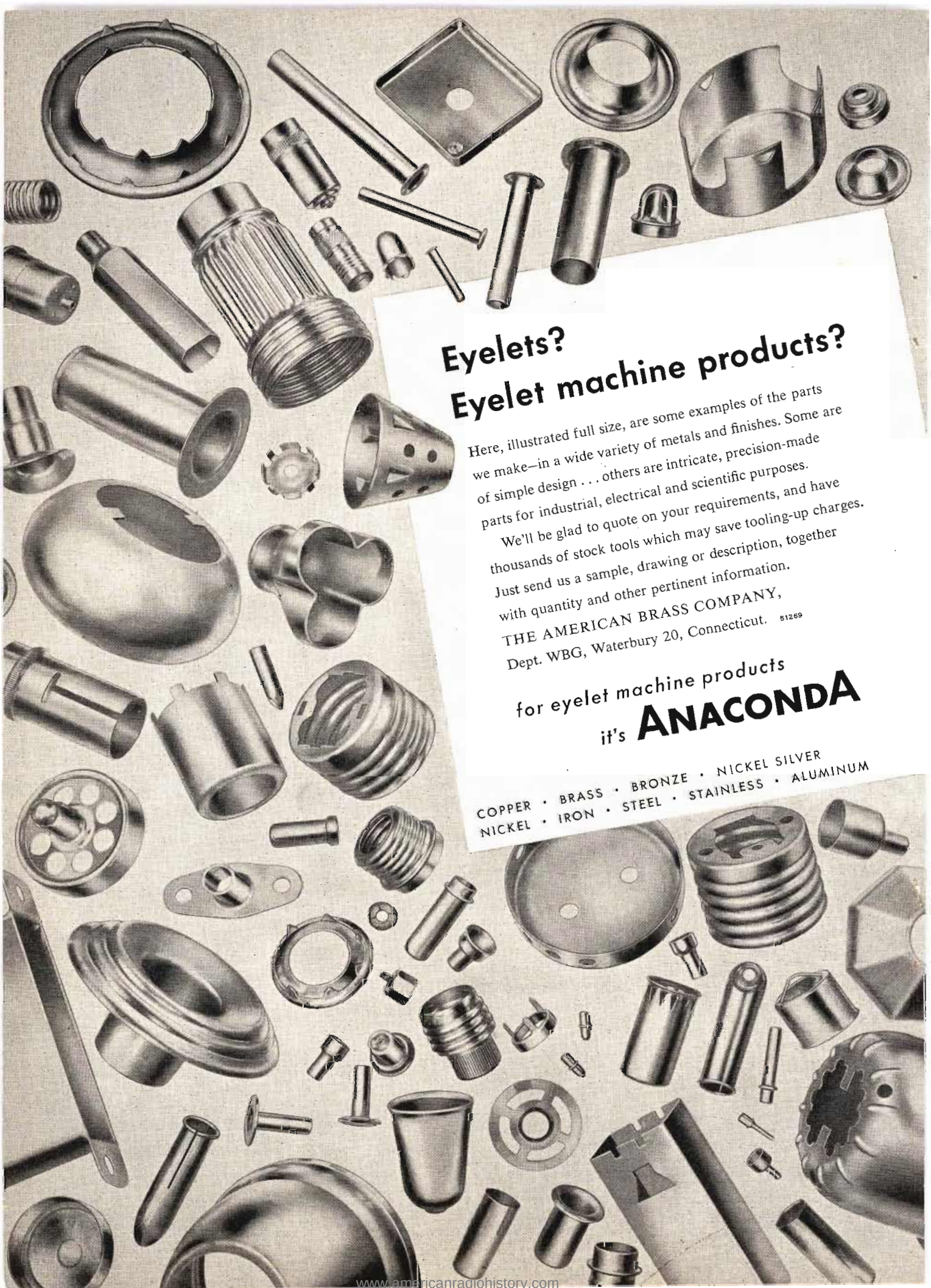
TITLE_____

COMPANY_____

ADDRESS_____

CITY_____ ZONE_____ STATE_____

J. F. ARNDT & CO., ADV. AGENCY



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Eyelet machine products?

Here, illustrated full size, are some examples of the parts we make—in a wide variety of metals and finishes. Some are of simple design . . . others are intricate, precision-made parts for industrial, electrical and scientific purposes.

We'll be glad to quote on your requirements, and have thousands of stock tools which may save tooling-up charges. Just send us a sample, drawing or description, together with quantity and other pertinent information.

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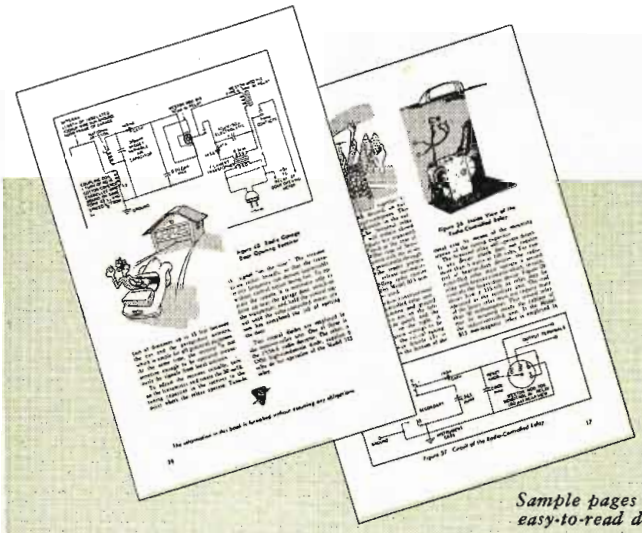
IN YOUR HOME!



Sample pages showing easy-to-read diagrams.

HERE'S HOW TO MAKE 24 VALUABLE TIME- AND LABOR-SAVERS

You don't have to be an electronics engineer to build these useful household gadgets. The step-by-step instructions in Sylvania's fascinating new book, "Electronic Shortcuts for Hobbyists," are written expressly for the home hobbyist, model maker and electrical experimenter. With this book you can build:

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ONLY 25¢

All you need is some inexpensive Sylvania Crystal Diodes and a few everyday materials. Book contains full instructions and easy-to-follow diagrams. Send a quarter along with the coupon for your copy.

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Dept. E-1305, Emporium, Pa.

Enclosed please find my 25¢ for copy of "Electronic Shortcuts for Hobbyists."

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SYLVANIA ELECTRIC

ELECTRONIC DEVICES; RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

New Era in Video -via REMOTE

Complex TV program continuity is reduced to a simple push-button operation with an RCA TS-20A System.

This Relay Switching System does what RCA's Audio Relay Systems have

This video relay system removes all switching restrictions from equipment operations. It imposes no limitation on equipment installation—no matter where you set up your units. It provides unlimited flexibility—enables you to add facilities as your station grows, *without losing a penny's worth of your original equipment investment.*

Actual switching in the RCA TS-20A system is done by d-c operated relays *located in the video line itself!* Designed by RCA for this special service, these relays are controlled by simple d-c lines from any point you choose. No expensive coaxial line required to and from control points. No extra cable connectors needed. You can rack-mount the relays wherever you want them. You can set up your control positions wherever you like. There are circuit provisions for sync interlocks and for tally lights.

The RCA TS-20 System provides complete master or studio facilities for program monitoring, production talk-back, and video switching between studio camera, film camera, remote pick-up and network programs. For example, you can fade or lap

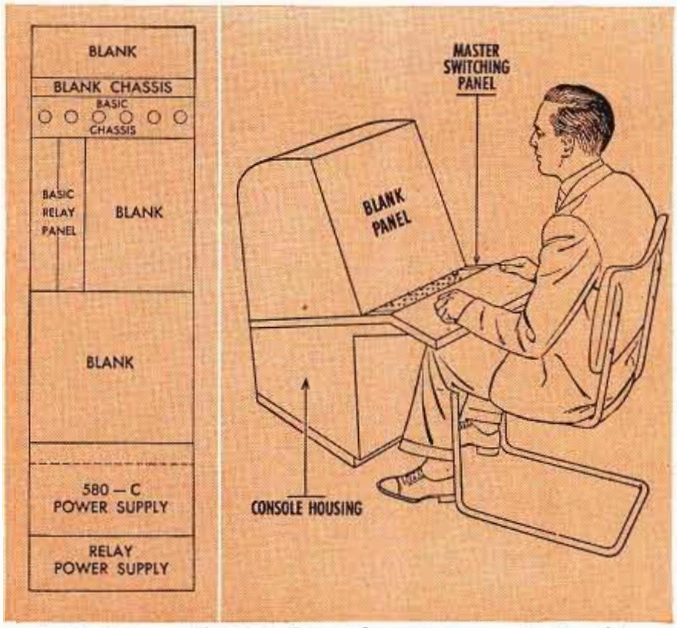
TELEVISION BROADCAST EQUIPMENT

RADIO CORPORATION of AMERICA

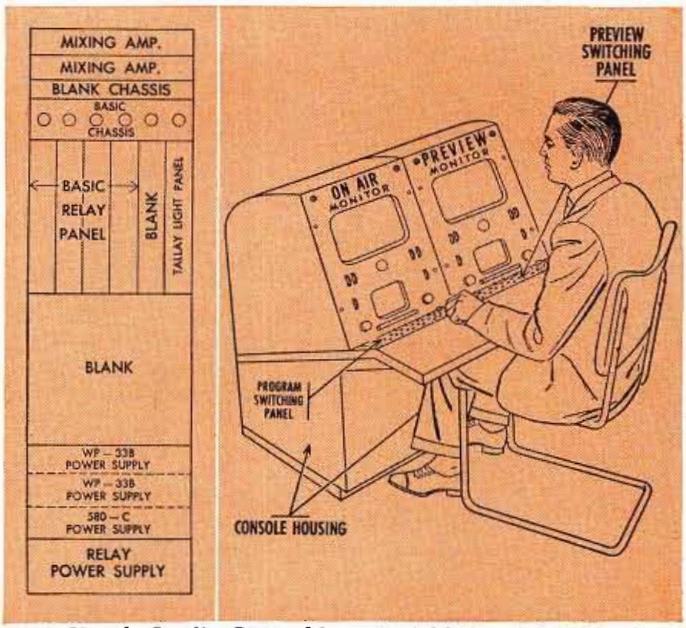
ENGINEERING PRODUCTS DEPARTMENT, CAMDEN, N.J.

In Canada: RCA VICTOR Company Limited, Montreal

3 OF THE MANY ADD-A-UNIT SET-UPS POSSIBLE WITH



1. Minimum Master Control arrangement. Combines simple operation with economy. Provides switching of 6 inputs to either of 2 outputs.



2. Simple Studio Control layout. Additional facilities include: Preview monitoring and line monitoring, fades, lap dissolves, and superimposition.

Switching RELAYS!

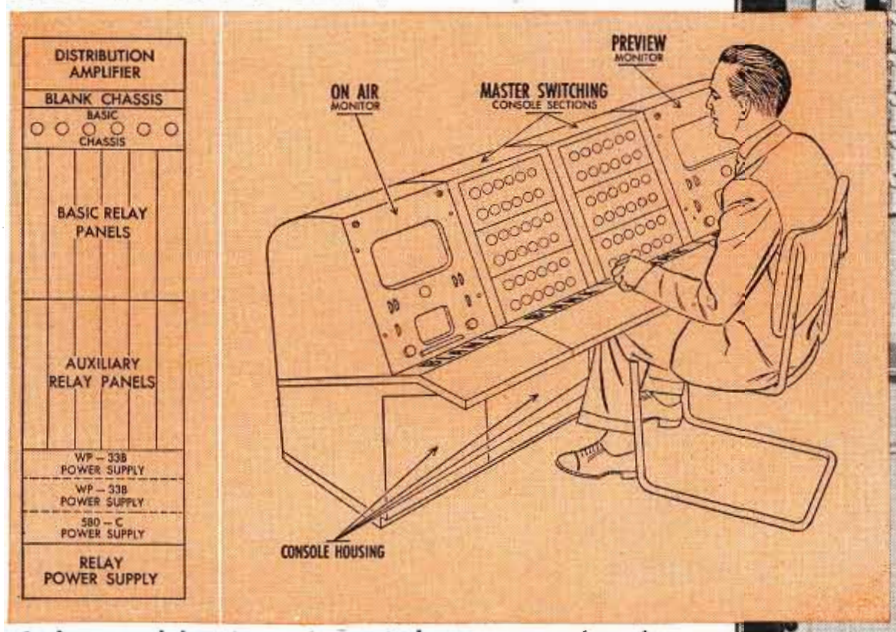
for TV master or studio control done for aural broadcasting.

dissolve between studios. You can set up for program previewing and other monitoring functions (up to 5 program monitors available). You can combine the TS-20A System with audio switching *and presetting*, so that the sound switches with the picture *automatically!*

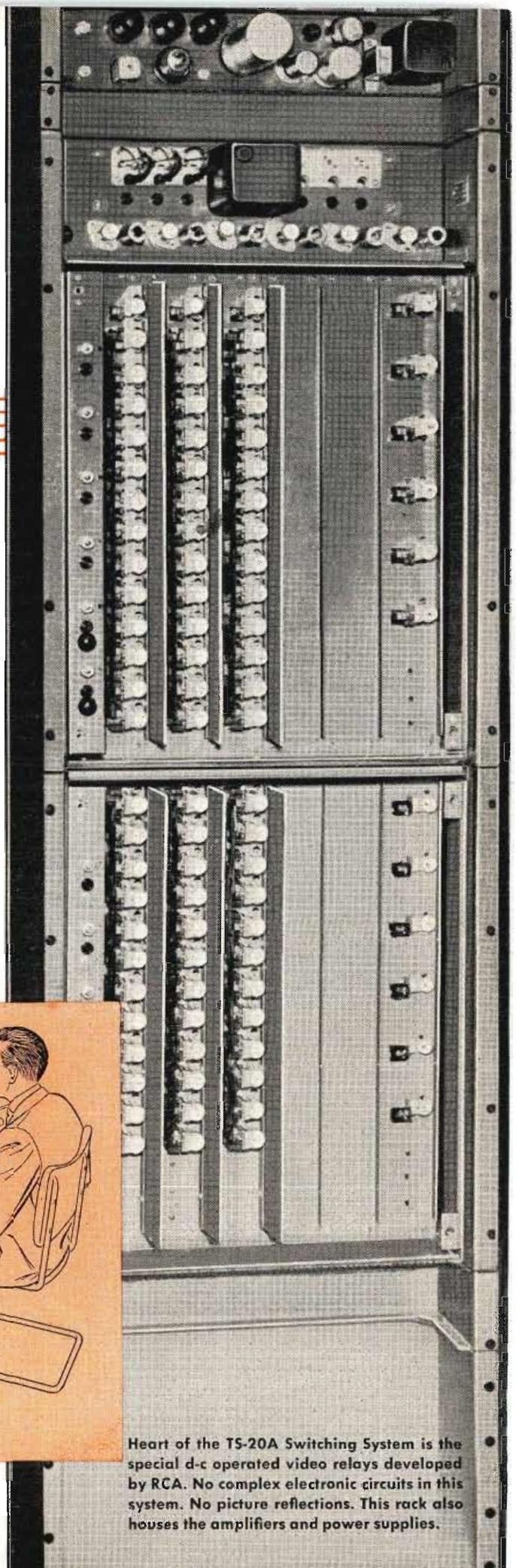
• • •

For long-range planning of your TV programming facilities, overlook none of the advantages of this revolutionary new relay switching system. Ask your RCA Broadcast Sales Engineer about it. Or write Dept. Q-87, RCA Engineering Products, Camden, N. J.

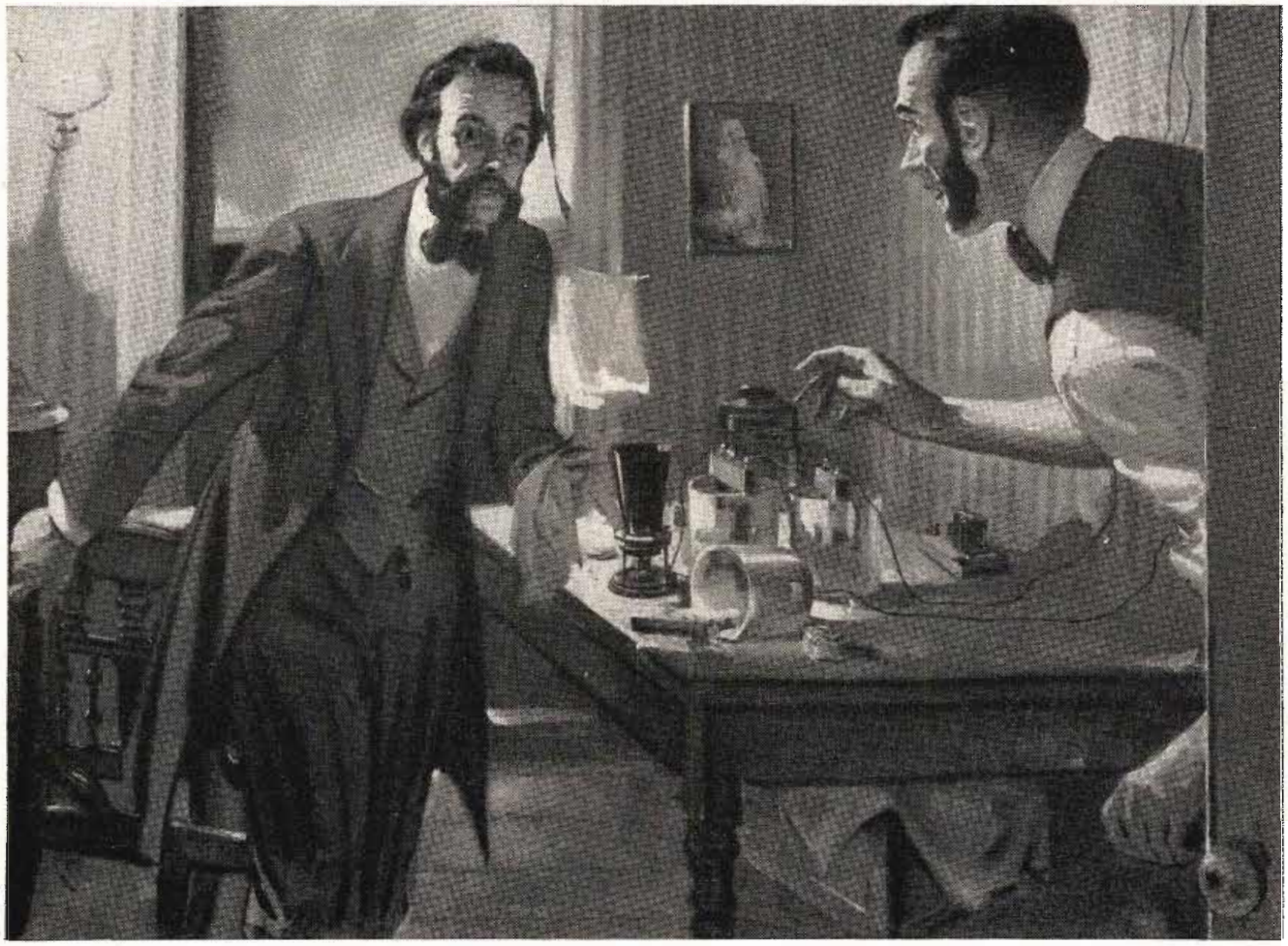
RCA'S TS-20A SYSTEM.



3. A more elaborate master control room set-up than shown in No. 1. Switches any of 12 inputs to any of 5 outgoing lines. Includes preview and line monitoring.



Heart of the TS-20A Switching System is the special d-c operated video relays developed by RCA. No complex electronic circuits in this system. No picture reflections. This rack also houses the amplifiers and power supplies.



"Mr. Bell, I heard every word you said — distinctly!" Thus, on March 10, 1876, Alexander Graham Bell (left) learned that his invention had transmitted the first intelligible speech.

75 Years of Tomorrows

Like today's telephone, Alexander Graham Bell's invention was a product of research. For several years Bell had been investigating speech and hearing, and devising methods and apparatus for the electrical communication of intelligence. No one had transmitted speech sounds electrically but Bell saw that it must be possible—given the proper instruments.

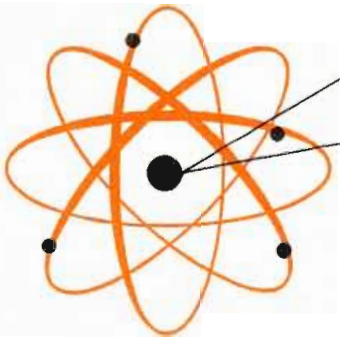
One day, while experimenting with his harmonic telegraph, Bell's alert ear caught an unexpected sound in the receiver. His trained mind told him that here at last was the proof that sound waves could travel as their facsimile in electric waves. Then followed a year of development, and in 1876, as shown above, he transmitted the first intelligible speech by telephone.

During the next three-quarters of a century, the telephone research which Bell started has grown and expanded to serve your telephone system . . . often fruitfully overflowing into other fields of electrical communication. In today's Bell Telephone Laboratories, promising ideas find the right skills to bring them to life. Through skilled manufacturing by Western Electric Company and skilled operation by the telephone company they are brought to the service of the telephone user.

The high quality of your telephone today, its fine, swift service at reasonable cost, are the products of work in the telephone laboratories in the past. The greater value you may expect in the future is taking form there already.

BELL TELEPHONE LABORATORIES

Exploring and Inventing, Devising and Perfecting, for Continued Improvements and Economies in Telephone Service



diversified experience in electronics

● Contracts with U. S. and foreign governments for electronic work are nothing new at Air Associates! For many years, our Electronic Division has been developing and manufacturing LF, VHF and UHF communication and navigation systems, landing systems, firing error indicator systems, echo ranging systems (including sonar) *and* special miniaturized electronic devices. Our wide experience and expanded facilities for airborne, marine and ground electronics equipment are available to help solve your design and production problems. Your inquiry to Teterboro will receive prompt attention.

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TETERBORO, NEW JERSEY

SERVING THE NATION IN AVIATION

TELE-TIPS

SIGNAL PROCUREMENT AGENCY MOVING? We have it direct from a "reliable source" that the Signal Corps Procurement Agency in Philadelphia, now housed at the Quartermaster Depot on South 20th Street, will shortly move to new quarters. New home will be in mid-town Philadelphia in the former Philadelphia Athletic Club building on Rittenhouse Square. The building is now undergoing remodeling. It is further rumored that the Signal Corps Stock Numbering Agency will also move to the new address.

RELAX TAX on TV sets from 25% level originally proposed, to a more reasonable average tax of around 5 to 6% seems to be present thinking on "the Hill" (as Washington newsmen refer to the Capitol and its lawmakers). Already Congress is readily accepting TV as a non-luxury item. The House hearings have been completed but the Senate committee still has a date ahead for the TV industry to present its arguments.

RECEIVING TUBES are being added as an additional line by several manufacturers heretofore specializing on TV-picture tubes. Among the newcomers into the receiving-tube field are Sarkes Tarzian, Inc., and National Video Corp.

CBS DRUM COLOR-TV sets to the number of 500 have been ordered by CBS from one of the well-known TV-set makers in the New York area. Also, it is understood that since the distribution of information on color-tube manufacture to the RCA licensees, CBS has placed orders for several such tubes to demonstrate operation of the tri-color tube in the CBS system without whirling color disks at the receiving end.

KEFAUVER LIGHTING — Contrary to some opinions expressed by the witnesses, the brilliant lighting used during the Kefauver hearings was required only by the newsreels, and was not needed by the television cameras. Television did, however, utilize spotlights installed by the newsreel industry, which required more intense lighting than that needed by TV cameras. "For exam-

(*Continued on page* 16)

Complete Coverage!

2 to 700,000,000 cps

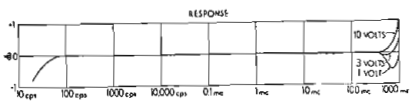
precision voltmeters for every ac voltage measuring need!

From 2 cps to 700 mc, there's an accurate, easy-to-use -*hp*- voltmeter for any voltage measuring job. You can choose from 5 precision instruments (including a battery-operated portable unit) the dependable -*hp*- voltmeter that exactly fills your need. Each gives you familiar -*hp*- operating characteristics of high sensitivity, wide range, broad applicability, time-saving ease of operation. -*hp*- also provides a complete line of voltmeter accessories—voltage dividers, connectors, shunts and multipliers—to extend the useful range of your equipment. For complete details, see your -*hp*- sales representative or write direct.

INSTRUMENT	PRIMARY USES	FREQUENCY RANGE	VOLTAGE RANGE	INPUT IMPEDANCE	PRICE
-*hp*- 400A	General purpose ac measurement	10 cps to 1 mc	.005 to 300v 9 ranges	1 megohm 24 μμfd shunt	$185.00
-*hp*- 400B	Low frequency ac measurements	2 cps to 100 kc	.005 to 300v 9 ranges	10 megohms 24 μμfd shunt	$195.00
-*hp*- 400C	Wide range ac measurements High sensitivity	20 cps to 2 mc	.0001 to 300v 12 ranges	10 megohms 15 μμfd shunt	$200.00
-*hp*- 404A	Portable, battery operated	2 cps to 50 kc	.0005 to 300v 11 ranges	10 megohms 20 μμfd shunt	$185.00
-*hp*- 410B	Audio, rf, VHF measurements; dc voltages; resistances	20 cps to 700 mc	0.1 to 300v 7 ranges	10 megohms 1.3 μμfd shunt	$245.00

New -*hp*- 410B Vacuum Tube Voltmeter

Gives same wide range and flat response performance as -*hp*- 410A voltmeter, but sets new standard of mechanical convenience, ease of operation, minimum bench space. Readily detachable probe leads fit in handy compartment in new, compact, streamlined case. Special diode probe design places capacity of approximately 1.3 μμfd across circuits under test. Shunt impedance is extremely high—10 megohms at low frequencies—thus circuits under test are not disturbed and true voltage readings are assured. New -*hp*- 410B provides 1 db accuracy from 20 cps to 700 mc; and may be used as a voltage indicator up to 3,000 mc. Also serves as audio or dc voltmeter or ohmmeter.



Response, -*hp*- 410B Voltmeter

-*hp*- 400C Vacuum Tube Voltmeter

General purpose precision voltmeter offering wide range, high sensitivity, high stability. Quick-reading linear meter scale shows RMS volts or dbm direct from −72 dbm to +52 dbm. Broad usefulness includes direct noise or hum measurements, transmitter and receiver voltages, audio, carrier or supersonic voltages, or power gain. Also may be used as 54 db amplifier to increase signal level to oscilloscopes, recorders, power amplifiers, etc.

-*hp*- 404A Battery-Operated Voltmeter

Precision vacuum tube instrument for general voltage measurement where ac power is not available. Compact, portable, splash-proof—ruggedly constructed for field operations. Wide voltage range permits all types of measurements including remote broadcast line and carrier checks, strain gauge system tests, telemetering and geophysical circuit measurements, etc. In the laboratory, offers completely hum-free measurements of very low noise level.

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HEWLETT-PACKARD hp INSTRUMENTS

FOR PULSE SERVICE . . .

use proved Eimac Tubes

Power tetrode type 4-1000A is but one of many Eimac tubes that make exceptionally fine pulse modulators, amplifiers, or oscillators. The 4-1000A, for example, will handle 20 kv. and 12 amps. as a pulse modulator.

4-1000A Typical Operation

Pulse Modulator, peak pulse values except as noted—Per Tube

D-C Plate Voltage	20,000 Volts
D-C Screen Voltage	1500 Volts
D-C Grid Voltage	–600 Volts
Pulse Plate Current	12 Amperes
Pulse Screen Current	3 Amperes
Pulse Grid Current	0.5 Amperes
Pulse Positive Grid Voltage	350 Volts
Load Resistance	1500 Ohms
Duty	.01
Pulse Power Input	240 Kilowatts
Average Plate Dissipation	240 Watts
Pulse Power Output	216 Kilowatts
Pulse Output Voltage	18,000 Volts

Since the very advent of pulse techniques, Eimac tubes have been, and still are, consistently chosen over other vacuum tubes not only because of outstanding performance but also because they can be depended upon for exceptionally long trouble-free service.

This leadership is a result of these time-proven Eimac policies:

- Rugged electrodes and electrode supports
- Elimination of troublesome internal insulating materials
- Thorough outgassing of all internal parts
- Oversize electron emitters for reserve emission
- Elimination of volatile getters
- Long, thorough pumping schedules for highest possible vacuum

Put our pulse experience and know-how (over 14 years of it) to work for you. Engineering advice pertinent to your specific problem or a generalized data sheet on how to employ Eimac tubes in pulse service is available . . . write today.

EITEL-McCULLOUGH, Inc.
San Bruno, California

Export Agents: Frazar & Hansen, 301 Clay St., San Francisco, California

Follow the Leaders to Eimac TUBES

281

WRITE FOR BULLETIN NO. 3 "PULSE SERVICE NOTES"

UNITED SPECIALTIES

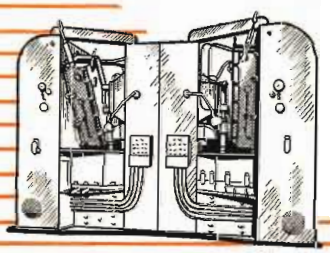
latest in television shells

21-INCH RECTANGULAR

Within the past year United Specialties Company has kept its shell designs right in step with the latest in picture tube requirements. Early in 1950 United produced deep-drawn, 16-inch round shells in quantity. This was followed by shallow 16-inch round shells and 17-inch rectangular shells. Now United is producing 21-inch rectangular shells and stands ready to answer new demands as developments unfold.

Equipped with the very latest in spinning machines, United's television shells meet the most rigid specifications of the industry.

UNITED SPECIALTIES COMPANY
Chicago 28, Illinois



NEW SPINNING MACHINES EXPAND PLANT FACILITIES

With the installation of the most advanced spinning machines available, United has facilities for manufacturing heavy gauge spun products for defense needs. Utilized for television shell production now, these machines can be allocated for military needs whenever necessary.

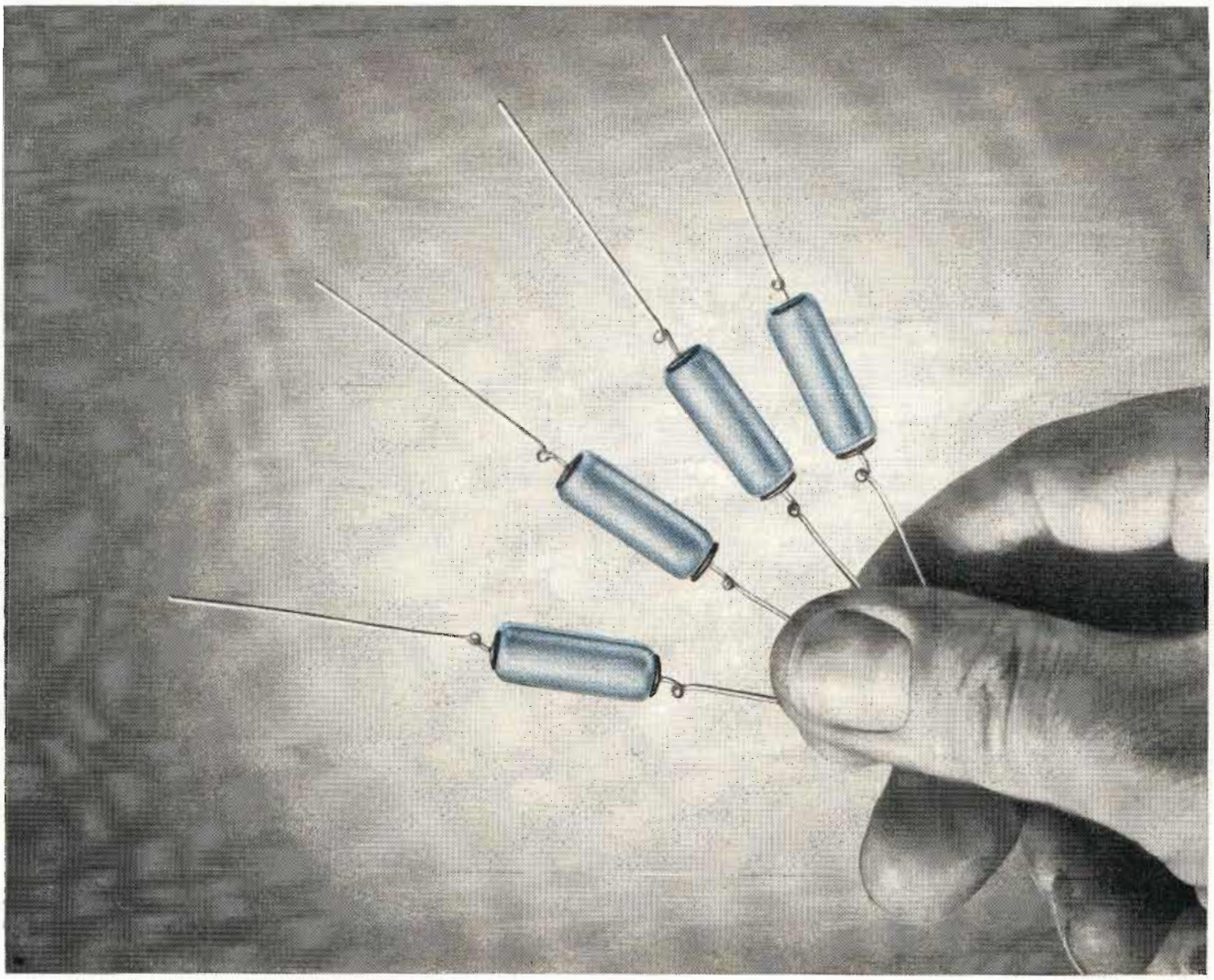
TELE-TIPS (Continued)

ple," explained a WPIX engineer, "when newsreel lighting was turned off at the request of the Committee during the New York hearings, television cameras were still able to televise good quality pictures."

AIR FORCE IS NEGOTIATING with a nationally recognized firm of consulting engineers to be employed for the purpose of making plant surveys to determine manufacturers' qualifications for defense production. Idea seems to be that consulting engineering firm would be best qualified to check on a manufacturer's facilities. Their report would go to Air Force Procurement and would be the basis for determining if a manufacturer should be placed on the "approved" list for prime contracting. Project was still in the "favorable consideration" stage when last heard of, had not been given the go-ahead.

RX FOR SUPREME COURT—The Color-TV argument before the Supreme Court brought many communication engineers into this beautiful building, some for the first time. The impressive court room, with massive stone columns supporting a square ceiling 44 ft. high, had to have its acoustics improved on four sides by gorgeous red velvet drapes 27 ft. 1 in. high. The result at present is so much sound absorption that spectators have to hold their breath to hear most of the eight black-robed men speak. It did not take the engineers long to mentally prescribe: Rx—one high-quality public-address system. The justices, slow to break with precedent, have turned down this modern electronic aid several times in the past. Soon they again will reconsider. If they once requested a temporary installation for a week's trial they would order a permanent installation forthwith.

TV SATURATION, 1951—Because it is now recognized that television stations regularly reach out far beyond the 40-mile radius originally expected, the broadcasters, beginning with 1951, are counting their markets in terms of 60-mile-radius circles. NBC's latest saturation figures on total homes and total TV sets in such areas, are here computed for the following cities: Milwaukee, 60%; San Diego, 48%; Minneapolis-St. Paul, 55%; Los Angeles, 57%; Cincinnati, 56%; New York, 57%; Philadelphia, 61%; Cleveland, 56%; Boston, 65%.



These are Tantalytic Capacitors

Here is one of the fastest moving developments in electronics in recent years—General Electric's amazing new electrolytic-type capacitors. These Tantalytic capacitors have small size, excellent low-temperature characteristics, long operating life and in many cases, can replace bulky hermetically-sealed paper capacitors. Ratings presently available for consideration range from .02 mu f up to 12 mu f at 150 v dc. Units pictured are 1.0 mu f at 150 volts, a size that is already on order in quantities of several hundred thousand.

Other features of G-E Tantalytic Capacitors include:

- No known limit to shelf life.
- An operating temperature range from −55°C to +85°C.
- Exceedingly low leakage currents.
- Ability to withstand severe physical shock.
- Completely sealed against contamination.

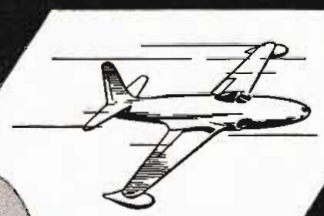
If you have large-volume applications where a price of 3 to 5 times that of hermetically-sealed paper capacitors is secondary to a combination of small size and superior performance—get in touch with us. Your letter, addressed to Capacitor Sales Division, Bldg. 42, Room 304, General Electric Company, Pittsfield, Mass. will receive prompt attention.

Apparatus Department, General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

407-300

Putting the *HUSH* on radio background noises...



AEROVOX "INTER-FERENCE" FILTERS

● That "radio quiet," so vital to satisfactory communications, radar and allied radio-electronic functions on land and sea and in the air, is now simplified with AEROVOX INTERFERENCE FILTERS. These latest filter units provide maximum attenuation from 150 KC well up into the UHF range. And they are extra-rugged, extra-compact, extra-efficient, by any comparison with previous filters.

Primary applications are in r.f. noise suppression work in military or commercial aircraft and for vehicular low-voltage d.c. applications. Also, for special applications such as battery or low-voltage d.c. filters, for shield room applications, and for critical equipment.

Available in seven standard types meeting a wide variety of applications. For extraordinary requirements, special filters can be developed and built to your order.

● **Write on your letterhead for latest literature. Consult AEROVOX on your noise-suppression problems, as well as capacitor requirements in general.**

Remarkably small sizes and minimized weights.

Cases and terminals based on time-and-service-proven AEROVOX hermetically-sealed containers and terminals.

Cases of non-magnetic material suitably protected to withstand military service requirements for humidity, immersion, vibration, etc.

Advanced pi type construction for highest efficiency.

Capacitor sections utilize AEROLITE* metallized-paper dielectric, assuring maximum reliability and life including "fault isolation" characteristics for protection against extreme surge voltages above rated voltages.

Filter chokes of newest design, embodying high impedance to r.f. currents and low d.c. resistance, assuring low voltage drop and minimum heating.

*trade-mark

AEROVOX INTERFERENCE FILTERS			
Aerovox Type	Amps.	VDC	Size (l. x w. x h.)
IN 148	2.0	150	1¾" x 1" x ⅞"
IN 150	3.0	150	1 13/16" x 1" x 1"
IN 151	5.0	150	1 13/16" x 1¼" x 1"
IN 152	10.0	150	2 1/16" x 1¼" x 1"
IN 153	25.0	150	2" x 2" x 1¾"
IN 156	40.0	150	5 1/16" x 1 13/32" x 1 1/16"
IN 154	100.0	150	3 1/16" x 2⅛" x 2⅞"

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A Rauland "Exclusive"

Helps you Cut Production Costs

Rauland's new Indicator Ion Trap can help you in your battle to cut pennies off production costs and thereby to price receivers competitively.

First of all, the Indicator Ion Trap completely eliminates the need for any equipment and any trained judgment in the adjustment of ion trap magnets. Adjustment can be made faster than equipment could be attached. The ion trap magnet is simply moved until the green glow signal is reduced to minimum. It can be done in seconds with absolute accuracy—without even seeing the front of the picture tube.

Second, the Rauland Tilted Offset Gun which incorporates this Indicator Ion Trap requires only one Ion Trap Magnet instead of two, nibbling a little more off production costs. Yet it gives better results—the electron beam is bent only once and is focused to maximum sharpness.

Specify Rauland tubes with these exclusive advantages, and get the benefits that only Rauland offers.

For further information, write to . . .

RAULAND

The first to introduce commercially these popular features:

Tilted Offset Gun

Indicator Ion Trap

Luxide (Black) Screen

Reflection-Proof Screen

Aluminized Tube

•

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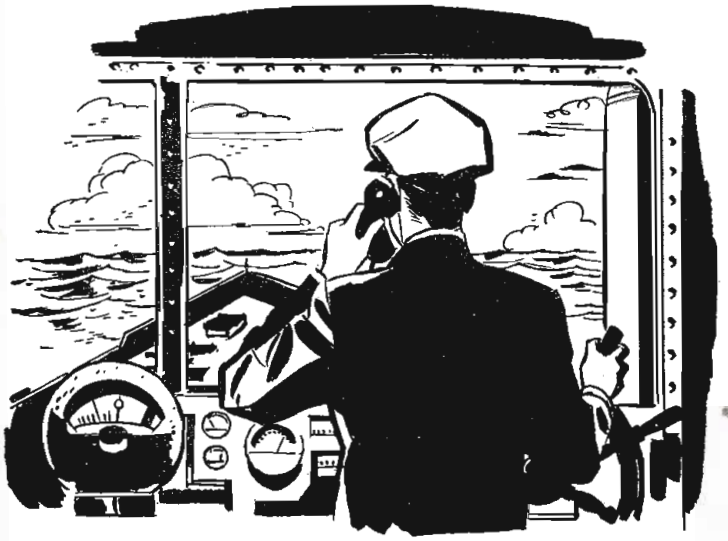

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NORWEGIAN AMERICA LINE

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SCANDINAVIAN AMERICAN LINE

SWEDISH AMERICAN LINE

ON THE SHIPS THAT SAIL THE SEVEN SEAS

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You'll find equipment of many leading manufacturers on the ships of these famous world-wide lines.

In radio and communications, especially, where reliability is indispensable, Sylvania tubes are constantly on watch.

For, Sylvania is a pioneer in the development of dependable radio tubes. Improved manufacturing techniques and quality control methods, over a period of 25 years, have resulted in Sylvania's recognized leadership in the radio and TV tube field. Receiving or transmitting, Sylvania tubes offer outstanding performance and long life.

Moreover, the Sylvania tube line is a complete line, including practically every known type . . . from tiny sub-miniatures to large TV picture tubes. For detailed information, ratings, prices, or deliveries write today to: Sylvania Electric Products Inc., Dept. R-1405, Emporium, Pa. *Sylvania representatives are also located in all foreign countries. Names on request.*

SYLVANIA ELECTRIC

RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

Now Studio Flexibility Anywhere

with GPL's NEW PACKAGED, PORTABLE VIDEO SWITCHER

New GPL Video Switcher set up with two camera control units, a film chain control unit, and master monitor. This studio quality, field size switcher accommodates 5 cameras, 2 incoming lines.

NOW you can view, preview, switch, fade and dissolve with studio flexibility in the field. The new GPL Video Switcher simplifies field operations, reduces setup and operating time and trouble, and matches the full resources of the studio for programming variety.

Portable, and entirely self-contained, the GPL Switcher sets up in seconds and may be used with your present studio or field equipment. The monitor can view any of 5 camera inputs, plus 2 remotes, and an additional "Transmission" button switches the master monitor to view the outgoing line. Lucite self-illuminating buttons light up when depressed. Twin fading levers afford complete flexibility in fades and dissolves. An "effects" bus permits effects to be previewed on the master monitor before switching to the air.

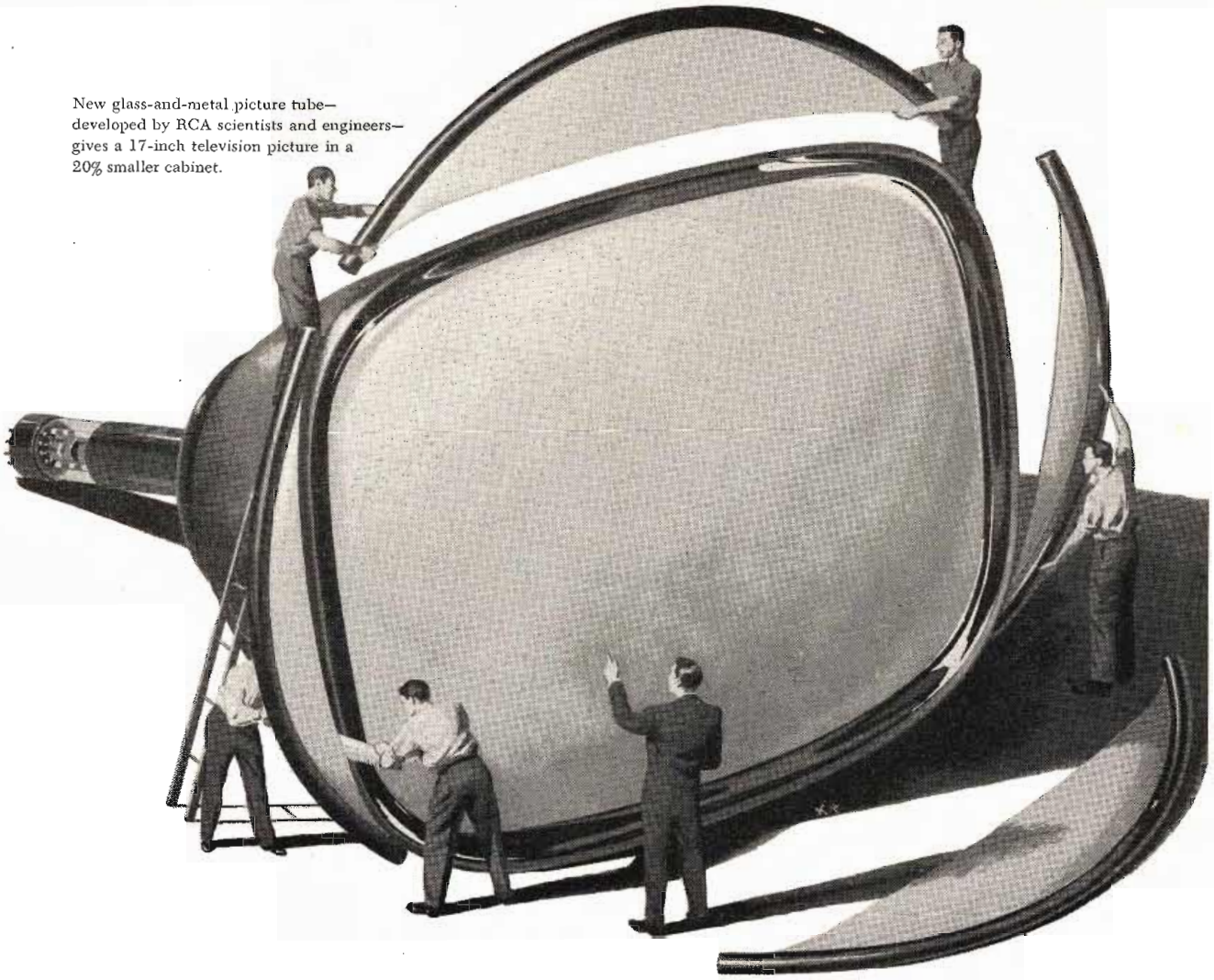
This newest GPL development matches the other compact elements of the GPL Image Orthicon Chain, bringing to a full complement the industry's leading line in quality and design. Investigate its advantages for your operation at the earliest opportunity.

GPL Video Switcher closed for transportation.

Write, Wire or Phone for Details

General Precision Laboratory
INCORPORATED
PLEASANTVILLE **NEW YORK**

TV Camera Chains • TV Film Chains • TV Field and Studio Equipment • Theatre TV Equipment



New glass-and-metal picture tube—developed by RCA scientists and engineers—gives a 17-inch television picture in a 20% smaller cabinet.

Now—television "squares away" with a Bigger Picture—smaller tube!

Ideal for mass production, compact, and lower in cost, RCA's glass-and-metal picture tube was a major advance in television history.

Now comes still another important RCA engineering advance, *rectangular* glass-and-metal kinescopes. Engineered for the big 17-inch pictures you want in a receiver that takes up *less* cabinet space—as much as 20% less—the new kinescope gives you finer pictures than ever before . . . in sharp and brilliant focus over every inch of your screen.

And, as yet another step ahead, RCA's new picture tube offers an improved type of Filterglass faceplate—frosted Filterglass—developed on principles first investigated by scientists of RCA Laboratories, to cut reflection, and give you sharper picture contrast.

* * *

See the latest advances in radio, television, and electronics at RCA Exhibition Hall, 36 West 49th Street, N. Y. Admission is free. Radio Corporation of America, RCA Building, Radio City, New York 20.

See the new RCA Victor home television receivers—with the 17-inch rectangular picture screen—at your RCA Victor dealer's today.

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Raw materials testing is Stage One in Tinnerman's program to guarantee you highest quality SPEED NUT brand fasteners for all types of attachments. Follow your fasteners through all stages of Tinnerman quality control . . . write for your copy of "Story of Quality", new 20-page booklet.

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Superior construction features give LOW COST Vee-D-X sectional towers the highest safety factor of any tower in its price class.

If you have an elevated installation problem, absolute permanency of your installation is assured when you use a VEE-D-X sectional tower. Strength is a major factor. Don't take chances with structural failure. Be sure with VEE-D-X!

- *Rugged, all-welded construction diagonally laced with angle iron for maximum rigidity.*
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- *Patented plate spaced at two foot intervals prevents twisting and affords rigidity found in no other tower.*
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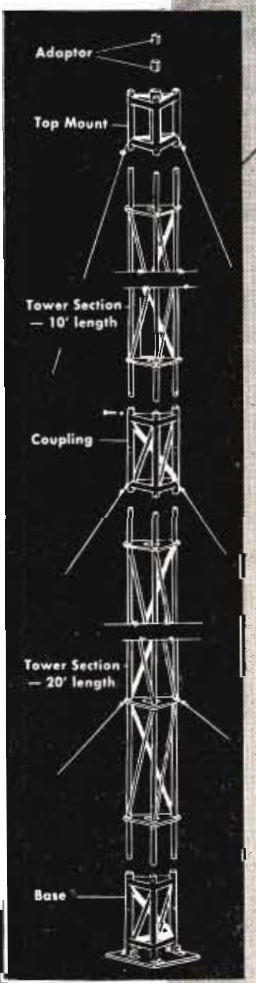
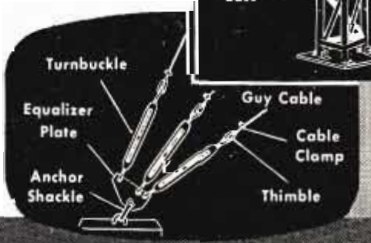
- *Completely galvanized, light weight tubular steel . . . 20 ft. section 72 lbs.*



PRE-ASSEMBLED
for fast, inexpensive installation

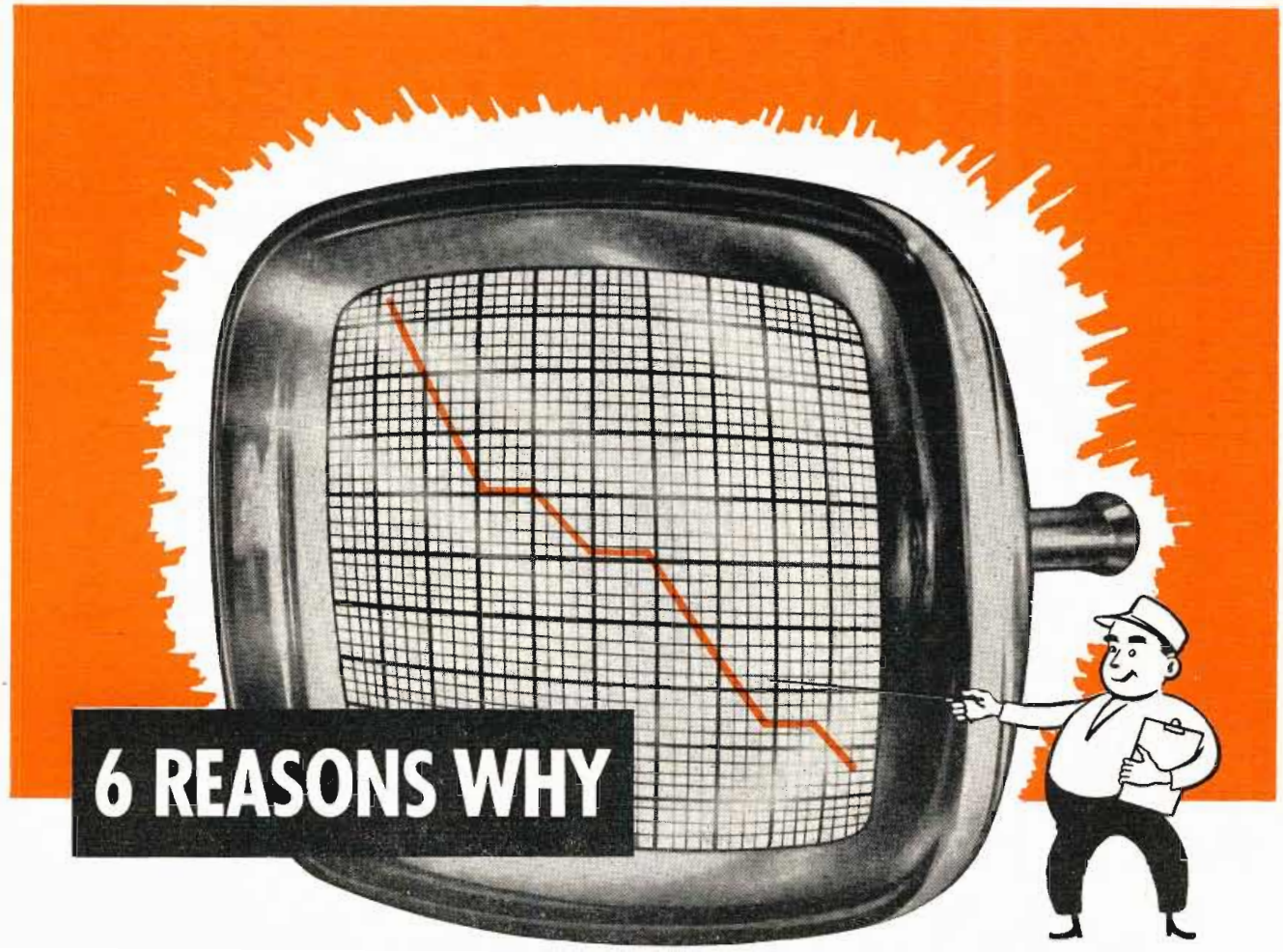
VEE-D-X towers are designed for use at any height from 10 to 140 feet. They are self-supporting up to 20 feet and, where space is limited, *semi-guyed** type installations may be used at 30, 40, and 50 foot heights. Sketch at right shows the basic parts and necessary accessories for a complete installation. Three types of top mount are available. VEE-D-X towers may be ordered in separate units or as a complete package for a specific height. (Either guyed or semi-guyed.) Write the LaPointe-Plascomold Corporation of Windsor Locks, Conn. for complete information.

*Semi-guyed towers employ one set of guy cables attached at a height of 10 ft. up the tower and anchored at a 6 ft . radius from the base.



VEE-D-X

BUILDERS OF THE WORLD'S MOST POWERFUL ANTENNAS



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3. Strong, uniform bulbs permit very low processing losses.
4. Steadily reduced bulb weights, resulting from lead-free glass and improved manufacturing techniques, save on handling and transportation costs.
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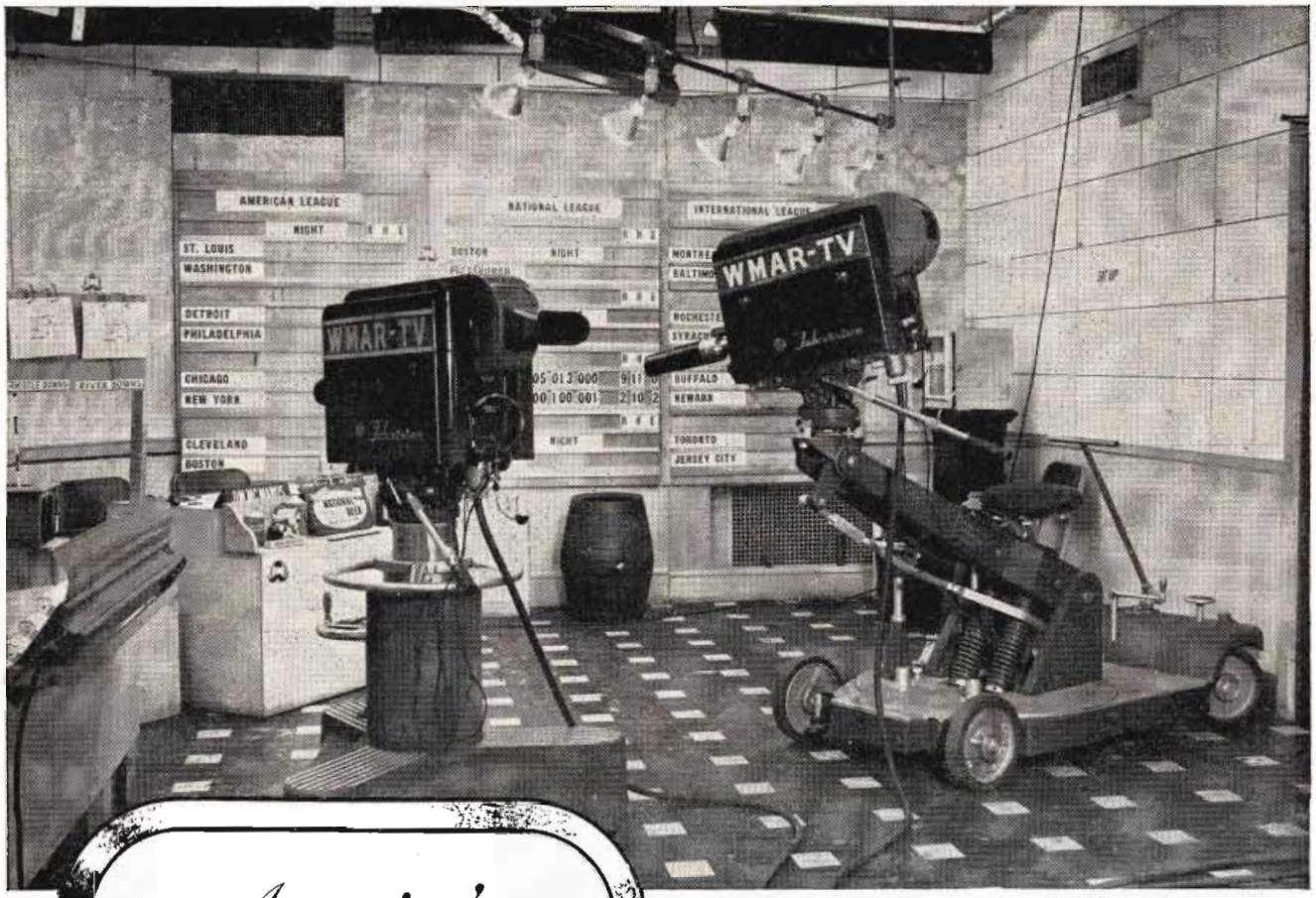

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For complete camera mobility, smooth pan effects, angle shots, running shots, tilts, dolly shots...most television stations rely on Houston-Fearless equipment . . . standard of the motion picture industry for 20 years. Houston-Fearless dollies, cranes, camera pedestals, tripods and heads combine brilliant engineering, superb quality, precision craftsmanship and proved dependability that assure perfect, reliable performance at all times.

More and more television stations and film producers are discovering the many advantages and economies in operating their own film processing labs. Whatever your needs, Houston-Fearless film processing equipment will do the job faster, better, automatically and with complete dependability.

Write for information on specially-built equipment for your specific needs.

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Tele-Tech's Military Procurement Studies

With this issue TELE-TECH publishes the third of its series of articles on military procurement: "How to Sell to the Air Force." Others in the series, on selling to the Navy and Signal Corps, were published in TELE-TECH in March and April, respectively.

As in the previous articles, the Air Force story is accompanied by an exclusive TELE-TECH chart defining procurement organization and naming important procurement personnel. It tells how the Air Force picks its contractors with whom it spends two-thirds of the total dollar volume available to all the military for TV-radio-electronic equipment.

The Air Force procurement story reflects the rapidly changing procurement picture. There has been a modification in estimates on electronic equipment spending; a switch from advertised bidding to negotiation, with new situations created. Some of this is explained below. See the article, "How to Sell to the Air Force" on page 33, for specific procurement data.

The Vanishing Advertised Bid

Ninety per cent of all procurement is now on a negotiation basis; the advertised bid is disappearing. While this situation has been welcomed by many manufacturers, it has resulted in hundreds of TV-radio-electronic equipment makers practically being shut off from prime contracts. Assumption is that they will get subcontracts—which points-up the importance of editorial warnings, which have appeared in TELE-TECH's series of articles on military procurement, that subcontracting is a best bet for most manufacturers.

More than ever, it is necessary for manufacturers to SELL THEMSELVES to the procurement agencies. You can't sit back and wait for an invitation-to-bid to arrive by mail. You have to go after the contract by convincing procurement officers that your firm is best qualified to perform a contract. Even so, the pickings are thin. Many contracts for complicated end products are awarded to one manufacturer who has the responsibility for sub-contracting and guaranteeing performance on subcontracted work.

This means that subcontracting is still the opportunity for hundreds of TV-radio-electronic manufacturers who are being shut out by the vanishing advertised-bid and who are unlikely to be favored with prime contracts for the specialized military equipment required for defense.

How Much Defense Business?

TELE-TECH has previously published its estimate of dollar volume on TV-RADIO-ELECTRONICS for defense at approximately $2.1 billions for the calendar year 1951. Estimates from other sources have never made it clear whether the figure was for a calendar or fiscal year, with much confusion as the result.

After careful analysis of all procurement figures issued by both government and industry sources, and in view of the leveling-off in military spending now likely by 1953, we publish the following as being realistic, sober estimates of actual military spending for electronic equipment for defense for the present and near future:

ALL SERVICES

Calendar Year 1950: $1.1 Billion
Calendar Year 1951: $2.1 Billion
Calendar Year 1952: $2.5 Billion
Calendar Year 1953: $1.5 Billion

It is estimated that thereafter, expenditures for electronics for defense will not exceed $1.5 billion annually unless a state of all-out-war exists. On a fiscal year basis, expenditures may reach $3 billions for 1951-52, but this is merely a juggling of the calendar-year figures.

TYPES OF MILITARY CONTRACTS DEFINED

There are four types of contracts. The first type is the advertised or competitive bidding contract which, under the 1948 Renegotiation Act, is not audited by the Government.

The second type is negotiated; that is, the Government service and the supplier come to an agreement as to the unit price and stipulate this in the contract. These contracts are later audited.

The third type of contract, again is at a fixed negotiated price, but has a redetermination clause which requires setting an exact price at a *stated point* during the contract. These are audited.

The fourth type is a cost reimbursement contract which may or may not carry a fixed fee. This is the CPFF type, a cost-plus-fixed-fee contract. These are invariably audited.

The RADARSCOPE Revealing at a Glance

REARMAMENT

$2½ BILLION PEAK—"Our latest information indicates that military-electronic production will reach a peak rate of $2.5 billion in the fall of 1952 and thereafter will decline to an annual rate of about $1.5 billion," reports RTMA Chairman Robert C. Sprague. "In this connection, it should be borne in mind that military production dollars have about half the impact on our industry as civilian production dollars. This is for a variety of reasons, but particularly because a considerable portion of special and elaborate mechanical gear is obtained from manufacturers not generally considered a part of our industry.

"These figures on military electronics production indicate that our industry will not be so heavily loaded with military contracts but that it will be able to maintain a substantial amount of civilian production, even at the peak of the military output—except in the unfortunate event of an all-out war. Apparently only the shortages of certain critical materials will prevent manufacturers from turning out as many radio and television sets as their plant facilities and military orders will permit. It is, therefore, highly important that government officials make provision in their planning for the healthy continuation of our civilian economy, for we do not know when all of the present manpower and production facilities in our industry may be needed for the nation's defense."

MILITARY AVIATION

AIR FORCE REQUIREMENTS now represent quite a slice out of the entire military appropriation for radio-electronic equipment. While there has been considerable guesstimating as to the exact portion of the military appropriation that is being spent on electronic items for defense, we have it on direct authority from Lt. Colonel Philip A. Gugliotta, Chief Electronic Production Branch, Headquarters U. S. Air Force, that "in some airplanes the cost of communication-electronic devices and instruments almost equals the cost of the other components, engines and structure combined. Small aircraft, such as jet fighters, are only equipped with the minimum bare essential electronic equipment, but only due to space limitations."

MANUFACTURING

CIVILIAN vs. MILITARY COSTS—Lt. Colonel Gugliotta, who is quoted above, further reports that "within one year, the rate of production of electronic equipment for defense will have multiplied 4½ times," [compared with July, 1950]. In making a cost comparison between civilian and military TV-radio costs, Colonel Gugliotta points out that the average civilian set includes in its cost approximately 3% for engineering and 25% for parts and components, whereas the average cost for military communication equipment requires 9% for engineering and 51% for parts and components.

COLOR FILM

IF, AND WHEN COLOR TV comes into its own, it will find no dearth of film color processes for producing suitable color films for transmission. Today there are as many as six color film processes, most of which are already in use. These are: Technicolor, already well known; Supercinecolor, a modification of Cinecolor; Trucolor, which uses Du Pont film; Ansco Color; Lenticular film, which is being investigated by 20th Century-Fox; and Eastman Kodak-Tru Art Color. The latter is the newest in that it employs for the first time, to any degree, a *color negative* which is used for printing the release positives in complementary colors.

MANPOWER

ENGINEER MORTALITY is becoming a major concern, particularly in the executive echelons. "Actuarial tables show graphically what the obituary columns tell us daily," says Don Vescelius of Bill Brown's famous health farm at Garrison, N. Y. "Engineers and business executives die at the peak of their careers. Their years of training and preparation are long but their years in key posts are short. This waste of highly trained, capable men is unnecessary. Farsighted executives have attacked this problem as individuals, either through regular check-ups or by physical conditioning programs at home or at health establishments. In this way, companies can guard the health of their men as carefully and wisely as they do their valuable equipment. The most ingenious accounting system cannot determine the cost of replacing a business executive. Top management has so much invested in each man that deliberate waste of personnel is something no company can afford."

MINIATURIZATION

OUTSTANDING RESULTS achieved in the tube and component subminiaturization programs were viewed by more than 20,000 visitors to the military exhibits at the recent IRE Convention. The Navy, for example, displayed a new 12 tube low-frequency superheterodyne receiver about 55 cu. in. in volume, or less than 1/5 the size of the earlier unit, as well as a number of samples of printed and potted subminiature circuits. Notable among Signal Corps exhibits was the new AN/PRC-10 Walkie-Talkie (See April TELE-TECH, p. 88) which is about one half the size and weight of its WW-II predecessor. Since many of the technological developments for military purposes are ultimately absorbed by industry into the production

of civilian goods, it is certain that Radio-TV manufacturing as we know it today will be due for many changes in the future. More than likely the trend will be for present day component assembly operations to fall more into the domain of the vacuum tube manufacturers, where in turn, the mounting of subminiature tubes and components together in hermetically sealed or in evacuated containers will make complete plug-in stages in equipments a practicality.

DAYTIME TV

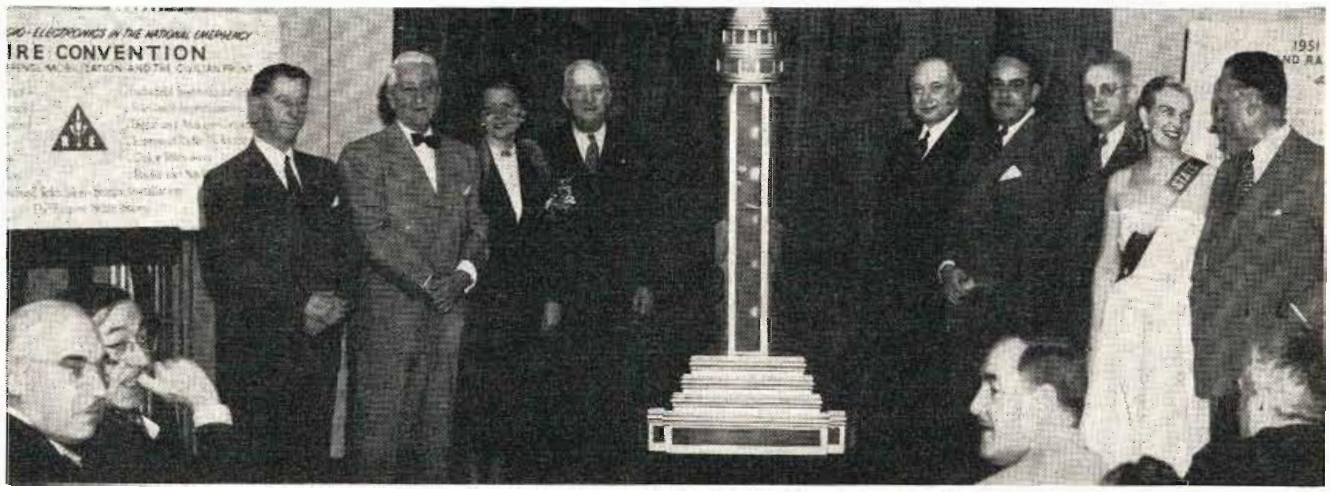
KEFAUVER CRIME Investigating Committee proved to be the most spectacular video attraction that ever hit morning viewing in New York. According to WPIX, which originated the hearings and handled the technical and production details, the TV audience on the morning of Monday, March 19, was just eighteen-and-a-half times the size of the average morning television audience. Normally, about 34,000 sets and 130,000 people are tuned to television broadcasts during the 9:30 A.M.-12 noon period on an average, non-Kefauver day in New York, according to Hooper. On March 19, however, about 600,000 TV sets and 2,400,000 Gothamites—plus uncounted thousands in bars and public places—were tuned in for ex-Mayor O'Dwyer's TV appearance before the Senate Committee members.

AUDIO

THE LOUD SPEAKER, though one of the most common and important of audio components, still presents a most severe problem to the industry in the matter of standardized ratings and/or specifications. A review of the literature from the different manufacturers reveals such ratings as "handles 25 watts" and "frequency response from 30 to 1300 cps." Such ratings are, of course, misleading since the power handling capacity merely describes an input power which the speaker can safely withstand without coming apart physically, and has no relation to frequency response or to distortion. Likewise, in the case of frequency response, at low frequencies the physical size of the unit is so small compared to that required acoustically that the unit becomes a highly-distortive radiator with very low efficiency. In a 12-in. speaker, for example, for one acoustic watt output, one manufacturer measures 67% total harmonic distortion at 50 cps and nearly 700% at 20 cps in his higher fidelity designs. The matter of radiation patterns is also controversial. RTMA has had these problems under committee consideration for some time and is now reported to be having measurements and tests made by independent research groups. The results of this program are eagerly awaited by manufacturers and users alike.

DISTRIBUTION

ONE BIG SHOW IN '52!—Radio parts manufacturers and distributors are pretty well agreed that *one* national radio-parts show a year is enough—in place of the two present gatherings, one in May and one in September. The extra cost to the industry, for the present duplication, exceeds a million dollars a year—with manufacturers' extra outlays estimated at $500,000, distributors expenses at $400,000, and "reps" $100,000. While each show has its own devoted defenders with proper pride of accomplishment, the present National Emergency points the need for combining forces in the public interest. That is why,—after present obligations for the 1951 May and September exhibitions are completed as planned, thoughtful leaders are urging the trade to concentrate on "One Big Show for '52!"



Gathered at IRE convention before replica of Empire State TV antenna are: (standing, l. to r.) George Sterling, FCC; Comdr. Mortimer W. Loewi, DuMont TV Network; Frieda Hennock, FCC; Lt. Gen. Hugh Drum, president Empire State Building, Inc.; Brig. Gen. David Sarnoff, chairman of board, RCA; Philip B. Stephens, business manager, Daily News (WPIX); E. M. Webster, FCC; "Miss Empire State," Kay Burke; and Edward J. Noble, chairman American Broadcasting Co. And in lower left corner are seen the heads of Raymond Guy, retiring president IRE, and Ralph R. Batcher, ex-TELE-TECH, now RTMA

Modernizing

Twenty-five years after was put into operation, new

Fig. 1: Typical CAA communications and control tower shows multiplicity of transmitting and receiving VHF antennas

By ***RICHARD BATTLE,*** *Deputy Chief, Facilities Division*
1st Region Office, C.A.A., New York City

A QUARTER of a century ago, the first low frequency four-course range was commissioned on the continental airways by the Federal Government. Thus began an era of construction of radio navigation and beacon light facilities which provided good substitutes for the railroad track and the bonfire. For the first time, it was possible to fly "over the top" on the nation's range-equipped air routes with a greater degree of precision than was assured by any other known means. In less than 20 years, the Federal Government had established an extensive network of airways and communications systems. By the end of 1946, approximately 70,000 miles of implemented civil airways were in use throughout the United States, served by more than 375 low frequency ranges and related facilities.

In the early days of range navigation, four radial courses of approximately 3° width appeared more than adequate to serve the few established air routes of the country. However, within a relatively short period from the date of commissioning of the first radio range, experimental work had begun on a twelve-course visual range in early recognition of the necessity for visual course presentation and for maximum possible use of the air space. The multiple course range was short-lived due to a number of undesirable characteristics and, therefore, never placed in service as a commissioned facility.

The LF-four-course range in its original and modified form has served well the flying public these many years. It has successfully survived several stages of modernization, beginning with the aural loop range with its independent weather broadcast station to the present five-tower array having simultaneous transmission of voice and range signals. Its many infirmities and few virtues have long since been known to the airman and the traffic controller. Oft-heard criticism of this system now incompatible with present-day air traffic is, therefore, a natural one. It is concluded, therefore, that this facility has approached obsolescence and, except for long range over-water navigation and the possible continued use of the center tower of the simultaneous range for ADF approaches, is scheduled for retirement from service within three or four years.

The need for conversion to very high frequency (VHF) with its relative freedom from atmospherics was recognized in the early 1930's during which time Government and private industry research groups worked in concert on a program of development of VHF navigational and communications aids. Although much progress was made during this period, installation along the airways of many newly approved electronic devices was seriously retarded by World War II. During the war years, many low frequency and VHF marker facilities were removed from the continental airways and reinstalled at overseas locations by C.A.A. engineers and technicians to satisfy an immediate need of the military services for long range navigation facilities.

A number of ingenious systems were developed for the military services during the war years, many having considerable promise of ultimate use on the civil airways. However, as a number of installation programs had begun, it was a natural course that there should be no delay in the installation of already proven equipments because untested devices in the laboratory appeared a little better. Before large sums are appropriated for any new device, its use must survive the four stages of technical progress: i.e., research, development, flight test and production. A normal progression of equipment replacements is therefore inevitable —for example, high frequency ranges now operating in the 112-118 MC band and being installed in large numbers may be replaced ultimately by a system in the 960 to 1650 MC spectrum. Prototype equipments in the UHF and SHF bands have already been produced, some of which are under test.

The war's end brought about renewed activity toward the solution of the immediate air traffic problem and the replacement, as rapidly as possible, of obsolete equipment. The primary aid at this time continued to be the low frequency range augmented by a number of VHF four-

the Federal Airways

the first low frequency four-course radio range for airways use equipment operating on decimetric waves commences to replace it

course visual-aural ranges established on several airways and instrument landing systems at a few major terminals. A statistical survey was made of civil and military traffic requirements by the Air Coordinating Committee which requested the Radio Technical Commission for Aeronautics (a cooperative association of Government and industry aeronautical communication agencies) to undertake a study of air traffic control. The assignment of this task was made to a Special Committee of the R.T.C.A. (SC-31) composed of scores of aviation experts from as many fields of industry and Government service. This Committee had for its objective the development of recommendations and plans for an interim and long range system for an air traffic control "common system" mutually beneficial to all users of the air space, would meet the requirements for national defense and would eliminate the chaos usually resulting from competing systems. Resolution of many of its complex problems to the satisfaction of all participants involved compromise and support of the plan by the many aviation interests involved.

It has been estimated that a minimum of fifteen years would be required to implement fully this plan on a national scale. Any attempt at cost analysis would be speculative although reasonable estimates have placed the cost at one billion dollars or more. The limited space of this article precludes discussion of the items proposed under the ultimate system and serves only to high-light objectives of the interim plan.

SC-31 Report

Performance requirements desired for equipments of the future have been disclosed in SC-31 report, technical papers and in official Government releases and are in most part available to the public. Methods of accomplishment of a large part of this program are still in early stages of research and development. Briefly, the ultimate system would provide a comprehensive network of interrelated aids for surveillance and control of aircraft within the continental limits and would move air traffic under "all weather" conditions with a far greater degree of efficiency, speed and safety than heretofore possible. Maintenance of airline schedules through the application of the "block system" to aircraft is expected to approach the regularity of our railroads. During the progress of a flight, instruments in the aircraft will warn the pilot of his exact position at all times and advise him whether he is ahead or behind his schedule. Radarscope presentation in the cockpit and at ground surveillance points will keep the pilot continuously informed of obstructions, storms and his relation to other aircraft in the immediate vicinity. These and many new electronic miracles based on radar principles are on the drawing boards, under contract development or undergoing evaluation tests. It is of particular interest to note that the ultimate navigational system built almost entirely around VHF and microwave electronic equipments, employs many of the devices being placed into service today. Radar has been thoroughly time-tested and proven of such substantial value in controlling aircraft movements into congested terminal areas that it is practically assured to become the primary traffic control facility of the immediate future.

The scope of the overall rehabilitation of the airways is of such extent that the program has been divided by necessity into two distinct phases, (1) the transitional, and, (2) the ultimate plan. Cooperative effort between Government and industry is rapidly carrying the transitional phase toward completion.

Using the SC-31 report as an initial guide, avionic development contracts are now being let under the authority and sponsorship of the Air Navigation Development Board[1] for intensive study of traffic control problems and electronic equipment needs. Under the direction of this Board, responsibility for execution of the program is being shared by the respective Government agencies for the many phases of development and evaluation.

What does the present day modernization program consist of, what is its cost and what advantages can

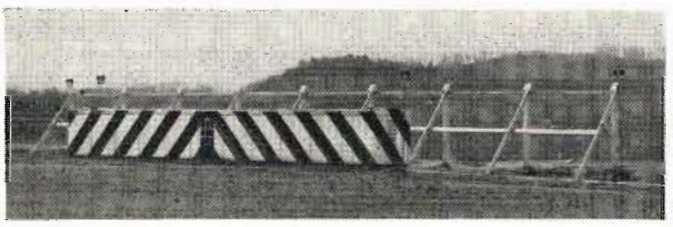


Fig. 2: CAA localizer installed at end of runway with reflector

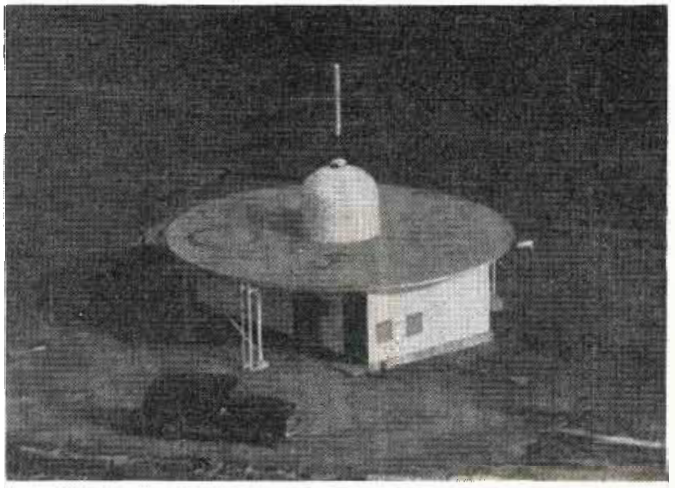


Fig. 3: Modernized VOR transmitting station showing DME and VOR antennas

FEDERAL AIRWAYS (Continued)

be expected from it over a time-tested system of low frequency aids? These questions are frequently asked and rightfully so for thorough public understanding and acceptance of both present and future plans can accelerate completion of the program. The rehabilitation program of the immediate future (the transitional program) includes the following basic items:

1. VHF air/ground/air phone communications.
2. Instrument landing system (ILS).
3. Omnidirectional range (VOR).
4. Radar, Airport Surveillance (ASR); Precision Approach (PAR) and long range.
5. VHF automatic direction finder (VHF-ADF).
6. Distance measuring equipment.

Most of these developments have already made their appearance on the airways and are not new to the airman. The air navigation system of the immediate future was demonstrated by a cooperative military and C.A.A. group at the C.A.A. Technical Development and Evaluation Center at Indianapolis during the late Fall of 1948. A highly successful public showing at this Center of an integrated system of navigational aids based on the VOR, DME, course line computer, ILS and radar portrayed the utility of the installations now being made on the airways. It further aroused an interest and confidence in the ultimate success of the entire program.

For a number of years, the primary C.A.A. instrument approach facility has been the familiar instrument landing system composed of a localizer, glide slope and distance markers and augmented by low frequency locators at one or both of the marker sites. In 1946, the C.A.A. acquired from the Air Forces three mobile ground-controlled approach radar units (GCA) and evaluated these units from a civilian rather than military aspect. At first used to monitor ILS approaches, PAR and ASR have become primary aids and are being commissioned at many high traffic density airports. Reliable operation of tower-controlled radar equipments over a period of four years as a complementary facility to ILS has guaranteed its continued use for this service.

Radar, having a surveillance radius of approximately 120 miles, has been operated by the Air Forces at the Washington National Airport for several years and for a brief period at La Guardia Field during which time it had been under continuous observation by C.A.A. traffic controllers. This equipment is now in the process of transfer to C.A.A. for thorough evaluation tests under civil requirements. En route traffic control will be handled with greatly increased efficiency with the assistance of long range radar. Targets will be identified on the surveillance scopes with the aid of VHF-ADF which are soon to be commissioned at all radar facilities.

At this writing, over 300 omniranges are commissioned or scheduled for commissioning before the end of the fiscal year 1951. It is planned that omnirange signals will eventually blanket the country, with stations so located that radiation patterns from adjacent stations will be overlapping at minimum flight altitudes. DME has been installed at several VOR sites with all VOR and ILS facilities to be implemented by DME equipments now coming off the production lines.

Completion of this program on a scale acceptable to the flying public is not without its handicaps. Admitting the many advantages to be gained by the transition to VHF and the microwave spectrum there are certain basic limitations to these frequencies which require an entirely new approach to range antenna siting.[2] Optical line-of-sight propagation demands certain VOR siting techniques wherein numerous conditions must be satisfied:

1. Elevation—Horizon profile should be .25° or less throughout 360° of azimuth in order to produce at least 50 miles coverage at minimum flight altitudes.
2. Immediate site typography—Site should be reasonably flat to a radius of approximately 500 ft. or more free of trees, overhead lines, buildings, etc.
3. Availability and accessibility—Prohibitive costs will be involved if sites are not reasonably accessible.
4. Traffic Control—Stations must be located with respect to airport to satisfy local traffic requirements.

In many sections of the country serious siting problems are obviously imposed in conforming to these criteria. Poor siting and terrain conditions have a disturbing effect upon the quality of transmission of directional VHF signals. To provide for the exacting requirements for optimum VOR performance, considerable time and effort are being expended toward obtaining sites which will permit high quality course characteristics throughout 360° of azimuth, at the same time meeting, by location, the requirements of air traffic control.

Wherever practicable, course characteristics of a VOR range site are determined in advance by the use of mobile transmitters. A series of orbital and radial flight checks are conducted on the facility prior to the construction of the permanent station and recordings analyzed for site and terrain errors. Performance of the course line computer, an airborne instrument permitting flight on parallel tracks using one or more omnirange stations is directly related to the information fed to it by omnirange and DME; hence, the ne-

(*Continued on page* 74)

Fig. 4: Full operational model designed by the author (left) to demonstrate all the facilities mentioned in this article. ASR and PAR screens, rear, operate in phase with scanning radar antennae, and neon bulbs with RC network simulate radar blips. Every phase of approach control is authentically and visually illustrated by use of standard cockpit instruments. Unit is ideal for aviation radio aids instruction

DEFENSE CONTRACTS — How to Sell to the Air Force

By LT. COL. STANLEY GERSTIN, Manager, Government Manuals Division, Caldwell-Clements, Inc., New York City

Here is the low-down on Air Force procurement, organization and current practices and how these affect the TV-radio-electronic industry today.

Shut-down on advertised bidding and switch to negotiation basis means curtains for many manufacturers as potential prime contractors; points-up their role as subcontractors.

Complicated electronic devices required for war planes, all of a classified nature, influenced airplane manufacturers to enter radio-electronic manufacturing field; procurement agencies claim TV-radio makers lacking in specialized equipment experience.

Air Force will account for two-thirds of total dollar volume to be spent for TV-radio-electronic equipment for defense, estimated at $2.1 billion for all services, for calendar year 1951.

AIR FORCE PROCUREMENT of communication-radar-electronic equipment for 1951 has been estimated by TELE-TECH at $1.3 billion. It is further estimated that for the calendar year 1952, the Air Force will probably spend $1.6 billion in this industry.

Current opinion is that military spending will reach its peak in 1952 and level-off thereafter so that for 1953 onward, the Air Force will be spending a little under $1 billion for communication-radar-electronic equipment.

What does this mean in terms of procurement?

What effect will this procurement have on an industry whose capacity is more than double what it was in 1944 and whose ability to produce goods for civilian consumption has been restricted by government stock piling and by shortages of essential material?

The entire procurement picture has changed considerably from what it was like in February of this year. Advertised bidding is rapidly disappearing; awarding of contracts by "letters of intent," followed by negotiated price-determination, has practically replaced the advertised-bid practice; the urgency and subsequent speed necessary to assign military contracts has resulted in the elimination of many of the established practices developed by the Air Force in handling advertised bids.

The reluctance on the part of procurement branches, responsible for awarding contracts for specific equipment, to spread the awards too thin has resulted in concentration of contracts among a relatively few manufacturers. The reason for this, as given by one procurement branch chief was that, actually, total requirements are too small and will be for too short a period to justify spreading these contracts too much.

What does this mean to the manufacturer interested in prime contracts as well as subcontracts?

Here are some of the facts presented in a brief and realistic manner, designed to help answer many of the questions which have been troubling manufacturers.

In previous articles on procurement with the Navy and Signal Corps, which appeared in TELE-TECH'S March and April issues respectively, we reviewed in detail answers to the following questions:

Who gets a negotiated contract and why?

Who is invited to bid and why?

Who gets the business and why?

What are YOUR chances of getting defense contracts as a prime contractor? As a subcontractor?

Answers to these questions, which appeared in the Navy and the Signal Corps articles, are also applicable to the Air Force. Their repetition at this point should not be necessary, although a quick recapitulation is desirable:

Who gets negotiated contracts?

Negotiated contracts are awarded to manufacturers whose facilities have been inspected and approved; who have experience with military contracts and with the specific product; who have

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the necessary knowhow, research facilities, etc.

Who is invited to bid?

Manufacturers who have done a "selling job" to both the engineering and procuring personnel; who have convinced these government people that the manufacturer's facilities are suited to produce specified items.

Who is getting the business?

The bulk of the business has been going to a limited number of manufacturers for reasons mentioned in the beginning of the article. Decision as to who gets the business is further tempered by the fact that many manufacturers are assemblers, and also by the fact that there are more experienced facilities and production capacity available than the Air Force can make practical use of.

What are your chances of getting contracts?

The chance for new facilities to get prime contracts has been and is now slimmer than ever. Security clearance, when required, is more difficult to obtain because so many previously cleared facilities are available. As mentioned earlier, various Air Force procurement branches are hesitant about spreading contracts too thin because the manufacturer would be in production for too short a time.

What are your chances of getting subcontracts?

Again, your best chance of getting military work is as a subcontractor. You are thus relieved of the many headaches involved in prime contracting; you can do a concentrated selling job to other manufacturers in this industry whom you know and who know you; you have a better chance of getting security clearance, if necessary, through the prime contractor.

The above is not to suggest that you cannot or should not become a prime contractor. As the military procurement picture is clarified, the opportunity to become a prime contractor also becomes a greater reality to many who have heretofore been going around in circles, talking to the wrong people and unable to get some of the right people to take definite action in their direction.

Necessary, routine procedures for being placed on a bidder's list, such as complete identification of your facilities and organization, have been explained in detail in the Navy and Signal Corps articles, published in March and April, respectively. The explanation given in those articles are equally applicable to the Air Force. The procedure requires a detailed report of your company; registration with all procurement offices; response to all invitations to bid, regardless of whether you bid or not.

One of the most important details is identification and listing of what you can actually make. A manufacturer whose attitude is that "he can make anything," is the one least likely to get a contract.

The Air Force publishes an index of equipment catalogs, identifying everything it buys according to the class under which the equipment is placed. As an example, Class 16 is for communications equipment; Class 05, aircraft instruments, etc. Classes of equipment applicable to this industry are listed with the procurement chart (see inside). In addition to the index, subclasses and itemized lists of products in each class are also available from AF District Offices. Detailed specifications for any item in this product and component list are available from Dayton. AF field offices will furnish specification numbers for any product so that a manufacturer can then write to the Air Force Base in Dayton for the specification. This will enable the manufacturer to determine what the manufacturing and performance requirements are for a particular item and whether or not he can furnish it to the Air Force.

To those manufacturers primarily set up to produce components, it should be pointed out that the Air Force generally buys one year's supply of replacement parts and components with the original contract for the end product; thereafter, additional supply is generally purchased from the original manufacturer. The significance of this information is that component manufacturers, even more than others, will do best to direct their selling efforts to other manufacturers in the industry for subcontract work rather than to the Air Force as prime contractors.

Air Force engineering personnel influence contract awarding.

Engineering personnel in the Air Force (as well as in other branches of the military) play an extremely important role in selecting and approving potential prime contractors.

It is as important to see the engineer responsible for the engineering of a certain product as it is to see the procurement men responsible for issuing the contract. While the chart on the inside pages gives complete procurement information by types of items, we are restrained from publishing the corresponding engineering information except in the very limited form as shown on the chart under "Electronic Subdivision."

The Electronic Subdivision has engineering responsibility for all airborne radio - radar - communication - electronic items as briefly recapitulated in the Electronic Subdivision chart. It makes recommendations to Procurement Division for employment of specific manufacturers.

Air Force procurement is well organized. Manufacturers visiting Wright-Patterson Air Force Base in Dayton are funneled to the main reception center in Area B. After registering, they are directed to the Contractors Relations Office in Building 15. From there they are funneled to appropriate engineers and procurement officials responsible for the particular product which the manufacturer wishes to discuss.

It has been frequently stated that personal visits to procurement offices are not necessary; that all business can be conducted by mail—it is definitely recommended that one or more personal visits are positively desirable and effective.

Air Force field officers have been reorganized and renamed.

In streamlining its field procurement organization, the Air Force now operates six, instead of seven, field procurement offices, now identified as Districts. As an example, the New York Air Force Procurement Office is now the AF Eastern Procurement District. See chart.

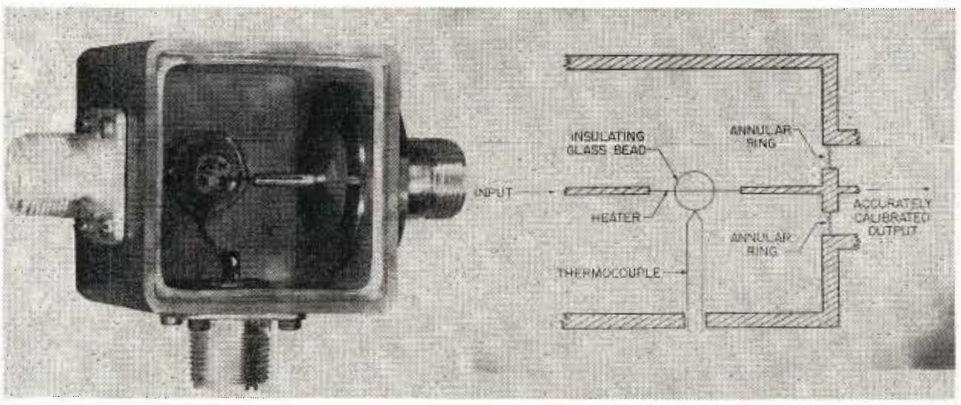
Watson Laboratory, Redbank, N. J., develops ground equipment, and procures, through its own procurement office whatever items are required to perform its research and development function. Manufacturers interested in selling to Watson Labs should go to Redbank, N. J.

The rapidly changing procurement picture makes it difficult to be more specific; restraints make it impossible for the writer to include supplementary information, particularly about the Electronic Subdivision. Manufacturers must determine their own position as a prime or subcontractor, but in any case, a manufacturer must continue to *sell himself, his facilities and his product* to procurement personnel; he should remember that procurement people in government, like purchasing agents in private industry, are human and are influenced by selling techniques, by institutional and product advertising, by your brochure and by the personalities of the men who represent you.

New R-F Micropotentiometer

Device provides known voltages from 0.001 to 0.1 volts over a frequency range of 0-300 MC

By FRANKLIN LOOMIS



Interior view of new r-f micropotentiometer unit with functional diagram at right

AT the National Bureau of Standards in Washington, D. C., M. C. Selby has developed what has been termed an "R-F Potentiometer". This device provides known voltages at frequencies from zero up to 300 MC at its output terminals. Voltages as small as 1 millivolt and as great as 0.1 volts are obtained with an accuracy of 10% or better, and these will prove valuable in calibrating commercial signal generators, voltmeters, attenuators and other VHF radio equipment and especially in measurements of radio and television receiver sensitivity.

In the past, laboratory workers often have found relatively large inaccuracies in the measurement of output voltages from commercial voltage generators at very high frequencies and at low voltage levels. These were due to fairly high output impedances, which when connected to, say, a receiver input, varied with frequency in an unknown manner; to lack of precise voltage-dropping attenuators; to drift in the calibration of the voltage indicator. Stray coupling caused trouble unless special attention was paid to shielding. Manufacturers of voltage generators are familiar with these troubles so they probably will welcome the r-f potentiometer type of design for it appears to have removed most of these difficulties thus permitting improved accuracy even in the hands of personnel with limited training.

An accurately measured r-f current is passed through a resistor especially constructed to have substantially constant resistance over the frequency range 0 to 300 MC. The voltage-drop across this resistor produces the desired voltage at the output terminals of the device.

A view of the resistor, together with the circuit in which it operates is shown in Fig. 1. The resistor comprises a thin (0.1 mil) conducting disc of metal or carbon about 1½ in. in diameter. The current enters at a center connection and flows radially to the outer edge of the disc where a brass clamping ring forms the outer contact. Due to its physical form, its symmetry, its low impedance and the absence of skin-effect because of the thin conductor, the resistance with dc and at 300 MC is substantially the same.

The resistive element may be produced in several ways, for instance, clamped circles of metal foil, metallic films sputtered on an insulation disc, etc. The best form to date results from placing over a circular insulator thin silver foil. Foils of gold, tin, and platinum have been tried as has the use of silver applied in a manner similar to that used in Printed Circuits. These discs resistors have been made with resistances as high as 1 ohm and as low as 0.0002 ohms. To change the range of the voltage output from the device, the brass-mounted resistor is unscrewed from a metal housing and one of another value is screwed in. At the same time the associated thermo-couple is changed if necessary. To cover a wide range of output voltages about 8 units are needed because the value of resistance, unit to unit, decreases by a factor of 5. Of course these units could be assembled as a single unit with switching means for rapid change of range.

The precision with which the voltage output of the device is known depends upon the accuracy with which the current flowing through the resistor is measured. A special thermo-couple, located near the input terminal of the resistor and housed within the metal box is employed for this purpose. It is a glass-enclosed vacuum thermo-couple resembling in size and glass structure an "Acorn" type of vacuum tube. The important thing is that it has a "straight through" heater. To this is attached, by means of an insulating bead, the thermal junction. Leads from the junction are taken, through a filter, to a sensitive, low-resistance (10 ohms or lower) dc millivoltmeter having a full scale reading of 2 MV and also 5 MV. In the NBS laboratory thermo-couples rated in increasing current from 5 up to 1,000 milliamperes were available. These are of British manufacture* and cost about $7.80. No satisfactory U. S.-built couple has been found.

To produce the desired VHF voltage output the proper resistor unit is screwed into the metal housing and a thermo-couple of correct rating is placed in the circuit. By means of shielded, concentric connectors the device is attached to the output of a signal generator which is equipped with a smoothly-operating power control (thermo-couples, when overloaded, burn out with the greatest of ease). The output of the generator is slowly increased until the reading on the dc millivoltmeter indicates the current flowing through the couple is that calculated to produce the desired voltage at the output.

Research is continuing, according to L. F. Behrent who has collaborated with Mr. Selby on this interesting development, to find the best method of fabricating the resistor element; to determine its variation of resistance with time; to extend the range and further increase the accuracy of the device. The Bureau laboratory in which this development has been underway for about 12 months is restricted, by orders, to VHF investigations so they stop at 300 MC but it is evident to the reader that the device is capable of giving good results to 1,000 MC.

* The Bureau does not recommend commercial products but the name seen on the thermo-couple boxes was "Best Products, Ltd. London."

Signs of Spring — FCC

AFTER nearly three years of freeze the Federal Communications Commission has made its first move toward recommencing the issuance of television construction permits with announcement of final VHF-UHF Rules Standards, and Allocations. These proposed regulations will be discussed at a combined industry-FCC conference on May 23, 1951 in Washington. At that time any errors of omission or commission will be rectified and requests for changes in the allocation plan will be considered.

The proposed new TV allocations plan covers the whole of the United States plus the territories of Alaska, Hawaii, Puerto Rico, and the Virgin Islands. Suggested allocation data for Canada and Mexico are also given, but those in border areas of all countries will naturally be subject to international agreement between the U. S. and Canada and Mexico, and the allocations given are merely for illustrative purposes to provide a basis for the FCC's plan. In all, 1965 assignments have been made in 1256 communities. This breaks down into 526 commercial and 82 educational VHF assignments, and 1230 commercial and 127 educational UHF assignments. Those made for the territories are naturally in the VHF band since no other sources of VHF TV operation exist in their vicinities to provide interference, or otherwise limit their range.

This is not yet firm for the reason that in addition to the possible changes made at the hearing there is still a decision to be made concerning the disposition of the common carrier application for use of the region 470 to 500 MC for common carriers. If the proposal is rejected there will be 70 UHF TV channels starting with number 14 at 470 MC; otherwise there will be 65, with number 14 starting at 500 MC. In any case there will be 52 UHF channels, instead of the 42 proposed earlier by the FCC. A maximum of 18 channels will be retained for future "experimental use", and 209 TV assignment will be reserved for education use. This is approximately 10% of the total available channels. The wisdom of this move will be strongly questioned since so many (82) of the few VHF channels are thus tied up, and the educators have long shown their indifference to radio by persistently ignoring the FM educational channels. Also very few of the institutions will be able to finance the great expense of television station construction and operation.

Only two grades of service—A and B are envisioned.

Grade A service will require 68 db, 71 db, and 74 db above 1 microvolt per meter for channels 2-6, 7-13, and 14-83 respectively.

Grade B service will require 47 db, 56 db, and 64 db respectively for the same channels.

A single class of station is proposed with provisions for maximum and minimum powers which depend on the location of the station.

Population	Minimum Power
1,000,000 or more	50 kw
250,000 to 1,000,000	10 kw
50,000 to 250,000	2 kw
under 50,000	1 kw

Maximum Power all cities: ch. 2-6—100 kw; ch. 7-13—200 kw.

Antenna heights of varying elevation may also be used with these powers.

By the recommendation of an i-f of 41.25 MC for receivers and careful observation of the spacing of UHF channels receiver radiation problems have been reduced to a negligible degree. Further comparatively simple receiver modifications will suffice to improve adjacent channel selectivity to a degree which will remove that as a source of interference.

The proposed allocations plan provides for shifting the channel assign-

PREDICTION OF AREAS OF

I. Grades of Service

Television broadcast service is classified into two grades of service which are defined in the tables below:

A. *Required median field strengths in db above 1 uv/m:*

Grade of Service	*Channels 2-6*	*Channels 7-13*	*Channels 14-83*
A	68 db	71 db	74 db
B	47 db	56 db	64 db

B. *Permissible co-channel ratios in db of median desired field strengths to 10% undesired field strengths:*

Grade of Service	*Channels 2-13*		*Channels 14-83*	
	Non-offset	*Offset*	*Non-offset*	*Offset*
A	51 db	34 db	53 db	36 db
B	45 db	28 db	45 db	28 db

C. *Permissible adjacent channel ratios in db of median desired to undesired field strengths:*

Grade of service	*Channels 2-83*
A	0 db
B	0 db

II. Specifications of Required Field Strengths

The required field strength specified in Section IA were determined in accordance with the following assumptions and procedures:

A. *Grade A Service—Required Field Strengths, in db above 1 microvolt per meter:*

(a) To overcome receiver noise:

		Channels 2-6	Channels 7-13	Channels 14-83
(1)	Thermal Noise (db)[1]	7 db	7 db	7 db
(2)	Receiver Noise Figure	12	12	15
(3)	Peak Vis. Car./RMS Noise	30	30	30
(4)	Trans. Line Loss[2]	1	2	5
(5)	Antenna Eff. Length[3]	−3	6	8
(6)	Local Field Strength	47	57	65
(7)	70% Terrain Factor[4]	4	4	6
(8)	90% Time Fading Factor	3	3	3
(9)	Median Field Strength (db)[5]	54 db	64 db	74 db

(b) To overcome local noise and interference under urban conditions:

	Channels 2-6	Channels 7-13	Channels 14-83
Median Field Strength (db)	68 db	71 db	74 db

Prepares to Thaw Allocations

ments of thirty-one existing TV stations in the VHF band instead of only three as proposed earlier.

While not prohibiting any of the suggested methods of improving coverage and signal strength by the use of novel methods such as "Stratovision" which uses high flying aircraft to rebroadcast television signals, and "Polycasting" which uses a number of low power stations in the same area to lay down a blanket of signals, the Commission has not allocated any specific channels to these services. However, the 18 specially reserved channels for experimental work will provide operating areas for these systems. In this case the use of UHF will be a convenience since there will be more receivers suited to reception of such UHF signals than if the UHF band were not allocated.

In the summary which follows the main factors involved in determining the service areas of a television station are given, together with a condensed description of the method of predicting service field strengths. Charts 1 to 4 of the appendix have been omitted in the interest of space and because their use requires cutting the page to obtain the sliding scale for use with various powers.

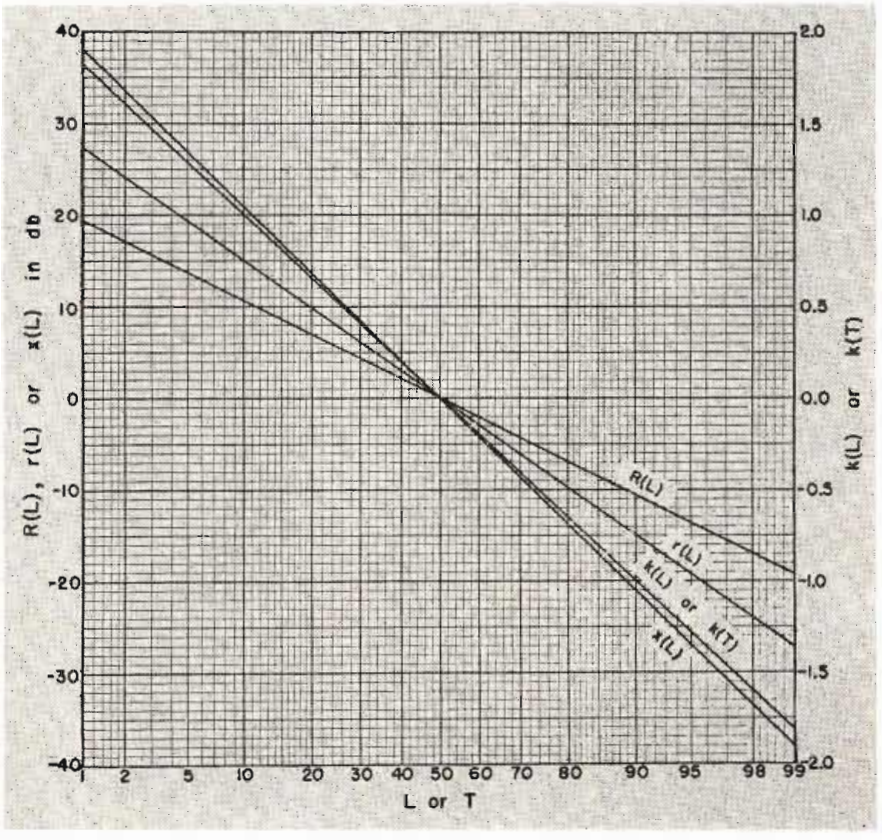


Fig. 1. This is Fig. 5 of Appendix 5 of the FCC proposed standards. It shows the expected percentage of the receiving locations, L, or percentage of the time T, at which the ordinate value will be exceeded. It is used in calculating coverage.

SERVICE AND OF INTERFERENCE

(c) Required field strengths to overcome (a) or (b), whichever is the greater:

	Channels 2-6	Channels 7-13	Channels 14-83
Median Field Strength (db)[8]	68 db	71 db	74 db

B. *Grade B Service—Rural Field Strengths, in db above 1 microvolt per meter, required to overcome receiver noise:*

	Channels 2-6	Channels 7-13	Channels 14-83
(1) Thermal Noise (db)	7 db	7 db	7 db
(2) Receiver Noise Figure	12	12	15
(3) Peak Vis. Car./RMS Noise	30	30	30
(4) Trans. Line Loss	1	2	5
(5) Antenna Effective Length[7]	−9	0	3
(6) Local Field Intensity	41	51	60
(7) 50% Terrain Factor	0	0	0
(8) 90% Time Fading Factor[8]	6	5	4
(9) Median Field Intensity (db)	47 db	56 db	64 db

III. Specification of Permissible Co-channel Interference Ratios

The permissible interference ratios specified in Section IB were determined in accordance with the following assumptions and procedure:

A. *Grade A Service:*

	Channels 2-13		Channels 14-83	
	Non-offset	Offset	Non-offset	Offset
(1) Local Desired/ Undesired Ratio	45 db	28 db	45 db	28 db
(2) 70% Terrain Factor[9]	6	6	8	8
(3) 50% Location d/u Ratio	51 db	34 db	53 db	36 db

B. *Grade B Service:*

	Channels 2-13		Channels 14-83	
	Non-offset	Offset	Non-offset	Offset
50% Location d/u Ratio	45 db	28 db	45 db	28 db

IV. Specifications of Permissible Adjacent Channel Ratios

The permissible adjacent channel ratios specified in Section IC were determined in accordance with the following assumptions and procedure:

A. *Grades A and B Service:* *Channels 2-83*

Local desired/undesired ratio (db)	−6 db
90% time fading factor (db)	6
Time median desired/undesired ratio (db)[10]	0 db

(*Continued on following page*)

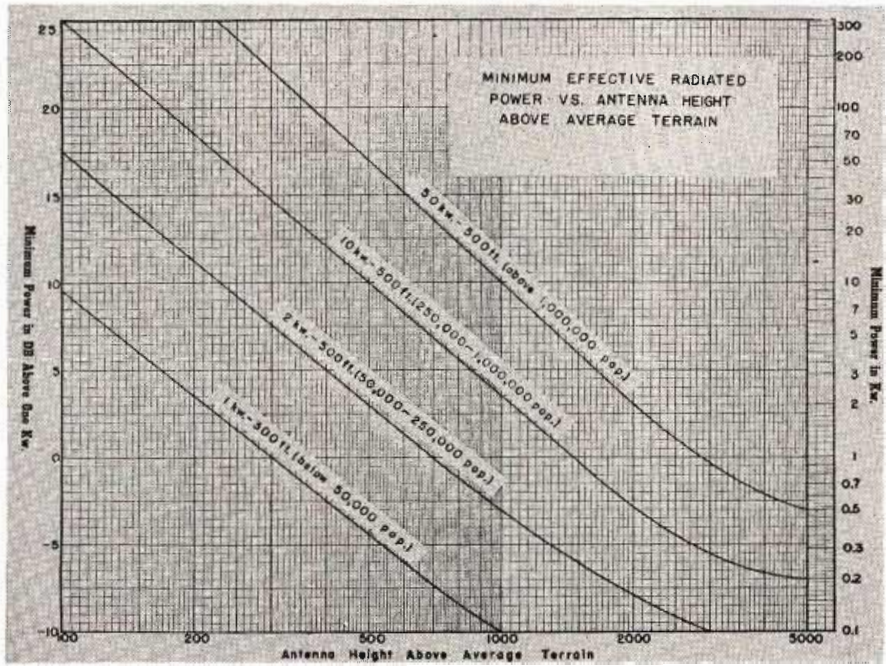


Fig. 2. Appendix 4 of the proposed standards provides data for coverage calculation

V. Propagation of Television Signals

For the purpose of predicting the propagation of television signals for the estimation of service and interference areas under the rules proposed in Part III of these proceedings, the following procedures have been observed:

A. *Prediction of Service Field Strengths:*

The minimum field strengths of the service field which will be available at any percentage of receiving locations for any percentage of the time may be described by the following relation:

(1)
$$F'(L,T) = P' + F(50,50) + R(L) + R(T)$$

Where F'(L,T) is the minimum field strength to be expected at the poorest location of the best L percent of locations for T percent of the time, expressed in decibels above 1 microvolt per meter, P' is the effective radiated power in db above 1 kilowatt, F(50,50) is the minimum field strength in decibels above 1 microvolt per meter expected at 50 percent of the locations and 50 percent of the time for a radiated power of one kilowatt, R(L) is the terrain distribution factor for L percent of locations, and R(T) is the time distribution factor.

The effective radiated power, P' is expressed in decibels above 1 kilowatt radiated from a half-wave dipole and may be calculated by means of the following formula:

(2)
$$P' = 10 \log_{10} P - P'' + G$$

In the above, P denotes the actual transmitter power delivered to the transmission line expressed in kilowatts, P'' denotes the transmission line and antenna power loss expressed in decibels, and G denotes the gain of the transmitting antenna array in the direction of the receiving location expressed in decibels relative to that of a half-wave dipole.

The time distribution factor, R(T) for fields exceeded for 10% of the time, R(T=10), is found by substracting the value exceeded for 50% of the time F(50,50) from the value exceeded for 10% of the time F(50,10).

(3) $R(T=10) = F(50,10) - F(50,50)$

No charts are included to show the service fields for 90% of the time, but these fields lie below the 50% curve by the same amounts that the 10% curves lie above the 50% fields.

Thus, the time distribution factor R(T=90) is numerically equal but opposite in sign to R(T=10), and

(4) $F(50,90) = F(50,50) + R(T=90)$
$= F(50,50) - [F(50,10) - F(50,50)]$

In order to determine the field strengths to be expected for other percentages of time, T, use may be made of the relation: $R(T) = R(T-10)k(T)$. The value of k(T) for any percentage of time T is given in Figure 5 of proposed Appendix V. In order to determine the field strengths which will be exceeded at some percentage of the receiving locations other than 50%, use is also made of Figure 5. For channels 2 through 13, the curve labelled R(L) is to be used; for channels 14 through 83, the curve labelled r(L) is to be used. The departure from the 50% value in db, shown on the left scale, corresponding to the desired percentage of locations on the bottom scale, is to be added to the field intensity in db above one microvolt per meter existing at 50% of locations.

For channels 2-13,

(5) $F(L,50) = F(50,50) + R(L)$

For channels 14-83,

(6) $F(L,50) = F(50,50) + r(L)$

Thus, as shown in Figure 5, the terrain factor for 70% of locations corresponds to —4 db for channels 2-13 and —6 db for channels 14-83, as used in Section II above.

1. Reference level db above 1/uv across 300 ohms impedance.

2. Transmission line is assumed to consist of 50 feet of 300 ohm twin-lead cable.

3. The antenna is assumed to consist of a half-wave dipole for channels 2-13 and an antenna with 8 db gain for channels 14-83.

4. The terrain correction factor for channels 2-13 is taken from the curve R(L) and the factor for channels 14-83 is taken from the curve r(L) of Figure 5 of proposed Appendix V, attached hereto.

5. The median field strength is equivalent to the field F' (50,50) specified in Section V-A herein and will provide grade A service under suburban or rural conditions where receiver noise provides the service limitation.

6. It is realized that it may not be desirable nor practical in some heavily built-up areas to meet the assumptions of an outside antenna, and that inside antennas will be used. If it is assumed that the inside antenna will have an effective length equal to that of a half-wave dipole and that the transmission line loss is negligible, the instantaneous local field strength required will be 46, 55 and 68 db above one microvolt per meter, respectively, for channel groups 2-6, 7-13, and 14-83. However, the median field strengths required under these conditions cannot be stated with assurance, because the average terrain distributions which have been calculated from available measurements apply only to exterior conditions in suburban and rural areas. If the range of signal variation in building interiors is comparable to the exterior range, the median signal levels specified to overcome local noise and interference in (b) will be adequate. Until reliable data are available to indicate otherwise, the specified median field strengths are considered adequate for urban service other than in the principal city.

7. Antennas with a 6 db gain compared to a dipole are assumed for channels 2-13, and an antenna gain of 13 db for channels 14-83.

8. The time fading factors decrease with increasing frequency because the grade B service radii decrease.

9. The terrain factor for channels 2-13 was taken from the curve r(L) and for channels 14-83 from the curve x(L) of Figure 5 of proposed Appendix V for 70% of the receiver locations.

10. The median field strength ratio of 0 db is based upon an assumed receiver terminal ratio of —6 db. With an acceptable terminal ratio of —6 db, at least one service or the other is available at any particular receiving location at any particular time, provided that the field strengths are otherwise satisfactory for service. By specifying a permissible time median field strength ratio of 0 db, a particular receiving location is expected to have service available for at least 90% of the time from one station despite fading. Although this does not assure 70% of locations to each station at the Grade A contour, owing to the terrain distribution the areas of actual service will overlap. Each station will on the average recover from the other station as many locations beyond the indicated 0 db contour as it loses to the other station within the 0 db contour.

British Components Show

The eighth annual private exhibition of British radio and electronic components was held by the Radio and Electronic Component Manufacturers' Federation at Grosvenor House, London, on April 10 to 12. The important contribution made by the industry to Britain's defense program was borne out by the display of special components and apparatus made to conform to service requirements.

Dayton IRE Air Conference

1951 Meet on May 24-25 features 72 papers on airborne communications; 23 exhibitors participating

CO-SPONSORED by the IRE and the Dayton section of the Professional Group on Airborne Electronics, the National Conference on Airborne Electronics will be held May 24-25 at the Dayton-Biltmore Hotel, Dayton, Ohio. Principal speaker at the conference will be Harold B. Richmond, chairman of the board of General Radio Co., Cambridge, Mass. More than 1000 registrants are expected. The ladies program includes socials, tours, luncheon and a style show. Among the technical papers to be presented are:

Communication and Navigation

Long Range Navigation, B. Alexander (Federal Telecommunication Lab.)
Design Trends in Military Airborne Communication Equipment, G. H. Scheer, Jr. (AMC)
Some Problems of Selective Communication with Aircraft, D. G. C. Luck (Radio Corp. of America)
Audio Problems in Aircraft Communication, I. H. Bowker (AMC)

Electronic Components and Techniques

Electro-Mechanical Filters, J. F. Beckerich, (Radio Corp. of America)
Etching—A General Fabrication Technique for Miniaturized Components, W. H. Hannahs and J. A. Caffiaus, (Sylvania Electric Products, Inc.)
Application of Printed Circuit Techniques to IF Amplifiers, R. Bahr, Jr. and W. H. Hannahs, (Sylvania Elec. Products, Inc.)
Semi-Automatic Assembly with Miniaturization Techniques, W. H. Hannahs andW. Serniuk, (Sylvania Elec. Products, Inc.)

Theory of Communication

Cross-Correlation in Periodic Radio Systems, N. Marchand and M. Leifer, (Sylvania Elec. Products, Inc.)
The Infomax Concept for Improving Radio Communication, M. A. Antman, (AMC)
Multiplexing by Orthogonal Functions, N. Marchand and H. R. Holloway, (Sylvania Elec. Products, Inc.)

Antennas I

A Glide Path Cavity Antenna for Jet Fighter Aircraft, L. E. Raburn, (Electronics Research Inc.)
Vertical Stabilizer Antenna Systems for Multiple Operation, R. DeLiban, Dr. J. T. Bolljohn, A. R. Ellis, D. R. Scheuch, (Stanford Research Institute)
Fin Cap Zero-Drag Loran Antenna, G. Weinstein, (Boeing Airplane Co.)
Metal-Clad, Progressive-Phase, Dielectric Antennas, W. Rotman, (AFCRL)
A Small Unidirectional Antenna, R. T. Leitner, (Ohio State University Research Foundation)
An Aural Homing Antenna Pattern Range, W. R. Fried, (AMC)

Microwave

The Design and Construction of a Microwave Resonant Cavity for a Linear Electron Accelerator, H. C. Hyams, (The Glenn Martin Co.)
Coated-Conductor Wageguides and Antennas, Prof. R. E. Beam and E. Bedrosian, (Northwestern Univ.)
Microwave Printed Circuits, R. M. Barrett and M. H. Barnes, (AFCRL)
Hybrid Waveguide Rings, H. Kahn, (W. L. Maxson Corp.)

Antennas II

Systems Consideration in Aircraft Antenna Design, Dr. J. V. N. Granger, (Stanford Research Institute)
A Versatile GCA Antenna, Dr. H. Schutz, (The Glenn Martin Co.)
Theory and Applications of the Power Equalizer, R. W. Masters, (Ohio State University Research Foundation)
Multizone Extra Wide Band Radiating System, E. L. Bock, (Airborne Instruments Labs.) J. F. Byrne, (Motorola, Inc.)
A Wing Tip Omnidirectional Range Antenna for Jet Fighter Aircraft, J. D. Martin, (Electronics Research, Inc.)

DESCRIPTIONS and PHOTOGRAPHS of components and equipment to be displayed at the Airborne Electronics Conference are shown on page 58.

Vacuum Tube I

Crystal Controlled Klystrons for Airborne Application, Dr. V. R. Learned, (Sperry Gyroscope Co.)
The Application of the Theory of Oscillators to Microwave Generators, J. S. Schaffner, (University of Illinois)
Recent Developments in Dark Trace Tubes, E. R. Jervis, (National Union Radio Corp.)
An R. F. Amplifier for UHF, B. F. Tyson and J. G. Weissman, (Sylvania Elec. Products, Inc.)
Development of Cold Cathode Gas Tubes and Application to Airborne Equipment, M. A. Babb, (Bendix Aviation)

Measurements I

Measurements to 2000 MC with the UHF Admittance Meter, R. A. Soderman and W. M. Hague, (General Radio Co.)
An Automatic Phase Plotting Machine, R. M. Barrett and M. H. Barnes, (AFCRL)
An Improved Standing Wave Amplifier, J. G. Rubenson, F. H. Blecher, (Polytechnic Research & Development Co., Inc.)
Compact VSWR Indicator for Field Use, F. Klawsnik, (Sperry Gyroscope Co.)
A 20 Cycle to 50 Megacycle Signal Generator, J. Van Beuren, (Measurements Corp.)

Vacuum Tubes II

On the Characteristics of Microwave Oscillations in Gaseous Discharges, L. Brennan, J. Saloom, R. Wellinger, (Univ. of Illinois)
Practical Developments in the Traveling-Wave Tube, S. F. Kaisel, R. W. Peter, W. J. Dodds, (Radio Corp. of America)
Consideration of New Experimental and Theoretical Analysis of Germanium Diodes, N. Salz, W. B. Whalley and C. Masucci, (Sylvania Electric Products, Inc.)
Rating of Electron Tubes at Very High Altitudes, R. J. Bibbero, (Bell Aircraft Corp.)

Measurements II

Precision Measurements of Air Stream Velocity Vector, W. M. Kaushagen, (Cornell Aeronautical Lab.)
An Audio Spectrum Recording System, N. L. Laschever and A. B. Todd (AMC)
Application of High Speed Electronic Counters, G. J. Giel, (Berkeley Scientific Co.)
Precision Phasemeter for Audio Frequencies, J. Kritz, (W. L. Maxson Corp.)

Shock and Vibration

Shock Testing of Airborne Electronic Equipment, Charles E. Crede, (The Barry Corp.)
The Electrical Characteristics of Shaker Systems used for Vibration Testing of Equipment, R. C. Lewis, (The Calidyne Co.)

Systems Analysis and Reliability Measurements

Reliability Testing of Airborne Electronic Systems and Components, W. T. Sumerlin, (Fairchild Guided Missiles Div.)
Marginal Checking for Airborne Electronic Equipments, G. C. Sumner, (Consolidated Vultee Aircraft Corp.)
A New Concept of Measurement of System Performance, A. L. Witten and R. E. Henning, (Sperry Gyroscope Co.)
Tolerance Measurement in Complex Systems, Dr. E. W. Pike & T. R. Silverberg, (Raytheon Mfg. Co.)

Circuits

Method of Generation of Fractional Microsecond Positive Pulses at High Repetition Rates, Dr. F. M. Pelton, (Cornell Aeronautical Lab.)
The Reluctance Amplifier, F. G. Willey and F. S. Macklem (Servo Corp. of America)
A Simplified Servomechanism Approach to the Automatic Gain Control Problem, E. E. Lewis and W. A. Adkisson, (Minneapolis-Honeywell Regulator Company)
Application of Single-Sideband Suppressed-Carrier Modulators in Narrow Band Techniques, H. R. Holloway and H. C. Harris, (Sylvania Electro Products, Inc.)
Design Considerations in DC and AC Electronic Voltage Regulated Power Supplies, J. E. Zimmerle, (General Electric Co.)

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Standard Radio & Elec. Products Co., 135 E. 2nd St., Dayton 2, Ohio.
Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.
Superior Electric Co., 83 Laurel St., Bristol, Conn.
Sylvania Electric Products, Inc., 1740 Broadway, New York 19, N. Y.
Anthony Wahl, Green Hills, Ohio
Westinghouse Electric Corp., First National Bank Bldg., Pittsburgh, Pa.

Electron Tube Ratings at Very

How temperature derating curves, which assure normal tained for types employed in high-altitude long-range

By R. J. BIBBERO, Servomechanisms Engineer,
Bell Aircraft Corp., Buffalo 5, N. Y.

IN operation of electronic equipment in unpressurized compartments of high altitude long range aircraft, the effect of low ambient pressure on the ratings of electron tubes must be considered. It may not be apparent at first why ambient pressure should have any effect on electron tube rating. Since tubes are sealed components, usually under high vacuum, it is difficult to see any connection between ambient pressure and operation except for the danger of voltage flashover between pins.

Consideration of the meaning of maximum plate dissipation, however, will reveal the important part played by ambient pressure in this rating. An electron tube is a heat generating device in an envelope of fixed size, the parts of which are subject to certain allowable limits of temperature. The temperature of the tube is determined by the usual law of heat transfer, namely:

$$q = UA\Delta t \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (1)$$

where q is the rate of heat dissipation in BTU per minute, or in watts, A is the heat dissipating area, and Δt the rise in temperature above ambient. U, the overall heat transfer coefficient, is the reciprocal of the sum of thermal resistances imposed by conduction, radiation and convection through and from the glass envelope. A certain amount of heat is also lost by direct conduction through the pins—this can also be expressed by the same type of equation as (1).

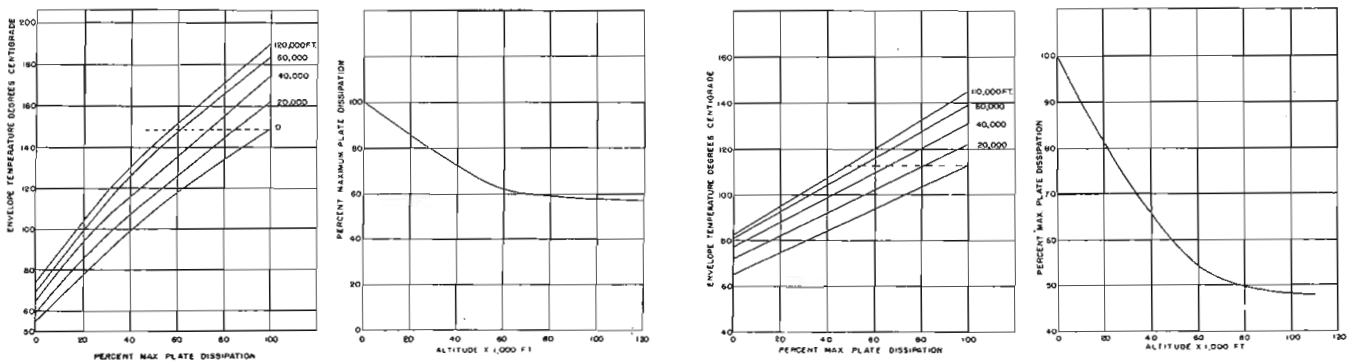
For a given ambient temperature the heat dissipated is proportional to the envelope temperature, and since the area A and the filament dissipation are constant for any tube, the maximum allowable plate dissipation must depend on the maximum allowable envelope temperature. The relation between plate dissipation and temperature rise is not strictly linear, since U is also a function of temperature. The relation is further not an easy one to calculate for a structure such as a vacuum tube, since the effective area, influence of tube element location, proportion of heat lost by lead conduction, and even exact values of thermal resistances are not readily determined.

In the rating of high powered transmitting tubes the maximum envelope temperature is almost always given by the manufacturer, since it is recognized that without adequate forced air or water cooling, the glass envelope would melt or the seals fail under the tremendous heat evolved. In receiving tubes however, the envelope temperature is given in only a very few cases. A notable exception (1) is in the case of a recent line of subminiatures where not only the maximum allowable bulb temperature is given but also the magnitude of the effect of decreasing bulb temperature on increasing statistical tube life.

Higher than normal envelope temperature tends to shorten the time to filament burnout, to shorten cathode emissive life and to increase grid contamination and emission, or to promote gasiness in the tube by forcing absorbed gases from the metal elements and the tube envelope and by reversing the action of the getter. If a high enough temperature is reached at the press, the glass may become conductive (2) (3) or differential expansion between pins and press may cause the seal to fail. In general, the effect of moderately increased envelope temperatures is to shorten tube life rather than to cause immediate failure or drastic change in characteristics.

It is probably true that these effects of envelope temperature were not considered as such at the time of rating most older receiving tubes. Nevertheless, the plate dissipation ratings, based on experience and on exhaustive life tests, imply directly a maximum allowable bulb temperature for full normal tube life. It is certainly a conservative procedure to take this envelope temperature, measured when the tube is operating at the same ambient pressure and temperature and the same plate dissipation as at the time of the life test, as a rating, rather than the wattage given by the manufacturer.

Fig. 2: (Left) Envelope temperature vs. plate dissipation for various altitudes and altitude derating curve for type 12AU7 (Right) Envelope temperature vs. plate dissipation at various altitudes and altitude derating curve for SN957A subminiature triode



High Altitudes

tube life are ob- aircraft equipment

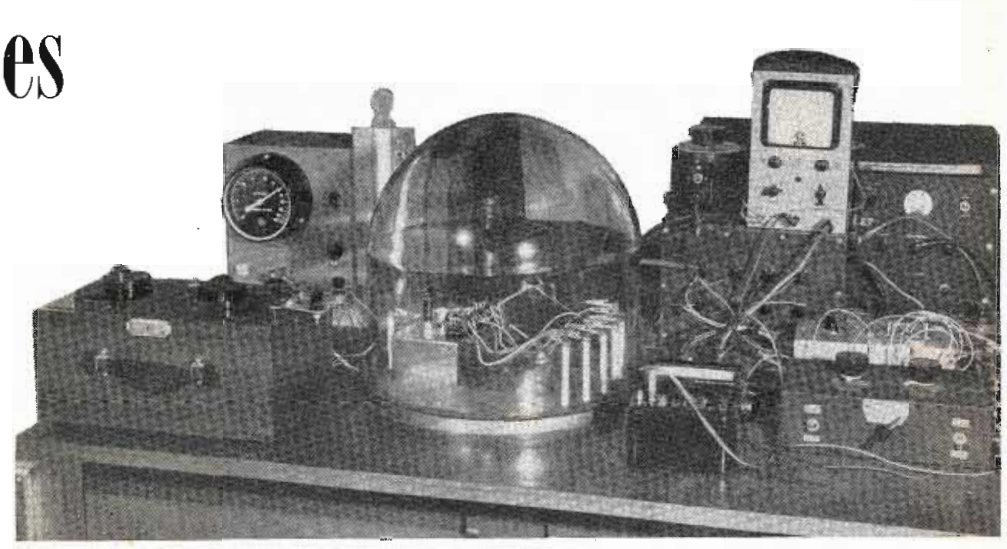


Fig. 1: Experimental arrangement for derating measurements at reduced pressure

(The separate ratings of plate voltage and cathode current, based on different considerations and not always consistent with the plate dissipation, should be observed, of course, in any case.) The effects of chassis crowding, presence of other tubes or heat dissipating components, and of increased chassis ambient are unpredictable, but compensated by the same safety factors as was the original wattage rating.

The significance of the envelope temperature at maximum rated plate dissipation is established then as an index of the probability of achieving normal tube life. Although it is not possible, without elaborate life tests, to state the exact relation between increase above normal envelope temperature and decrease in life, it remains true that full normal life can be expected only when the tube is operating so that the envelope temperature is at or below the normal achieved with standard test conditions and full plate dissipation. The problem of determining an altitude derating reduces then to the problem of finding the effect of air pressure on envelope temperature.

From the basic equation (1) it is obvious that with constant q and A the temperature rise of the tube is dependent on the magnitude of U. U, on the other hand, is inversely proportional to the convection heat transfer coefficient h_c. Expressed as an equation,

$$U = \frac{1}{1/h_c + d/k + 1/h_r} \quad \ldots\ldots (2)$$

where $1/h_r$ is the average thermal resistance to radiation heat transfer and d/k that of conduction through the envelope. These latter are not dependent on the presence or absence of air beyond the envelope; however, h_c is so dependent. It is obvious that in a vacuum there would be no air currents to remove heat from the envelope by convection. By the application of dimensional analysis and by experiment, it has been determined (4) that for natural convection in air, the expression for h_c takes the form

$$h_c = C \left(\frac{\Delta t}{L}\right)^n (P)^{\frac{1}{2}} \quad \ldots\ldots\ldots (3)$$

Where C is a constant, L depends on the dimensions and P is the ambient pressure in atmospheres, h_c is then proportional to the square root of the air density (and to some extent to the temperature difference, since the value of the constant depends somewhat on the temperature range). By application of standard NACA atmosphere-pressure tables, (5) it is a simple matter to calculate the variation of h_c with altitude.

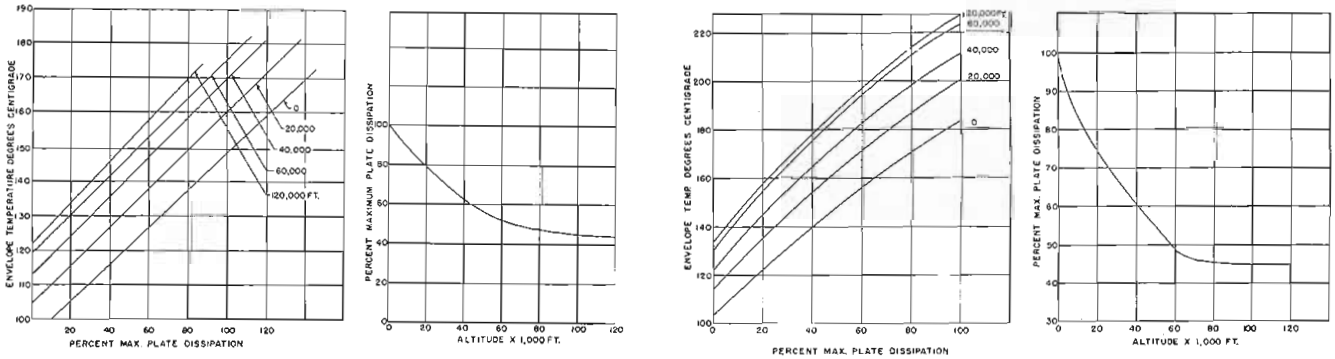
The problem of calculating Δt variation with altitude is not yet solved since the effect of convection relative to radiation and conduction is not yet known. Rather than resort to laborious and at best approximate, calculation for each tube structure it is simpler to measure the variation.

Effects of Altitude

To measure the effect of altitude on envelope temperature and to find the magnitude of plate dissipation derating that must be applied to prevent the envelope temperature from exceeding the normal value, and reducing tube life, the following setup was used. (See Fig. 1)

The electron tube under test, mounted without a tube shield in a standard chassis, was placed under a large bell jar on a metal base plate. The latter was fitted with a number of pressurized electrical leads fabricated from sealed glow-type spark plug bodies. Plate, grid, cathode, and heater leads were taken out to the test bench. A fine (30 AWG) iron-constantan thermocouple was affixed to the tube envelope at the "hottest spot" (opposite the center of one side of the plate) and was

Fig. 3: Envelope temperature vs. plate dissipation at various altitudes and deratings curves for types 5U4G (left), 5687 (right)



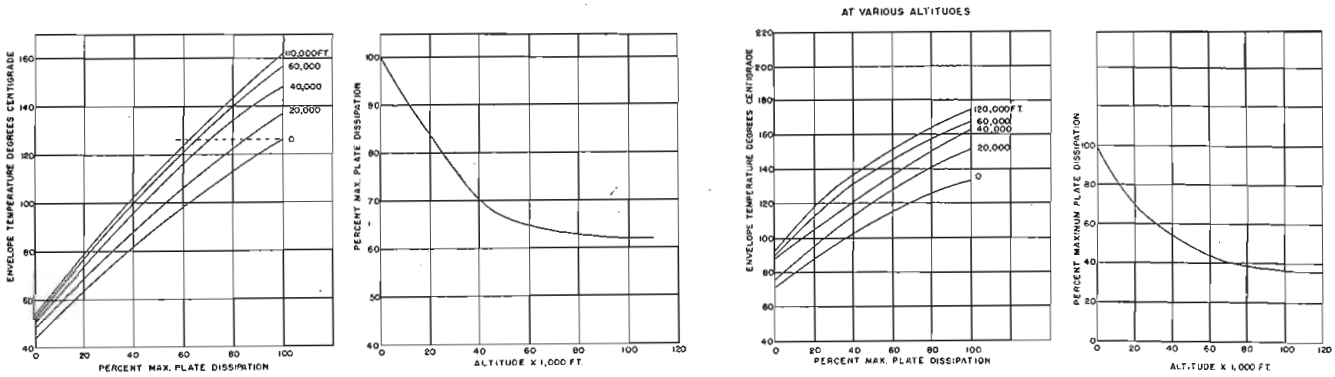


Fig. 4: Envelope temperatures vs. plate dissipation at various altitudes and derating curves for types 6C4 (left), 6AH6 (right)

taken through the vacuum-tight leads. A test set-up was arranged similar to that used to measure static characteristics of tubes, with meters monitoring plate and grid voltages, cathode and heater current. With the heater wattage kept constant at rated value, plate dissipation was adjusted by varying the grid bias.

Envelope Temperature

With the total element dissipation fixed at the maximum rated value and with the bell jar kept at room pressure, the equilibrium envelope temperature was measured by means of the thermocouple and a null-type potentiometer. This value was called the normal maximum envelope temperature. The pressure was then reduced to correspond to standard NACA pressures of 20, 40, 60, 80 and 100 thousand feet. Measurements of bulb temperature were made at maximum sea level plate dissipation and at 75% and 50% of this value. The resulting plots of envelope temperature vs. plate dissipation are families of curves deviating slightly from straight lines. Figs. 2 to 4 show these results for the indicated tube types.

From these families of curves it is possible to obtain a plate dissipation derating based on maintenance of the normal maximum envelope temperature. A straight horizontal line corresponding to constant temperature is drawn from the point representing this temperature at "100% plate dissipation" and sea level pressure. From the intersection of this line with the temperature curve for each altitude, it is possible to find a corresponding "percent maximum plate dissipation". These percent maximum plate dissipation values are replotted against altitude as an abscicca and constitute a plate dissipation derating curve for altitude.

It is possible to argue that at altitudes up to approximately 35,000 feet, the ambient temperature is reduced as well as the pressure. The temperature rise measured would then be from a lower ambient and actual bulb temperatures might be reduced rather than increased. The validity of this argument depends on the particular application of the tubes in question. The author has considered, as a simplification, that the chassis containing the equipment is placed in a heated but unpressurized compartment. The heating may be purposeful, as in the pilot's cabin or as in a special compartment heated to eliminate warm-up time or frequency drift of the equipment, or it may arise from the presence of other heat dissipating equipment and components in the same or adjacent chassis. In these cases, the self-heating effect of the tubes on the ambient temperature would be the same or greater than on the ground and the tube derating due to increased temperature rise would be that indicated in the figures.

Special Heating Effects

Special heating effects, such as aerodynamic heating of supersonic aircraft, or of forced cooling must be evaluated for each application. In these cases, the rating of the tube should also be determined by the normal or sea level maximum bulb temperature which should be specified for each tube manufacturer.

It has been shown that electron tube life is dependent on envelope temperature to a degree which is on the whole unknown, but which can be presumed to be of considerable magnitude. The envelope temperature at maximum rated element dissipation and at sea level pressure is at least as rational a basis for tube dissipation ratings as is the wattage, and in fact, is implied therein. In the absence of extensive life test data at high temperatures, it is conservative to derate plate dissipations to maintain constant envelope temperature and to assure rated statistical tube life. It has also been shown, theoretically and experimentally, that envelope temperatures increase with altitude unless the tube dissipation is derated. For the test conditions, i.e. 25°C. ambient, derating curves for several miniature and subminiature tube types have been given.

Appreciation is expressed to Mr. Edwin R. Sanders for his counsel and assistance in determining the prior art; to Messrs. Frank Andrix, J. Schantz, and Dr. Charles Rife for criticism and advice, and to Messrs. R. Anderson, H. Hamer, E. Metzger, R. Borsos and J. LeGare for assistance in the experimental work. All are engineers at the Bell Aircraft Corporation. The author also gratefully acknowledges helpful discussion of the problem by private communication with Mr. George H. Gage of the General Electric Co., Owenboro, Ky., and with engineers of the Sylvania Electric Co., Tube Div., and Radio Corporation of America.

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Page from an Engineer's Notebook

Number 11 R-F Solenoid Design Chart

Means for quickly solving the "how many turns" problem

By PETER G. SULZER,
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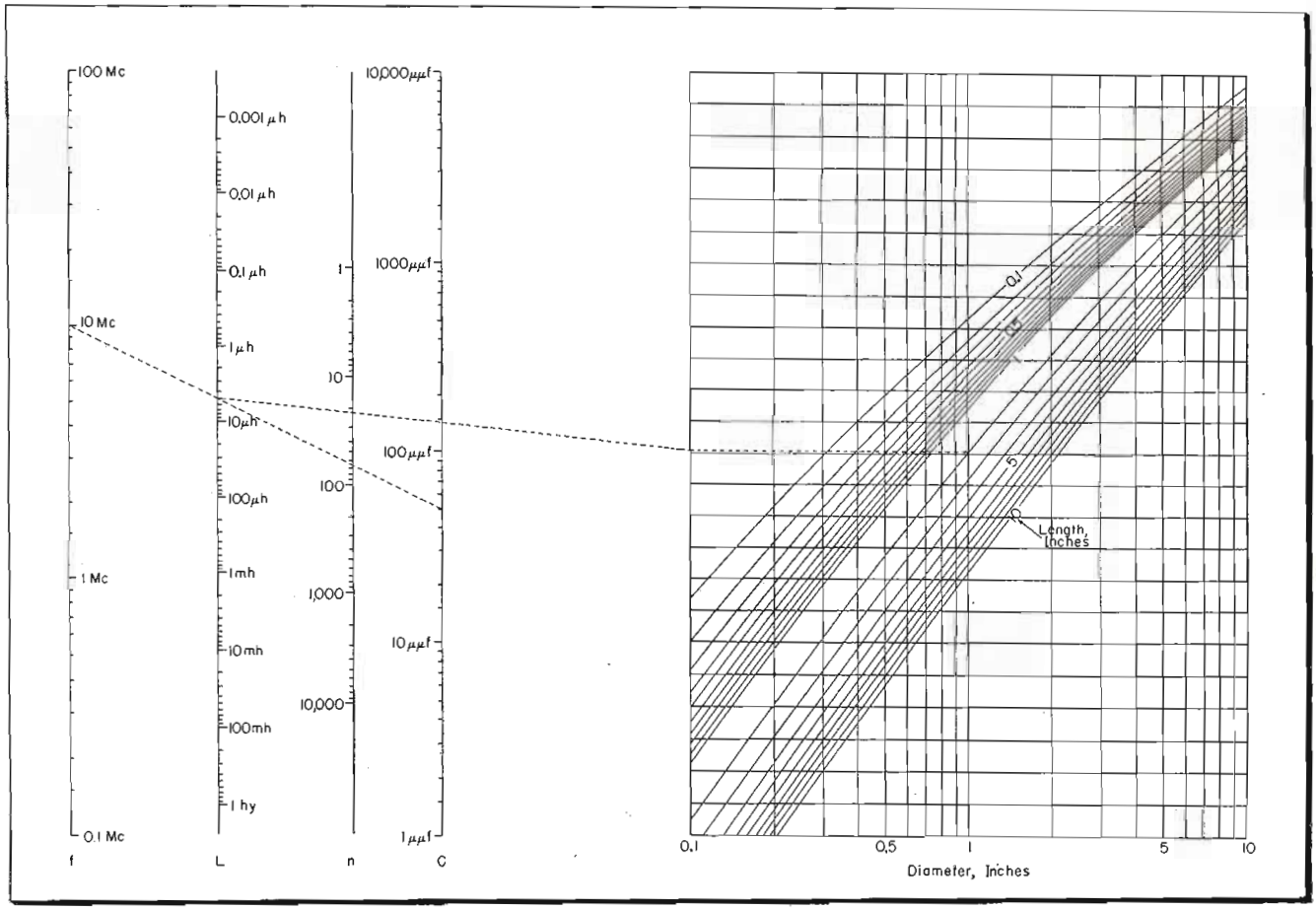
THE radio engineer is frequently faced with the problem of designing a solenoid inductor to resonate at a specified frequency with a given value of capacitance. Although formulas can be applied, use of the chart presented here can effect a worthwhile saving of time and effort when moderate accuracy is sufficient. This includes almost all practical cases where the inductor is not to be used as a standard of inductance.

The following example will indicate the method:

It is desired to design a coil for a harmonic generator which is to operate at a frequency of 10 megacycles with a total capacitance of 50 micromicrofarads. Drawing a straight line between 10 megacycles on the *f* scale and 50 micromicrofarads on the C scale, the inductance L is found to be approximately 5 microhenrys. This value need not be recorded unless it is required for some other purpose. Assuming that the winding is to be one inch in diameter by two inches long, the intersection of the appropriate lines is found in the graph at the right-hand side of the figure. This intersection is projected horizontally to the left as shown, and then a straight line is drawn to the 5-microhenry point on the L scale. The result is found to be 22 turns, as indicated on the n scale.

Chart for rapidly determining number of coil turns required to resonate with a fixed value of capacity at specified frequency



Explosion-Proof LOUDSPEAKER

Fig. 1: Explosion-proof type loudspeaker

By SAUL J. WHITE, Chief Engineer, University Loudspeakers, Inc. 80 South Kensico Ave., White Plains, N. Y.

ALTHOUGH explosion-proof devices are in common demand in the electrical industry, the requirement for an explosion-proof loudspeaker is a provocative and stimulating thought to the audio engineer. In this complex industrial civilization of ours, there are numerous locations where the existence of a spark or flame may have serious consequences to life and property. In such locations, it is possible for a loudspeaker to initiate an explosion just as readily as might be done with, say, the arcing brushes of an unprotected motor commutator.

To prevent the possibility of such hazards, the Underwriters' Laboratories have instituted a set of specifications which electrical apparatus must meet before it can be approved for use in these hazardous areas.

At first it might be thought, what in the world is there about a loudspeaker that could cause an explosion? Consider a coal mine, where the air is laden with fine particles of coal dust, and with an atmosphere perhaps charged with highly explosive natural gases. In such an atmosphere, a spark would result in a violent explosion. This spark could be caused by the accidental rupture of the loudspeaker lead, voice coil, or some part of the electrical circuit. Or, consider the dangers from even a small electrical spark in an operating room permeated with ether. There are industrial hazards where even the discharge from static-charged clothing must be avoided, where personnel wear grounding devices attached to their heels.

While the current is, of course, small, nevertheless a 25-watt loudspeaker may have as much as 1¼ amperes through its voice coil with 20 volts present across the terminals, or when the speaker is equipped with a line matching transformer, as much as 700 volts may be present when the transformer has a high input impedance, with some amperage. In the laboratory, test explosions have actually been developed by these currents.

It is not required that the loudspeaker withstand an explosion caused externally. It is, however, required that when an explosion should occur *within* the loudspeaker that the explosion be confined only to the loudspeaker housing and that no flame or spark be communicated outside of this housing to the surrounding flammable atmosphere. To meet such a requirement, the physical specifications for the speaker are extremely severe, especially when, after a moment's thought, it is considered that the diaphragm must still exercise its impulses upon the atmosphere. The problem, therefore, resolves itself into two aspects: (1) A mechanically strong enclosure or housing surrounding the entire speaker mechanism, or at least the electrical components, and (2) a means of utilizing a relatively fragile diaphragm and permitting it to direct sound waves to the atmosphere and at the same time prevent the passage of spark, flame or concussion to the atmosphere in the event that this diaphragm is ruptured due to explosion within the loudspeaker proper.

The first problem of mechanical design may be considered as more or less straightforward, with all requirements well established by the Underwriters. This calls for the mating of parts on ground surfaces with a surface width of at least ⅜ of an in. The enclosure is called upon to withstand a hydrostatic test of approximately 600 psi and the assembly bolts are required to withstand tensile strength of 135,000 psi. Cast parts must be able to withstand a steam-stability test without evidence of corrosion or disintegration.

Testing Enclosure Strength

The requirements for rupture-proof physical protection can be met by designing an enclosure of adequate thickness and so shaped as to provide the maximum resistance against static and explosive stresses. The loudspeakers are actually tested on the assumption that explosive mixtures had entered the housing in some hypothetical manner. The mixture is ignited and the structure must remain intact during the resulting explosion with no possibility of flame being communicated to the outside atmosphere. Actually, the test is performed with an extremely highly concentrated explosive mixture, many times more concentrated than could normally exist.

The design further requires that fine dust held in suspension in the atmosphere cannot enter any of the seams or crevices of the assembly. These seams cannot be gasketed by any of the conventional material, the best design calling for metal-to-metal fit with accurately machined or ground surfaces in mating conjunction. Dust laden atmosphere, a Class II condition, is more severe than that of Class I, namely, for atmospheres merely containing explosive gases. These dust-bearing atmospheres contain particles so very

Variable porosity barrier enables speakers to resist sudden internal or external blasts but permits normal audio transmission. Operation in explosive dust-laden or gaseous atmospheres requires special construction

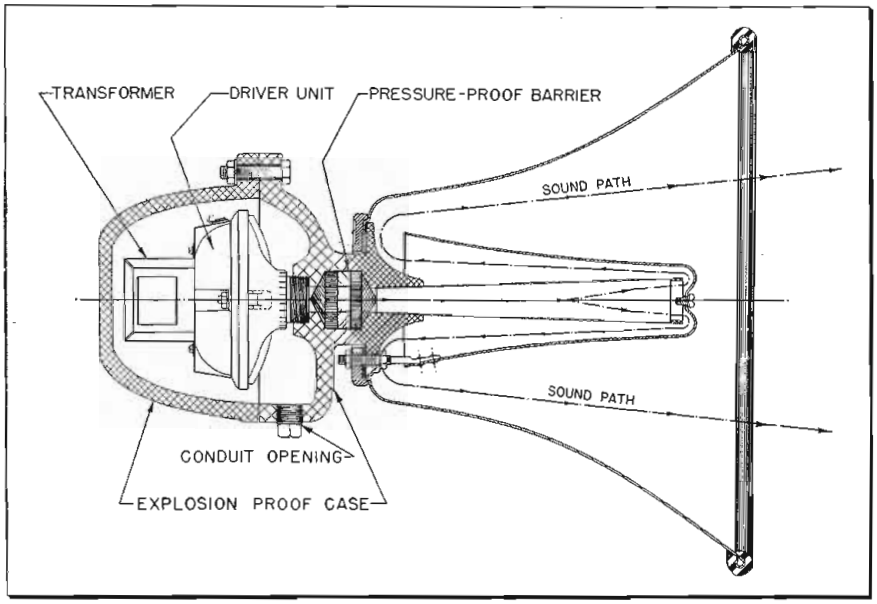


Fig. 2: Cross-section view shows pressure-proof barrier located ahead of driver unit

small, of microscopic dimension, that they can be held in free suspension in the air for days. Under one type of test for Class II conditions, extremely fine magnesium dust is circulated around the loudspeaker for a period of ten (10) days. At the conclusion of this test, there must be no evidence that the dust has entered the enclosure. In fact, it may not even reach the outer surface of the diaphragm from which the sound waves are generated.

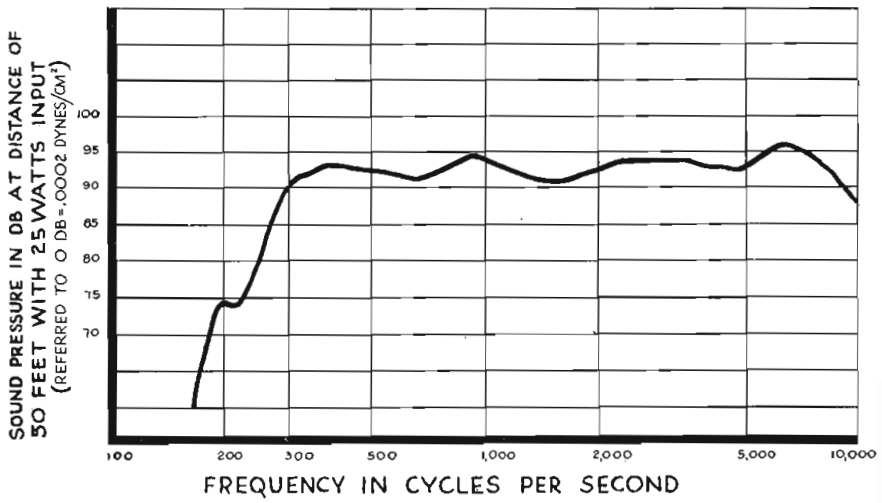
For Class I application, namely, areas which contain gases, the diaphragm side of the loudspeaker could be protected by a series of fine mesh screens on the principle of the Davy Miner's Lamp. This very simply and successfully prevents flame from being conducted through the mesh. However, such a screen is no defense against the entrance of fine combustible solids or particles. Prior to the design of the loudspeaker under discussion, no successful speaker had been built which could meet this requirement.

This requirement was finally successfully met by the use of a "pressure resistance." This is a specially developed barrier installed across the throat of the loudspeaker mechanism directly in front of the diaphragm which has the peculiar property of being relatively porous to small pressures as represented by sound waves, namely pressures under 2,000 dynes per square centimeter. As the pressure of the wave increases, the porosity of the barrier decreases, thus impeding the flow of violent pressures. It is this negative flow character that is comparable to dashpot type governors where movement is obtained with a slight pressure on the piston, but the piston becomes completely braked if the pressure is increased too severely. This pressure barrier has no moving parts; it is not in the nature of a flapper-valve. It is based on a material having a non-linear acoustic resistance characteristic. Its action is instantaneous, since its effective porosity is a function of air particle velocity. It will respond to transients and peak pressures with steeper wave fronts than occur in any type of man-made explosion.

Before the discovery of this particular barrier, attempts to develop a tortuous path arrangement of screens were unsuccessful. It was simply amazing the degree of penetration which the dust particles could achieve through a series of fine mesh screens with their openings staggered. This present barrier acts as a non-linear pressure resistance. The sound transmission loss is a minimum under normal operating conditions of the loudspeaker. However, where the air pressure from either side of the barrier increases beyond the normal value, the transmission loss through this barrier increases at something that approaches an exponential rate, although quantitative data for a detailed hypothesis is not available. At great pressures, as represented by the concussion of an explosion, the emerging pressure on the opposite surface is of a greatly reduced order and is insufficient to cause injury. The effectiveness of the barrier in arresting a shock wave has been repeatedly demonstrated by service gun blasts tests. This barrier effectively prevents the transmission of flame because of its heat conductivity characteristics, on the same prin-

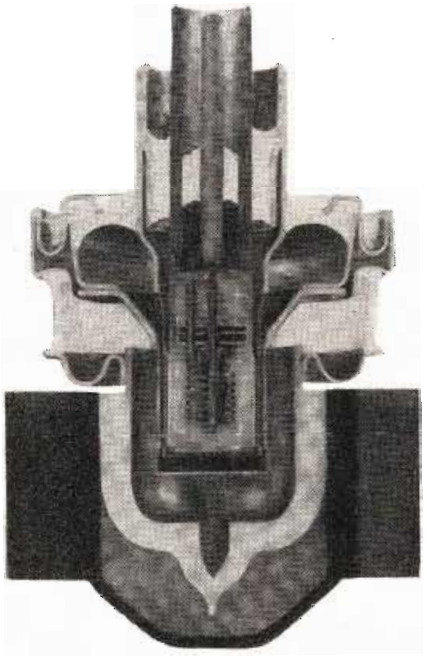
(*Continued on page* 86)

Fig. 3: Frequency response characteristic of model 7201 explosion-proof loudspeaker



Pulsed R-F Tetrode

4X150G using short pulses delivers radar, navigation or communication



Cross-sectional view of Eimac 4X150G

By DONALD H. PREIST,

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IN the September[1] issue of TELE-TECH, a description was given of a pulsed oscillator for 1000 MC and above, using the Eimac 4X150G coaxial tetrode. The superiority of a power amplifier type of transmitter, having the radio frequency controlled by a stable source over the comparatively unstable oscillator, is so great that it seems worthwhile to describe briefly the final stage of an amplifier type of transmitter giving powers of 20-KW peak at around 1000 MC using short pulses.

It is not always recognized even today that the effectiveness of a pulse transmitter, considered as one of a number of transmitters comprising a system, whether used for radar, navigation or communication, depends not only on the power output but on the cleanness of the radiated spectrum. In any pulsed r-f transmission, the side bands involved in the pulse must be accommodated by the apparatus both at the sending and receiving end, just as for any other type of modulation. The bandwidth required to contain the signal will determine the separation between adjacent channels. When an unstable transmitter is used, such as a self-excited oscillator, and especially in the case of the magnetron, spurious side bands may be emitted far beyond the extent of the necessary side bands containing the desired information. This is principally because during the rise and fall of the pulse, frequency modulation is bound to occur, to an extent dependent on the stability of the oscillator. Even with the best power oscillators available, however, the results are very inferior to what can be obtained with a stable amplifier transmitter in which substantially zero frequency modulation takes place during the pulse. Other deficiencies of oscillators such as frequency changes due to changes in supply voltage, tube variations, changes in antenna loading, etc., can generally be taken care of by an automatic frequency control system although this is by no means easy to design, but the frequency modulation at the edges of the pulse can not be eliminated by this method because of the very short time intervals involved. Because of this, it is probably fair to say that the separation between channels can be reduced with amplifiers to at least half the separation that could be tolerated using oscillators with automatic frequency control.

Circuit Analysis

A schematic diagram of the amplifier and its equivalent circuit are shown in Figs. 1 and 2. Coaxial lines are shown as parallel wire lines for greater ease of interpretation. This is similar to the oscillator with the exception that the screen grid bypass capacitor in the amplifier is large, having a reactance approaching zero, whereas in the oscillator, the capacitor had a definite reactance chosen to provide the correct feedback. At first it is easiest to consider the tube inter-electrode capacitances as zero to obtain a simple picture of the working of the amplifier. If this were so, the open-ended line attached to the control grid would be one-half wavelength long or an integral multiple thereof, and the closed line between the cathode and screen grid would have the same length. Assuming for simplicity that the characteristic impedances of the inner and outer spaces were the same, and that the fringing effects at the open end of the intermediate line were negligible, then it is clear that if the circuit were excited from an external source, the r-f voltage between the control and screen grids would be equal to and in phase with the voltage between the control grid and cathode. (See Fig. 9.) Essentially there is a transmission line one wavelength long, folded back, connected to G_1 and G_2 at one end and G_1 and cathode at the other end. Thus, the r-f potential between the cathode and screen grid would be zero, and in this respect the circuit appears to resemble a standard tetrode amplifier circuit at low frequencies. It may also be shown that by varying the relative characteristic impedances of the spaces, and by varying the lengths, an r-f voltage can be made to appear between the cathode and screen grid having any desired phase and amplitude compared with the r-f voltage between the cathode and control grid. This property of the circuit is valuable, as will be shown later.

The effect of the tube capacitances is to shorten the external lines, and if the G_1 to G_2 capacitance is not equal to the G_1 to cathode capacitance, as is usually so, and if in addition the grid to cathode input resistance can not be considered infinite, then it is necessary to arrange the external circuit accordingly, to produce the desired characteristics. In practice this can be done by controlling the relative diameters of the coaxial circuit elements, and also the relative lengths of the line attached to the control grid and the line between the screen grid and the cathode.

It will be seen that the principal feature of this type of amplifier is its inherent feedback, which occurs because the fundamental component of anode-to-cathode current passes through the control-grid to cathode to screen-grid circuit and produces resultant r-f voltages between these electrodes. A moment's consideration will show that this is true even when the net screen-grid to cathode r-f

Amplifier for 1,000 MC Band

peak power of 20 KW, but effectiveness of a pulse transmitter for is also dependent on the cleanliness of the radiated spectrum

voltage is zero, as in the theoretical case outlined above. For this reason, operation of the circuit with the screen grid and cathode at the same r-f potential does not correspond to a standard L.F. tetrode amplifier in which there is zero feedback (apart from that due to control grid to anode residual capacitance).

This kind of feedback may be called "Electronic feedback" in contra-distinction to feedback applied via an external circuit transferring power from the output to the input circuit of an amplifier. In the amplifier under discussion, there is no such external circuit; the feedback occurs via the electron stream. It may therefore be compared to the grounded grid triode amplifier with its inherent negative feedback via the electron stream. In the present case, however, the feedback is controllable.

Magnitude of Feedback

The magnitude and phase of the feedback will depend on the geometry of the circuits, the tube interelectrode capacitances, and the input impedance between control grid and cathode. For most practical purposes it may be controlled over a wide range by the circuit geometry only. An important application of this principle is in the design of amplifiers for TV service, where the bandwidth must be critically controlled. A more complete analysis of the tetrode feedback amplifier with special reference to broadband applications is to be published. In the present case, where the bandwidth is not critical except insofar as the sidebands contained in the pulse envelope must be faithfully transmitted, it is sufficient to observe that the required bandwidth is of the order of 10 MC/P.W.; where P.W. is the pulse width in microseconds. This is for pulses having relatively steep leading and trailing edges. For 5 microsecond pulses the bandwidth is therefore about 2 MC. At 1000 MC and up, there is no problem in achieving such a bandwidth with normal circuits; indeed, the grid losses tend to broaden the input circuit to an extent where positive feedback can be used with advantage.

It is apparent, then, that the coaxial tetrode in a feedback amplifier permits great flexibility in UHF amplifier design. In this type of amplifier, substantial power gains can usually be attained because the bandwidth of the amplifier is a function

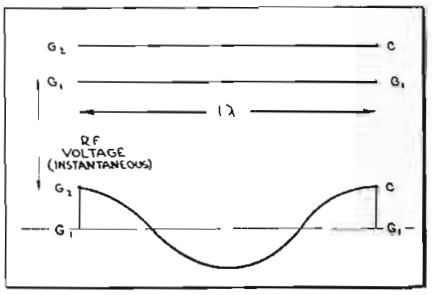
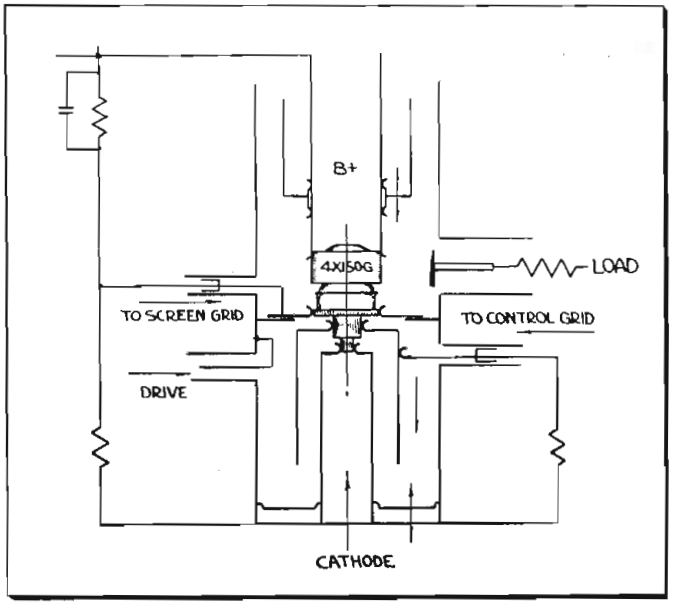


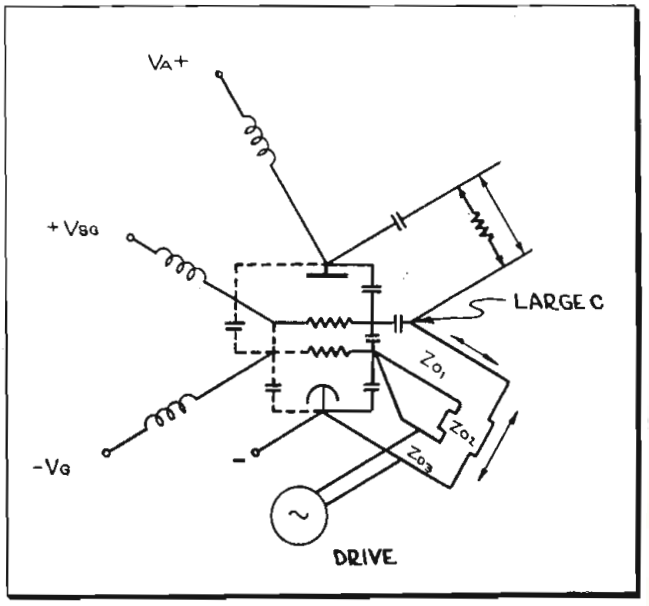
Fig. 3: Element voltage relationships upon the application of external signal

of the geometry of the external circuits, and can be tailored to fit the application desired. Since the gain-bandwidth product of the amplifier is basically set by the properties of the tube used, it follows that if the bandwidth can be adjusted to the minimum tolerable, the gain will be maximized. This is in contrast to other amplifiers such as the grounded-grid triode and the tetrode having the two grids at the same r-f potential, for in both cases these amplifiers will possess inherent negative feedback which may, at UHF, result in bandwidths which are much too large for the purpose at hand, and gains which will be lower than

(*Continued on page* 81)

Fig. 1 (left) Amplifier schematic. Coaxials are shown as parallel wire lines for easy interpretation. Fig. 2 Equivalent circuit





Applications of Radar

Modern high-speed aircraft require quick-acting instruments to warn pilots flying through bad weather areas. Radar's blips on airborne's scopes provided the information

By ***JOHN H. BATTISON,*** *Associate Editor*

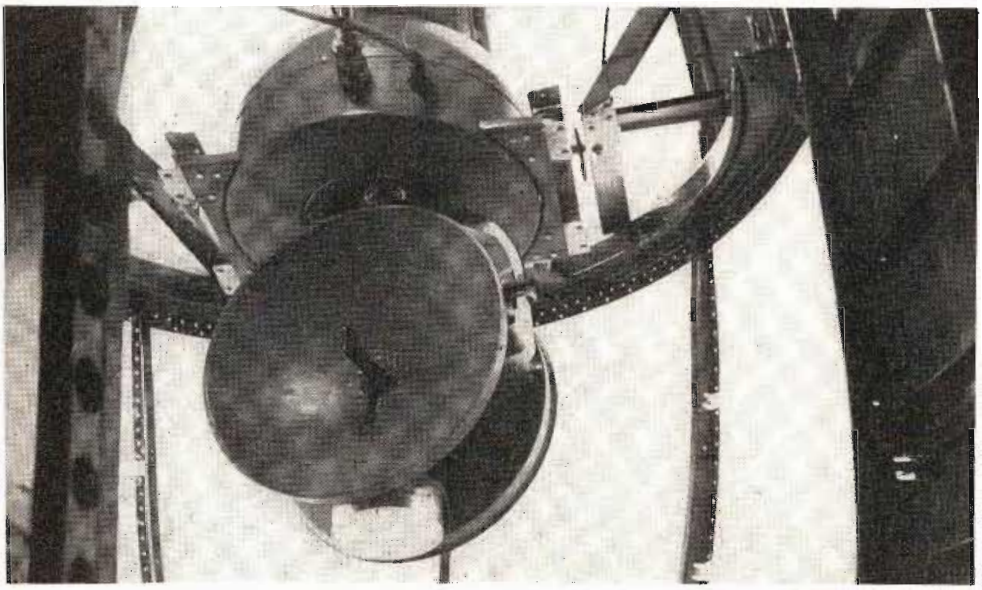
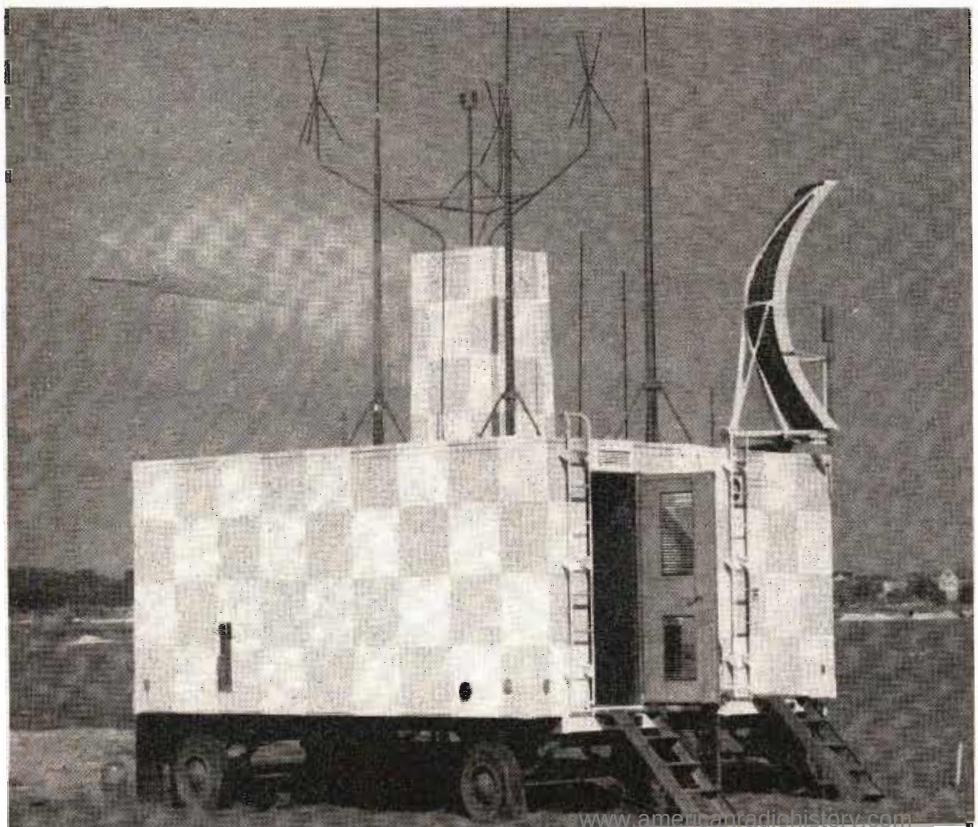


Fig. 1: Allison lightweight radar installation in radar dome of company's B-18 test aircraft

Fig. 2: GCA trailers beside airport runway. Permanent installations are now in use



TODAY pilots, whether they be in military planes or airline transports, are learning to lean more and more on radar for guidance and safety during flight. During the after years of World War II the Provisional International Civil Aviation Organization, later to become the International Civil Aviation Organization, established some plans for the advanced use of radar to increase air safety. Most of the countries which were signatories to that agreement have implemented all, or part, of the programs which they discussed. The United States has probably outlined, and nearly completed, the most ambitious of all the programs.

Both radio as well as radar are included in the ICAO program, but radar's part is growing all the time. Today, radio is used for communications between the control tower and aircraft, long distance communication while in flight between airfields, and for navigational purposes—the old established low frequency ranges with four courses indicated by "A" 's and "N" 's and new very high frequency ranges, or omniranges as they are called, which provide an infinite number of courses for aircraft in flight.

While in flight, it is possible for the crew to receive warning of obstacles ahead, such as high mountains, even heavy storm clouds, or other aircraft in the vicinity. For this purpose collision warning radar is used. Until recently very few aircraft carried equipment of this type because there was none available in sufficient quantities and at a low enough cost. However, in the last few years a number of radar versions have been designed for this work, and among these is the Allison Radar illustrated in Fig. 1.

The use of collision warning radar would have prevented two or three bad accidents which have occurred since the end of World War II when aircraft flew into high mountains when off their tracks in bad weather, or through taking short cuts. A modified version of the collision warning radar also indicates the absolute altitude of the aircraft above ground — the ground over which it is passing, not the height based on the assumed pressure at a point on the ground. In other words, it operates as a collision warning set *vertically* instead of

to Aeronautical Operations

horizontally. Modifications of this are used for automatic flying when connected to the automatic pilot and maintain the plane at a constant height irrespective of variations of pressure, which was not always the case with the older pressure operated gyro-pilots.

Probably the most spectacularly useful piece of radar equipment in use today is located at the airfields (Fig. 2) and is in the form of Ground Controlled Approach (GCA) equipment. Although originally installed as a means of landing aircraft it is now used as a supervisory aid in connection with ILS (Instrument Landing Systems). Located at the runway, its two radar beams scan the surrounding area to check both azimuth (horizontal direction) and altitude of approaching planes.

As normally used, GCA monitors the approaches made by aircraft using ILS and the pilots can ignore the GCA operators' instructions if they desire. But occasionally light aircraft without radio or ILS, or commercial or military planes with ILS trouble make use of GCA and are "talked down" by the operator in the tower. It is beyond the scope of this article to go into details of these episodes, but hundreds of lives have been saved by the radar "blips", as any radar GCA operator can testify.

The cover picture shows Gilfillan Brothers GCA monitoring equipment in use at Los Angeles International Airport. The left scope shows elevation and azimuth on the final approach to the runway, the radar blips marking the aircraft, and the right scope shows the surrounding area. The latter is known as Area Surveillance Radar (ASR) and the former Precision Approach Radar (PAR). Fig. 3 shows a similar scene in daylight with the "Tent" over the screens removed to show the indicators. Naturally in daylight it is more difficult, if not impossible, to see the radar indications clearly.

A variation of ILS referred to briefly earlier in this article is the Lear Approach Control Coupler. This ingenious device feeds the signals from the ILS beams—the Localizer or azimuth signal and the glide slope signal—into the automatic pilot. After establishing contact with the localizer beam about ten miles from the field the pilot switches over to automatic control and sits back controlling the speed of the aircraft with his throttles.

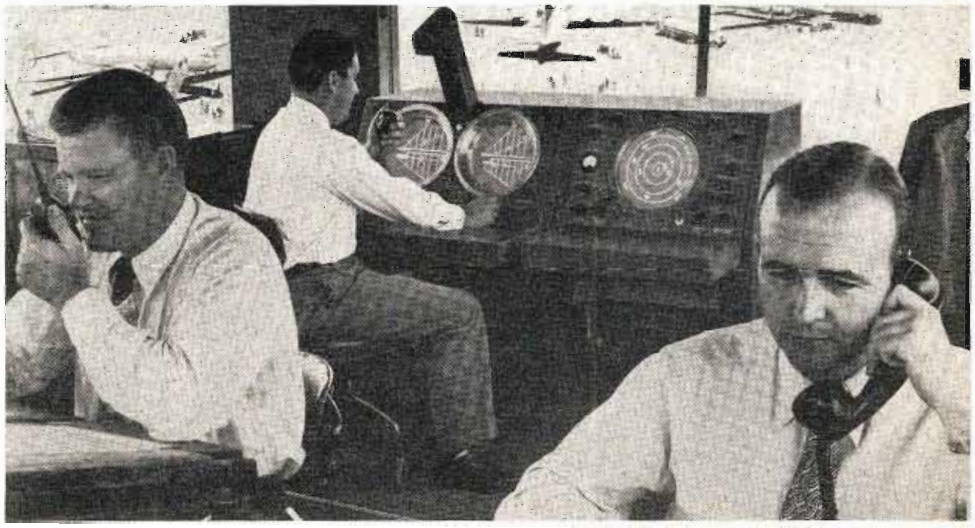


Fig. 3: Control tower at Los Angeles airport with "tent" over Gilfillan GCA removed. Scope at right shows all aircraft within 60 mile radius of field. Moving target indicator eliminates clutter caused by other aircraft and moving objects in the immediate vicinity

One of the problems still exercising some of the best minds in the aviation radar field is the development of a "flare-out" control unit. The landing aircraft approaches the field at an angle of about 3°, but obviously it has to flatten out this slope to bring its path parallel to the ground to assume the proper landing attitude. So far attempts to devise a means of bending the radio signals in this region have not been too successful in producing a smoothly coordinated transition from glide to level flight. Once this problem is satisfactorily accomplished by methods which lend themselves to quantity production and practical routine operations one of the major problems involved in harnessing radar to blind landings will be overcome.

Flight Coupler Controls

Other automatic flight coupler controls are the Sperry, the A-12, and the Bendix Flight Path Control. However, both of these are suitable for heavier aircraft than the Lear Approach Coupler Control, which has been designed primarily for use by single engine fighters and similar lighter type planes.

Distance Measuring Equipment, the latest addition to Radio Ranges solves one of the pilots' most pressing problems, that of determining how far he is from a given location on the earth's surface. It makes use of transmissions in the range 960 to 1200 MC. A transmitter in the aircraft sends out pulses which operate a transponder at the receiving point and transmit a reply to the plane. The time taken for the reply to be received after sending the original pulse determines the distance between the plane and the ground point. The pilot can obtain continuous readings from as many stations as are within range by merely changing the tuning of his equipment. To prevent false information from being transmitted when more than one aircraft are interrogating the transponder replies are sent on different frequencies, and the limit of interrogations which can be handled is about 60 a minute. If more than this number are received they will not affect the receiving mechanism which is controlled by an automatic gate.

A form of radar which was used for precision bombing in World War II and which made it possible for the aircrews to "see" through clouds to bomb targets they could not see by eye also has possibilities for general navigational use, although to a limited extent, since in flight there is not much necessity for the crew to be able to observe the ground. Air navigation today is always performed by a combination of radio, celestial navigation, and dead reckoning based on radio and other navigation information.

CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Edited by John H. Battison

Line Hum Correction

ROBERT V. BEADLES, KLO, Ogden, Utah

WHEN a condition arises so that one side of a balanced line develops a resistive path to ground, an undesirable hum results. An unbalance of ten or twenty thousand ohms usually results in considerable hum.

Sometimes such an unbalanced condition occurs during a rain or sleet storm and will be of only a temporary nature; when the line dries out the unbalanced condition will disappear. Also, sometimes the carbons in the line protectors will become dirty, resulting in an unbalance of a few thousand ohms causing more hum.

A simple device for overcoming this unbalanced condition is in use at KLO. It consists of a 50,000 ohm potentiometer across the line with the arm grounded. When conditions are normal, the arm is set to the midpoint. The shunting effect of the relatively high resistance across the line is negligible. When a line hum develops due to one of the above conditions, the potentiometer is adjusted to the point of minimum hum. For example, if one side of the line develops a 5,000 ohm path to ground (say, due to a wet cracked insulator), the potentiometer is adjusted so that the other side of the line has the same effective path to ground and cancellation of the hum results.

Of course, if one side of the line is grounded through only a few ohms, the above device will be useless. Generally an unbalanced condition due to such variables as a wet line or dirty carbons in the line protector will bring about an unbalanced condition within the correcting range of the potentiometer and still not be so low that the correction loads or short-circuits the line. On many occasions this simple device has been the means of restoring a line for program service.

Line Frequency Lock Indicator for Sync Generator

P. A. WILLIAMS, KPIX, San Francisco, Calif.

A NUMBER of television stations use the RCA TG-1-A Studio Synchronizing Generator. A minor modification of the CRO indicator circuit in this equipment has been found to facilitate the adjustment of the master oscillator tuning and also provides a rapid check on the operation of the AFC locking circuit.

It is usually necessary to set up a test oscilloscope when making these adjustments as the internal indicator is normally used only for checking the frequency divider circuits. However, the internal indicator may be readily used by providing a switch connected to disconnect the ground from one of the horizontal deflection plates of the indicator in one position, and connect this plate to one side of the heater circuit instead. Although the 6.3 v. available are not as great as would be desirable for horizontal deflection it is sufficient for the purpose, and is conveniently available where the wiring change is made.

The normal procedure for setting the master oscillator inductance may be followed: After setting the divider chain for the usual division the AFC selector switch is turned to the "Off" or free-running position and the "H" deflection of the indicator is supplied with 60 cycle ac. With the counter-test switch set on the output of the "3" counter (180:60) a three line pattern will be obtained which will rotate until the output of the divider synchronizes with the 60 cycle line frequency. The slug of T3 is adjusted until this condition is obtained, after which the AFC control may be returned to the usual 60 cycle control position. Because of the physical construction of the sync generator the indicator scope screen may be observed from the rear by sighting through the side of the 3KP1 tube from slightly above the screen. In this position the adjustment of the slug in T3 is readily reached and the results may be conveniently observed.

$$$ FOR YOUR IDEAS

Readers are invited to contribute their own suggestions which should be short and include photographs or rough sketches. Typewritten, double-spaced text is preferred. Our usual rates will be paid for material used.

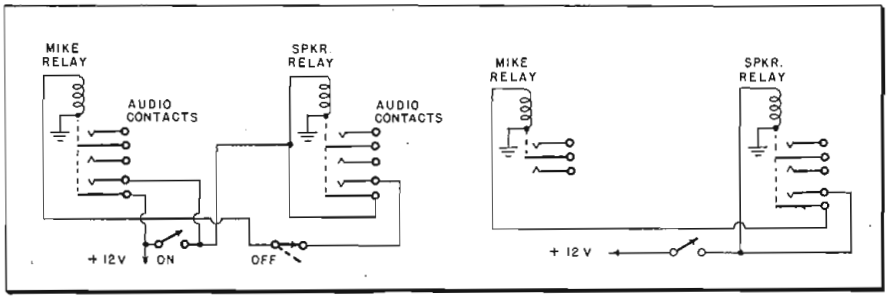
Anti-Feedback Mike Relay Connection

R. S. HOUSTON, 18 Oak Lane, Havertown, Pa.

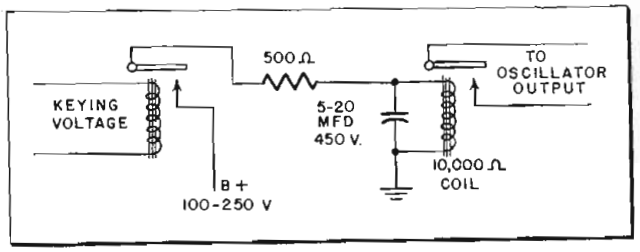
FREQUENTLY when the gain of the announcer's mike is high, or the speaker is loud, there is a tendency toward feedback at the instant the mike is opened. This sometimes occurs when low 12 volt supply is causing sluggish relay operation. If the mike circuit is relay controlled, there are two simple arrangements which can prevent such feedback. The first is intended for use where the "push-on-push-off" type of relay control is used. In this circuit, the "on" button actually operates the mike relay, after the speaker is off. The holding contacts on the mike relay then perform their usual function of shorting out the "on" button. The "off" button is connected in the usual way, in the return lead of the mike relay. This insures that the mike is off before the speaker is returned to operation since the speaker relay is still held in by the mike relay.

The second method makes use of a detent switch. If there is only one set of contacts available, then the circuit shown must be used. Either the hot or the return lead may be connected through the switch. In

Two relay circuits which can be used to prevent speaker feedback in studios



this case, the mike relay is still connected through the extra set of contacts on the speaker relay. However, both relays will be de-energized at the same time, and if the speaker relay is faster, it will operate first. There is less chance of feedback at the end of an announcement because the studio is quiet.



Time delay circuit for time signal keying in independent stations from time clock

Checking Remote Telephone Lines

JACK C. ANDREWS, WHOT
South Bend, Ind.

IN past years, WHOT has on several occasions lost part or all of a remote broadcast because the telephone line was either open or grounded.

This was cured by placing a 10,000 ohm resistor directly across the remote end of the telephone line at the connection block. Then, sometime during the day, the line can be checked by placing an ohm meter across the line at the studio end and reading the line resistance which should be 10,000 ohms. Grounded lines can be checked by reading the resistance from each side of the line to ground. If this is less than several thousand ohms, it would indicate a partial ground on the line. The trouble can usually be corrected well in advance of air time by calling the telephone company immediately.

In our case the telephone company installed the resistors, and it is a standing order that they install a resistor on every line at the time of installation. Even if the local telephone company will not install them, the price of the resistors and labor will be more than offset by the reduction of lost time in remote broadcasts.

Time Signal Keying and Delay

HAROLD H. HOOVER, JR., Chief Engineer, WBSM, New Bedford, Mass.

IN independently operated stations it is often found necessary to have some form of time signal tone on the hour. There are many different ways of doing this but the following method appears inexpensive and foolproof in operation.

Stations which have some form of automatic type setting clocks can utilize the on-the-hour-setting pulse to key this circuit. The problem here is that the pulse usually is not of sufficient duration to give a good tone. If this pulse is not available a push button can be depressed momentarily to key this.

The keying relay required depends upon the value of voltage or current which is to be applied to it. A sensitive relay with a coil resistance of 10,000 ohms is used for the delay relay, and is a typical plate circuit relay with approximately 5 ma. operating current.

Operation is simple; when the keying relay is closed, momentarily, B+ is applied to the sensitive relay closing it and also charging the condenser. When B+ is removed, the relay is held closed by the charge on the condenser until the charge leaks away. The size of condenser user determines the holding time, also the voltage applied. The 500 ohm resistor limits the current and prevents arcing of the relay contacts.

Audio Console Improvements

GENE RIDER, Chief Engineer, WQAM, Miami, Fla.

THE audio facilities of many local and regional stations consist of two, standard, six-channel consoles, one used as a main console, the other for recording and standby. The main console generally has microphones from two studios and an announce booth normalled up to it. Two turntables feeding the main console through push button switches disconnect two mike positions when pushed to TT—which can cause many errors.

In the two console set-up installed at WQAM, we normalled a three mike studio, an announce booth and a two mike studio to the main console. We built external preamps for our four turntables and normalled them to a four channel external mixer. This mixer has the 250 ohm transformer output paralleled with the console mixer's output transformer, providing six mike channels and four turntable channels without patching or switching. An external turntable cue amplifier is bridged across each of the turntable preamplifier outputs through a selector switch.

Instead of making patches or requiring complex switching to connect microphones and turntables to the auxiliary console for recording, we bridged the preamps of the main setup with 20,000-250 ohm, flat-curve transformers, normalling their secondaries to the mike and turntable inputs of the auxiliary console. The studio and announce booth cue speakers are wired up to transfer switches in the control room; one side gives main console cue and speaker knockout, and other auxiliary console cue and knockout. It is necessary to use load resistors with this speaker cue transfer arrangement so that the console's monitor amplifiers look at the connect load at all times.

A logical extension was to put small bridging transformers in the 1620 tube plate circuits of the field OP7 mixers, and bringing out the 250 ohm secondaries to Cannon receptacles installed at the rear of the OP7. On important field broadcasts from theaters where a PA feed is required, instead of feeding an overall bridge from the OP6 line amplifier to the house PA, we feed the bridge outputs of each mike position of the OP7 mixer into another OP7 mixer whose output feeds the house PA. This permits us to have a separate PA mix—putting only the announce and vocal mikes on the house system —an important consideration for the house audience when a low voiced announcer is talking over a loud orchestra. This set up is especially useful on any broadcast where the air announcer has something to say to the radio audience but not to the house PA.

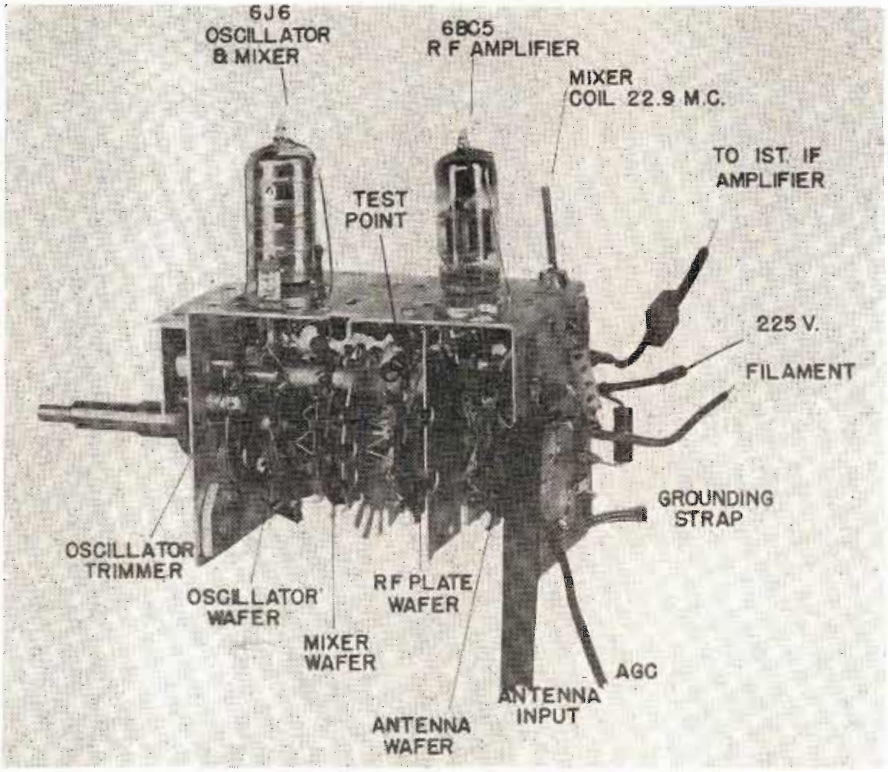
By virtue of being able to parallel two OP7 mixer outputs into one OP6 line amplifier, there is never any need to limit a big broadcast to four microphones. And, with another man and another mixer running the PA side of the show, better air and house shows result.

Prevents Small Components Overheating While Soldering

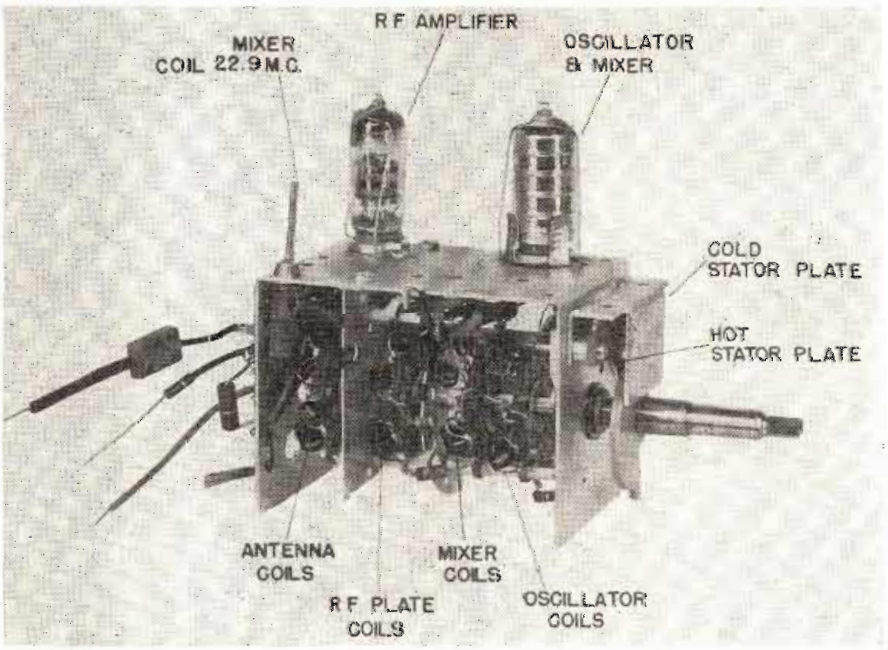
WHEN soldering small resistors or condensors damage to the elements, which sometimes causes changes in the marked values, can be avoided by clipping heavy copper alligator type clips with a copper connector to each wire lug close to the component.

Two-Tube

By CHARLES S. ROOT,
Television Engineering Dept.,
The Magnavox Co.,
Fort Wayne 4, Ind.



Tuner side views show construction and location of switch sections and components



Channel	Sensitivity*	Noise Figure (db)	Image Rejection (db)	I-F Rejection (db)	Interference Rejection (db)
2	15	8	55	83	35
4	15	8.5	55	74	30
6	16	8	54	74	30
7	19	9.5	51	74	37
10	17	10	48	74	35
13	18	11	47	75	37

* Microvolts for 1 volt dc at pix detector

Fig. 1: Performance table indicates the results obtained on a production type tuner

THE well-designed television tuner of today is somewhat unique in that it must provide essentially precision characteristics without the use of expensive precision construction or processes. In general, the tuner which has probably been most successful in providing such precision in an economical manner has been the so-called switch type tuner. The greater inherent precision of such a tuner arises from the fact that optimum circuit conditions may be set up on each and every channel by means of the channel switch. The tuner described here represents an attempt to approach more closely to the maximum performance obtainable in such a tuner by painstaking attention to many small design details without resorting to prohibitively expensive measures.

In this design the 6J6 mixer-oscillator tube is located at the front of the tuner to facilitate location of the oscillator fine tuner and oscillator trimmer at the front end. The oscillator trimmer is adjustable from the front of the cabinet by removing the channel selector and fine tuning knobs.

It was found possible to forego individual front panel oscillator adjustments for each channel in favor of a single trimmer for all channels. In order to do this safely, the fine tuner was arranged to have a relatively large range so that the channel tuning point could, if necessary, change appreciably without getting outside the range of the fine tuner. The resulting tendency toward more critical tuning due to the wider tuning range was countered by using a 300° total fine tuner rotation and a 2.5 in. diameter fine tuning knob located concentrically outside the channel selector dial.

A variable dielectric type fine tuner was used, because of its great simplicity, smoothness of operation, stability and low cost. Despite the narrow tuning range inherent in this type of fine tuner (because of its comparatively large minimum capacity), it was found possible to obtain the relatively wide range necessary for elimination of individual channel adjustments. This was accomplished by using a considerably thicker stamped bakelite tuning cam than usual. Since the minimum air space between each

Television Tuner Design

PART ONE OF TWO PARTS

Electrical and mechanical design features; construction details of new rotary switch type unit now being used by Magnavox

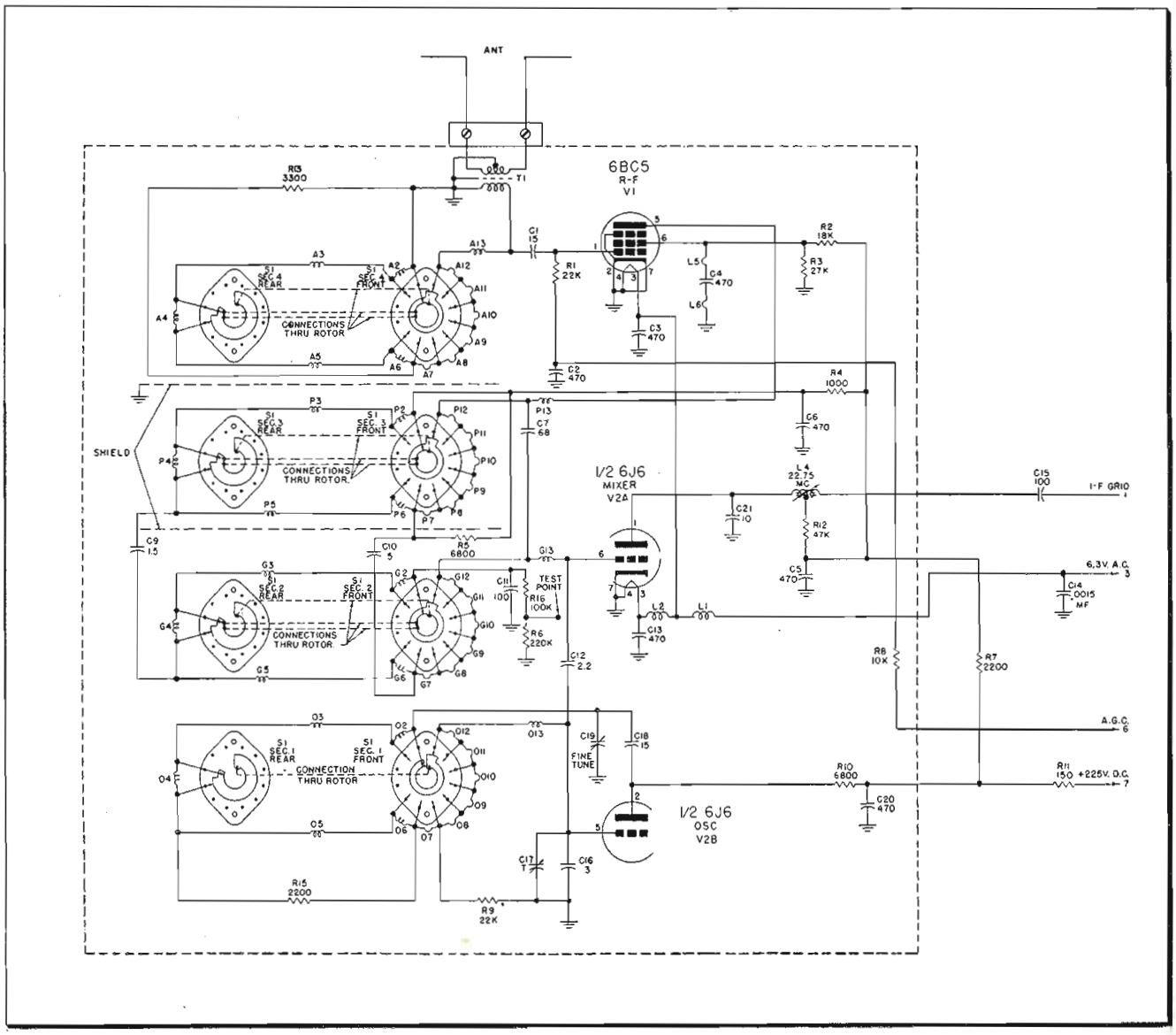
side of the cam and the capacitor plate on each side is more or less fixed for clearance reasons, this results in a bigger percentage of the space between the plates being changed to bakelite when the cam is rotated in between the plates. The thicker cam is also more stable. The area of the plates was then increased to provide the proper capacity value.

Greater accessibility is provided by the use of the standard, low cost 12 position wafer switch. This switch has considerably less diameter than the 18 position switch formerly used, and by the elimination of the space required for the individual oscillator channel adjustments all wafers could be repositioned providing more space between adjacent wafers. The location of the fine tuner on the outside of the chassis also provides more room inside. Inductances, adjustable by bending or spreading, are provided on every channel on every wafer, for ease of precision alignment.

All external power and signal connections to the tuner are accomplished by means of the 2 rear terminal boards. These provisions were kept the same as on a preceding tuner in order to utilize existing test jigs and to facilitate the transition from the old to the new tuner, both in the

(*Continued on page* 70)

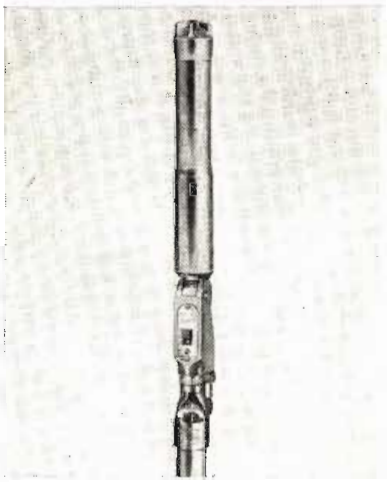
Fig. 2: Schematic diagram of the tuner which uses a 6BC5 as an r-f amplifier, ½ 6J6 as a mixer and ½ 6J6 as the oscillator



New Equipment and Components

Microphone

A moderately priced "Slimair" dynamic microphone combines high fidelity wide-range response with dynamic rugged-



ness and versatility. It requires no closely associated auxiliary equipment and can be used on a stand, in the hand, or overhead. Unique grille head is acoustically treated to prevent wind and breath blasts, without affecting frequency response. Outdoor pick-up is sharp and clear, free of annoying wind rumble. Speakers can work extremely close because accentuated "pop" of percussive sounds is eliminated. Scientifically determined dimensions of the "636" Slimair sound chamber extend bass response to 60 cps. Non-metallic Acoustalloy diaphragm and special magnetic structure provide uniform, peak-free response to 13 KC.—**Electro-Voice, Inc., Buchanan, Mich.**—TELE-TECH

Audio Transformers

In the CFB series of audio transformer, use is made of the latest grain orientated strip wound 'C' cores. Built to the very

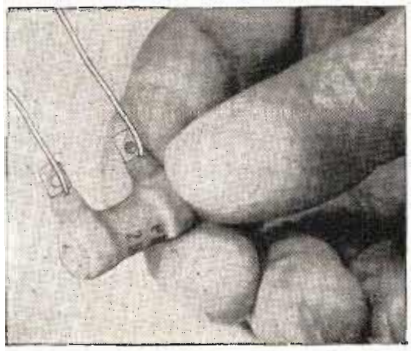
highest standards these components are intended for equipment reproducing the full audio band width with the very lowest distortion of any kind. The characteristics are such that a very considerable amount of negative feedback voltage can be taken from the secondary winding and injected into the circuit at a point three or four stages back. The band width without feedback is 15 octaves. The complete unit is hermetically sealed for all climates.—**Partridge Transformers Ltd., Roebuck Rd., Tolworth, Surrey, England**—TELE-TECH

Timing Motor

For the first time, accuracy in a dc timing motor is unaffected by varying load or voltage applied to the motor. The timing motor is geared directly to a cam which oscillates the motor lever, causing the control contacts to separate and open the motor circuit. When the balance wheel returns from its free swing it releases the escapement lever and allows the control contacts to close thereby applying full voltage to the motor. Thus pulses of full line voltages are applied to the motor at regular intervals controlled by the escapement, and the duration of these pulses is determined by the travel of the motor. This results in a uniform travel of the motor during each time interval, and consequently a constant rotor speed is obtained. The unit always stops with contacts closed, and is reliably self-starting and reversible.—**A. W. Haydon Co., Waterbury 20, Conn.**—TELE-TECH

Power Resistor

PR 5 F Greenohms, 5-watt fixed wire wound resistors with the characteristic inorganic-cement coating, are now avail-



able in the increased resistance values of 8,000, 8,500, 9,000 and 10,000 ohms. Heretofore, the top resistance value has been 7,500 ohms. In the Series AC 10 F or 10-watt Greenohms, the 9,000 ohm value has been added between the 8,500 and 10,000 ohm numbers.—**Clarostat Mfg. Co., Inc., Dover, N. H.**—TELE-TECH

Decimal Scalers

Two new nuclear instruments, recently developed, offer potential users a choice of either a basic Geiger-Muller scaler devoid of nonessential features at an absolute minimum cost (Model 100) or a universal scaler suitable for both Geiger-Muller or Scintillation work (Model 110). Both the models provide true decimal presentation on an electronic scale-of-100 with capacity extended by a mechanical register. A single high voltage control simplifies operation and prevents inadvertent overvoltaging of G-M tubes. Single continuous control is provided from 0-2500 v. Maximum continuous counting rate is 1 KC. Resolution of random pulse pairs is better than 7 microsec. These instruments are small and light and weigh approximately 18 pounds. Model 110 universal scaler includes a positive or negative high voltage supply selectable by simple internal switch, thus permitting use with either G-M or scintillation detectors. It also includes a built-in predetermined counter with presettable scaling factors of 100, 200, 400, 1000, 2000, 4000, 10,000 and 20,000.—**Berkeley Scientific Corp., 2200 Wright Ave., Richmond,** Calif.—TELE-TECH

FM Communications Tuner

A new FM communications tuner has been designed for ultra high frequency reception. It is available in several fre-

quency ranges and is ideally suited for reception of police, fire, taxicabs, aircraft, and civilian defense services. Among the frequency ranges available are 152-162 MC. The entire unit is housed in a compact box 5¼ x 3½ x 5¼ in.—**Gonset Co., Burbank, Cal.**—TELE-TECH

Power-Tetrode

For high-power TV through channel 13, the 4W20000A power tetrode is recommended. Among the features of the 4W20000A are a unipotential cathode of thoriated tungsten heated by electron bombardment, a water-cooled anode rated at 20 kw dissipation, and coaxially arranged terminals.—**Eitel-McCullough, Inc., San Bruno, Cal.**—TELE-TECH

Electronic Standard Cell

A new electronic standard cell for laboratory use provides a dc reference voltage stable to 0.25%. Output ripple on the

low current models is less than 0.01%. Stability is maintained under wide temperature range operation and under continuous, long term use. The electronic standard cell is ruggedly constructed and contains JAN-type components. It is immune to damage by momentary short circuits and is unaffected by temperature changes. The unit is for use with self-balancing potentiometers, wire strain gauges, recording oscillographs, resistance thermometers, and other applications which require a stable dc source. Operation is from an ac source; 90 to 130 volts, 50 to 500 cps.—**Hastings Instrument Co., Inc., Super Highway at Pine Ave., Hampton 10, Va.**—TELE-TECH

Rotary Switches

Long-life rotary selector switches are now available with up to 6 poles, 15 positions per pole, on each deck. This large number of poles and positions on each deck is due to patented "knee-action" type of rotor arm. "Knee-action" insures low contact resistance and uniform contact pressure over the life of the switches. Silver alloy contacts and rotor arms are used on all units.—**Daven Co., 191 Central Ave., Newark 4, N. J.**—TELE-TECH

for Designers and Manufacturers

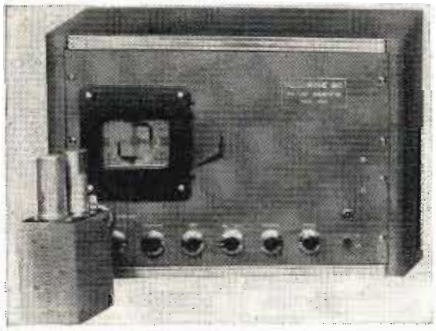
Power Triode

The ML-5682/380, designed for super-power applications, can be used in high-power AM, FM, and low-band TV broad-

casting, particle accelerator amplifiers and oscillators, and dielectric and induction heating. It is ideally suited to cavity operation and its low plate impedance makes it advantageous for broad band service. Design features include high-conductivity, gold-plated Kovar glass-to-metal seals, sturdy electrodes, integral anode water jacket, quick-change water coupling and high-conductivity heavy wall copper anode capable of dissipating 100 kilowatts. The grid can withstand unusually high heat dissipation, contributing to maximum stability of tube performance and circuit operation. The cathode is a stress-free self-supporting thoriated-tungsten filament. Maximum ratings for Class C CW Service at frequencies up to 30 MC include 16 KV dc plate voltage, 20 Adc plate current and 300 KW plate input. Higher frequency operation is permissible with lower values of plate voltage and input.—**Machlett Laboratories Inc., Springdale, Conn.**—TELE-TECH

Video Picture Generator

Model 300-A flying-spot low-cost television picture generator uses 3 x 4 in. slide transparencies and negatives. De-



signed to supplement or replace monoscopes, camera chains in TV stations, laboratories, factories, schools and colleges, it is completely self contained with regulated power supplies. Resolution is greater than 500 lines and it meets RMA picture quality specifications. Operation is on standard driving pulses, off-the-air sync, or on self contained sweep generators. Unit is supplied with driven sweep 10 in. monitor.—**Telechrome, Inc., 88 Merrick Road, Amityville, L. I., N. Y.**—TELE-TECH

High Voltage Capacitors

Designed specifically for high voltages, high temperature applications in television receivers and vibrator power supplies, a new line of 26 capacitors in working voltage ranges of 3000, 5000, 6000 and 10,000 volts dc have been developed. The new capacitors, rated for dependable operation up to 85°C., are housed in a molded phenolic casing which is humidity resistant, non-inflammable and mechanically sturdy. Corona has been minimized in the electrical design and a specially treated mineral oil has been utilized as impregnant. Stamped with the rated voltage and capacity, each capacitor has a tolerance of plus or minus 20%.—**Philco Corp., Philadelphia, Pa.**—TELE-TECH

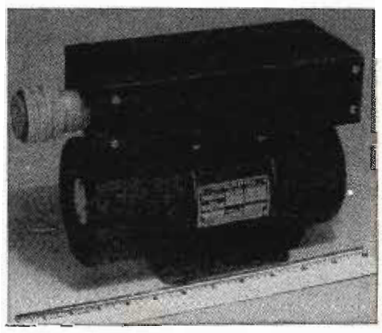
Noise-Suppression Filters

Thoroughly rugged noise-suppression filters offering high attenuation and current ratings are housed in hermetically-

sealed metal cases smaller than previously available units. Primary application is in r-f noise-suppression work in military or commercial aircraft, and in vehicular dc applications or battery or power line dc filters for shielded room applications or specialized equipment. Capacitor sections utilize Aerovox metallized-paper dielectric and include "fault-isolation" characteristics for protection against surge voltages above rated values. Filter chokes are of newest design, embodying high impedance to rf currents and low dc resistance, thereby assuring minimum heating and low voltage drop.—**Aerovox Corp., New Bedford, Mass.**—TELE-TECH

Inductor Alternator

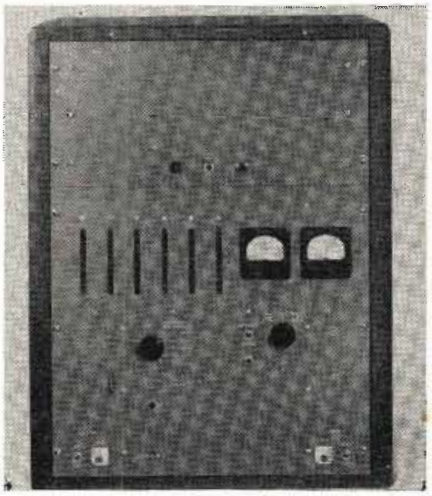
An improved design of the Carter inductor alternator, first introduced about a year ago, has just gone into produc-



tion. The filter unit has been placed on top of the frame, instead of the base. This lowers the center of the gravity of the entire unit, and gives a lower overall height due to the more compact design. It also requires a smaller mounting area, and makes the connector receptacle more accessible. It provides a simple answer to the problem of obtaining mobile high frequency ac power from dc source. AC output is obtained from the rotary inductor principle. A magnetic field is established by the dc stator windings. Higher flux densities prevail at the teeth of the rotor, lower densities between. These variations cause pulsations in the field as the rotor turns, inducting the desired frequency output voltage from the ac inductor coils.—**Carter Motor Co., 2644 N. Maplewood Ave., Chicago, Ill.**—TELE-TECH

Frequency Counter

The Model 524A frequency counter measures directly and displays for direct reading the unknown frequency. It is



not necessary to employ any complicated equipment as is usually required, such as a secondary standard, multipliers, dividers, interpolation oscillators, oscilloscopes, etc. The unknown frequency is simply connected to the input terminals of the 524A and the measured frequency is automatically displayed on the front panel. Any frequency from 0.01 cps to 10 MC may be measured. The Model 524A may be used to measure rapidly and accurately the frequency of transmitters, crystal oscillators, supersonic audio and subaudio oscillators. The counting rate is fast enough so that adjustments may be made during the count process and the effect of the change is immediately reflected.—**Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Cal.**—TELE-TECH

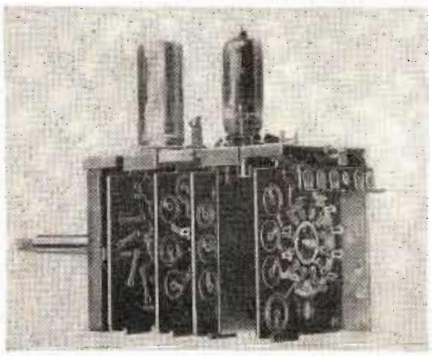
Powershear

The Di-Acro Vari-O-Speed Powershear offers an entirely new theory in the high speed production shearing field as its de-

sign and rugged construction provide full capacity continuous shearing within its entire speed range of 30 rpm to 200 rpm. The cutting cycle of this precision shear can be quickly adjusted to the fastest speed at which the operator can feed the material for any given shearing operation. Speed of the shearing stroke for both continuous and single cycle operation is positively controlled with the speed control handle conveniently located at the operator's left. Cutting range extends from the lightest of materials in plastics, fibre, mica, leather and rubber to heavy gauges of aluminum, cobalt steel, chrome molybdenum, leaded brass, stainless steel and many spring tempered materials.—**O'Neil-Irwin Manufacturing Co., 348 Eighth Ave., Lake City, Minn.**—TELE-TECH

Television Tuner

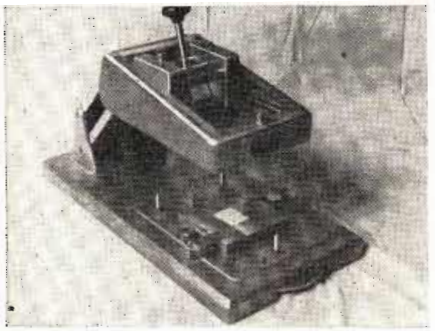
Completion of development work on a high quality television station selector which has an intermediate frequency



output of 41.25 to 45.75 MC has been announced. The tuner is a rotary switch type employing inductances for each of the 12 channels (2-13). Inductances and wiring are die stamped on low-loss bakelite wafers. Tuned circuits are employed in the input, r-f, oscillator and mixer circuits. The r-f stage uses a 6BC5 tube while the mixer and oscillator use a 6J6, resulting in a high sensitivity unit. Specifications and quotations are available upon request. Samples are available to responsible manufacturers. **—Franklin Airloop Corp., 43-20 34 St., Long Island City 1, N. Y.**—TELE-TECH

Screen Process Printer

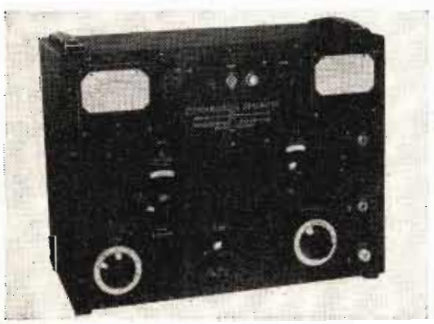
Model 30 screen process printer is a machine that automatically applies conductive patterns to flat work pieces up



to 3¼" x 3¼" dimensions. This machine is invaluable for precision work in printed circuit silver paint deposition, resist application for "etched" wiring, ceramic capacitor silvering, etc. The machine is operated by two simple hands motions. A standard work carrier plate is furnished with each machine; plates for special form factors also are available. Massive aluminum-alloy, precision-type castings are used for the base and frame, combining lightness with strength and rigidity.—**Mech-Tronic Equipment Co., P.O. Box 510, Silver Spring, Md.**—TELE-TECH

Signal Generator

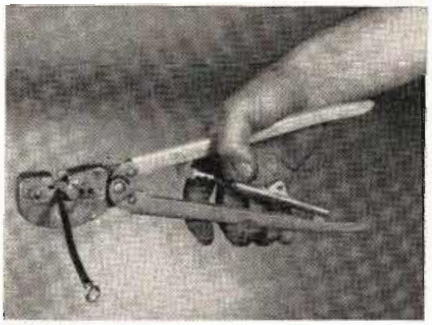
Model 82 signal generator comprises a low frequency oscillator covering the range from 20 cps to 200 KC and a high frequency oscillator covering the range from 80 kilocycles to 50 MC. The low frequency oscillator provides an adjust-



able output from 0 to 50 volts, across 7500 ohms, which may be used to amplitude modulate the high frequency oscillator. With the high frequency oscillator, measurements from 0.1 microvolt to 1 volt, across 50 ohms, can be made. Modulation is continuously variable from 0-50% from 20 cps to 20 KC from internal variable oscillator or external source. Harmonic output is less than 1% from 20 cps to 20 KC; 3% or less from 20 KC to 50 MC. This unit will be demonstrated at the National Conference on Airborne Electronics at Dayton, Ohio, May 23-25.—**Measurements Corporation, Boonton, N. J.**—TELE-TECH

Hand Tools

The possibility of faulty electrical connections resulting from operator fatigue or carelessness is eliminated when a



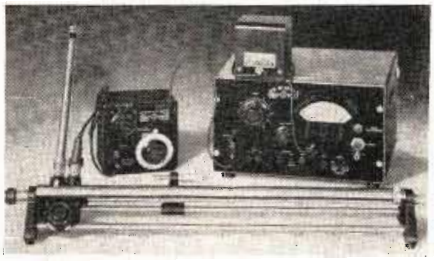
hand crimping tool with "Certi-Crimp" ratchet is used for the installation of solderless wire terminals. Feature of the new tool is a simple device that prevents re-opening for admission of a new terminal until it has been completely closed for a perfect crimp on a previous terminal. This tool will be displayed at the National Conference on Airborne Electronics, Dayton, Ohio, May 23-25.—**Aircraft-Marine Prodncts, Inc., 1523 N. 4th St., Harrisburg, Pa.**—TELE-TECH

VHF Receiving Equipment

Designed for airborne operation on the VOR, Runway Localizer (or VAR) VHF facilities, type 15 c VHF receiving equipment makes use of a tunable receiver. It is CAA Type-certificated and designed to meet the rigid requirements of the military, as well as civilian users where price is not a factor. This equipment will be exhibited at the National Conference on Airborne Electronics at Dayton, Ohio, May 23-25.—**Aircraft Radio Corp., Boonton, N. J.**—TELE-TECH

Slotted Line

Type 8740LB slotted line is a moderately-priced, precisely constructed slotted line for impedance and standing-wave



measurements at frequencies between 300 and 4500 MC. Probe travel distance is 50 cms, and accuracy of probe coupling is ± 2½% or better. Probe carriage incorporates a built-in crystal detector and provision is made for tuning the crystal with an adjustable stub. Standing-wave ratio of terminal connectors is less than 1.02 at 1000 MC. This slotted line will be shown at the National Conference on Airborne Electronics at Dayton, Ohio, May 23-25.—**General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH

REPORTS

on additional equipment and components appear on page 79

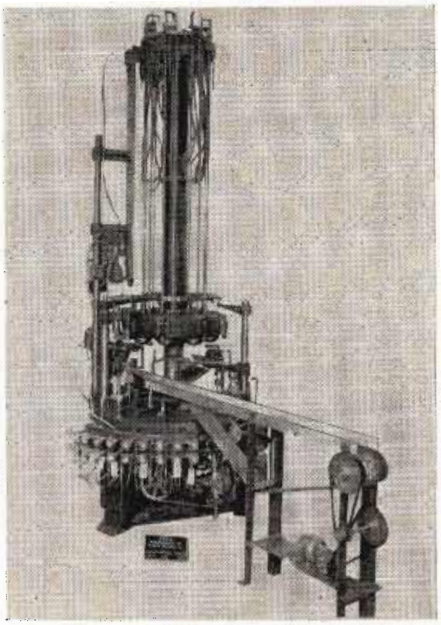
GCA Talkdown Trainer

With a degree of accuracy comparable to that of the actual equipment, the GCA talkdown trainer gives realistic

training to pilots and GCA Controllers in the techniques involved in the use of the system. In the actual GCA system, the plane on approach is tracked by precision radar, which determines its elevation, azimuth and range. This data is electronically compared with the Ideal Glide Path, and the amouut of deviation is displayed on elevation and azimuth error meters, calibrated in feet. An approach controller, who watches the meters, instructs the pilot as to the course changes necessary to return him to the Ideal Glide Path. The talkdown trainer duplicates the conditions of an actual approach with three units that are designed around a flight simulator. They are: a GCA controller's position, a Simulated Aircraft Controller, and an Error Computor and Glide Path Recorder. This unit will be exhibited at the National Conference on Airborne Electronics at Dayton, Ohio, May 23-25.—**Division of Bendix Aviation Corp., Baltimore, Md.**—TELE-TECH

Bulb-Blowing Machine

A new automatic bulb-blowing machine incorporates motor-operated cutting knives to replace old-style flame



cutting in the interests of more positive and faster production. New, improved chucks reduce the waste of tubing ends. In order to increase the ease of adjustment during the operation of the machine, a new type airblow system has been installed on the lower part of the unit. For those manufacturers who so specify, the machine is equipped with automatic tube feed elevator which returns the feeding chuck automatically to loading position. Aside from hand feeding of four foot lengths of glass tubing, all other operations are automatic. Allowing for speeds up to 2400 per hour, bulbs can be blown into a mould of any feasible design or shape. Bulbs can be blown up to 2½ in. o.d. by 5½ in. overall length, including stem or tubulation. **—Kahle Engineering Co., North Bergen, N. J.**—TELE -TECH

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. . . molded general purpose connectors from three to fifty contacts, or more . . . to meet the requirements, are available in low loss mica, or melamine for chassis mounting or assembled with cap for cable applications, terminals gold or silver plated. Designed and made of materials as desired to Armed Forces requirements. *Consult Cinch.*

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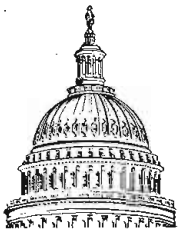
WASHINGTON
News Letter



Latest Radio and Communications News Developments Summarized by TELE-TECH's Washington Bureau

PERMANENT TOP-POLICY BOARD—Creation of a three-member permanent Telecommunications Advisory Board to formulate a national telecommunications-radio policy in such fields as frequency assignments and the operation of radiocommunications systems by government agencies was the only basic, definitive recommendation of the temporary President's Communications Policy Board, headed by West Virginia University president and former FCC Commissioner, Dr. Irvin Stewart.

GOVERNMENT FREQUENCIES—Most important function of proposed permanent Telecommunications Advisory Committee would be to establish a system of justification of frequency assignments to federal government agencies and to supervise the division of frequency space between government and non-government users. This subject has been a source of controversy, especially with the recent huge growth of television, and the editors of TELE-TECH soon after the creation of the Stewart Board strongly advocated the principle that Federal government agencies should be compelled to justify their frequency requirements and assignments, just as civilian radio and television services do before the FCC.

FREQUENCY POLICIES—The President's Communications Policy Board stated most emphatically that the present setup, including the FCC's operations, no longer is adequate to resolve the frequency problems of the management of the spectrum, and the current difficulty from television's requirements emphasizes this inadequacy. The Federal government's share of the spectrum is large, the Board cited, and government radio services must have the most adequate justification and careful management to attain the greatest benefits of the spectrum space assigned them.

TWO MONTHS OF ALLOCATION HEARINGS—At least two months of hearings on the city-by-city television station proposals in the 65 to 70 UHF channels, to be added to the 12 existing VHF channels, are in prospect for the FCC with the proceedings commencing May 23. The Commission in this allocation plan for television, even though it has suffered some criticism from television broadcasting engineering circles as not too realistic, is aimed to provide the nationwide distribution of nearly 2000 additional video stations in some 1200 communities of the United States. The FCC proposes in the new TV-UHF allocation plan to reserve "indefinitely" 10% of both VHF and UHF channels for non-commercial educational television stations; to unfreeze as soon as possible VHF-UHF channels in the nation; where possible to grant existing VHF stations substantial power increases; and generally to lift the UHF freeze in the country.

COLOR TV MAY BE LANDMARK CASE—The FCC color television decision, approving the color telecasting method of Columbia Broadcasting System, may be a landmark determination in American jurisprudence. With one exception, a recent National Labor Relations Board case, the U. S. Supreme Court has always regarded the factual decisions of a Federal administrative or regulatory agency as "sacrosanct" or inviolate as an expert judgment of a government body which could not be upset or overruled by a court. In the FCC case, three Supreme Court Justices—Black, Frankfurter and Jackson—in their questioning cast doubt upon the court's ability to review such a technical matter. After the argument between the Radio Corp. of America, CBS and the U. S. Solicitor General, there was some speculation that the Supreme Court felt the case should be remanded to the special three-judge Federal tribunal in Chicago which did not pass on the merits and disadvantages of the CBS color TV method and the FCC basis for the latter's sanction.

HUGE MILITARY LOAD AHEAD—While during the first two months this spring the radio-television manufacturing industry had to curtail employment due to shortages of critical materials and lack of finalized military procurement orders, the situation of production contracts by the armed services was slated to become considerably brighter this month and the remainder of 1951. As previously cited in TELE-TECH'S Washington Column, the flow of procurement awards to the industry will have been well completed and the orders from prime contractors down to subcontractors of components and parts will keep our industry extremely busy.

LITTLE CIVILIAN DROP IN '51—An illustration of one military service, the Army Signal Corps, exemplifies the large flow of imperative radio-electronic equipment—a total of $2.3 billion for the current fiscal year ending June 30 with much of that amount for our industry. Then the prospect of $70 billion procurement for the armed services in the 1952 fiscal year definitely means a tremendous flood of military orders. The biggest production impact will come early next year (1952), Mobilization Director Charles E. Wilson has forecast, but the output of radio receivers will be little changed this year with only a slight drop in television sets.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

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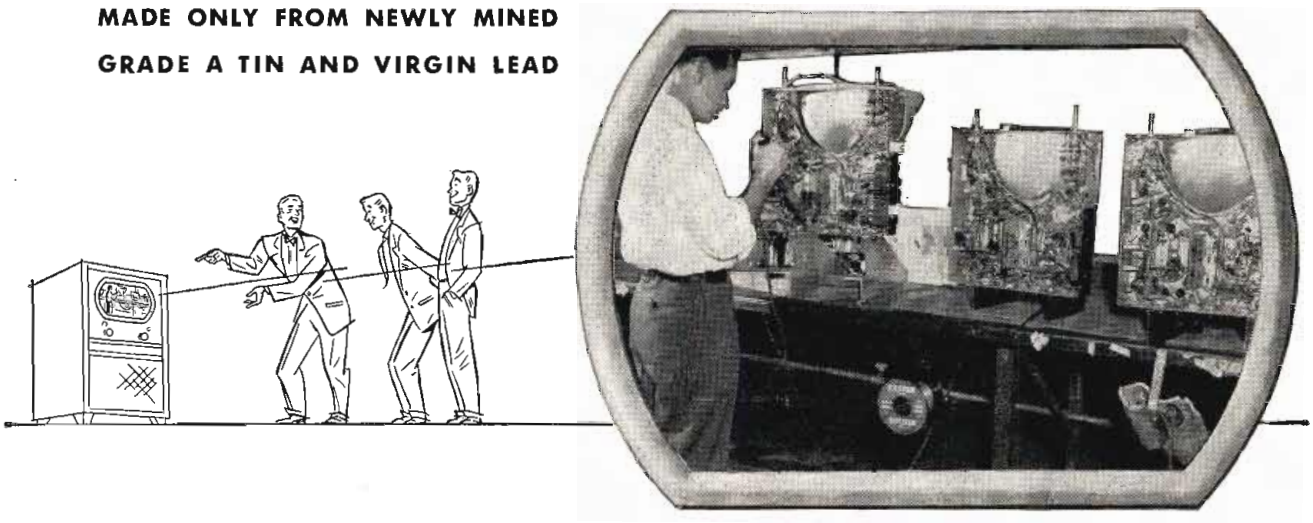

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TELE-TECH's NEWSCAST

Progress Report on Empire State Antenna

The latest reports on the five TV station antenna construction situation indicate that it will be about another three or four weeks before the first of the five occupants commences using the new facilities. WNBT (channel 4) will use the super turnstile on the top at that time. Following WNBT, will be WJZ-TV, since it is the other previous occupant. The other occupants may be expected to begin operating in descending order of position on the tower; WPIX, WABD, and WCBS-TV. According to the engineers' estimates, about three to four weeks of *working days* will elapse between each inauguration. But due to the weather conditions at the top of the tower it may take much longer in terms of *lapsed* time. For example since the first of the year there have been 66 normal working days—of these only 21 were fit for work on the tower due to weather.

The five television antennas are now ready, in fact the superturnstile for channel 4 is installed. The remainder will be shipped from RCA at Camden as they are required for erection since the small amount of space in the tower makes storage rather impracticable.

An interesting fact is that the roots of the tower extend twice the height

Steelwork as seen from tower base

of the tower itself into the top of the building. The maximum sway of the tower, plus building, when loaded in a 100 mph. wind is 30 to 36 in. But there is a safety factor of 3 to 4 so that it is not in the slightest degree hazardous. It is understood that about $10,000,000 of insurance is carried by the various parties concerned with its use.

Although this is the first installation of its kind which has a single support for five antennas the principle is not new. Mount Wilson in California where seven TV stations have their antennas very close together provided a test place for the electrical considerations. July 1st was quoted as the latest probable date for operation to commence from the new tower with WNBT breaking the ice.

FM in 18% of Radio Sets

Eighteen percent of all home radios and ten percent of all TV receivers produced in 1950 contained FM reception facilities, the Radio-Television Manufacturers Association reported.

Statistics Chairman Mansfield's estimates show a total of 1,471,900 radio receivers with FM circuits produced in 1950. This compares with an estimate of about 1.000,000 such sets manufactured in 1949. TV receivers capable of FM reception numbered 756,120, or ten percent of the entire television set production in 1950 of 7,463,800, RTMA said. This compares with 500,000 TV sets with FM facilities produced in 1949.

The new RTMA industry estimate showed a total of 8,174,600 home radios, excluding portables, of which 86 percent represented straight-radio table models.

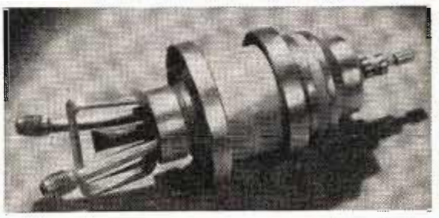
TV Cameras for UN

The Marconi Wireless Telegraph Co. of England has been chosen by the United Nations to supply three image orthicon cameras for the new Manhattan headquarters. The recent series of telecasts from the UN have been produced by two earlier models which were on loan from Marconi's. The complete camera chains have been feeding the US networks with excellent pictures, thus proving the interchangeability of the British television equipment when used on US standards. A camera of this type recently telecast a view of London from 1,000 ft. during a BBC remote pickup.

Herold Defense Facilities

Herold Radio & Television Manufacturing Corp., 12-30 Anderson Place, Mount Vernon, N. Y., has announced the availability of a new booklet describing its production and plant facilities. History of key personnel and previous government contract experience is outlined in detail.

NEW UHF CERAMIC TUBE



The new Central Electric type GL-6019 is an all-ceramic and metal power tube, capable of operating up to and beyond the top frequency (890 MC) of the proposed UHF television channels. The use of ceramic in the new tube minimizes the problem of high-frequency losses and makes envelope cooling problems less difficult compared to glass tubes. Other features include: a gold-over-silver plating on all external metal parts provides low-loss electrical contacts; concentric ring-seal construction enables the tube to be easily inserted or removed from its cavity; water pipes are so arranged that connections can be made outside the r-f cavity. Maximum ratings of the GL-6019 at synchronizing level for Class B TV service include: dc plate voltage, 4,000 volts; dc screen voltage, 600 volts; dc plate current, 700 ma; plate input, 2.5 kilowatts; plate dissipation, 2 kilowatts.

Coming Events

April 30 - May 4 — Society of Motion Picture and Television Engineers, 69th Semi-Annual Convention, Hotel Statler, New York City.

May 21-23—Electronic Parts Distributors Conference and Show, Stevens Hotel, Chicago.

May 23-24—American Society for Quality Control, Fifth Annual Convention, Hotel Cleveland, Cleveland, Ohio.

May 23-25—National Conference on Airborne Electronics, Dayton Section of IRE, Dayton Biltmore Hotel, Dayton, Ohio.

June 18-20—American Society for Testing Materials, Annual Meeting, Atlantic City, N. J.

June 21-22—Ninth Annual Conference on Electron Devices, Sponsored by IRE and AIEE, University of New Hampshire, Durham, N. H.

June 25 - 29 — AIEE Summer General Meeting, Royal York Hotel, Toronto, Canada.

June 28 - 30 — Institute of Navigation, Annual National Meeting, Hotel New Yorker, New York City.

August 15-18—Associated Police Communication Officers, 1951 Conference, Everglades Hotel, Miami, Fla.

August 22-24—7th Annual Pacific Electronic Exhibit, 1951 IRE Western Convention, Civic Auditorium, San Francisco, Calif.

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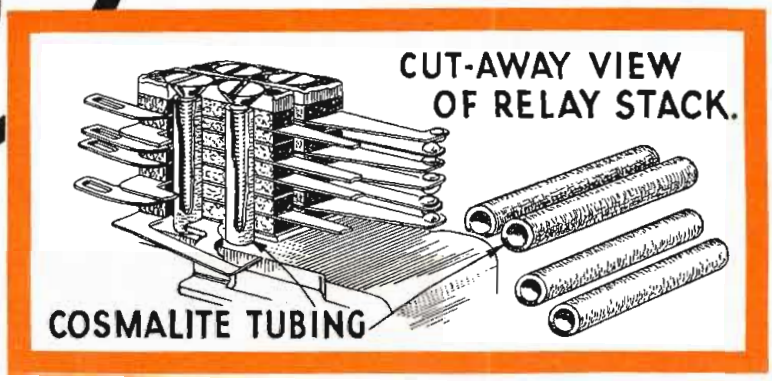

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FM Multiplexing Tests

William Halstead, president of the Multiplex Development Corp., has announced that the recently carried out series of tests of his new system of multi-programming has succeeded in providing up to 18 channels on a standard FM channel.

The multiplex system operates on the principle of superimposing a subcarrier for each additional service required on the carrier. For general use these subcarriers are approximately 20 KC. The engineering report recently filed with the FCC by Murray Crosby Laboratories on behalf of Multiplex Development Corp. showed that with 90% modulation applied to the main carrier and a relative modulation of 10% for the subcarriers a signal-to-noise ratio of 50 db or better could be obtained within the 1000 microvolt contour. There is negligible distortion or other interference to the main program when the subcarrier is operating, and the noise level even during subcarrier modulation periods was down to 75 db below 90% modulation.

Economically, this method of operation is very attractive to the FM station operator. For example, a normal broadcast program could be transmitted for the use of home receiving installations; at the same time background music could be provided on one of the subcarriers, and storecasting or some other similar captive audience type of program could be carried by the other subcarrier. These two latter services would pay for the deficit operation of the broadcast FM station, and remove the existing stigma in the eyes of the FCC from programs which use supersonic signals to activate volume controls to delete commercials.

An FM station could program its main carrier without commercials, if its source of revenue were provided by the auxiliary subcarrier channels.

Field tests have been conducted in the New York Area over the facilities of the old WGYN station at 70 Pine St., New York City. For the purpose of the tests the station operated under the experimental call letters KE2XKH. Multiplex Corp. has a petition pending before the FCC to set up a rule-making procedure which would allow FM stations to use this new system.

Crest Transformer Rep

Crest Transformer Corp., Chicago, has announced the addition of G. G. Willison Co., 2030 Harold St., Houston 6, Texas, to the Crest sales staff as representatives for Louisiana and Texas.

TONE ARMS— STYLI

...still available
...still tops

PRODUCT shortages? Sure. But there's *never* a letdown in the *quality* of G-E phono-accessories . . . and the items shown above are still available to manufacturers, jobbers, dealers and servicemen.

The G-E tone arm is built to accommodate the famous G-E Triple Play Cartridge (also in stock). It's equipped with ball bearings for smooth lateral movement . . . special light weight alloy keeps the arm mass to a minimum . . . stylus pressure is *constant at 6-8 grams for all three speeds* to reduce record wear. Plainly marked selector knob projects through the top of the arm—a single twist places either stylus in playing position.

General Electric's high compliance Baton Stylus with diamond or sapphire tip is unsurpassed in its field. Stock it in quantity—give your customers listening quality that lasts.

MANUFACTURERS: Your production requirements of General Electric phono-accessories can still be filled. General Electric application engineers have suggestions that will help you design a better product. Call or wire us today for details. *General Electric Company, Parts Section, Electronics Park, Syracuse, New York.*

HERE'S PLUS BUSINESS!

Use G-E phono Preamplifiers to sell *modernization* to your customers. Self-contained for easy installation, these units are ready to operate when connected to a power source. They provide sufficient amplification to enable the Variable Reluctance Cartridge to be used with any standard phonograph.

General Electric Company, Section 4851
Electronics Park—Syracuse, N. Y.
Please forward information on the G-E phono accessories checked:

☐ Variable Reluctance Cartridges ☐ Replacement Styli ☐ Phono Preamplifiers ☐ Tone Arms

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GENERAL ELECTRIC

"25 Years of TV," Leslie Woods, Philco

Speaking before a recent dinner of Philco engineers, Leslie Woods, Philco's vice-president in charge of engineering and research said:

"My first job in Philadelphia, almost twenty-five years ago, was as a junior engineer. The first assignment given to me was to build a television laboratory transmitter and receiver. With the invaluable help of Reynie Brown I worked long and hard on this project and succeeded in building a receiver which picked up television signals from the C. Francis Jenkins experimental transmitter in Washington, and the De Forest station near Newark, N. J.

"Those were the days when revolving discs were an essential part of a television receiver. Long ago we threw these wheels into the ashcan and there they have remained until just recently, when they were retrieved by the advocates of a system of color-television which has been widely publicized. I think we can pretty safely predict that it is only a question of time when the trash barrels will be filled with a lot of colored discs.

"That we are on the threshold of a great new era of color television there can be no doubt. You should know that Philco is spending a great deal of research and engineering effort not only in the development of direct-view color tubes and circuits but in spearheading a cooperative effort within the industry to develop a *system* of color television which combines the best ideas of the three or four companies, which have been actively engaged in color research. Under the leadership of Philco's David Smith, wholeheartedly supported by our management, Philco has taken the initiative in the development of this industry system and great progress has already been made."

British IRE Convention

The British Institution of Radio Engineers has organized, as a contribution to the national effort for the Festival of Britain, an unusual type of Convention for 1951. Instead of a continuous session devoted to a limited number of topics, six separate sessions covering the whole field of radio and electronic engineering will take place at four different centers during the Festival period, July to September.

Subjects to be covered are:

Session 1—"Electronic Instrumentation in Neucleonics", July 3 and 4, at University College, London.

Session 2—"Valves Technology and Manufacture", July 5 and 6, at University College, London.

Session 3—"Radio Communication and Broadcasting", July 24 and 25, at University College, Southampton.

Session 4—"Radio Aids to Navigation", July 26 and 27, at University College, Southampton.

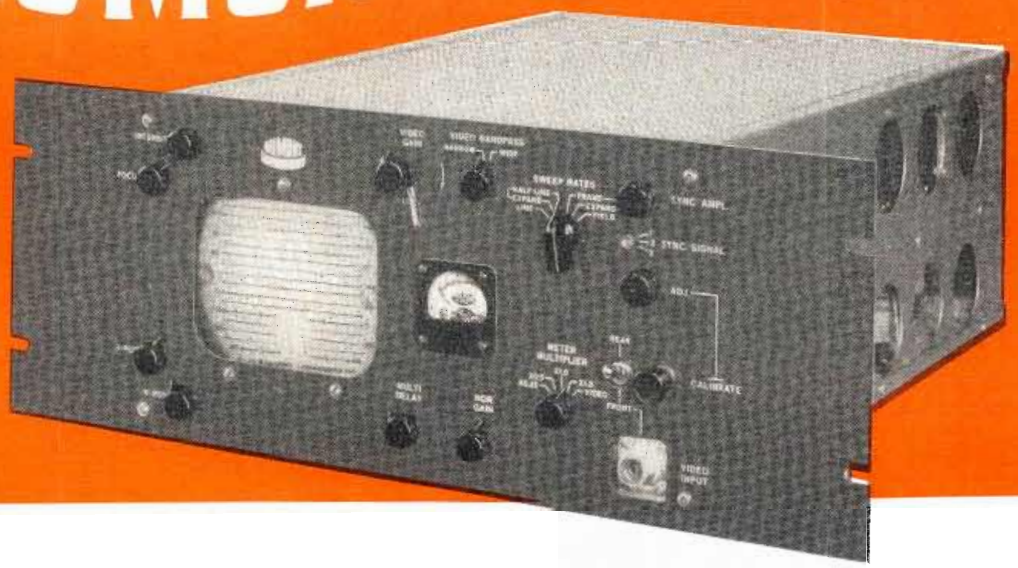
Session 5—"Television Engineering", August 21 to 24, at Kings College, Cambridge.

Session 6—"Audio Frequency Engineering", September 4 to 6, Richmond Hall, National Radio Exhibition, Earls Court, London.

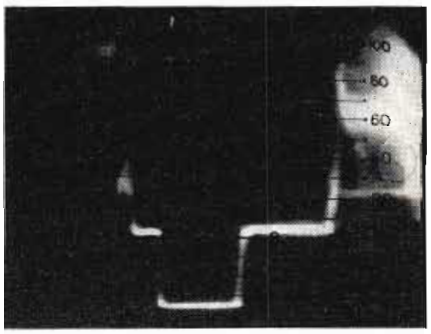
A STANDARD VIDEO LEVEL MEASURING SCOPE

and Precision...

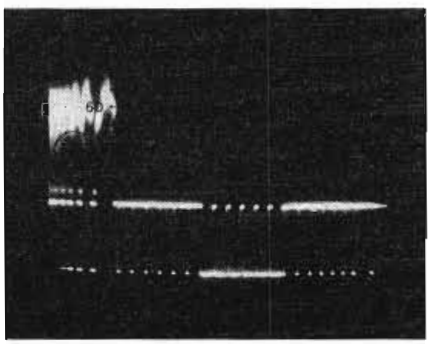
DU MONT waveform monitor



Du Mont proudly announces the availability of the FIRST precision video waveform monitoring and measuring equipment to meet the stringent requirements of quality television broadcasting. The Du Mont TA-169-A Waveform Monitor and power supply (not shown) combines amplitude linearity over large deflection with wide bandwidth and no overshoot, yielding a truer measure of a video signal than is achievable on ANY standard TV equipment currently in use. A filter may be switched in to provide the standard amplitude-frequency response recommended by I.R.E. and R.T.M.A. for level setting measurements. A precise meter and calibrator are built in. Expanded sweeps show detail in equalizing pulses and front and back porches.



Expanded line sweep rate to inspect horizontal sync signal in detail.



Expanded frame sweep rate to inspect vertical sync period — serrated and equalizing pulses in a single field — in detail.

FEATURES:

- **7.5 mc bandwidth video amplitude with no detectable overshoot for rise time of 0.03 micro-seconds instantly switchable to standard I.R.E. 4 mc roll-off for level measuring.**
- **Peak-to-peak input signal of 0.2 to 3.0 volts produces full scale deflection (2.5") on CRT screen with amplitude linearity of better than 2%.**
- **Voltage calibration with accuracy of 2% is provided. High impedance input available on front panel, 75 ohm input on rear of chassis.**
- **Type 5268-A Power Supply supplies all high and low voltages.**
- **Filament transformer located in power supply to eliminate hum distortion.**

First with the Finest in Television

TELEVISION TRANSMITTER DIVISION

ALLEN B. DU MONT LABORATORIES, INC. 1000 Main Avenue, Clifton, N. J.

Belmont Contracts Administrator

W. L. Dunn, vice president Belmont Radio Corp., manufacturer of Raytheon television, Chicago, Ill., announces the appointment of Allen Henry as contracts administrator. In addition to his new duties, Henry will retain supervision of Raytheon television advertising, assisted by Charles R. Lunney, who recently joined Belmont. Henry became a member of the Belmont organization in March, 1945, when he was appointed administrator of the engineering department. Shortly before the start of World War II, Henry became contracts co-ordinator for Stewart-Warner in charge of organizing that company's sub-contract work.

New Crest Quarters

Albert J. Eisenberg, vice president of Crest Television Laboratories, Inc., manufacturers of test equipment has announced the opening of new quarters in the Whitehall Building, Far Rockaway, N. Y. The plant and general offices will occupy two floors.

Named RCA Field Rep

Dixie B. McKey, radio engineering consultant, has been appointed a field sales representative for RCA microwave and mobile communications products. He will supervise sales and installations of RCA microwave equipment throughout the Southern United States and will also act as field sales representative for RCA mobile equipment in the Eastern Texas territory.

GE ENGINEERING MANAGER

Dr. Martin A. Edwards has been appointed engineering manager of the General Electric general engineering laboratory. Formerly associate engineer in charge of the laboratory's technical division, he will be responsible for engineering activities of the laboratory and engineering relations with other divisions and departments.

New Bolex TV Film *Titler* has so many professional features!

For all movie cameras

A superlative movie titler for all 16mm and 8mm movie makers.

The Bolex Movie Titler is built to the high standards of Swiss precision craftsmanship, not down to a price. Yet dollar for dollar it is the finest value in its field—no other equipment of this type can offer the same ruggedness and versatility so essential to professional 16mm film makers of advertising and television films.

Its rock steady track and massive camera cradle (with rack-over for perfect centering) accepts not only Bolex H cameras, but all Bell & Howell and Kodak Cine Special models—as well as every type of 8mm movie camera.

Basic Titler with 30-page manual and case, size 7 x 16 x 47; total weight 60 lbs., price including F.E.T. $180.25

The *Accessory Kit* for unlimited trick effects!

Cartoons, animations, flip-flaps, zooms, three-planes and a whole range of trick work is made possible to a wider range of movie makers than ever before.

Kit may be purchased separately: it includes—

1. Multi-purpose frame
2. Roller screen for horizontal or vertical operations
3. Turntable for operation in horizontal or vertical position
4. Drum for horizontal or vertical work
5. Transparency, screen and mirror frame
6. Animation frame with registration pins
7. Hand-crank calibrated drive
8. Tilting or pivoting plates for horizontal and vertical flip-flaps
9. Additional stem for three-plane work

Above Accessory Kit, weight 10 lbs., including F.E.T. $165.00. Basic Titler and Accessory Kit, wt. 70 lbs., inc. F.E.T. $345.25

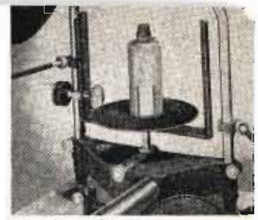
BOLEX FILM TITLER

FROM YOUR BOLEX DEALER

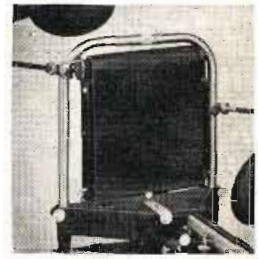
Literature on request from

Paillard Products, Inc., 265 Madison Avenue, New York 16, N. Y.

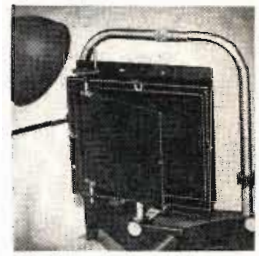
Bolex paillard



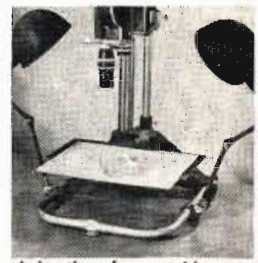
Rotating table, horizontally mounted, with friction drive



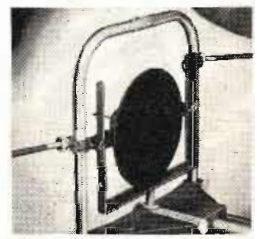
Roller screen, horizontally mounted



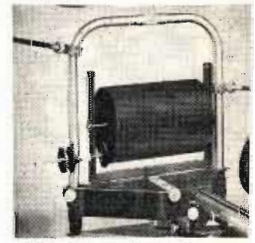
Flip-flaps, horizontally mounted



Animation frome with Titler in vertical position



Rotating table vertically mounted



Roller drum, horizontally mounted

Transparency screen frame

Two-Tube Tuner

(*Continued from page* 55)

factory and in the field.

The schematic diagram of this is shown in Fig. 2. Basically, the tuner consists of a 6BC5 r-f amplifier stage, a ½-6J6 mixer stage and a ½-6J6 oscillator. The performance table, Fig 1 indicates the results obtained on a production tuner. These measurements were made with a TV set having a 3 stage i-f amplifier of 3 MC bandwidth at 2 times down.

One of the important features of this design is the antenna input transformer (T1 in Fig. 2) with electrostatic shield between the primary and secondary. This shield acts to prevent most man-made interference voltages on the antenna from appearing on the r-f grid. Such voltages are usually picked up equally on both sides of the antenna (or antenna lead) and thus create no voltage across the primary as a whole. Because of the shield they cannot be fed directly from the ends of the primary to the secondary by capacity between these elements. The rejection of such interference is indicated in the right hand column of Fig. 1.

By careful design it was found possible to provide very nearly optimum antenna coupling from channel 2 to 13 with the one transformer. This avoided the expense and complexity of 2 separate units for high and low bands, an extra switch wafer for switching and electrostatic shielding of the extra wafer from the r-f grid wafer.

As shown in the schematic, the secondary of the antenna transformer T1 is tuned for each channel by shunting it with the proper value of inductance to provide the net resultant inductance required to resonate with the r-f tube input capacity. The selection of the proper shunt inductance to do this is accomplished by the rear switch wafer (S1, Section 4).

It will be noted that the so-called series coil string system of coil switching is used for all coil switching. With such an arrangement, the switching is accomplished entirely in the low side by a grounded switch blade which merely grounds the appropriate point on the coil string. This has the two very important advantages of providing mounting for all the coils right on the switch lugs themselves and avoiding the connection of switch elements to the tube grid which would add appreciable capacity across all the coils. If this were done on all wafers, a very considerable reduction in tuner gain would result.

The use of a standard 12 position

wafer switch, previously mentioned, is very advantageous because of its lower cost and smaller diameter. In the past it was considered necessary to short both ends of all low band coils if a series coil switching system in all 7 high band switch positions, in order to assure against a low band coil (or series combination of coils) resonating and absorbing energy in the high band.

With a 12 position switch and series coil switching, it is not possible to short both ends of all 5 low band coils throughout all 7 high band switch positions without shorting some of them also in some of the 5 low band positions—at least not on one wafer. It was, however, found that by shorting both ends of the channel 4 coil in all 7 high band switch positions, high band resonances of low band coils could be avoided. With this arrangement the series combination of the channel 3 and 2 coils will also be shorted because the channel 2 coil returns to ground, and also the series combination consisting of the channel 5 and 6 coils and the high band coils between the channel 6 coil and the high band coils being used, will be shorted because the low end of the used coils is grounded by the switch. The shorting of the ends of the channel 4 coil on all high bands is accomplished by a separate switch blade on the rear of the wafer as shown in Fig. 2, this blade being grounded by connections through the rotor to the ground switch blade on the front. The use of only 2 extra contacts for shorting greatly reduces the switching effort required and also allows more positive detent action.

Automatic Gain Control

Automatic gain control of the r-f stage is provided by application of the negative AGC voltage to the r-f grid through resistor R1. The r-f coil system is connected to the r-f grid through capacitor C1 so that the AGC will not be shorted out by the coil system. It will be noted that the r-f screen is fed from a relatively stiff bleeder which provides sharp cut-off under strong signal conditions, thus protecting the i-f amplifier against overload.

Tuning of the r-f plate and mixer grid is accomplished by wafer sections 3 and 2, respectively, which are identical to the r-f grid wafer and have similar series strings of channel coils associated with them to resonate with the r-f plate capacity and mixer grid capacity respectively. Coupling capacitors C7, C9 and C10, connected between appropriate points on the r-f

(Continued from preceding page)

plate and mixer grid coil strings, provide the necessary coupling for the proper bandpass on all channels.

Shields between the r-f grid, r-f plate, and mixer grid wafers reduce stray coupling.

With series coil string switching, channel 13 is tuned by the #13 coil, channel 12 by the #13 and #12 coils, channel 11 by the #13, #12 and #11 coils, etc. Therefore, channel 13 must be aligned first by aligning the #13 coil, channel 12 aligned next by aligning only the #12 coil, etc.

The #13 coils and the low band coils are air core solenoids. The #12, 11, 10, 9, 8 and 7 coils are single loops. The solenoid coils are aligned by spreading their turns apart or pressing them together. The loop coils are aligned by bending the loops up or down to bring them closer to or farther from the rotor blade.

In order that there be sufficient range of coil adjustment to take care of relatively wide tube and component tolerances and substitutions, the loop coils should have a minimum loop projection of about .25 in. from the switch wafer lugs to which they mount. In the case of the r-f plate circuit, the tube plate capacity is small enough that the loops do come out to be at least that long. In the case of the r-f grid and mixer grid circuits, however, the tube capacities are larger so that difficulty is experienced in obtaining large enough loop coils to provide sufficient range of adjustment. For the r-f grid circuit this difficulty is resolved by making the grid coupling capacity C1 small enough that the capacity effective across the tuned circuit is so low that .25 in. loop coils may be used. This, in effect, taps the tube input down somewhat on the tuned circuit which, however, does not reduce the gain appreciably because the coil inductances become larger due to the lower effective capacity across them.

In the case of the mixer grid circuit, it is possible to use the capacitor C11 in series with the coil string (in this case it is in the ground return). This capacity, however, must be kept relatively large compared to the mixer tube grid to plate capacity because the mixer tube i-f output voltage will exist across the series combination of the two capacities, and if very much of it exists across C11 there will be considerable degeneration of the i-f signal, thus lowering the overall tuner gain. The capacitor C11 is placed in the ground return of the coil string rather than in the grid return because this keeps its stray capacity to ground and that of the dc feed resistor R16 from being across

the coil string which would further reduce the size of the loop coils.

With the capacitor C11 made as small as it could be without appreciable i-f degeneration, the effective capacity across the mixer grid coil system was still too large to allow .25 in. loop coils on the high band. It will be noted that switching from channel 13 on down to channel 7 progressively increases the amount of rotor blade between the grounded switch lug and the switch lug connected in on each channel. By adding the two lower connections through the switch rotor as shown in the schematic (switch sections 2, 3 and 4), the wide rear rotor blade was connected in parallel with the narrow front one thus lessening the rotor blade inductance increase so that .25 in. loop coils could be used. The connections through the rotor are very simply made by merely soldering the proper tabs attached to one rotor blade to the other rotor blade where the tabs come through the rotor. The same switch wafer is also used in the r-f grid and plate circuits, for standardization.

An indication of the precision obtainable in actual production in a carefully designed switch tuner with wide range adjustable coils on every channel of every wafer is shown by the tuner curves of Fig. 3. These curves were taken on the same production tuner as the performance data of Fig. 1.

A test point is provided in the mixer grid circuit (as shown on the schematic) to which a scope may be connected for observing the r-f bandpass curves obtained with sweep generator input.

Part Two will appear in the June issue.

Patent Examiner Tests

The United States Civil Service Commission has announced an examination for patent examiner to fill positions paying $3,100 a year in the United States Patent Office, Department of Commerce, and in other Federal agencies in Washington, D. C., and vicinity. To qualify, applicants must pass a written test and (1) have completed an appropriate 4-year college course; or (2) have had 4 years of pertinent experience; or (3) show a combination of appropriate education and experience. Applications will be accepted from students who expect to complete the specified college courses not later than 4 months after filing application.

The age limits, 18 to 35 years, will be waived for persons entitled to veteran preference. Application forms may be obtained from the United States Civil Service Commission, Washington 25, D. C.

Modernization of Airways

(*Continued from page* 32)

cessity of establishing highest quality signals from the two basic facilities.

Accurate aircraft position determination by tuning in two or more adjacent omnirange stations under ideal conditions can be accomplished through the triangulation process whether on or off airways. It provides for the first time a method of maintaining accurate knowledge of the course of the flight without the use of the fan marker or locator (ADF) station. Therefore, in obtaining optimum performance from omnirange and DME, the rigid criteria established by C.A.A. for site selection must be met.

Conversion to VHF communications at C.A.A. control towers, centers and interstate communication stations has been virtually completed. Additional channels available to the VHF band and used for specific purposes have greatly improved the efficiency and dependability of the entire communication system. VHF military equipments designed for limited combat service were installed at war's end and satisfied the immediate need for a thorough evaluation of a universal VHF system. These are being rapidly replaced by more modern receivers and transmitters having greater range and reliability. At present over 85% of all enroute air/ground and approximately 98% of terminal traffic communications are now handled through the medium of VHF.

To further stimulate public interest in the many facets of the present rehabilitation program, the Civil Aeronautics Administration has devised and installed in the lobby of its first Regional Office, Federal Building, New York International Airport, an animated model of the basic ground facilities and aircraft instruments used with the new system. For the benefit of the laymen most of whom do not have ready access to the control tower or the cockpit of a modern airliner, it was intended through use of this exhibit that a better appreciation of the integrated use of electronic aids and coordination between pilot and controller could be established. It was further desired that as a training device, the pilot should have a better understanding of the basic ground equipments which serve him from take-off to destination.

This working model has been constructed around the recommendations of the SC-31 report for an interim system and incorporates all the

basic electronic devices now being installed under this plan. It is composed of two interrelated electronic displays, i.e., the ground equipment of the C.A.A. center and tower and the aircraft instrument panel. Control tower and center scope demonstrate the enroute long range and terminal area surveillance radar with moving target indicator (MTI) and VHF-ADF; also the azimuth elevation scope (azel), th latter used by the radar controller to "talk down" the aircraft to touchdown. (Radar targets are simulated by means of miniature neon tubes.)

Simulataneous three-dimensional indications of aircraft position on "final" with respect to glide path, localizer and distance from runway are shown on both control tower and cockpit instruments. The monitor alarm system, also illustrated, reports to the controller and to the pilot any failure or malfunctioning of the localizer or glide path.

All basic elements of the OBD (omni-bearing distance) system are demonstrated on the panel including the omni-bearing selector, course deviation indicator, ambiguity meter and the distance indicator.

A receiver tuned to the LaGuardia Field approach control simplex frequency of 118.7 MC demonstrates the superior quality of air/ground communications using VHF.

It can be safely stated at this time that great progress has been made toward complete rehabilitation of the airways of the immediate future with the equipments now available. The system ten years hence may bear little resemblance to that of today. The demands of the future call for equipments which today appear imaginary or impossible. It will be remembered, however, that the "impossible" was accomplished during World War II through the determined efforts of Government and industry.

1. The ANDB administratively under C.A.A. is composed of a staff of expert technical personnel representing the Departments of the Air Force, Army, Navy and C.A.A.

2. Flight-testing the V.O.R., A.E. Jenks, TELE-TECH, May, 1950.

British Component Specs

The British Radio Industry Council has issued the following specifications for components. They are available from The Radio Industry Council, 59 Russell Square, London, W.C.1, England, and cost five shillings each.

RIC/136—Capacitors, Fixed, Paper Dielectric, Tubular, Metallized.

RIC/141—Capacitors, Variable, Air Dielectric, Tuning.

RIC/214—Transformers, Power, up to 2 K.V.A. Rating.

RIC/321—Plugs and Sockets (for frequencies up to 1 MC).

NRDB MEMBER JOINS GPL

Alfred C. Haemer, Jr., a member of the National Research and Development Board, will head General Precision Laboratory's field engineering department, Pleasantville, N. Y. He first joined the National Research and Development Board as the Navy representative on a working group which supervised the design and development of pioneer guided missile training equipment. He serves as chairman of group within the Board.

Portable Tape Recorder

As this section goes to press, (early April) word has been received of a newly developed magnetic tape recorder featuring extreme portability and professional type operating characteristics. The first of these units is scheduled to be introduced at the Chicago NAB conference, April 15-18, and the following technical specifications have been reported:

Overall size—10¼ x 4¼ x 3¼ in. Tape drive is obtained from a spring-wound constant torque motor which provides a tape speed of 1⅞ in./sec. A new 4-in. 300 ft. reel of tape is employed for dual track recording and frequency response obtained is 100-5000 cps. ± 2 db.

Electrically, printed circuits along with miniature and subminiature tubes are employed. A built-in crystal microphone is provided and operating power is obtained from a 90 volt battery rated at 100 hours life. 500-ohm output terminal operating at 0 db. level is also provided and signal to noise ratio is 45 db.

Audio & Video Products Corp., 1650 Broadway, New York City will distribute this equipment whose price is initially announced as about $250.00.

Electronic Conference at Chicago, Oct. 22-23

Dr. E. H. Schulz, chairman of the electrical engineering department at Armour Research Foundation of Illinois Institute of Technology, has been named 1951 president of the National Electronics Conference, Inc. Dr. W. G. Dow, electrical engineering department, University of Michigan, was named chairman of the board. The seventh annual conference will be held October

22, 23, and 24 at the Edgewater Beach hotel in Chicago.

Other officers who will plan and present the 1951 conference are: executive vice president—J. A. M. Lyon, Northwestern Technological Institute, Evanston, Ill.; executive secretary—Karl Kramer, Jensen Radio Co., Chicago; recording secretary—J. H. McCreary, Automatic Electric Co., Chicago; treasurer—C. E. Skroder, University of Illinois, Urbana, Ill.; exhibits committee chairman—R. M. Soria, American Phenolic Corp., Cicero, Ill.

Tel-O-Tube Opens New Production Lines

Joseph E. Marra, superintendent of production of the Tel-O-Tube Corporation of America, East Paterson, N. J., manufacturers of cathode ray tubes, announced recently that the company had completed the installation of two completely new production lines, permitting the increased production of their complete line of cathode ray tubes from 10 to 20 inches.

The addition of the new machinery will help to bring Tel-O-Tube's production capacity to more than 3000 tubes of all sizes per day. The need for the increased production was seen early last summer when it was felt that the expanding conversion and replacement markets would necessitate the installation of additional new equipment. Tubes are currently being offered to set manufacturers for installation as original equipment.

GE UHF TV ANTENNA

One section is shown of a revolutionary new type of television transmitting antenna developed by General Electric at Electronics Park, Syracuse, N. Y. GE has developed a five-kilowatt uhf TV transmitter and has petitioned the FCC for permission to operate it on an experimental basis. The new antenna, which will be made up of four sections like this one, will increase the effective radiated power of the transmitter twenty times.

PERSONNEL

James B. Lindsay was elected vice president and director of engineering of Thomas Electronics, Inc., Passaic, N. J. He will direct the corporation's new expansion program in cathode, miniature and sub-miniature television tubes.

Louis H. Niemann of Sylvania Electric Products Inc. has been chosen to serve as chief of the Electron Tube Section of the Electronics Division, National Production Administration.

Rear-Admiral Stanley F. Patten, USN, (Ret.), has been named director of mobilization planning for the Government Department of Allen B. Du Mont Laboratories, Inc. He will be responsible for maintenance of master production control and plant loading of all Du Mont plants as well as security matters and Federal controls.

Jerome Tannenbaum has joined the staff of Concord Radio Corp. as chief engineer of the audio division.

Maurice L. Levy has been named director of engineering of Tele-Tone Corp. Until the present appointment, he had been director of special engineering. Before poining Tele-Tone in 1949 he served as assistant chief radio engineer, Stromberg-Carlson Co.; chief engineer of the special product division, Emerson Radio & Phonograph Corp.; and as engineering staff consultant, Philco Corp.

W. G. (Bill) Many, who for the last twelve years has been editor of the "C-D Capacitor" and advertising manager of Cornell-Dubilier Corp., has resigned to conduct a personalized public-relations service on engineering catalogs and related promotional activities for electronic and radio manufacturers, with temporary headquarters at his home in Metuchen, N. J.

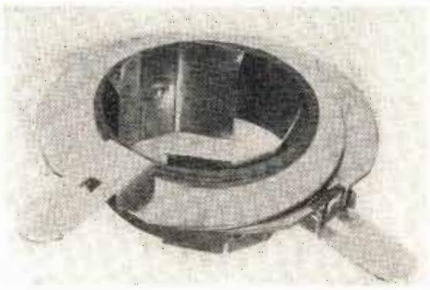
John S. Boyers, formerly chief engineer and assistant treasurer of the corporation since 1946, has been elected president of Magnecord, Inc. Magnecord, whose general offices and plant facilities are located at 225 West Ohio St., was organized five years ago and licensed to manufacture by the Armour Research Foundation.

W. A. Weiss has been appointed general manager of Sylvania Electric's radio receiving tube plant in Burlington, Iowa. It is planned to have construction work on the new $1,000,000 plant completed in time for early Fall production of receiving tubes for national defense. Mr. Weiss will take up his new duties at that time.

Sidney Lidz has been appointed chief engineer of Starrett Television Corp., New York City. He was formerly assistant chief engineer and director of color research.

Centering Unit

A new self-supporting centering unit has been developed which needs no mounting facilities of any kind. Coarse beam adjustment is accomplished by ro-



tating the whole unit. The fine adjustment is controlled by rotating handles. High coercive magnets are used to eliminate demagnetization effect of aging and nearby magnetic field. Use of this unit does not defocus electron beam.—**Heppner Manufacturing Co., Round Lake, Ill.**—TELE-TECH

Power Supply

A portable selenium rectifier power supply has been developed for production line testing and checking of broadcast and communications relay rack mounting units. Continuously variable outputs (dc) from 24 to 32 volts, 30 amps are provided. Regulation is ±4%

from zero to full load current. It is designed to operate at 40° C. and has a response speed of 0.4 sec. The unit is furnished complete with voltmeter, ammeter, 6 ft. of three-phase cord and locking plug, dc circuit breaker, ac fuses, on/off switch and pilot light.—**Richardson-Allen Corp., 116-15 Fifteenth Ave., College Point, L. I., N. Y.**—TELE-TECH

Guyed Radio Towers

Truscon type "GW" guyed radio towers are triangular and of uniform cross section, and manufactured in heights up to 528 ft. They are manufactured of heavy solid round bars, plates, and shapes welded together in jigs to make them to exact sizes. The towers are made in standard shop welded sections 24 ft. long to be bolted together in the field by means of flanges which are welded to the ends of all leg sections. The minimum thickness of most structural members is one-half in. Permanent electrical connection between the main sections of insulated towers functioning as antennas is assured by the use of a copper track bond and wedge at each field bolted level. Electrical continuity of the tower as a unit is thus maintained without dependence upon the questionable efficacy of contact between the surfaces of members to conduct r-f current.—**Truscon Steel Co., Youngstown 1, O.**—TELE-TECH

BOOKS

Ferro-magnetism

By Richard M. Bozorth, Ph.D., Member Technical Staff, Bell Telephone Laboratories Inc. Published 1951 by D. Van Nostrand Co., Inc., 250 Fourth Ave., New York 3, N. Y. 986 pages. Price $17.50.

Here, for the first time, is a practical source book for engineers and students that covers the entire field of ferromagnetism from the fundamental magnetic particles to the complex alloys having permeabilities of more than a million times that of free space. The volume is composed of four main divisions. Part I covers concepts of ferromagnetism and factors that affect magnetic quality. Part II is a systematic description of the magnetic and related properties of known ferromagnetic materials. The physical phenomena of ferromagnetism is discussed in Part III and the data are interpreted by means of the domain theory which, in recent years, has made great strides in the interpretation of magnetic phenomena. Part IV and the Appendices describe various conventional and special methods of measurement of magnetic quantities, and tabulate the more important physical and magnetic properties of ferromagnetic materials. Manufacturing methods are outlined and special reference is made to the permalloys, grain-oriented silicon iron, the anicos and the ferrites.—B.F.O.

Applied Electronics Annual 1951

R. B. Blaise, Editor. Published 1950 by British Continental Trade Press Ltd., 222 Strand, London, England. Price $8.00, 263 pages. Obtainable from John D. Griffiths, American Sales Director, 2 Clark Court, Rutherford, N. J.

This is an interesting and useful compilation of articles by experts in the field, and provides a comprehensive outline of British and some continental radio engineering practices. There is a great wealth of detailed information on operations such as wire broadcasting, television, industrial applications, broadcasting, etc., and some valuable statistics. Engineers, and others doing business in the international field should find this book useful in providing a background for European operations.—JHB

Eidophore Big Screen TV

Twentieth Century-Fox has made arrangements with the Swiss Federal Institute of Technology to make a pilot model of the Eidophore system of large screen television (described in the February, 1951 issue of TELE-TECH, page 60). Up to $500,000 is said to be devoted to its development, and the Swiss have 18 months to produce the working model.

R-F Tetrode

(*Continued from page 49*)

might be desired. Although this may be overcome by the use of positive feedback via external circuits, such arrangements are often very critical and difficult to adjust in practice.

Turning to the output circuit of the amplifier, this is a standard coaxial arrangement operated in the ¾ wave mode, in which the r-f by-pass system in the high voltage lead is of the quarter wavelength choke variety. Loading is accomplished in any of the usual ways.

The drive is applied to the input circuit by any of the conventional arrangements such as loop, probe or antenna, and the screen grid and bias potentials are applied via r-f filters of normal design.

For reasons which are well known, it is greatly to be preferred if all the high voltages involved in an amplifier of this sort can be applied to the tube during the pulse only, rather than continuously. Briefly, this results in an easier time for the tube, not so much because the effects of abnormal tube characteristics (e.g., grid emission) are minimized, but because the tolerance on the misadjustments of the circuits and voltages involved can be very much larger.

From the point of view of operation in the field under difficult conditions, or where unattended operation is required, this system although not the most economical, is greatly to be preferred. One problem that then arises in the present case is how to pulse the screen grid when the screen grid to cathode by-pass capacitance is comparatively large. This is overcome very simply by the arrangement shown in Fig. 3, where the screen-grid dropping resistor is shunted by a capacitance of appropriate size, and the utility of the method is limited only by the required rate of rise of the pulse voltage on the screen grid. If extreme rates of rise are required, that is the order of less than 1/10 of a μ sec., the currents drawn from the anode modulation supply during the pulse rise time may become much larger than the currents during the steady part of the pulse, and the modulator design is thereby complicated.

For the case under discussion, however, where C_1 may be 500 μμf, and assuming that the pulse is not required to rise from 10% to 90% of its final value in less than 0.2 μ secs., the charging current through the network supplying the screen grid voltage is only one amp at the start

(Continued from preceding page)

of the pulse, while the total current during the steady part of the pulse may be as high as 7 amps. The modulator problem is therefore simple to solve under these conditions. This method of providing the screen voltage is much simpler and cheaper than the use of a separate modulation channel for the screen grid, or the provision of a steady screen grid voltage, which in any case is not the preferred arrangement, as mentioned earlier.

Assuming that the screen grid voltage is pulsed, the control grid bias may be obtained either from a steady dc supply or from a resistor through which the grid current is passed, depending upon the particular needs of the amplifier in question.

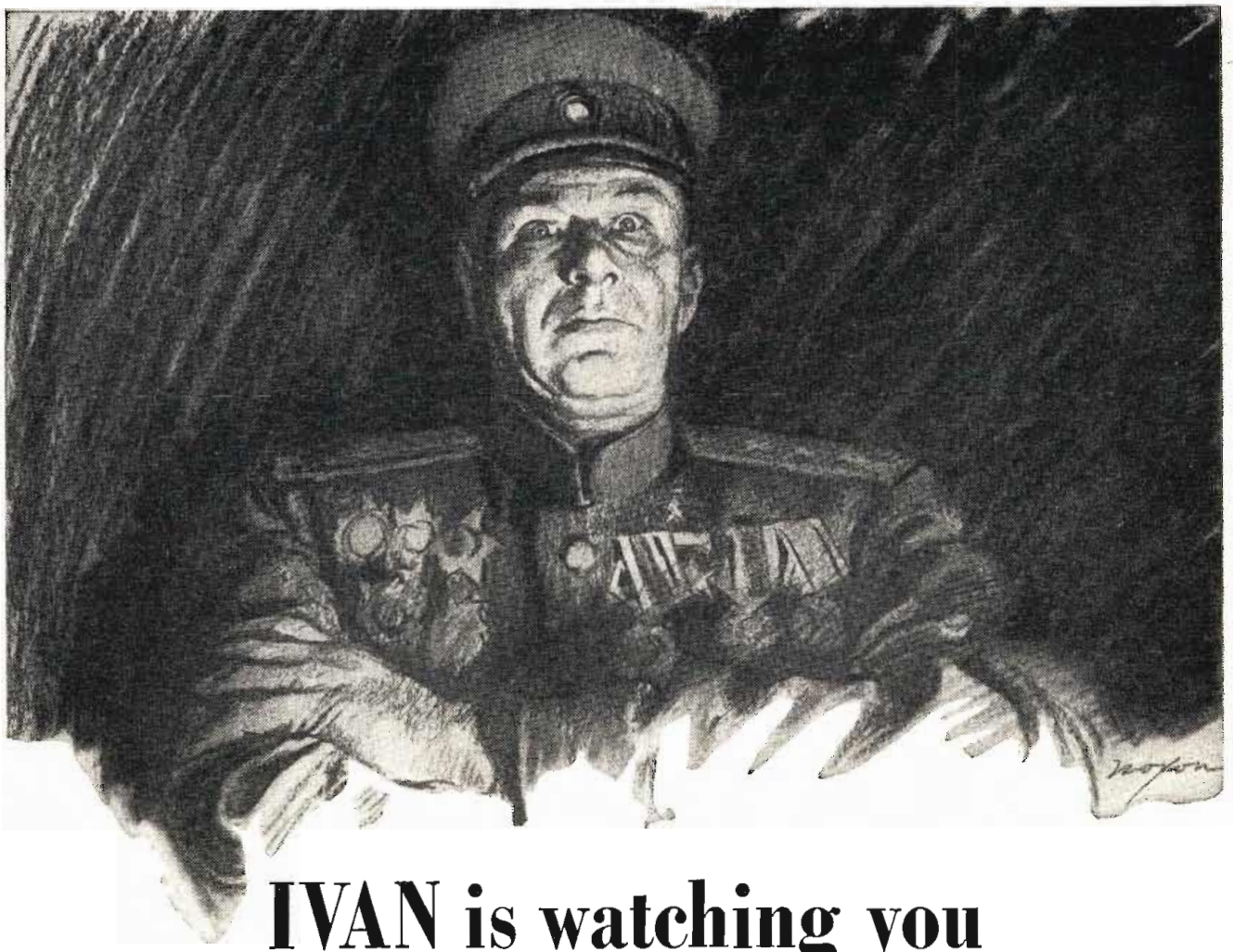
For applications where anode modulation is deemed uneconomical or undesirable because of modulator size, some consideration may be given to pulse modulation of the screen-grid voltage only, simultaneously with the driving r-f voltage. This system, although the dc anode voltage is applied to the tube between pulses, is relatively tolerant to grid emission caused by heavy overloading of the grids by excessive bombardment. The modulating power for the final stage is only the product of the screen-grid voltage and current, compared to the product of the anode voltage and anode plus screen grid current for the first method described. Bias for the control grid may be obtained from a resistor passing the grid current when excitation is applied, or from a cathode resistor, or from a dc supply.

Lastly, control grid pulsing may be considered, with steady dc voltages on the screen grid and anode. This is not recommended unless extra care is used in the design and operation of the transmitter, although it has the advantage of being the most economical system since the modulating power required is the product of the cut-off bias voltage and the normal rectified grid current only, assuming the r-f drive is also pulsed.

The performance of this amplifier is very similar to the oscillator performance, with the exception that the efficiency is higher, because the grid drive and losses are supplied from an external source.

Typical operating data at 1250 MC for oscillator and amplifier are compared on following page. Values are for the duration of the pulse.

Power output was measured as



IVAN is watching you

IVAN is a dyed-in-the-wool Communist. There are only 6 million party members like him in all Russia, yet these Communist brass-hats enforce the iron dictatorship of the Kremlin over *200 million* Russians.

He's sold to the hilt on Red ideas. Which means he's out to get *you*. He believes it's either you or him . . . that the world is too small for both.

Ivan is working hard to beat you down. He has a big head start.

Right now he's got you in a bad spot.

Ivan is afraid of only one thing.

He fears your ability to out-produce him in guns, tanks, planes.

Frankly, he doesn't think you value your free system enough to do it . . . to make willingly the sacrifices he has squeezed out of the Russians.

But he's wrong!

Because you and all of us have set out to build more and better weapons—to do it faster all the time.

We must use every bit of know-how and inventive skill we have to improve our machines and methods—to turn out more and more for every hour we work. Only in this way can we become militarily strong.

But we've got to supply essential civilian needs as well. We can't allow needless shortages to take prices skyrocketing and lower the value of our dollar.

Sure, that means sacrifices for everybody. But doing this double job well is the only sure way to stop Ivan in his tracks—and to save the freedoms which are ours and which he has never known.

FREE *. . . this important booklet tells you how our American System Grew Great*

How Americans developed better machines, power and skills to build a great nation . . . Why we have been able to produce constantly more per hour . . . How this has given us the world's highest living standard.

How we can meet today's challenge—Why we must expand our productive capacity . . . supply arms and essential civilian needs, too. Read how this dynamic process works in free booklet, "The Miracle of America," endorsed by representatives of management and labor. Send for your free copy today!

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THE BETTER WE PRODUCE
THE STRONGER WE GROW

(Continued from preceding page)

average power in a water load by calorimetric methods, and converted to peak power by dividing by the duty cycle. Power gain was measured with a Bethe hole directional coupler.

	Oscillator	Amplifier
Anode volts (KV)	7	7
Anode Current (amps)	6	6
Power Output (KW)	20	23
Efficiency (%)	47.6	54.8
Screen Grid Voltage	1200	1200
Screen Grid Current (amps)	0.4	0.4
Control Grid Current (amps)	0.6	0.6
Control Grid Bias Voltage	—350	—350
Power Gain (times)	——	10

Adjustment of the amplifier is not difficult. It is necessary to try various combinations of grid line length and cathode shorting bar position to find the optimum; this is easily done.

Regarding the possibility of self-oscillation at or near the desired frequency, this will probably not occur at 1000 MC or above for any combination of adjustments, because the maximum achievable positive feedback will be insufficient. If it does occur, it indicates incorrect adjustment of the relative circuit lengths, and stability may be restored by lengthening the cathode to screen-grid circuit and shortening the control-grid line. If oscillation persists, an insufficiently large screen-grid bypass capacitor may be diagnosed.

Optimum screen-grid voltage is a function of the load coupling, as in other tetrode amplifiers. Optimum bias is cut-off or slightly more, and it is usually found in common with other negative grid amplifiers operating under conditions of large electron transit angle, that an increase in bias and r-f drive does not give an increase in anode efficiency as at low frequencies.

1. "A Tetrode Power Oscillator for UHF," D. H. Preist, TELE-TECH, September, 1950.

"Conservation" Shield For Manufacturers

CONSERVE CRITICAL MATERIALS

Dr. Burton Browne, president of Burton Browne Advertising, 619 North Michigan Avenue, Chicago, Ill., has designed a shield for advertising insertions during the defense effort, which he is making available to firms interested in giving a portion of their paid advertising to the government.

A number of advertisers are now using it, including four Burton Browne clients: Simpson Electric Company, Littelfuse Inc., Regency Booster, and Jensen Manufacturing Company. Any advertiser wishing to use the design in his ads may have a cut made from the reproduction here or from ads now running.

Loudspeakers

(*Continued from page 47*)

ciple of the Davy Miner's Lamp.

This loudspeaker is made in the form of a reflex horn as shown by Fig. 2. It is of the indirect radiator type. The horn, which is internally folded twice, has an air column length of 30 in., but in physical size the horn is actually only 12 in. in length. The bends in the horn, together with the aid of gravity, minimize the possibility of moisture and larger particles, such as cinders, etc., becoming trapped in the inner horn section. The cast housing which encloses the driver unit mechanism is permanently affixed to the horn structure. Internally, between these two members, is the pressure-resistant barrier. It is impossible to separate these two in the field. The assembly is tamper-proof, as it is impossible to gain access to the barrier without destroying the horn.

Driver Unit

The driver unit utilizes a blast-proof phenolic diaphragm, a 2 in. diameter voice coil, and 16 oz. of Alnico V permanent magnet of special shape. In cross-section, this magnet takes the form of a "W", and eliminates the customary pole piece and bottom plate of conventional magnetic structures. The diaphragm operates in a sound chamber which adds acoustic stiffness and corrects the tendency for high frequency cancellation because of path-length inequalities. This design gives reproduction to 10,000 cps, which is a tremendous advancement in speakers of this class, and imparts fidelity and naturalness to speech and music; see Fig. 3. An impedance matching transformer is attached to the rear of the driver unit, and forms part of the inner assembly within the main casting. Since the transformer is thus protected, it is not necessary to employ a separate or special explosion-proof transformer. Wiring is brought into the loudspeaker through solid pipe conduit.

This design results in a high-powered loudspeaker which is "explosion-proof" in the sense that there can be no mechanical failure when an explosion is set off *inside* the loudspeaker, and further, it is "blast-proof" in the sense that there can be no mechanical or electrical failure should an explosion occur *outside* of the speaker equivalent to the concussion of a 5-in. 38 caliber high-explosive shell at a distance of 25 ft.

MILITARY CONTRACT AWARDS

Manufacturers who have received contract awards for producing of radio-radar-electronic equipment for the Armed Services are listed below by name, city, equipment and amount of contract. Subcontractors interested in bidding on performance of any part of each contract should sell their services to these prime contractors. This list, which is current up to our press time, covers the period from February 14 to March 28.

Alliance Mfg. Co., Alliance, Ohio, 2,500 aux. interphone equipment, and 1 lot parts, $134,000. Air Associates, Teterboro, N. J., radio sets. ARF Prods, River Forest, Ill., 1,236 radio relays 1 lot spare parts, $1,000,000. ARF Prods., River Forest, Ill., and Motorola, Inc., Chicago, Ill., 470 signal generators and 1 lot prime contractor spare parts; 849 signal generators and 1 lot spare parts, sub-contract, $659,500. Automatic Radio Mfg. Co., New York City, 1,028 auxiliary interphones, $55,000. Amer. Television Co., St. Paul, Minn., 3,500 power supply, $150,000.

Bendix Aviation Corp., Teterboro, N. J., 367 water pressure indicators and transmitters, $157,815; tuning meters, $37,780. Brunswick Radio & Television, New York City, 30,000 control boxes, $150,000. J. H. Bunnell & Co., Brooklyn, N. Y., 391 reperforator sets, $174,000; 59 sound ranging sets, $40,000; 296 rectifier power units, $45,000.

Caroled Company, New York City, 4,700 multimeters, TS-297/U; 4 tabular lists of parts; 1 literature for item 1, and 25 supplement to technical manuals, and 5-99 increase in unit cost for export packing, $25,000. Chatham Electronics Corp., Newark, N. J., hydrogen thyratron tubes: 25 5948/1754, 25 5949/1907, 25 VC-1257, 500 VC-1258 industrial preparedness study, $188,000. Collins Radio Corp., Cedar Rapids, Iowa, 1,917 radio sets, 1 lot parts, and 1,917 radio sets, 1 lot parts, and 1,917 export packing, $750,000. Connecticut Telephone & Elec. Corp., Meriden, Conn., 18,385 telephones, $100,000; 97 switchboards and 1 lot literature, $45,000. Continental Carbon Co., Cleveland, Ohio, 384,000 resistors, fixed, accurate metal film type, $52,176. Continental Electronics, Ltd., Brooklyn, N. Y., connectors. Cook Elec. Co., Chicago, Ill., 34,016 repeating coil assemblies, $110,552; 20,512 connector sets, $35,896; 19,008 terminal boxes, $190,080. Cornell-Dubilier Elec. Corp., South Plainfield, N. J., 3,570 fixed capacitors, $51,333. Crosley Corp., Cincinnati, Ohio, 1,746 radio sets, $400,000. Cyeleth Motor Corp., Div. Howard Industries, Racine, Wis., 530 power units, 6 tabular lists of parts, 2 sets manuscripts and illustrations, $65,000.

Allen B. Dumont Labs., Clifton, N. J., 350 TS-34 () AP oscilloscope, $200,000.

Eclipse-Pioneer, Div. Bendix Aviation Corp., Teterboro, N. J., 450 filter box assemblies, 450 generators and 450 voltage regulators, $104,036. Emerson Radio & Phonograph Corp., Philadel-

(Continued from preceding page)

phia, Pa., 11,427 detector sets, 1 lot maint. parts, 11,427 export packaging and packing and 1,427 arctic headsets, $2,000,000. Emerson Radio & Phonograph Corp., New York City, 5,551 radio sets; 1 lot maint. parts and 5,551 export packing, $500,000; glide path receiver, $869,817. EMR Electronics, New Canaan, Conn., component parts for radar beacon, $40,920. Espey Mfg. Co., New York City, 370 radio terminal sets, and 1 lot parts, $400,000; 251 radio relay sets, $300,000.

Fairchild Camera & Instr. Corp., Jamaica, N. Y., aircraft cameras, cl-10D; aerial cameras, cl-10A. Federal Telecommunications Labs., Nutley, N. J., research and development of thermosetting molding materials technical reports, 2 quarterly and 1 final, $29,865. Federal Telephone & Radio Corp., Clifton, N. J., 12,665 switchboard, $2,500,000; 380 radio sets; 80 multiplex power supply group; 40 amplifier power supply group, $300,000; 966 telegraph terminals, $1,400,000; radio transmitters and receiver equipment, $8,000,000. Finee Facsimile Corp., New York City, 210 facsimile equipment, $110,000. Freed Radio Co., New York City, 9,160 radiac detector chargers, 1 tabular list of parts, 1 lot literature and 25 supplement to technical manuals, $30,000. Freiland Mfg. Co., Springfield, Mass., 441 antenna equipment and 926 antenna equipment, $50,000.

Garod Radio Corp., Brooklyn, 5,645 radiosondes, $100,000. General Elec. Co., Syracuse, N. Y., 270 switch boxes, $68,696. General Elec. Co., Washington, 50 generators and regulators, $200,000. General Electronics, Paterson, N. J., 11,000 electron tubes, $187,200. General Transformer Corp., Homewood, Ill., 297 rectifier power units, $45,000. A. C. Gilbert, New Haven, Conn., 22,336 power supp., and 22,332 export packaging and packing, $180,000.

Hallicrafters Co., Chicago, Ill., 130 radio terminal sets, $200,000; 197 radio sets, $400,000; 66 radio sets, $400,000; 295 radio sets, $1,000,000; 248 radio sets and 248 overseas packings, $250,000. Harvey-Wells Electronics, Southbridge, Mass., 275 R. F. signal generators, 1 lot parts, 6 tabular list of parts, 1 lot literature, 25 instruction books, $110,000; 57 radio transmitters, $50,000. Haspeth Telephone & Radio Corp., Brooklyn, N. Y., 500 reperforator sets, $322,000. Hazeltine Electronics Corp., Little Neck, L. I., 100 attenuator and modulation loads, complete, $49,100. Henry Prods. Co., Brooklyn, N. Y., 812 antenna equipment and 1,390 antenna equipment, $95,000. Heydu Bros., Plainfield, N. J., 4,600 multimeters, 6 tabular lists of parts, 1 lot literature, 245 tech. manuals, $25,000. Hoffman Radio Corp., Los Angeles, Calif., 1,747 radio sets, 1 lot parts, and 1,747 export packaging and packing, $400,000; components for radar direction finding assembly, $40,124. John R. Hollingsworth Corp., Clifton Hgts., Pa., 2,500 power units, $250,000. Homelite Corp., Port Chester, N. Y., 430 power units, 6 tabular lists of parts, 2 sets man. and illus-

trations, $65,000; 88 motor generators, $25,000. Hupey Mfg. Co., New York City, 70 facsimile equipment, $57,000.

Industrial Television, Clifton, N. J., 4,600 multimeter TS-297()/U, 6 tabular list of parts, 1 lot literature for items 1 and 24 supplement to technical manual, $25,000. Jacobson Mfg. Co., Racine, Wis., 1,570 power units, $115,000. Johnson Service Co., Milwaukee, Wis., radio-sonde, modulator; 40,000 radiosonde modulators, $572,400.

Kellogg Switchboard & Supply Co., Chicago, Ill., 2,604 telegraph terminal sets, $695,000. Kings Electronics, Brooklyn, N. Y., 4,151 CG/568/U cable assemblies and 2,905 MT-298/GR mountings, $100,000. Stanley Knight Corp., Chicago, Ill., 102 tool equipment, $44,115. Kohler Co., Kohler, Wis., 3,966 power units, $500,000. Kollsman Instr. Corp., Elmhurst, N. Y., maint. for airspeed indicators, $51,209; tachometer indicators, $40,898; 270 tachometer indicators, $54,405; 1,269 airspeed indicators, $52,776; 76 wire sondes and 1 lot spare parts, $47,500; 58 humidity and temperature measuring kits. $47,850; 6,000 radiosondes, $100,000. Kurman Elec. Co. L. I. City, vibrator.

LaVoie Labs., Morganville, N. J., 305 test equipment, 12-9; 6 tabular list of parts; 1 lit. for item 1; 25 instruction books; 5-24 increase in unit cost for packing and packaging, $140,000. Lewyt Corp., Brooklyn, N. Y., 1,866 radio sets; 1 lot maint. parts and 1,866 overseas packing, $300,000. Link Radio Corp., New York City, 202 amplifier equipment, $25,000. Lionel Corp., Hillside, N. J., 7,000 controls, $200,000.

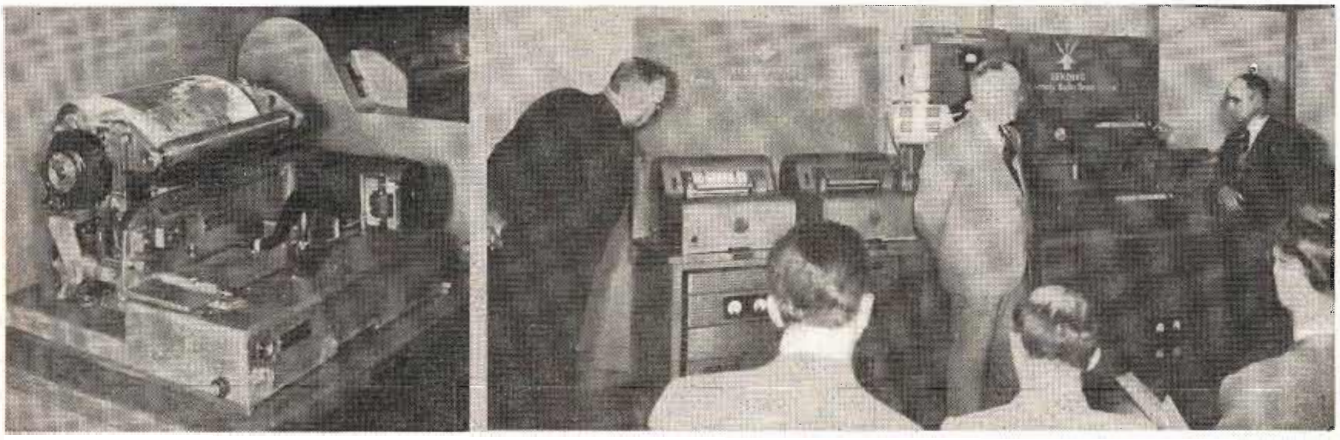
Loral Electronics Corp., New York City, 135 switching units, radio frequency input from 2 antenna and video output, $47,037.60.

Machlett Labs, Springdale, Conn., hydrogen thyratron tubes; 50 Jan 5C22, 25 Jan 5948/1754, 25 Jan 5949/1907 industrial preparedness studies, $132,000. Magnavox Co., Ft. Wayne, control assemblies, bomb arming, $123,014. W. L. Maxson, New York City, 6,430 power supply, $200,000. Molded Insulation Co., Phila., Pa., 18,020 radiosonde transmitters, $128,843. Motorola, Inc., Chicago, Ill., radio sets, tabular list of parts; electronics spare parts, $38,312. Measurements Corp., Boonton, N. J., 200 R. J. signal generators, 1 lot maint. parts, 6 tabular lists of parts, 1 lot literature, 25 instruction books, $80,000.

Neiner Electronics Co., New York City, 128 test sets, 6 tabular lists, 1 lot literature, 25 tech. manuals, $35,000. Neptune Electronics Co., New York City, filters. N. Y. U. College of Engineering, University Hghts., New York City, 1 experimental model; 4 development models; 2 instruction books; 2 sets mfrs drawings, $103,899. North Elec. Mfg. Co., Galion, Ohio, switchboard, telephone, list of parts.

O'Keefe & Merritt Co., Los Angeles, 6,000 power units; 6 tabular lists and 1 lot manuscript and illustrations, $3,000,000. D. W. Onan & Sons, Minneapolis, Minn., 3,008 power units; 6 tabular lists of parts and 1 lot manuscripts

NEW HIGH-SPEED FAX SYSTEM DEVELOPED BY WESTERN UNION



At left, close-up of new facsimile recorder with cover removed. Unit, developed by Western Union Telegraph Co., 60 Hudson Street, N. Y. C., is capable of recording 3000 words per minute. Recording styli, mounted on steel tape which is driven by an 1800 rpm synchronous motor, provide a definition of 120 lines in. New electro-sensitive dry recording paper, invented by R. J. Wise and termed "Teledeltos," is automatically fed from 9¼-in. roll in the recorder. At the end of message, which may be any length up to 14 in., transmitter signal causes knife to cut facsimile copy from roll and to eject it from recorder.

Complete WM-136 Facsimile Terminal is at right where (l. to r.) H. P. Corwith, Director of Research views the recorder, L. G. Pollard, Project Engineer describes equipment, and C. R. Diebert, Asst. Research Engineer attends transmitter. Copy to be sent is inserted in horizontal transparent cylinder and is held firmly in place during transmission through the centriugal force developed by 1800 rpm speed. Automatic changeover from one transmitter to the other is provided for, and two second sync pulse periods locks recorder motor to transmitter motor. Transmission is on a carrier frequency of 25 KC with a 30 KC bandwidth. The terminal equipment may be connected to intercity telephone wire lines or multiplexed onto microwave radio relay systems.

(*Continued from preceding page*)
and illustrations, $1,300,000.

Packard Bell Co., Los Angeles, Calif., 659 amplifiers and 1 maint. parts, $100,000. Penn Boiler & Burner Mfg. Co., Lancaster, Pa., 850 power units; 6 tabular lists of parts and 2 sets manuscripts and illustrations, $125,000. Pilot Radio Co., L. I. City, 200 R. J. signal generators, 1 lot maint. parts, 6 tabular lists of parts, 1 lot literature, 25 instruction books, $80,000. Presto

Recording Corp., Hackensack, N. J., 365 sound locating and 1 lot spare parts, $1,808,562.

Radio Corp. of America, Camden, N. J., 55 search receivers; 2,266 radio sets, AN/PRC-8; 1 lot maint. parts; 2,266 packaging and packing; 5,138 radio sets, AN/PRC-9; 1 lot maint. parts; 5,138 packaging and packing; 16,633 radio sets, AN/PRC-10; 1 lot maint. parts; 16,633 packaging and packing, $2,050,000. Radio City Products, New York City, 4,700 multimeters, TS-297/U; 6 tabular list of parts; 1 lit. for item 1; 25 technical manuals, $25,000. Radio Frequency Labs, Boonton, N. J., 490 crystal impedance meters and 1 lot spare parts, $30,625. Radiomarine Corp. of America, New York City, 25 radar sets and 25 sets station spare parts, $50,000; 50 radar sets, 50 sets station spare parts, 1 lot maint. parts, $80,000. Raytheon Mfg. Co., Waltham, Mass., 722 switch rotarys, $60,128; 36,000 electron tubes, $119,160; 5,101 channel alignment kits; 1 lot maint. parts and 5,101 packaging and packing for export, $50,000.

Service Corp. of America, New Hyde Park, N. Y., 66 radio sets and 1 lot spare parts, $247,500. Sheldon Elec. Co., Div. Allied Elec. Prods. Corp., Irvington, N. J., 25 pilot run production, $75,000. Mark Simpson Mfg. Co., Long Island City, N. Y., 500 public address sets, $90,000. J. & H. Smith Mfg. Co., New York City, 5,870 antenna equipment, 1 lot maint. parts, item 1; 1 lot TLP, item 1; 1 lot literature, item 1; 1 lot repair literature; 25 instruction books; 2,205 packaging and packing export shipment, $1,952,014.

Taffet Radio & Television Co., Bronx, N. Y., interphone control. Electro Industries Corp., Long Island City, N. Y., 4,140 aux interphone equipment, and 1 lot, $222,000. Tele King Corp., New York City, 1,747 radio sets; 1 lot maint. parts and 1,747 overseas packing, $400,000. Teletype Corp., Chicago, Ill., 988 teletype-writers, and 625 reperforators, $750,000; 60 teletypewriters; 372 teletypewriters; 637 typing reperforators, $210,000; 2,596 items of teletype repair parts, $1,000,000. Tenney Engrg. Co., Newark, N. J., 176 calibration chambers, 1 lot parts, $25,000. Transmitter Equip. Mfg. Co., New York.

S. Walter Co., Brooklyn, N. Y.; 5,000 cabinets, radio set, $144,025. Waterman Prods. Co., Phila., Pa., 200 r-f signal generators, 1 lot parts, 6 tabular list of parts and 25 instruction books, $80,000. Webster Elec. Co., Racine, Wis., 134 recording equipment, $40,000. Western Elec. Co., New York City, 93 telephone terminals and 58 telegraph terminals, $120,000; 923 repeaters and 1 lot spare parts, $923,000; 126 repeaters, and 1 lot spare parts, $209,947; 1,220 carrier modulators, and 1 lot spare parts, $6,505,040; 3,067 radio sets, 1 lot maint. parts for 1 item, and 3,067 export shipment, $50,000; 1,000 electron tubes, $46,789; 1,805 telephone terminals, $2,800,000; 188 tele-typewriters, $84,000; test indicators, $106,406; 428 repeater telephones and 1 lot maint. parts, $523,000.

Color TV in Hands of Supreme Court

THE question of color-TV standards has reached the highest tribunal in the U. S.—the Supreme Court. To those who had listened for months to the FCC hearings on this subject, it seemed that neither the RCA nor the CBS head attorneys were able to present to the eight Justices their arguments in as forceful or as comprehensive a manner as they did during the prior hearing. Probably this was because their allotted time before the Supreme Court was so limited and the subject so large. Joined with RCA were attorneys appearing for the Emerson R. & P. Co. and for IBEW.

In the front row of the audience sat industry leaders following every word and in the next bench the FCC Commissioners were seated, their facial expressions reflecting the arguments of the attorneys and the numerous questions by the Justices. Television engineers thought the spokesmen for RCA and also for CBS made some claims which were over-optimistic and that both oversimplified the main problem, but it was a difficult task which these attorneys faced in placing before the jurists, in a very limited time, the intricate technical matters on which a final ruling would be handed down.

The importance of this decision to the principals can well be appreciated. The effect of a wrong decision upon the television industry and, most important, upon the American people, into whose home-life television has become a firm part, will only become fully evident ten years from today. Sad to relate, there is no assurance that the Supreme Court will come out with the right answer to "Which color TV standard will be best for the public?" This observation is based partly upon the questions that the Justices asked. It was quite evident these learned men knew nothing about number of scanning lines, flicker, picture definition, etc. Whenever they could convert the arguments presented into a legal category, such as "who filed first" or "what was the date" of a certain FCC order, or "was restraint of trade involved," then they were pleased that they had something that they could get their teeth into.

How did the Television Industry ever get into this fix? Why is the Supreme Court sitting on the highly-technical question of Standards for Color Television? What chance have these keen legal minds of judging between a rotating disc and an all-electronic system? Would that some of the Justices had sons who were "ham" operators and who knew enough about television to advise them what picture definition means!

The fix we are in now is attributed to the action of some members of the FCC. We enjoy satisfactory monochrome standards today because a group of television engineers, representing competing companies, met in the early 1930's under the sponsorship of RMA, pooled their knowledge and own interests in a *composite standard* in which every feature had to prove itself in grueling field tests under the eyes of critical engineers from competing companies. These standards were passed along to the NTSC which cooperated with FCC. With one or two changes they were adopted and approved by FCC for the U. S. This is the procedure that should have been followed with color. Why was the FCC stampeded into choosing an obsolete, inferior

system by the cry of one Commissioner that "We must have Color NOW?" Why did the Commission refuse to consider the later demonstrations of all-electronic color which showed such tremendous improvement over the earlier tests referred to in their report?

In the first place the Commissioners are only slightly better equipped to deal with the technical problems of color standardization than is the Supreme Court. Heretofore the FCC has relied heavily upon industry television engineers because they have no experienced television engineers on their staff. Why was the help of Industry in formulating engineering color standards, for FCC approval, rejected by the Chairman of the Commission when such procedure brought excellent results in the case of monochrome standards?

It may be June before we learn the decision of the Supreme Court and this decision can be either for RCA, for CBS, or that color is not ready for standardization. In event of the latter decision, the excellent progress in color TV in laboratories other than RCA or CBS, as reported at the I.R.E. Convention may have formed a basis for the standardization of a composite color system, bearing the name of no one company but utilizing the best features of all, a superior system of advanced performance which will be satisfactory in the American Home for years to come. Such a system is the only one that should merit FCC approval.

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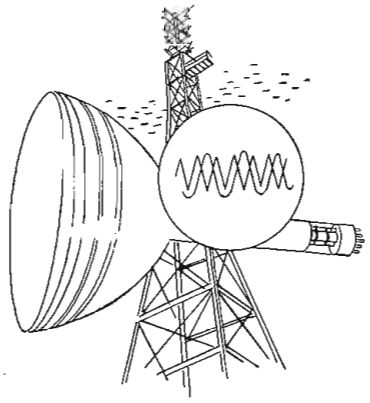

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"Wrong Roads and Missed Chances"—Armstrong

DR. E. H. ARMSTRONG, radio inventor and professor of electrical engineering at Columbia University was given the 1951 Washington Award of the Western Society of Engineers at Chicago, and in his address of acceptances spoke on the subject "Wrong Roads and Missed Chances—Some Ancient Radio History." In closing his remarks, the famous inventor of regenerative circuits, the superhetrodyne, and frequency modulation, said: "One of the great missed chances was the chance that every American amateur and radio experimenter had to tune in the Hendon-Birmingham beam telephone as early as 1922 and discover the daylight wave before Marconi. The Great Circle course of the Hendon beam lay across Eastern Canada and the United States. The 15 meter wave, as was later found, was a better daylight wave than those in the 30 meter range, though it was not effective at night. Full information about the Hendon station was available from Franklin's and Marconi's publications, and all necessary information about the most effective means of receiving such waves—the superhetrodyne—had been published.

"Had any radio experimenter in the United States thought to set up a superhetrodyne for 15 meters and listen for Hendon signals during the daytime, he would almost inevitably have heard them at some time during the day and he, instead of Marconi, would have discovered the daylight wave. But no one had the imagination to set up a receiver and listen. We all 'knew' too much about propagation; only a madman in those days would have proposed to receive 15 meter signals across the North Atlantic, especially during daylight hours.

"There is, however, a consolation for the American experimenters who missed the chance. The master experimenter himself, Marconi, also missed it. Though for more than 20 years he had made it a practice on voyages to the United States to take along receivers to listen to his British stations, when he crossed the Atlantic in the 'Elettra' in 1922 it seems not to have occurred to him to take along a 15 meter receiver and listen to Hendon. Had he done so, and turned the Hendon beam to follow the yacht, he would have discovered the daylight wave two years before he actually did.

"It is seldom given to a man to make two great discoveries, as Marconi did. He created the practical art of radio communication; and a generation later, when the limits of its ability to conquer distance seemed to have been reached, he came along with the discovery that made worldwide radio communication a reality.

"The lesson of his work is clear-cut. He did not unlock the secrets of radio by exercise of some superior reasoning process. He studied the phenomena of radio as he encountered them, with an inquiring and open mind; as he let Nature and his apparatus get the answers for him. The key to his achievement is that he was able to appreciate the limits of his own knowledge, and to doubt what others were ready to accept as dogma. For that rare ability and his infinite perseverance he gained the reward that always awaits the true discoverer—he builded better than he knew."

BULLETINS

Civil Defense Receiver

A catalog sheet describing the new General Electric civil defense receiver, for application wherever two-way radio systems exist, is now available from the Advertising Distribution Section of the G-E Electronics Department at Electronics Park, Syracuse, N. Y.

WCEMA Directory

San Francisco and Los Angeles Councils of the West Coast Electronic Manufacturers' Assn. (WCEMA) have published the third edition of their Directory as a product index and membership roster of the three score organization members. Distributed primarily to and by WCEMA members, a limited supply is available without charge at the Publication Office, 767 Castelar St., Los Angeles 12, Calif.

Test Equipment

"Precision Test Equipment by PRD" is the title of a large new catalog being distributed by Polytechnic Research & Development Co., Inc., 202 Tillary St., Brooklyn 1, N. Y.

Plant Facilities

Lektrolite Corp., 1907 Park Ave., New York 35, N. Y., have just issued a new twelve page booklet outlining and describing their plant facilities for subcontracting component and small assembly manufacture. Among the items listed for production are cable harnesses, chassis sub-assemblies, coils, transformers and condensers. Booklet will be forwarded to interested parties upon request.

Die-Stamped Circuits

The economical and rapid mass production of dependable electronic and electrical circuits is explained in a 16-page illustrated booklet published by the Franklin Airloop Corporation, 143-20 34 St., Long Island City, N. Y.

Components Catalog

In addition to its standard lines of fixed and variable resistors, line and slide switches, iron cores, choke forms and "gimmick" capacitors, the new 42-page RC-8 catalog just issued by the Electronic Components Division, Stackpole Carbon Company, St. Mary's, Pa., lists a number of items which are cataloged for the first time. Included among these are several single, dual shaft and special purpose volume controls, new 3-ampere slide switches; and Stackpole Ceramag non-metallic cores in "U", "E", width control and segmented deflection yoke types for modern television uses.

Adjacent Channel Problems

A new 10-page railroad radio booklet, "Analyze Your Adjacent Channel Problems," is available from Westinghouse Electric Corporation, 306 Fourth Ave., Pittsburgh 30, Pa.

Mobile Communications

In the public interest, the Leece-Neville Co., Cleveland 14, Ohio, has published "A Guide to Mobile Communications for Civil Defense." This booklet gives valuable information on how two-way mobile radio serves to help coordinate all operating services into an efficient team.

Marine Radio

Details concerning their world-wide marine radio and electronic service facilities are described in a 12-page, illustrated booklet just issued by Radiomarine Corporation of America, 75 Varick St., New York 13, N. Y. The booklet describes, in detail, the various types of "systematic service" plans available to American and foreign flag ships, and illustrates the varied assignments covered by Radiomarine technicians.

Parts Catalog

The A. W. Franklin Mfg. Corp. new 20-page catalog lists and illustrates a wide variety of acorn, cathode ray tube, ceramic, laminated, miniature, molded, octal and wafer type sockets.

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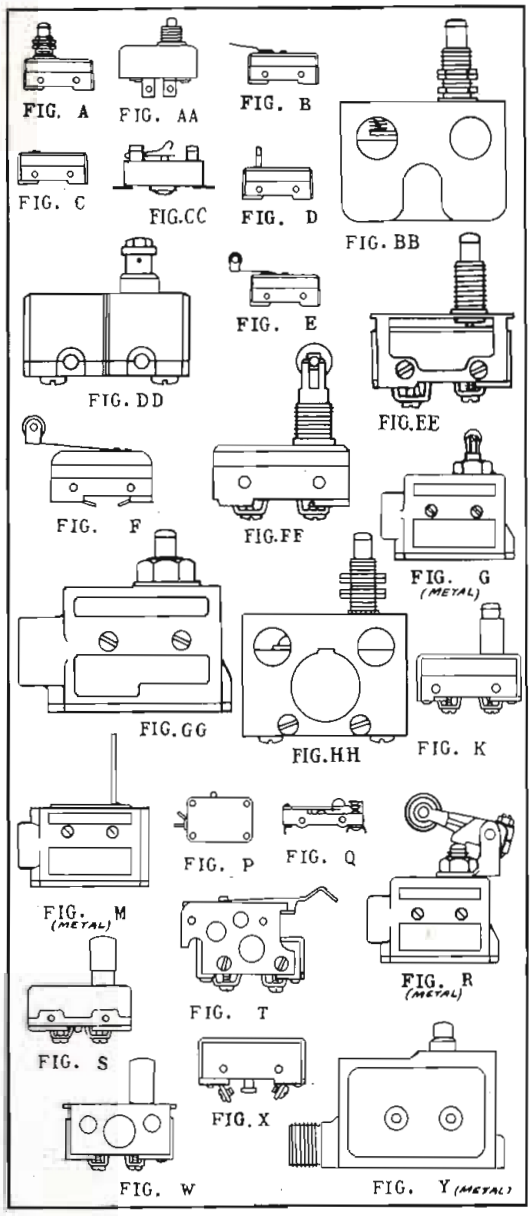

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41MC17	MICRO	B-1	NC	Y	1.45
41MC16	MICRO	B-1T	NC	DD	.90
41MC7	MICRO	B-14	NO	HH	1.70
41MD6Z	MICRO	B-R	SPDT	C	.70
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41MD47'	MICRO	R-RS13	NC	O	.50
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41MO59	MICRD	YZRQ41	NO	W	.75
41MDZ0	MICRO	YZ7RQT	NO	K	.65
41MD42	MICRO	YZRTX1	NO	X	.95
41MC22	MU	Z	NC	Y	1.45
41MD44	ACRO	Blue Stripe	SPDT	C	.70
41MO52	MU	Blue Dot	SPDT	E	.90
41MC8	MU	Red Dot	NC	C	.65
41MD18	MICRO	Open Type	SPDT	Q	.50
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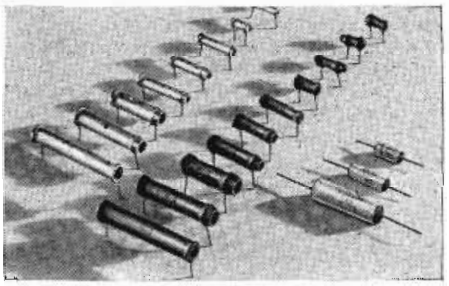

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