Including ELECTRONIC INDUSTRIES for Defense

See page 1

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Points of radio and television interest in New York City and locations of TV broadcasting antennae atop the Empire State Building

Industry Survey of Defense Subcontracting

Ceramic Capacitors in Circuit Miniaturization

October • 1951 CALDWELL-CLEMENTS, INC.

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RMC CERAMIC DISCAPS

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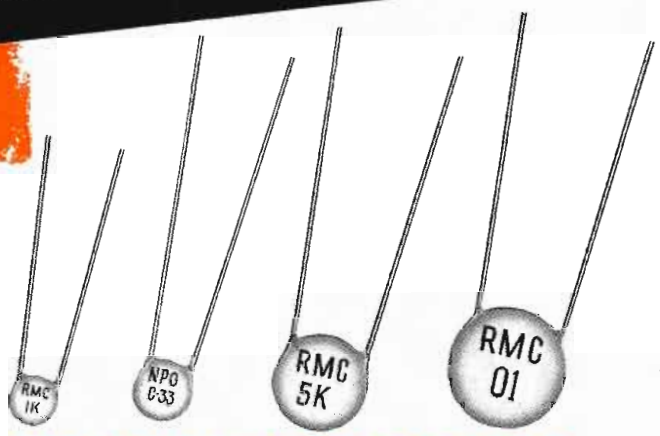
RMC DISCAPS are approved and used by leading manufacturers of TV sets and tuners, radio receivers and high frequency electronic equipment. In addition to their lower cost, they offer the advantages of small size, low self inductance, low power factor, high working voltage, greater mechanical strength and faster production line handling.



TYPE B DISCAPS

GMV By-Pass Series

Type B DISCAPS are the finest high frequency by-poss capacitors available and are engineered to exceed guaranteed minimum capacity at 85° C with 250 applied V.D.C. Capacity change between room temperature and 65° C is only +18%,—0%. Available in all standard capacities from .001 MFD to .02 MFD and in a number of dual capacity types.

SPECIFICATIONS

POWER FACTOR . . . . . 1.5% at 1 KC
WORKING VOLTAGE . . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS . . . #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . . . GMV

TYPE C DISCAPS

NPO and TC

Type C DISCAPS are ideally suited to coupling and tuned circuit applications. Their capacity will not change under voltage. Available in a wide range of capacities and temperature coefficients conforming to the RMA specifications for Class I ceramic condensers.

SPECIFICATIONS

POWER FACTOR . . . .
Less than .1% at 1 Megacycle
WORKING VOLTAGE . . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . .
Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . .
−5%, ±10%, ±20%

TYPE D DISCAPS

STABLE CAPACITY

Specify Type D DISCAPS when a more stable capacity is required for coupling and by-passing filter networks. Available in a capacity range between 150 MMF and 5000 MMF. They feature a very small capacity change between +25° C and +85° C.

SPECIFICATIONS

POWER FACTOR . . . . . 1% at 1 KC
WORKING VOLTAGE . . . . . 600 V.D.C.
TEST VOLTAGE . . . . . 1200 V.D.C.
INSULATION . . . . . .
Durez Phenolic—Vacuum Waxed
RESISTANCE . . . . Initial 7500 Megohms
After Humidity 1000 Megohms
LEADS . . . #22 Tinned Copper (.026 DIA.)
CAPACITY TOLERANCE . . . .
±20% at +25° C

NEW! RMC DEPENDABLE HI-VOLTAGE DISCAPS

ACTUAL SIZE

SPECIFICATIONS

CAPACITY . . . . . 500 MMF + 50% — 20%
WORKING VOLTAGE . . . . . 20,000 V.D.C.
TEST VOLTAGE . . . . . 30,000 V.D.C.
POWER FACTOR . . . . . 1.5% Max. at 1 KC
LEAKAGE RESISTANCE . . . . . Initial 7500 Megohms
After Humidity . . . . . 1000 Megohms
INSULATION . . . . . Moulded Plaskon

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OCTOBER, 1951

FRONT COVER—NEW YORK'S RADIO-TV HIGHSPOTS—Besides giving readers an airplane glimpse of the new combination TV-FM antenna tower atop the Empire State Building, showing positions of the various station radiators, the picture points out the studio sites of a number of Manhattan TV stations, and also such landmarks as Radio City, United Engineering Building, and IRE headquarters at Fifth Avenue and 79th St. The red target labeled "TV Relays" locates the radomes of the microwave receiving antennas through which local mobile pickups are completed. (*Photo—Thomas Airviews.*)

* *ELECTRONIC INDUSTRIES for DEFENSE . . . See articles marked with asterisks*

* **DEFENSE CONTRACTS** ..... *Stanley Gerstin* 36
Survey of Radio-TV defense production picture; 306 firms tell what happened to 3,716 contracts valued at $500 million

"ADD-A-UNIT" FEATURED IN NEW INEXPENSIVE HIGH QUALITY INSTRUMENTS ..... *D. B. Sinclair* 38
Plug-in units may be added together to form any desired instrument; only necessary to buy those elements needed

* **AUDIO PROBLEMS IN AIRCRAFT COMMUNICATIONS** ..... *I. H. Bowker* 41
High ambient acoustic noise levels and large air pressure variations are major deterrents to speech intelligibility

TRANSCONTINENTAL MICROWAVE RELAY COMMENCES TV BROADCAST OPERATIONS ..... *Bernard F. Osbahr* 44
East coast and west coast television networks linked through 106 repeater stations spaced across 2992 miles

NEW YORK TV STATIONS UTILIZE UNIQUE ANTENNA INSTALLATION *John H. Battison* 46
Increases in the effective radiated power of New York City's TV stations as result of FCC action are compared

FCC AND DU MONT VHF-UHF TV ALLOCATIONS COMPARED 47

SIMPLIFIED OPERATION KEYNOTED IN NEW TV EQUIPMENT *R. L. Garman and J. E. Cope* 48
Servo-controlled focus, extended remote control facilities including iris and lens change among features of TV chain

* **GLIDE PATH CAVITY ANTENNA FOR JET FIGHTER AIRCRAFT.** *L. E. Raburn* 50
Horizontally-polarized, zero-drag, 329-335 MC unit fits into air intake; receives signals from any forward direction

MODERN BROADCAST STUDIO DESIGN ..... *Herbert C. Eidson, Jr.* 52
How WIS remodelled its AM studios and the design features which dictated its construction; valuable construction data

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* **CERAMIC CAPACITORS IN CIRCUIT MINIATURIZATION** *J. M. Brownlow and G. N. Howatt* 56
New miniature titania and titanate based ceramic capacitors are coming into wider use in minature circuits

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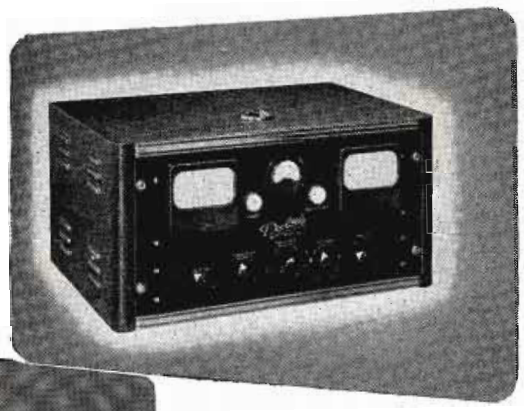

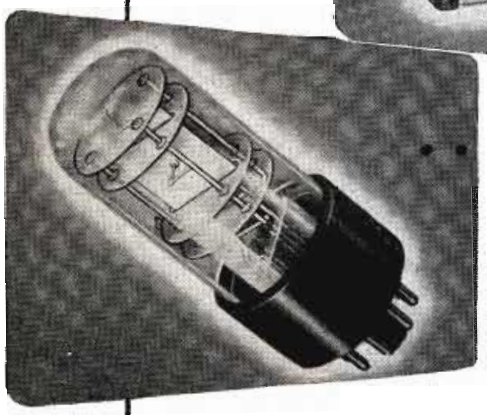

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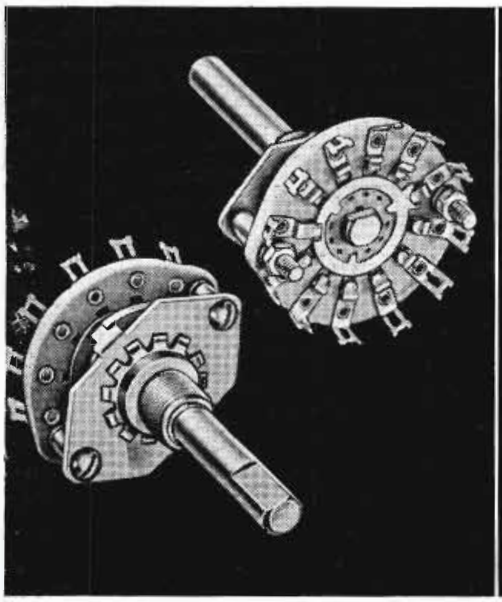
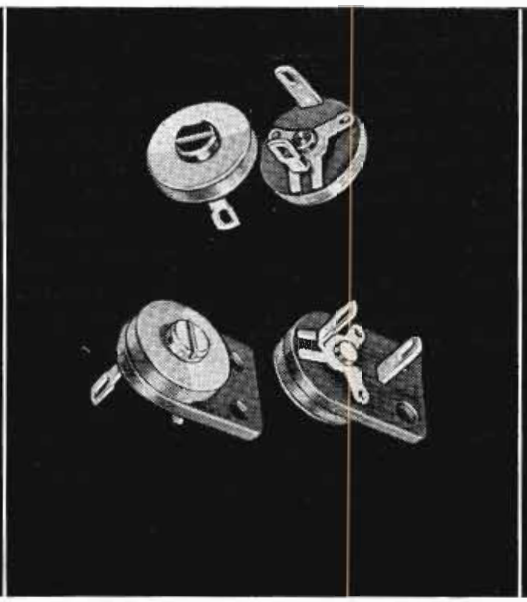


NEW miniature switches (1 1/16" dia.) available in multi-pole, multi-position, multi-section (phenolic or Steatite) units and in combination with line switches and controls. Check Nos. 42-156, 42-157 for technical bulletins (coupon next page).



NEW miniature 821 Ceramic Trimmer has voltage rating of 500 V.D.C.W. Can be base mounted to chassis or terminal mounted to coil or terminal board. Available in 4 trimming ranges—3 to 12 and 8 to 50 mmf. Check No. EP-16 for more information.

NEW High Torque Model 1 variable resistor — a truly miniature unit . . . no bigger than a dime! Available with or without off-on switch. These new high torque units will hold settings under conditions of vibration or shock. Check No. 42-158 on coupon.

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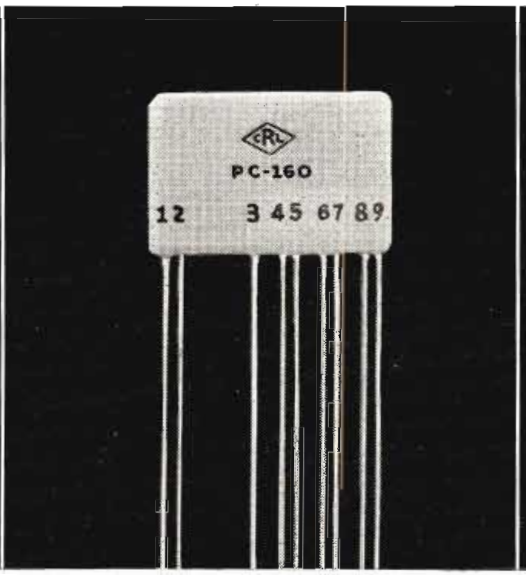
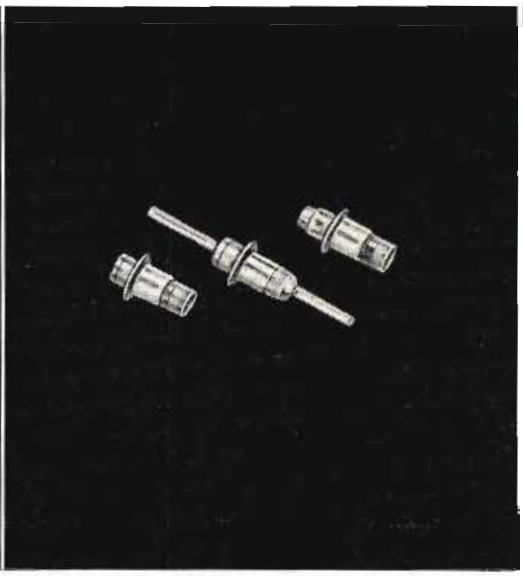


NEW Pendet . . . consists of 5 capacitors and 4 resistors on a single small plate with only nine leads. Designed to couple the diode-triode and pentode tubes in the output stage of AC-DC sets. Check No. 42-149 in the coupon inside for Technical Bulletin.



NEW Eyelet-Mounted Feed-through Ceramic Capacitors are exceptionally small. They meet JAN-C-20 and RTMA requirements for humidity resistance. Capacities range from 25 to 3000 mmf., Voltage rating. 500 V.D.C.W. Check No. EP-15 in coupon.

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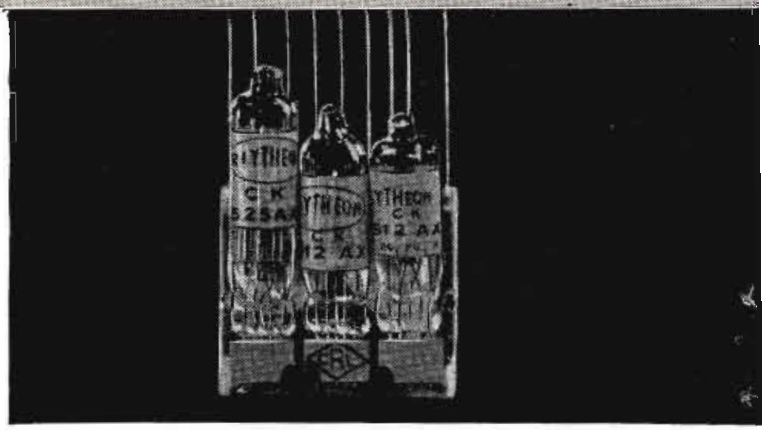

Ampec is a full 3-stage, 3-tube speech amplifier. Gives you truly highly efficient reliable performance. Size: 1¼" x 1⅛" x .340" over tube sockets! Widely used in hearing aids, mike preamps and other amplifier applications where small size and outstanding performance counts. Bulletin No. 973 in coupon below.

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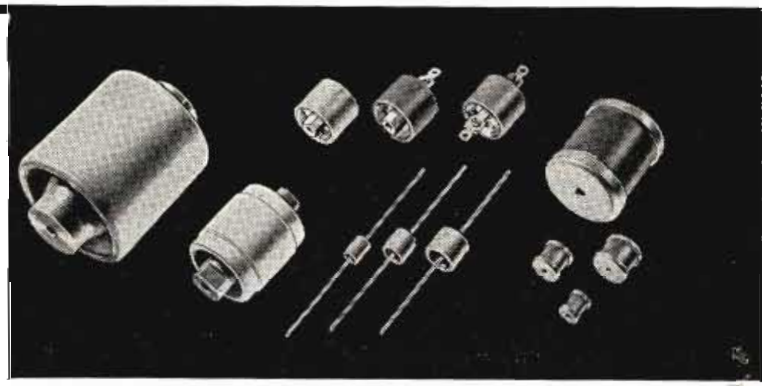

High voltage ceramic capacitors. Capacitance: 5 to 500 mmf., 5 KV to 40 KV D.C. working. Ideal for portable or mobile equipment. Primarily designed for high voltage, high frequency gear. For complete information, check Bulletin No. 42-102 in coupon below.

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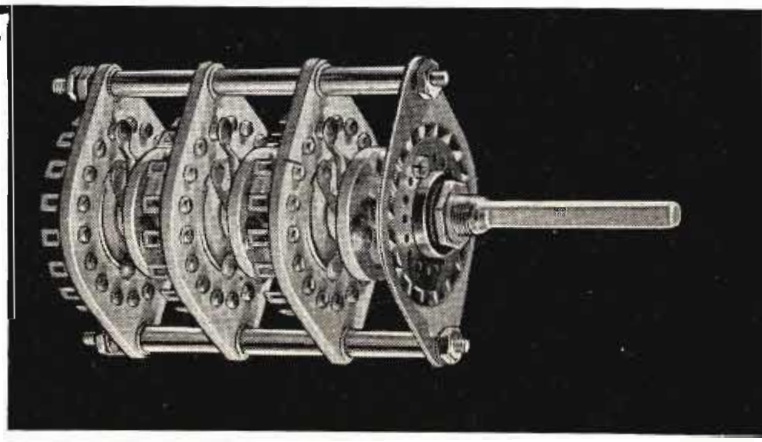

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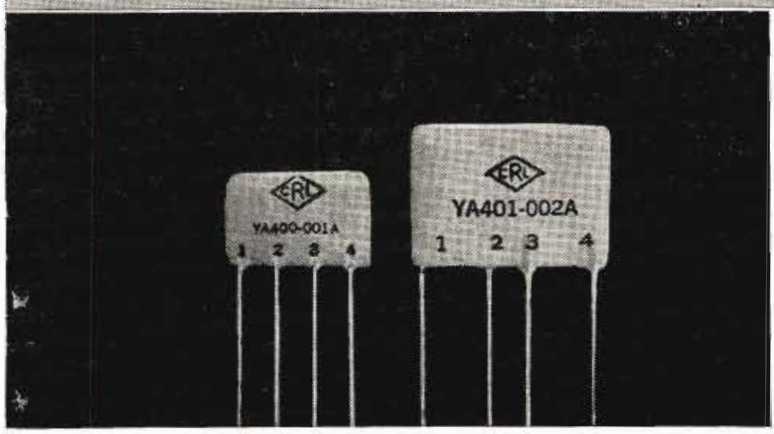
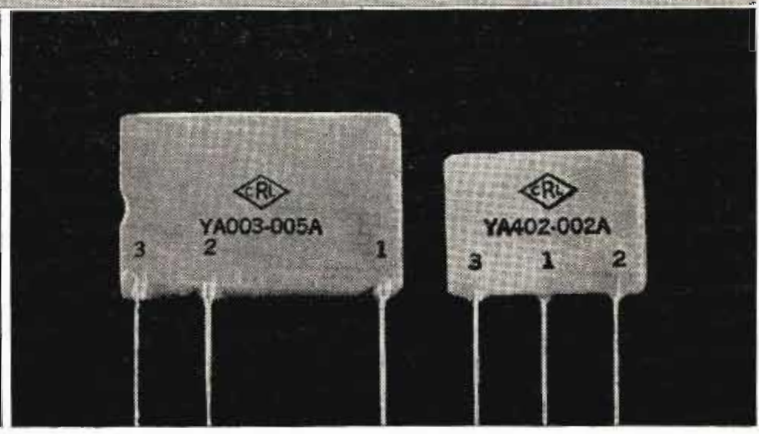
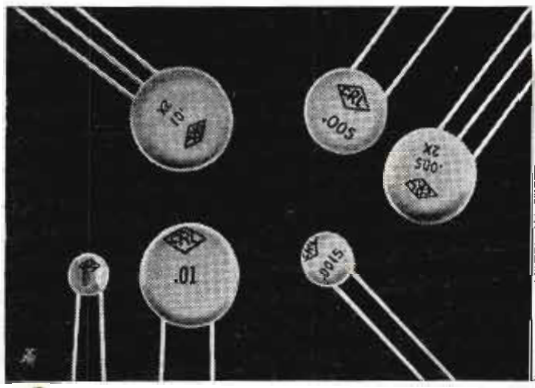


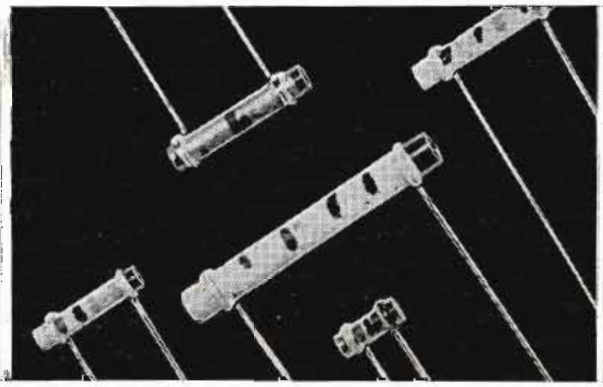
Centralab Triode Couplates save space and weight. They actually replace 5 components normally used in audio circuits. Triode Couplates are complete assemblies of 3 capacitors and 2 resistors bonded to a dielectric ceramic plate. Available in a variety of resistor and capacitor values. Bulletin No. 42-6 in coupon below.



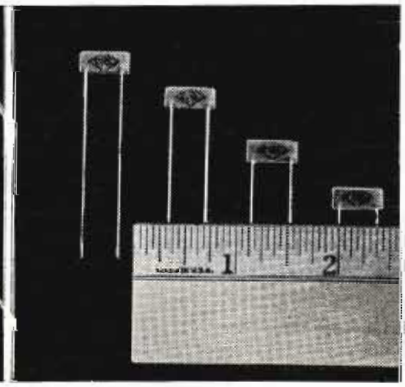
Centralab Vertical Integrators give you big savings in assembly costs, particularly in TV vertical integrator networks. One type consists of 4 resistors and 4 capacitors brought out to 3 leads . . . reducing the formerly required 16 soldered connection to only 3! There's a big saving in the number of parts handled, too! Bulletin No. 42-22.



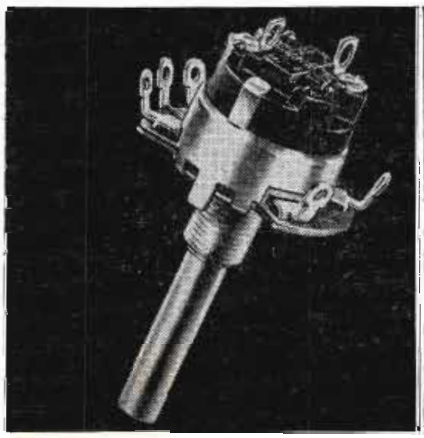
Ceramic Disc Hi-Kap Capacitors hold thickness to a minimum. Make possible very high capacity in extremely small size. Use in HF bypass and coupling. Bulletin No. 42-4R.



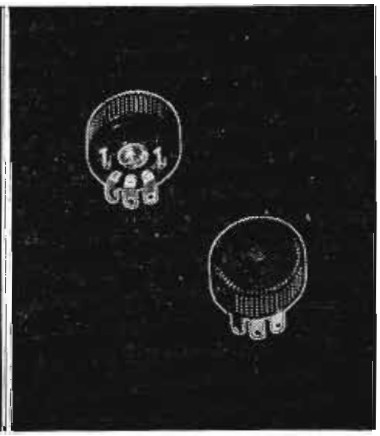
Tubular Ceramic Capacitors — Type TCZ show no capacitance change over wide range of temperature. Type TCN have special ceramic body to vary capacitance according to temperature. Bulletin No. 42-18.



Min-Kaps are very tiny capacitors used where space is at an extreme premium. Ask for Bulletin No. 42-24.



New high quality Model 2 Radiohms are designed for lower noise level, longer life. Bulletin No. 42-85.



Model "1" *Radiohm* control — 1/10 watt — plain or switch type. No larger than a dime. For miniature use. Bulletin No. 42-19.

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☐ 722	☐ 42-6	☐ 42-22	☐ 42-102	☐ 42-156	

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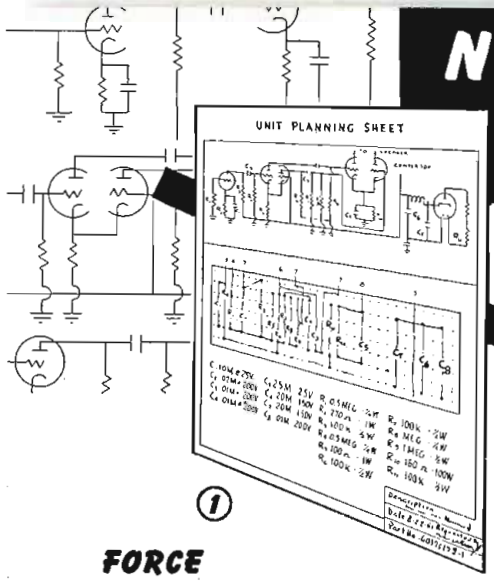

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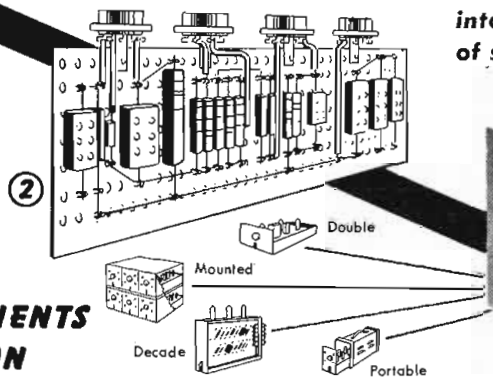

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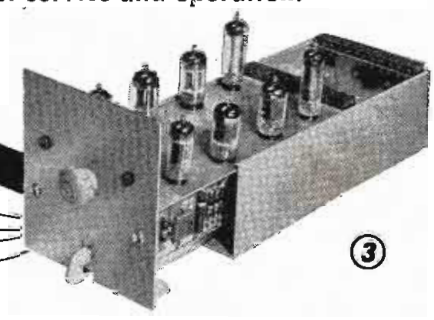
ALDEN BASIC CHASSIS

Easily fabricated sub-assemblies built into equipment that has utmost ease of service and operation.



③

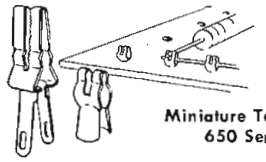
To design Electronic Equipment that must be produced quickly and in quantity, make your model with Alden Basic Chassis and "20" Packages. Save vital engineering and planning time — machine and tool hours — critical material and manhours.

① ORGANIZE CIRCUITS QUICKLY FOR SYSTEMATIC LAYOUT AND CONSTRUCTION

Schematics of most all electronic equipment can be broken down into circuit blocks of logically associated functions. These functional circuit blocks can be mounted readily either in the Alden "20" plug-in packages or Basic Chassis unit. The tube sockets and associated components lay out quickly on full scale Unit Planning Sheets for mounting on terminal cards. These special pre-punched, multi-hole terminal cards have wide flexibility to take an infinite variety of circuit variations. Both sides of card can be used to obtain maximum component density area. Using the Unit Planning Sheets, functional circuit units — components and housings — are all planned in one step.

② GET THE MOST NATURAL, EASY SUB-DIVISION OF LABOR IN MANUFACTURE

Solder terminals and sockets quickly rivet to Alden terminal card according to layout on Unit Planning Sheet. Components snap into the special **Alden Miniature Terminals** which hold them for soldering. — (No twisting or wrapping of leads necessary). — With all tube sockets and their associated components mounted on one card — the wiring and soldering of circuits is an open, easy-to-work sub-assembly operation.



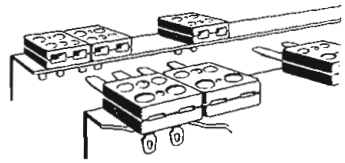
Miniature Terminals 650 Series

Terminal cards have been designed to accommodate tremendous number of circuit variations — to make neat tube and component sub-assemblies with a minimum of wiring.

③ INSURE THE LOWEST OPERATING AND SERVICE COSTS IN FINAL EQUIPMENT

The ALDEN BASIC CHASSIS UNIT is rapidly completed by mounting terminal cards into the chassis — soldering unit cables and making connections to **Alden Color Coded Back Connectors** and detachable front panel. Completed unit is easily piloted in and out of rack with the Serve-A-Unit Lock. Open sided construction, aided by the neat direct front and back connections, gives instant accessibility for rapid circuit checks and service.

Alden Terminal Card System means minimum of intercabling — but even this cabling can be laid out easily and proceed as simple sub-assembly. Open sided chassis construction makes cable easy to wire to front panel, terminal cards and back connectors.



Back Connectors — 462 Min Series

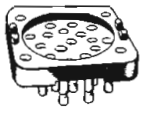
The **Alden Back Connectors** are units that can be discretely positioned on the back of the chassis — isolating lines with incompatible voltages, currents, or frequencies. This design insures accessible solder terminals for soldering — avoids rat nests of congested conventional back connector wiring. — Color coded, the Alden back connectors provide beautiful operational or service check points for all leads to and from chassis.

Hinged front panel design of chassis — allows rheostars, indicator lights, jacks, etc. to be mounted on panel as another easy-to-work sub-assembly. This panel attaches easily to chassis — is wired — swung up and fastened with Alden Target Screws.

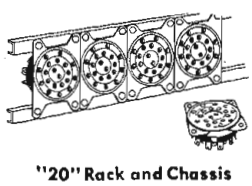
Assembled — Basic Chassis simplifies the operation of your equipment — Slashes service and maintenance time. Smooth, positive insertion and removal of the chassis is provided by the Alden "Serve-A-Unit Lock"

For Smaller Units Alden "20" Plug-in Packages

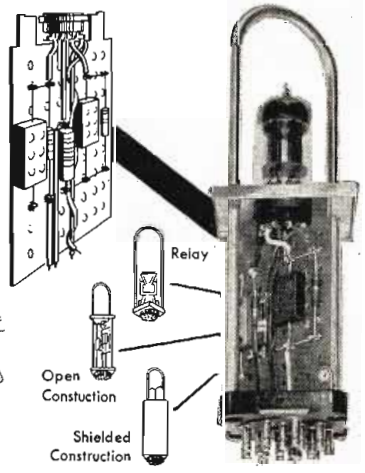
Here is a plug-in package unit using the above method of converting schematic into finished assembly quickly. Simply mount the completed terminal card sub-assembly on the Alden "20" Non-Interchangeable base, dip soldering the leads and adding cover or housing and handle . . . In operation, visual or instrument checks are easily made — if trouble occurs doubtful units are quickly isolated — these units easily unplug and a comprehensive inspection made. Spare units can be plugged in so equipment doesn't have to be inoperable while repaics are in process.



"20" Non-Interchangeable Base



"20" Rack and Chassis Mounting Sockets



TO GET STARTED QUICKLY **'phone our New Products Director for an appointment to visit our plant — or write Dept. T for booklet: "Basic Chassis and Plug-in Package Construction."**

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LETTERS...

Microwave Relay Outage

Editors, TELE-TECH:

From what I have read during the past several years, microwave relay is almost perfect from an outage standpoint. From my experience, however, I do not believe this to be true.

It is understood that the coaxial cable terminates in Dayton, Ohio, and that microwave relay stations carry TV programs to Cincinnati. During the past two years network programs have been available in Cincinnati through this network. During good weather, the quality is not too bad, but when thunderstorms occur between Cincinnati and Dayton, the TV programs are not of an acceptable quality most of the time. Apparently lightning paralyzes the relay units. Loss of picture, vertical roll, etc., occur during these periods and so we tune in Dayton directly.

I am wondering where I can find factual figures showing the actual outage percentage on the microwave relaying of TV programs.

DON CANADY
5125 Myerdale Drive, Cincinnati 36, Ohio

Editors, TELE-TECH:

In reply to your letter with reference to the operation of TV microwave networks, I should like to clarify one thing at the outset now that the network to which Mr. Canady refers is not our own, but is operated by A. T. & T. In checking over both our records and those of the telephone company, I find that a great percentage of the trouble is due to the failure of power lines serving the relay stations between Dayton to Cincinnati during thunderstorms. During such times, WLW-T picks up the signal transmitted by its sister station, WLW-D in Dayton, which usually carries the same network program and re-transmits it until network service is restored. Naturally, during a storm reception is not up to the usual standard of quality and some picture impairment is apparent.

The record, however, indicates that during the past three months, time lost through all troubles chargeable to the Dayton-Cincinnati microwave circuit, was only about $^{2}/_{10}$ of 1% of the actual time used.

C. C. BOPP, Chief Engineer
WLW-Television, 140 West Ninth St., Cincinnati 2, Ohio

Editors' Note—Attention is called to the very complete article on the A. T. & T. trans-continental relay system recently put into operation for television and telephone use, appearing on pages 44-45 of this issue. Here, however, experience has so far been too limited to afford any figures on outage periods.

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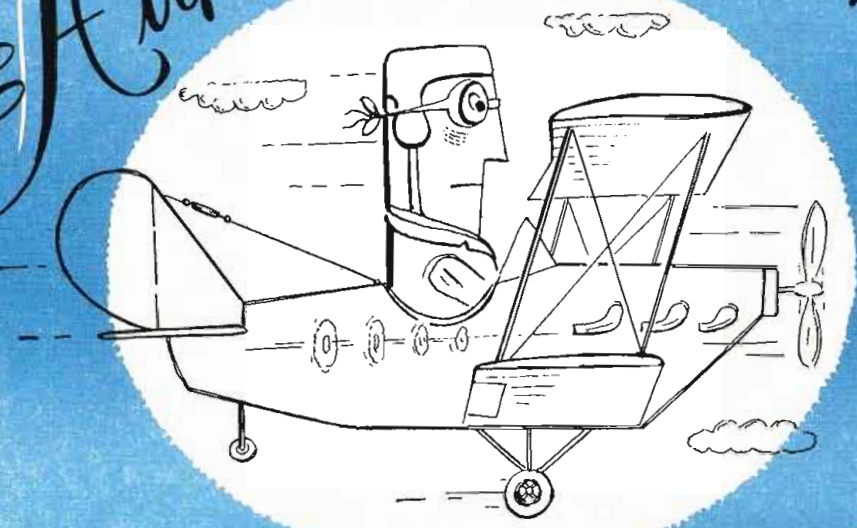
Airplanes are different now....



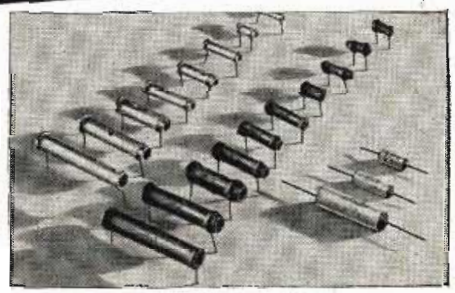
and in producing new navigation and safety devices MODERN ELECTRONICS LOOK TO HI-Q*

Capacitors • Trimmers • Choke Coils • Wire Wound Resistors

In the air, where space and weight are at a premium, the value of the minute compactness of **HI-Q** Components is vividly dramatized. Of equal importance is their never failing dependability under any and all conditions. For let a single small unit fail, and life itself may hang in the balance.

The same high engineering standards and unvarying quality which have made **HI-Q** a leader with producers of aircraft equipment, have found equal favor with other electronic manufacturers. Individual tests of every single component at each stage of production, and as a part of final inspection, insure the precise adherence to specifications, ratings and tolerances. That is one reason why **HI-Q** is now serving virtually every leading producer of television, communications and other electronic equipment. Another is the ready availability of **HI-Q** engineers to cooperate in the development of new components to meet specialized needs.

JOBBERS—ADDRESS: 740 Belleville Ave., New Bedford, Mass.



HI-Q TEMPERATURE COMPENSATING CAPACITORS

These high voltage tubular capacitors are available in capacities from 25 mmf. to 250 mmf. Units with working voltage of 3000 V. D. C., are 1.840" long with .375" diameter. Those between 500 V. D. C. and 3000 V. D. C. are slightly smaller. All are Durez coated and made of temperature compensating materials.

BETTER 4 WAYS

- ✓ PRECISION
- ✓ UNIFORMITY
- ✓ DEPENDABILITY
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**Trade Mark Registered, U. S. Patent Office*

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Electrical Reactance Corp.
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SALES OFFICES: New York, Philadelphia, Detroit, Chicago, Las Angeles

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The one and only...

Type TT-10AL/AH...and an will deliver 100 kw (ERP)

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10-kw TV transmitter for VHF

RCA high-gain antenna... at the lowest cost per kilowatt

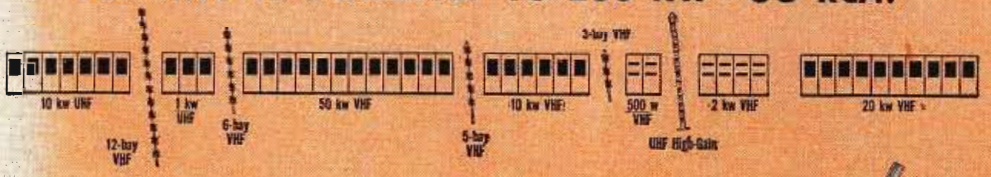
• This remarkable new 10-kw TV transmitter, and an RCA high-gain antenna (type TF-12AM), will provide up to 100 kilowatts of effective radiated power. More than twice the power of any commercial TV transmitter operating today—and AT SUBSTANTIALLY LOWER COST PER RADIATED KILOWATT than other transmitter-antenna combinations!

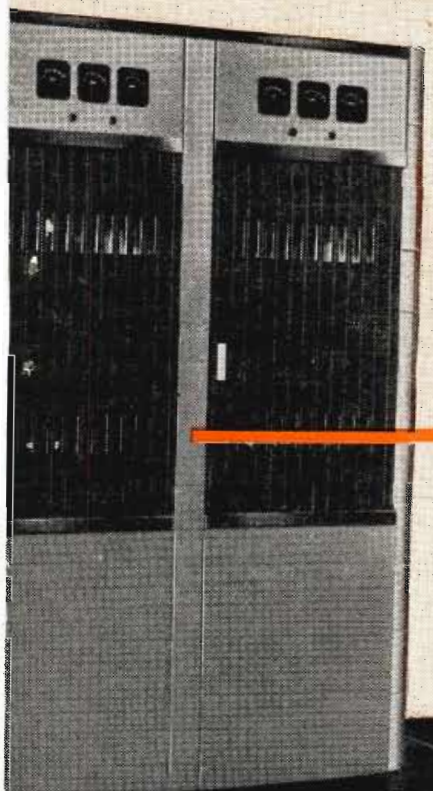
Using an improved type of air-cooled tetrode in the final power amplifier stages, this transmitter removes all former restrictions on interior cooling and floor-space requirements. No water supplies to bother about. No problem setting up the transmitter in tight quarters (it takes approximately half the floor area of previous 5-kilowatt models and weighs substantially less).

The new RCA 10-kw transmitter is available in two types. Type TT-10AL covers channels 2 to 6. Type TT-10AH covers channels 7 to 13.

For complete information on this new 10-kw...call in your RCA Broadcast Specialist. He can show you what you'll need to get "on the air"—with the power you want—at lowest possible cost. Phone him. Or write Dept. 119-V, RCA Engineering Products, Camden, New Jersey.

FOR ANY TV POWER UP TO 200 KW—GO RCA!





The Key to High Power and Low Cost

Improved RCA Air-Cooled tetrode—used in the aural and visual finals. Proved for long life, easy to handle.

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TELE-TIPS

1466 FT. above street-level, the top of the Empire State TV antenna travels two miles a day further than does the first-floor lobby, as the earth rotates. With this higher rotational speed, it also means that an object dropped from the antenna tower will be deflected 5 to 6 inches in the eastward direction of Fifth Avenue, before it strikes the ground. While a plumb-line supported from the tower would point straight down, a body dropped from the top of the plumb-line would not follow the line down but would veer east of it, because of the higher eastward velocity at the 2/7ths mile elevation at which it started. We just thought you might like to know.

EXPERIENCE PAYS OFF—The American Broadcasting Company has profited by a lesson learned from its Los Angeles affiliate, KECA-TV, in connection with the loss of coverage close to the antenna on Mount Wilson. When designing the new supergain antenna for WJZ-TV, the engineers took care to rephase the lower mid-section so that there was adequate field strength in the city area immediately below the antenna. Now we understand other stations on or about to go on the Empire State Building are thinking the same way and, in one case at least, are wishing they had taken action earlier.

PUBLIC RELATIONS—The average citizen is scheduled to become more cognizant of radio-TV-electronic engineering activities during this next year than ever before. The IRE National Public Relations Committee, under the chairmanship of Ralph R. Batcher, (Chief Engineer for RTMA Engineering Dept.) is now considering ways and means for launching an active promotion program this fall. Among the objectives is a plan whereby local newspapers and radio stations would receive news reports on new developments in techniques and products, and also on the activities of outstanding researchers and engineers. Technical data, that might be of interest to the general public, is to be rewritten so as to couch the more complicated expressions into easily understood terms.

(*Continued on page* 22)

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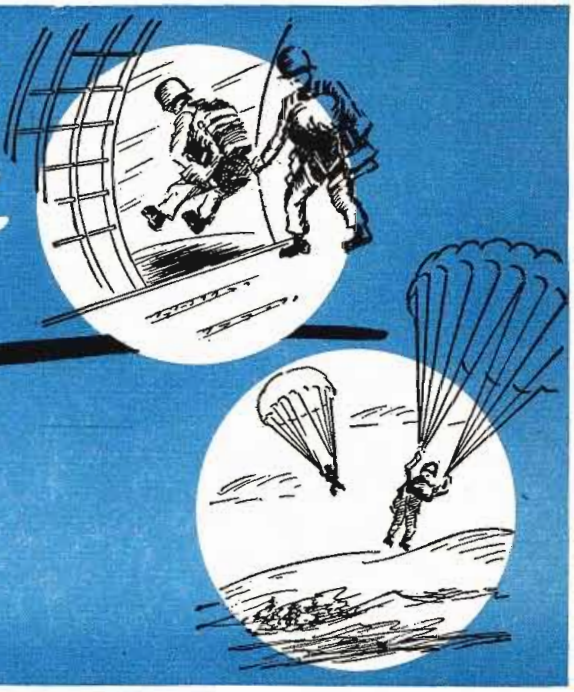
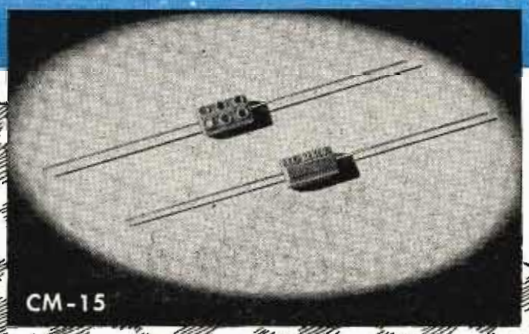
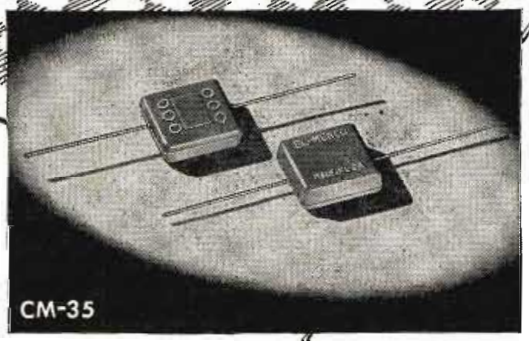
NO PLACE FOR AN *almost perfect* PARACHUTE







In military operations, complete success depends upon the unfailing performance of all parts of the war machine. Small as they are—hidden in the vitals of countless complicated devices—El-Menco Capacitors have won the highest praise for their absolute reliability.

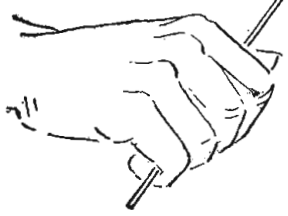
For higher capacity values, which require extreme temperature and time stabilization, there are no substitutes for...

– EL-MENCO SILVERED MICA CAPACITORS –

El-Menco Capacitors are made in all capacities and voltages in accordance with military specifications.

From the smallest to the largest, each El Menco Capacitor is paramount in the performance field.

Jobbers, Retailers, Distributors—For information communicate direct with Arco Electronics, Inc., 103 Lafayette St., New York, N. Y



Write on your business letterhead for catalog and samples.

MOLDED MICA El-Menco MICA TRIMMER CAPACITORS

Radio and Television Manufacturers, Domestic and Foreign, Communicate Direct With Factory—

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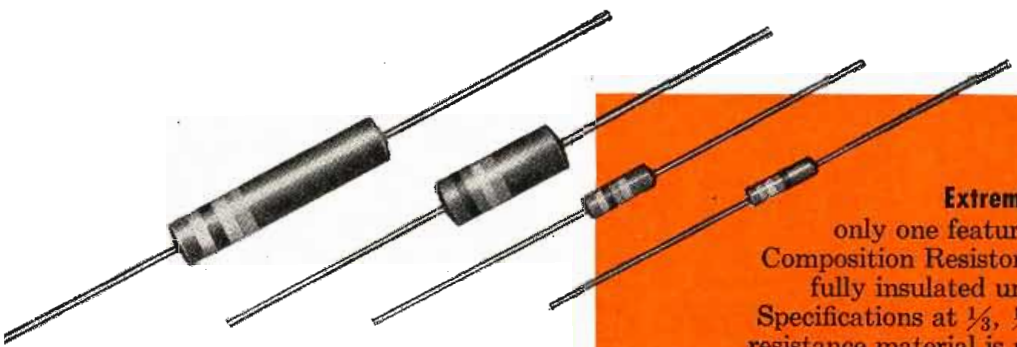
Low temperature is

in resistors too!

Any resistor can reduce voltage and dissipate heat. Amazingly few can do it without overheating themselves! Chief among those who *can* are IRC Resistors. Advanced, yet practical design—unusual use of heat-dissipating materials—and a rigid quality-control system—all combine to give these resistance units low operating temperatures, greater efficiency and longer life.



Low temperature coefficient and noise level. Meet and beat JAN-R-11 Specifications.

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

Easily meet critical requirements of television.

Fully tested by independent agencies under actual field conditions.

Extremely low operating temperature is only one feature of Advanced Type BT Fixed Composition Resistors. These compact, lightweight, fully insulated units actually surpass JAN-R-11 Specifications at ⅓, ½, 1 and 2 watts! In BT's, the resistance material is permanently cured and bonded to special glass. Leads extend into filament for faster heat conductivity. Molded bakelite seals element against moisture and prevents grounding. BT's are available in standard RTMA resistance ranges. Send for full details in 12-page technical data Bulletin B-1.

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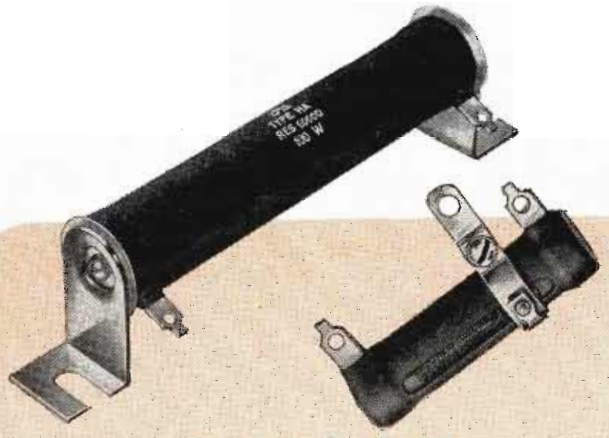
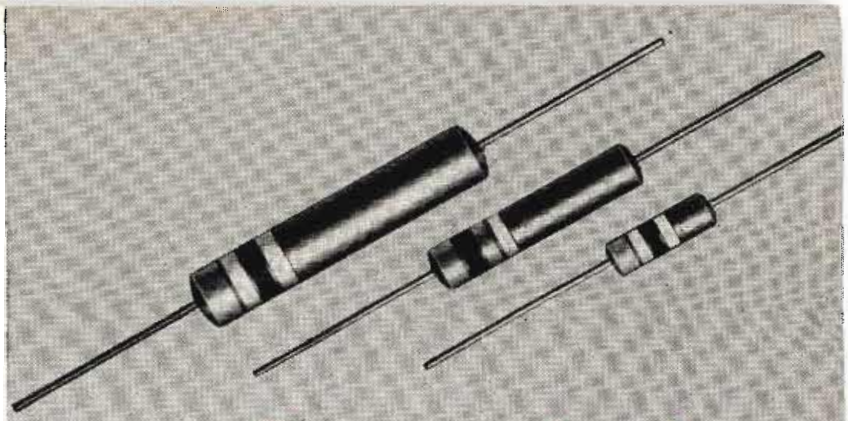
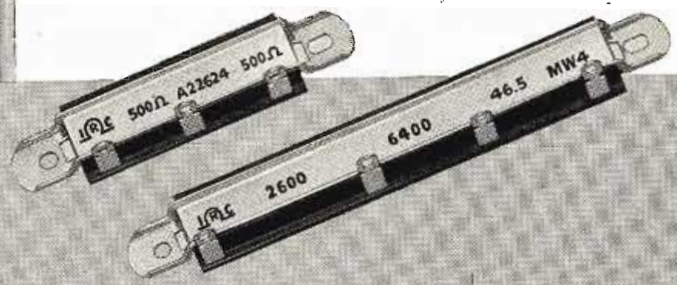
essential



Besides unusually rapid dissipation of heat, IRC Fixed and Adjustable Power Wire Wound Resistors give balanced performance in every characteristic. Special cement coatings are designed for low range high temperature requirements—or for maximum protection against extreme atmospheric conditions. For exacting, heavy-duty applications—high voltage bleeders, bias supply, grid and filament dropping resistors—PWW's are available in a full range of sizes, types and terminals. Leading industrial, aircraft and broadcasting users have specified them for more than 14 years. Technical data Bulletin C-2 gives complete information.



Temperature coefficients cover many resistance values in IRC Type BW Insulated Wire Wound Resistors. At ½, 1 and 2 watts, they are exceptionally stable, economical units for low range applications such as meters, analyzers, spark suppression units, TV circuits, low power ignition circuits. Resistance elements are wound uniformly on insulated core. Molded phenolic housing protects against humidity and grounding. Noise and aging are negligible. Technical data Bulletin B-5 contains full details.



For extremely fast heat dissipation, the unique mounting brackets of Type MW Wire Wound Resistors actually transfer heat from chassis to outside. Other radical departures from conventional design give MW's widest adaptability to individual requirements. MW's are flat wire wound resistor strips, permanently enclosed by high pressure molding in a special mica-filled phenolic compound. Special feet permit mounting on any flat metal surface. Low initial cost, lower mounting cost, flexibility in providing taps at low cost, and savings in space, all offer amazing economies. Ask for technical data Bulletin B-2.

When you're in a hot spot and need experimental or maintenance quantities of standard resistors *double-quick*, phone your IRC Distributor. IRC's Industrial Service Plan provides him with a full stock of uniformly dependable standard resistors; he can give you fast, round-the-corner delivery of small-order requirements. We'll be glad to send you his name and address.

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

IRC

Wherever the Circuit Says -WW-

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

- ☐ Advanced BT Resistors (B-1)
- ☐ BW Resistors (B-5)
- ☐ Power Wire Wounds (C-2)
- ☐ MW Resistors (B-2)
- ☐ Name and Address of nearest IRC Distributor

NAME_____

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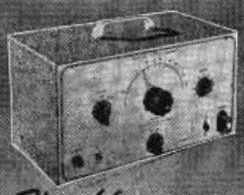
New 1952 HEATHKITS

Heathkit TELEVISION GEN. KIT $39.50

Heathkit ELECTRONIC SWITCH KIT $19.50



Heathkit AUDIO GEN. KIT $34.50

Heathkit CONDENSER CHECKER KIT $19.50

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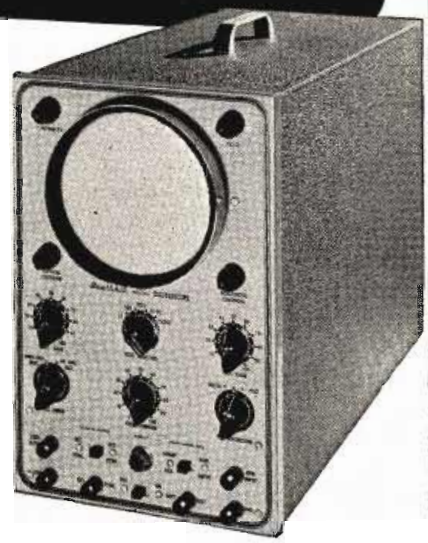
Heathkit INTERMODULATION ANALYZER $39.50

Heathkit AUDIO FREQ. METER KIT $34.50

Heathkit 5" OSCILLOSCOPE KIT



- New "spot shape" control for spot adjustment — to give really sharp focusing.
- A total of ten tubes including CR tube and five miniatures.
- Coscaded vertical amplifiers followed by phase splitter and balonced push-pull deflection omplifiers.
- Greatly reduced retrace time.
- Step attenuoted — frequency compensated — cathode follower vertical input.
- Low impedance vertical gain control for minimum distortion.
- New mounting of phase splitter and deflection amplifier tubes near
- CR tube base.
- Greatly simplified wiring layout.
- Increased frequency response — useful to 5 MC.
- Tremendous sensitivity .03 RMS per inch Vertical .6V RMS per inch Hor.
- Dual control in vernier sweep frequency circuit — smoother acting.
- Positive or negative peak internal synchronization.
- Multivibrator type Wide Ronge Sweep Generator.

A brand new 1952 Heathkit Oscilloscope Kit with a multitude of outstanding features and really excellent performance. A scope you'll truly like and certainly want to own.

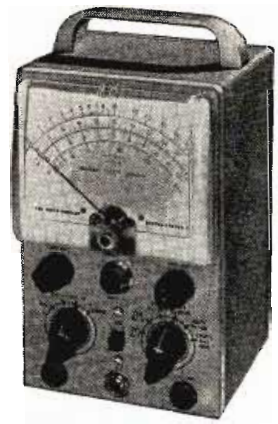
The kit is complete with all parts including all tubes, power transformer, punched and formed chassis, etc. Detailed instruction manual makes assembly simple and clear — contains step-by-step instructions, pictorials, diagrams, schemaric, circuit description and uses of scope. A truly outstanding value.

MODEL 0-7

SHIPPING WT. 24 LBS.

$43.50

Heathkit VACUUM TUBE VOLTMETER KIT



- New styling — formd case for beauty.
- New truly compact size — Cabinet 4⅛" deep x 4-1/16" wide x 7⅜" high.
- Quality Simpson 200 microamp meter.
- New ohms battery holding clamp and spring clip — assurance of good electrical contact.
- Highest quality precision resistars in multiplier circuit.
- Calibrates on both AC and DC for maximum accuracy.
- Terrific coverage — Reads from ½V to 1000V AC, ½V to 1000V DC, and .1 to over 1 billion ohms resistance.
- Large, clearly marked meter scales indicate ohms, AC Volts, DC Volts, ond DB — has zero set mark for FM alignment.
- New styling presents attractive ond professional appearance.

The 1952 Model Heathkir Vacuum Tube Voltmerer! Newly designed cabinet combines style and beaury with compactness. Greatly reduced size to occupy a minimum of space on your work-bench. Covers a tremendous range of measurements and is easy to use. Uses only quality components including 1% precision resistors in multiplier circuir for greatest accuracy, Simpson 200 microamp meter with easy to read scales for fast and sure readings.

All parts come right with kir, and complere instruction manual makes assembly a cinch.

MODEL V-5

SHIPPING WT. 5 LBS.

$24.50

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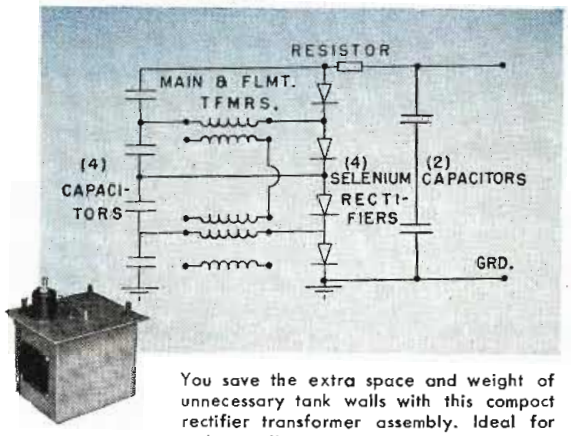
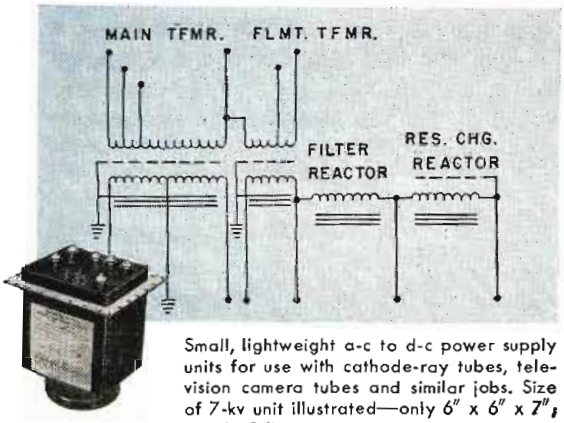
Buy your radar components "packaged"

to save space, weight and installation costs



You save the extra space and weight of unnecessary tank walls with this compact rectifier transformer assembly. Ideal for radar applications.



Small, lightweight a-c to d-c power supply units for use with cathode-ray tubes, television camera tubes and similar jobs. Size of 7-kv unit illustrated—only 6" x 6" x 7", weight 8 lb.

Filament and plate transformers plus charging and filter reactors—in fact, any combination of electrically adjacent units except pulse transformers*—can be packaged corona-free in one hermetically sealed, oil-filled container. You'll save space. You'll usually save weight. You'll make major savings in installation costs because of simplified mounting and fewer connections. You'll secure the high reliability typical of oil-filled units . . . and terminals and leads are under oil to eliminate corona.

If packaged components have an application in your work, we'd like to hear from you. These "packages" are always tailored to individual jobs, so no catalog is available. However, proposition forms will be supplied which list the information we need to prepare a quotation. For prompt attention, address General Electric Co., Sec. 43-328A, 100 Woodlawn Avenue, Pittsfield, Massachusetts or your nearest Apparatus Sales office.

General Electric Company, Schenectady 5, New York.

**Inclusion of pulse transformer not usually practical because of effect on capacitance.*

GENERAL ELECTRIC

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Your voice in Davy Jones' locker

To strengthen voices in the newest submarine cables between Key West and Havana amplifiers had to be built right into the cables themselves. With the cables, these amplifiers had to be laid in heaving seas; and they must work for years under the immense pressure of 5000 feet of water.

For this job, Bell Laboratories engineers developed a new kind of amplifier — cable-shaped and flexible, with a new kind of water-tight seal.

To serve far beyond reach of repair, they developed electron tubes and other parts, then assembled them in dust-free rooms.

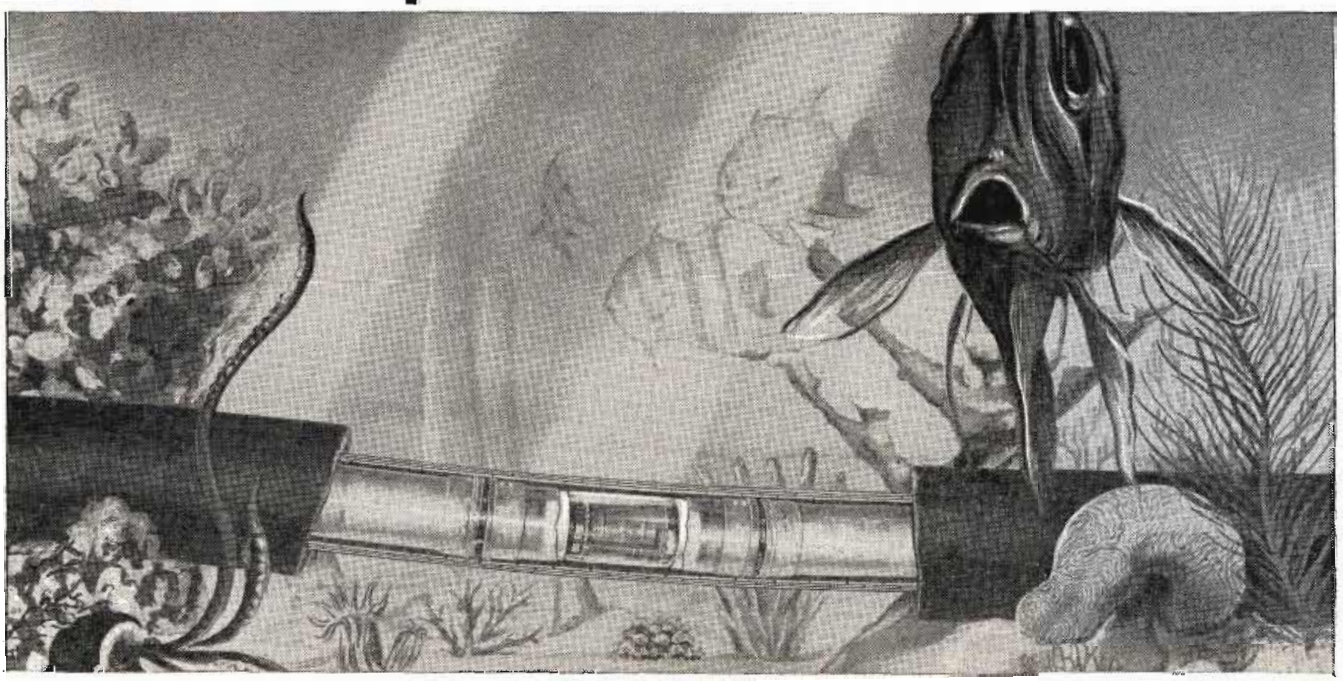
The two cables — each has but two conductors — simultaneously carry 24 conversations as well as current to run the electron tubes.

With these deep-sea amplifiers, submarine cables carry more messages . . . another example of how research in Bell Telephone Laboratories helps improve telephone service each year while costs stay low.

Cutaway view of deep-sea amplifier. Tubes and other elements are housed in plastic cases then enclosed in interleaved steel rings within a copper tube. Layers of glass tape, armor wire and impregnated fiber complete the sheath. Cable ship, shown right, payed out cable over large sheave at bow.

BELL TELEPHONE LABORATORIES

• Exploring and inventing, devising and perfecting, for continued improvements and economies in telephone service.



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Resolving

6 FACTORS

(troublesome)

into

6 POUNDS

(trouble-free)

How Utility Electronics paced the design and production of "Handie-talkie" AN/PRC-6

When the six factors of time, cost, weight, design, production engineering and production had to be overcome in a hurry to put a new, better "handie-talkie" into military service, Utility Electronics knew just where to begin.

Out of its experience in producing thousands of mobile police radios, Utility in cooperation with the U. S. Signal Corps engineered a rugged, compact unit that readily satisfied the specifications others had failed to meet. What's more, it is producible in quantity. Today production is rolling in ever-increasing volume from the lines of Utility and cooperating producers.

This is only one of the many ways in which Utility's design and production abilities are serving the U. S. Government. *These abilities are available to industry as well.* If you have electronic communication problems, especially those connected with design or production of miniaturized equipment, consult Utility – without obligation. Chances are we have the answer.

Utility Electronics Corporation

231 Grant Avenue . East Newark, New Jersey

Manufacturers of ELECTRONIC AND ELECTRO-MECHANICAL EQUIPMENT

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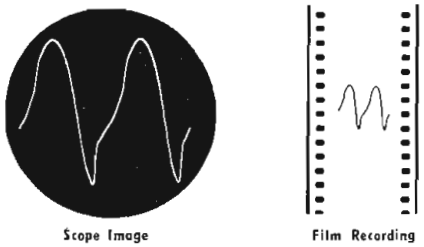
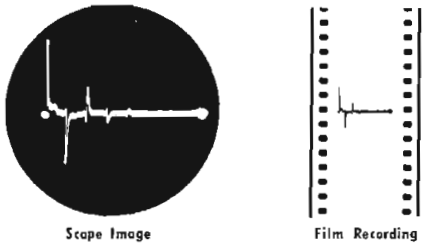
How much can you expect an oscilloscope camera to do?



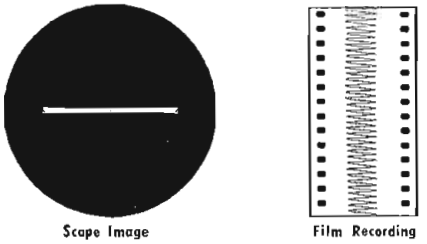
Scope Image — Film Recording

1. Single-frame photography of stationary patterns using a continuously running sweep.



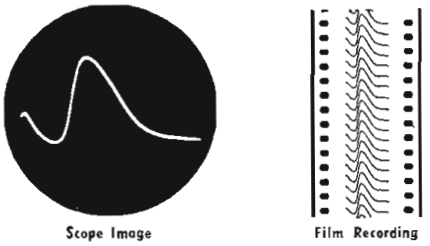
Scope Image — Film Recording

2. Single-frame photography of single transients using a single sweep.



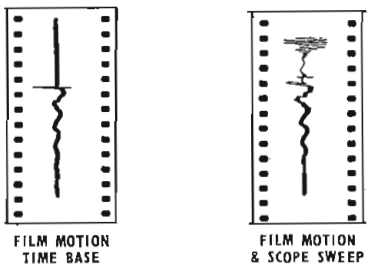
Scope Image — Film Recording

3. Continuous-motion photography employing film motion as a time base.



Scope Image — Film Recording

4. Continuous-motion photography employing oscilloscope sweep as a time base.



FILM MOTION TIME BASE — FILM MOTION & SCOPE SWEEP

5. Continuous-motion photography employing combination of film motion and oscilloscope sweep as a time base.

It's only reasonable that you should expect the oscilloscope camera you buy to record what you see on an oscilloscope screen during any period. But can it be expected to do any more? We think so.

For example, did you know that the *Fairchild Oscillo-Record Camera*—our idea of the most versatile 35-millimeter oscilloscope camera now available—can GREATLY EXTEND THE USEFULNESS OF YOUR OSCILLOSCOPE?

As you know, many non-recurring phenomena occur too rapidly to permit adequate visual study. Others occur so slowly that continuity is lost. Sometimes you have combinations of very slow-speed phenomena and occasional high-speed transients. In any one of these cases, the Fairchild Oscillo-Record Camera will take over where your eye and the oscilloscope leave off.

This extremely versatile instrument is now being used daily by many hundreds of engineers in widely divergent fields. For an idea of what it can do for you, study the five scope images and recordings illustrated at left. Each solves a particular problem.

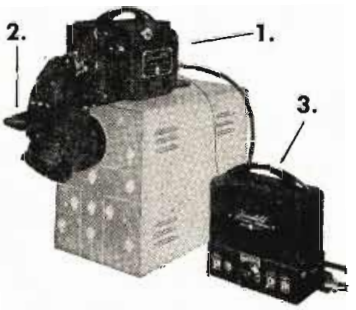
Oscillo-Record users especially like its:

CONTINUOUSLY VARIABLE SPEED CONTROL—1 in./min. to 3600 in./min.

TOP OF SCOPE MOUNTING that leaves controls easily accessible.

PROVISION FOR 3 LENGTHS OF FILM—100, 400, or 1000 feet.

For more data write *Fairchild Camera Instrument Corp., 88-06 Van Wyck Blvd., Jamaica 1, N. Y. Dept. 120-16B.*

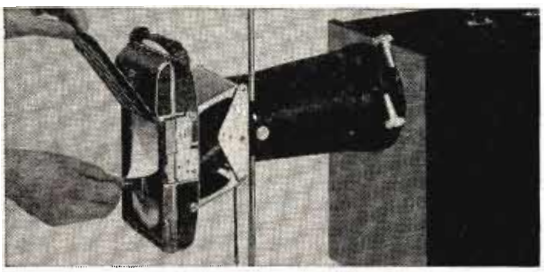


FAIRCHILD OSCILLO-RECORD CAMERA — 1. camera, 2. periscope, 3. electronic control unit. Available accessories include external 400 and 1000 foot magazines, magazine adaptor and motor, universal mount for camera and periscope, binocular split-beam viewer.

VALUABLE RECORDS FOR IMMEDIATE EVALUATION

The Fairchild-Polaroid® Oscilloscope Camera produces a photographic print in a minute

Valuable but inexpensive oscillograms for immediate evaluation; automatic one-minute processing without a darkroom; a set up time of two minutes or less—they're just three of the many advantages that are yours when you use the Fairchild-Polaroid Oscilloscope Camera. Wherever individual exposures meet your recording requirements—where you'd like to have permanent records of the traces you're now sketching or carrying in your memory, this is the camera that can bring new speed, ease and economy to your job. Prints are 3¼ x 4¼ and each records two traces exactly one-half life size. Write today for details.



A minute after you've pulled the tab a finished print is ready for evaluation

FAIRCHILD
OSCILLOSCOPE RECORDING CAMERAS

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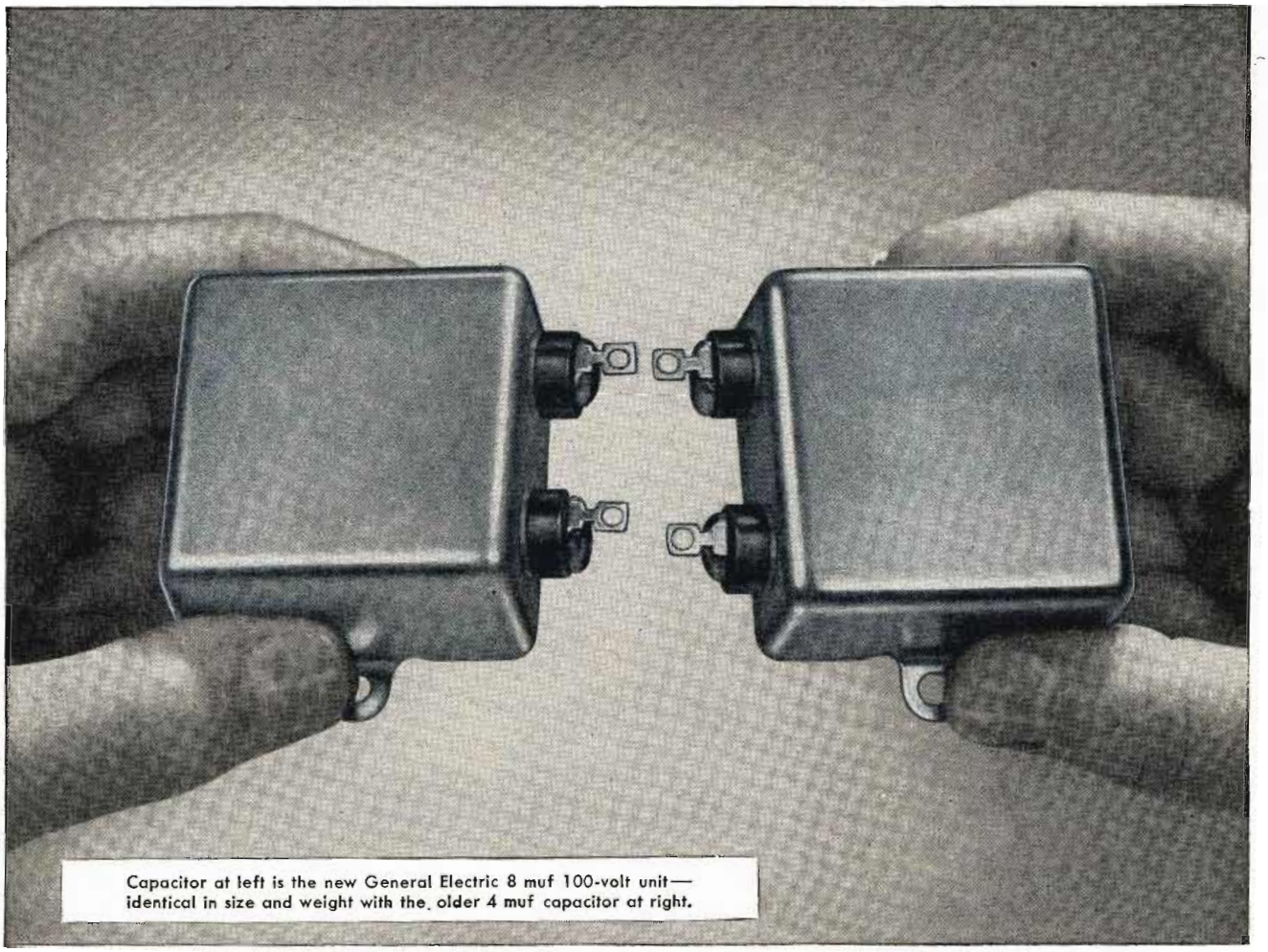

Capacitor at left is the new General Electric 8 muf 100-volt unit—identical in size and weight with the older 4 muf capacitor at right.

8 muf...in the space of 4

New General Electric line of 100-volt d-c capacitors marks another important step in reducing size and weight of electronic equipment.

Here is another outstanding G-E capacitor development—thinner paper, thinner foil, so that double or triple the capacitance can be designed into a cubic inch.

These new capacitors are comparable in all ways with previously offered paper dielectric units, are equally dependable, and in addition are smaller in size and lighter in weight. They will not introduce noises into the system. They will satisfactorily pass signal voltages approaching zero. Their insulation resistance values remain high after long periods of service. While primarily intended for d-c applications with allowable ripple voltages in accordance with JAN-C-25, they will withstand occasional discharges, and can be used in low-voltage a-c circuits.

In Regular Production. Units of 3, 8 and 10 muf in Case Style 53 and 4 muf in Case Style 61 are in regular production. Other ratings can be built in mass-production quantities.

These capacitors meet all requirements of "F" characteristics of JAN-C-25 for 100-volt d-c units. For applications where an expected life of 1000 hours at 40 C is satisfactory, rating can be increased to 150 volts. For ambients above 40 C, units should be derated in accordance with JAN-C-25 Specifications. There is negligible change in capacitance from −40 C to 105 C—and units will give full life at temperatures as low as +55 C.

If you have applications involving reasonable quantities, get in touch with us. Your letter, addressed to Capacitor Sales Division, 42—304, General Electric Company, Pittsfield, Mass. will receive prompt attention.

General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

407-305

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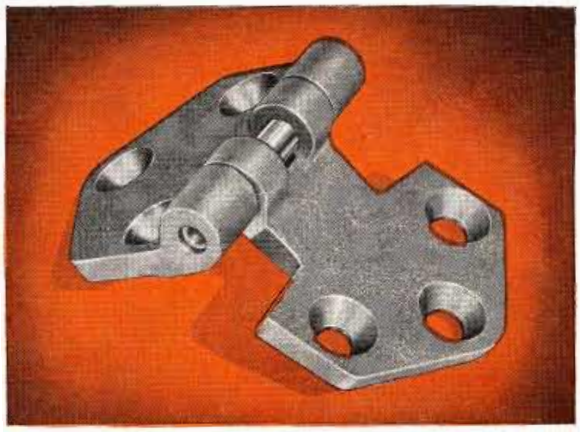
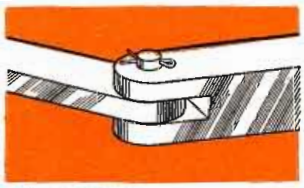
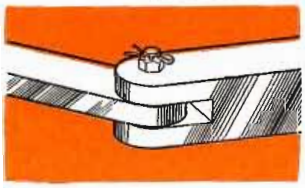


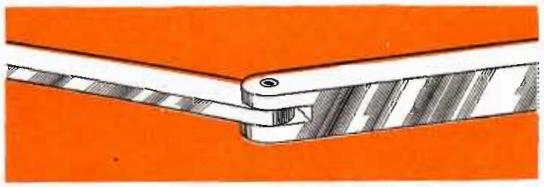
Rollpin replaces hinge pin for faster assembly of hinges. Inexpensively and simply driven in place, it cuts assembly costs. Constant spring tension holds Rollpin firm against vibration on heavy-duty automobile door hinges —on lightweight sheet metal hinges for meter or instrument panel covers.

How to replace hinge pins and cotter pins with ROLLPIN self-locking fasteners



IF YOU DO THIS ⋀ OR THIS ⋁ . . .





TRY THE ROLLPIN WAY INSTEAD . . . Rollpins offer many advantages as pivot and clevis pins for linkages or yoke assemblies. Heat-treated to provide excellent fatigue resistance and wear characteristics, Rollpins fit flush, grip firmly in the outer or inner members, depending on your design requirements, and are simply, inexpensively pressed in place. They are faster to install than cotter pins or safety wire . . . straight edges protect workers' fingers and clothing. Rollpins are readily removed with a punch . . . can be used again and again . . . assure simplified maintenance.

USE ROLLPINS (1) To replace set screws and rivets. (2) To pin or key gears . . . pulleys . . . levers . . . knobs. (3) As locating dowels, stop pins or shafts for small gear trains.

Once you test their effectiveness you'll want the secure, vibration-proof fastening of Rollpins in your products. Write now for a sample package and full details. Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J.

HERE'S HOW ROLLPINS PROVIDE A VIBRATION-PROOF FIT

Rollpins are easily pressed into production drilled holes—chamfered ends facilitate automatic or manual insertion.

Rollpins compress as they are driven—are self-retaining in production drilled holes—fit flush. Secondary hole-reaming or riveting operations are eliminated.

Constant spring tension against walls of hole locks Rollpins permanently in place until deliberately removed with a pin punch. Rollpins don't damage the hole and can be used again and again.

ROLLPIN TRADEMARK

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ELASTIC STOP NUT CORPORATION OF AMERICA

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Elastic Stop Nut Corporation of America
2330 Vauxhall Road, Union, N. J.

Please send me full application data and test samples of the Rollpin.

Name_____ Title_____

Firm_____

Address_____

City_____ Zone___ State_____

TELE-TIPS

(*Continued from page* 12)

TV POWER BOOSTS will not increase the service area of all TV stations, for the results will depend on local conditions. But in almost every case the boost *will* improve signal strength in the fringe areas where the signal-to-noise ratio is very low. These effects have been especially noticeable in metropolitan areas where indoor antennas are the rule rather than the exception. In fact many apartment dwellers are now enjoying for the first time really good TV reception.

CUBAN TV NETWORK is being established by Goar Mestre, director general of Circuito CMQ, Havana. Two Du Mont 500-watt transmitters and two General Electric 5-kw transmitters will be installed in Mantanzas, Santa Clara, Camaguey and Santiago. CMQ engineers are studying micro-wave-relay links which will enable the company to connect the four stations to the Havana transmitter giving CMQ TV coverage over approximately 80% of its national territory.

ATTIC TV-ROOMS may be the new style in home arrangements, when UHF becomes prevalent. Most UHF receiver demonstrations so far, it must be noted, have been made in 10th and 12th-story hotel rooms, suggesting that to get a good picture, the street-level householder at any distance from a UHF transmitter may have to move his television set up directly under his roof. Ordinary downleads at UHF frequencies show great loss of signal so that, by actual experience, a room dipole on UHF is about as effective as a rooftop pickup. Perhaps a slogan of the UHF-TV station of 1953 will be "Come UP and see me sometime."

IT IS HARD TO REALIZE that it is eleven years since the first color-television program was transmitted. In 1940 the Columbia Broadcasting System made the first known color-TV transmission in this country. Earlier than this in England the late John Baird demonstrated color-TV in the early thirties. Although the regular transmission of color-television has only just started, already the expected crop of ideas is maturing. Inventors, now supplied with a signal source, are tumbling over each other with Rube Goldberg schemes for producing cheap and compatible color-television.

(*Continued on page* 28)

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MODEL 22

AUTOMATIC DEVELOPER

Model 22 is a portable developing machine for 16mm black and white, negative, positive or reversal film. Operates in daylight. Capacity up to 60 feet per minute. Self contained, entirely automatic, easy to operate. Complete refrigeration, re-circulating systems, air compressor and positive temperature controls. Moderately priced.

More and more television stations are discovering the many advantages in operating their own film laboratory. It enables them to develop film of news events and special features and get it on the air in a matter of minutes. It gives them processing service that is days and weeks ahead of "out of town" schedules . . . a service that can be extremely profitable when offered to other film users in the community. Houston-Fearless processing machines handle the entire job from camera to screen under fully automatic control. Quality of work is unsurpassed. Houston-Fearless equipment has been standard of the motion picture industry in Hollywood and throughout the world for 20 years. Write for information on your individual requirements.

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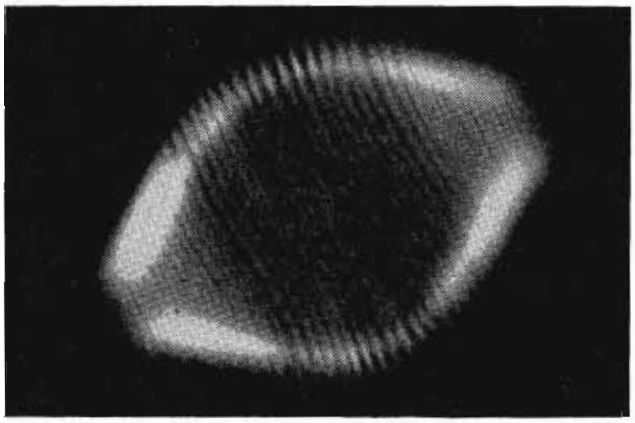
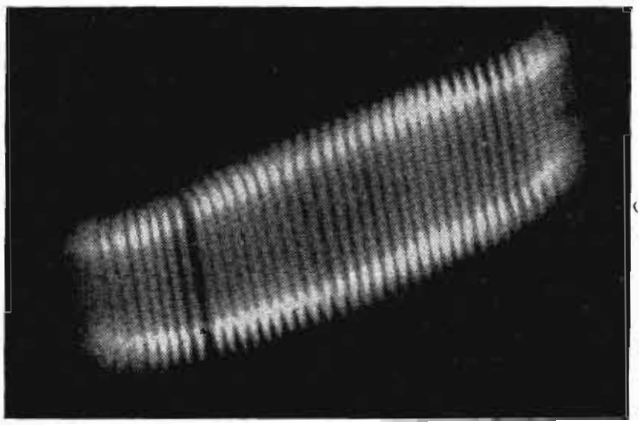
Why G-E dial lamps are seen

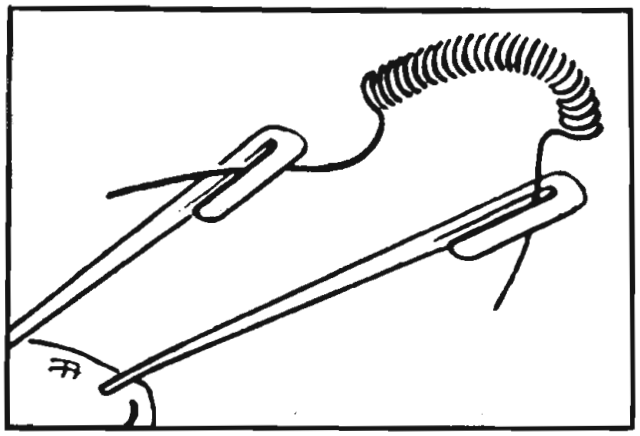


OLD FILAMENT. High notes often cause the filaments and lead-in wires of radio dial lamps to vibrate. In old-style lamps, they vibrate to frequencies different from those of the noise. This produces a whipping action (above) which eventually tears the filament apart.

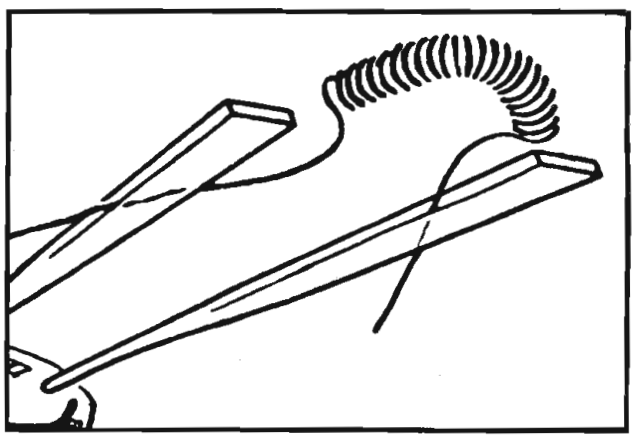


NEW FILAMENT. By redesigning the filament supports of G-E radio dial lamps, General Electric engineers matched the frequencies and greatly reduced the effects of vibration (above). As a result, G-E radio dial lamps give longer, more dependable service.

...but not heard



OLD-TYPE JOINT. Some types of dial lamps actually cause "static". Old-type clamp joints in the bulb (above) often permit changes in resistance or tiny arcs that cause the lamp to radiate bothersome interference.



IMPROVED JOINT. To prevent dial lamps from being "noisy", General Electric developed a better joint—one with tungsten filament legs pressed firmly into the softer metal of the lead-in wire. It's another reason why G-E dial lamps insure customer satisfaction!

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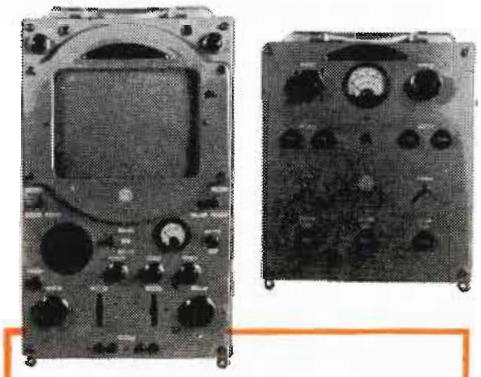
NOW...

GPL

Makes TV's Outstanding Camera Chain



Even Better!

GPL's 1951 Image Orthicon Chain is delivering even more features – better performance – than the previous model which itself set new industry standards! Compare it for ease of operation, uniform high quality, flexibility in studio or field.

Set this camera up to meet varying requirements . . . control it remotely if desired . . . select any of four lenses at the press of a button . . . adjust focus from right *or* left side of camera, with the same 300° arc of focus adjustment for all lenses . . . choose color filters, masks, at the flick of a thumb . . . control the motor-driven iris from camera or camera control unit. Normal optical focus range automatically adjusts for constant 9" diagonal at close-up, for all lenses except telephoto. Overtravel switch provides *extended* focus range, obtaining full optical focus on all lenses.

In every way, GPL's is a "human-engineered" camera chain, built to do a tough job more easily, built to do *your* specific job *best!* Arrange to see this great new model at the earliest opportunity.

Compare

THESE FEATURES WITH ANYTHING ON THE MARKET TODAY

- Three Compact Units
- Push-button Lens Change
- Right or Left Hand Focus Knobs
- Right or Left Hand Lens Iris Control Buttons
- Turret, Focus and Iris Controls from remote location if desired
- High Resolution Integral View Finder
- Enclosed I.O. Controls
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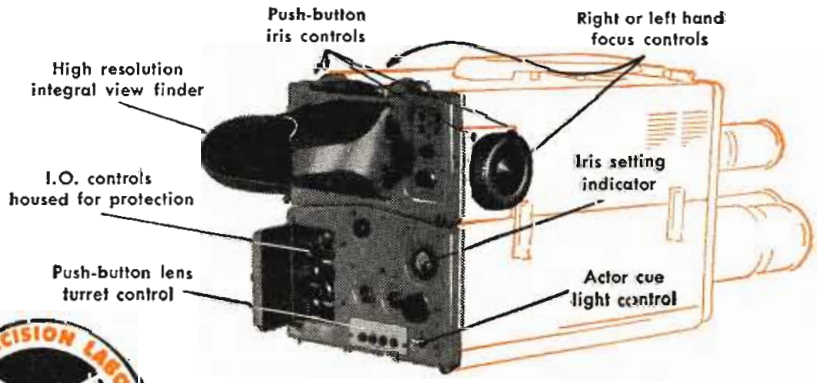
- Pre-loaded Color Filter Wheel
- Swing-up Chassis
- Focus Range Selector Switch
- Equal Flexibility in Studio or Field

WRITE, WIRE OR PHONE FOR DETAILS

FINGER-TIP OPERATION
from CAMERA or REMOTE LOCATION



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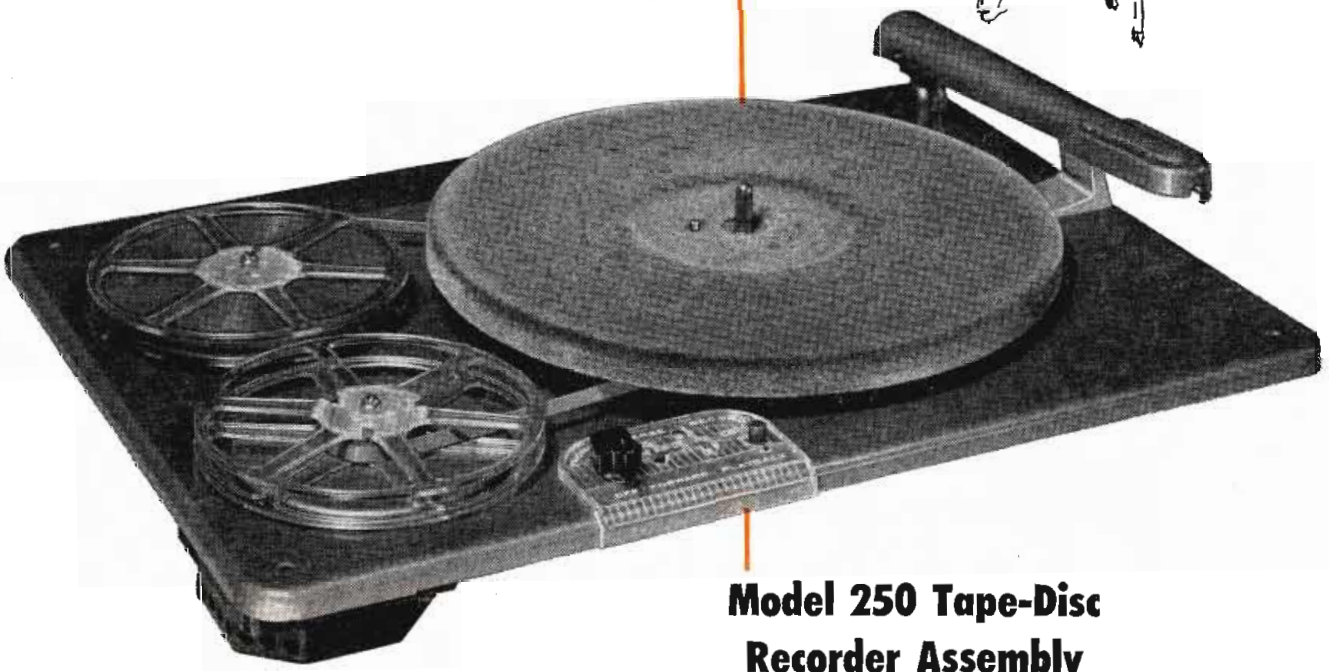
Buy Appeal

For Home Entertainment Units

High in quality . . . yet low in price . . . General Industries' Model 250 Tape-Disc Recorder Assembly meets every need for an all-purpose sound recorder. It is simple to operate, foolproof and dependable—built to the same high quality standards which identify all GI *Smooth Power* phonomotors and turntable assemblies.

Now is the time to investigate the tremendous profit possibilities offered by this versatile recording assembly. Write today for catalog sheet describing both recording and playback features of the GI Model 250.



Model 250 Tape-Disc Recorder Assembly

Suggested amplifier circuit and complete amplifier parts list is contained in a comprehensive service manual which accompanies each unit.

The GENERAL INDUSTRIES CO. **Department L • Elyria, Ohio**

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For the Best .. Call Cleveland

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No. 1003

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SELENIUM
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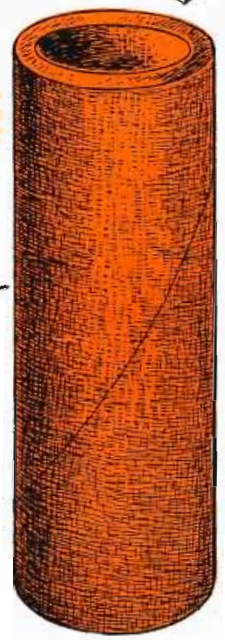

is used in Federal Selenium Rectifiers to insulate the live electrical parts of the rectifier from the central eyelet upon which the rectifier is mounted.

Federal Telephone and Radio Corporation is known as America's oldest and largest manufacturer of Selenium Rectifiers.

CLEVELITE and COSMALITE* high quality . . . low cost Phenolic Tubing is the first choice of the Radio and Television Industries.

Low Moisture Absorption . . . Dimensional Stabilty . . . High Dielectric Strength . . . Low Loss . . . Great Physical Strength . . . Good Machineability . . .

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Our tubing is available in . . .
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FREE SAMPLE made to your exact specifications gladly furnished.

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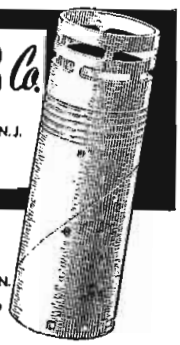

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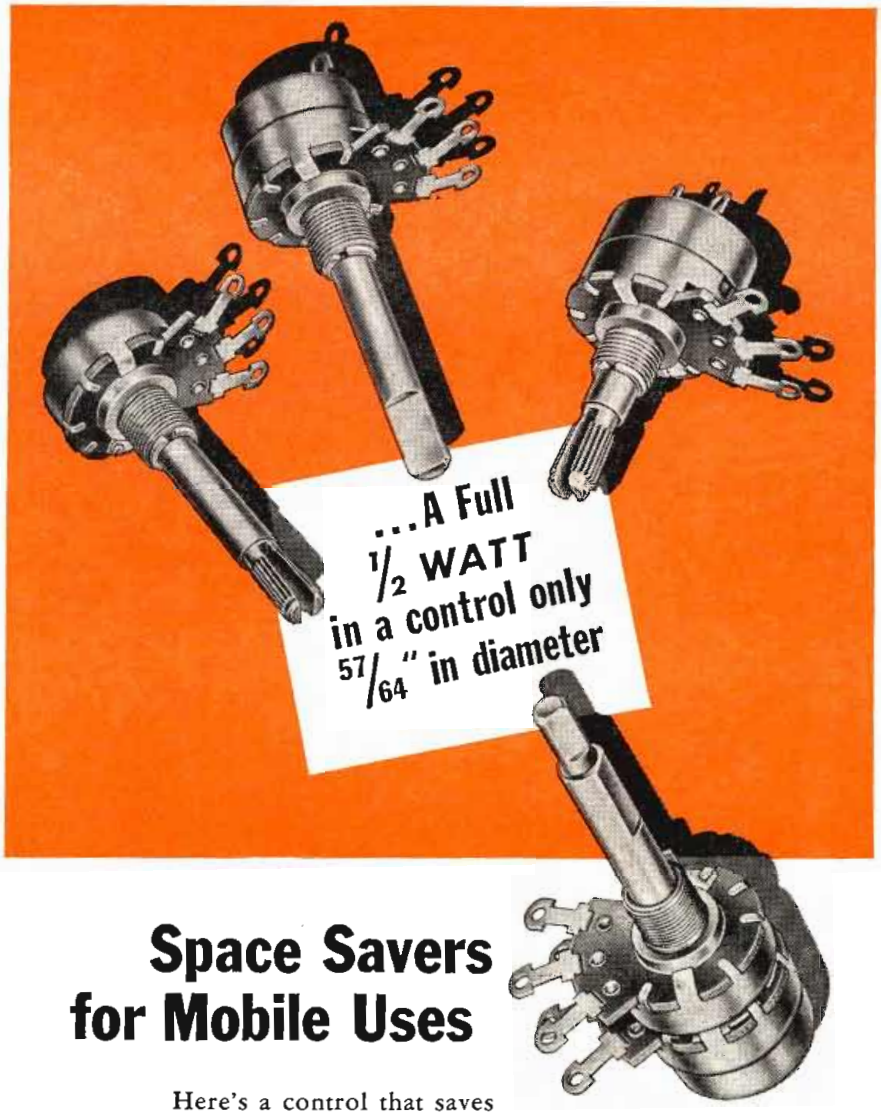

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You can get Stackpole LR controls with or without SP-ST or DP-ST line switches and in dual concentric arrangements. The wattage rating is conservative and these sturdy little units have proved their dependability on dozens of jobs formerly handled by materially larger controls.

Data bulletin covering the complete line of Stackpole controls on request.

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TELE-TIPS

(Continued from page 22)

VIDEO RECEPTACLES or outlets for TV cameras may ultimately become as much a part of new building design as the familiar electrical outlets employed to-day. This would be particularly true in buildings constructed for municipal or governmental activities as well as those constructed for shows or sports. In New York City, local TV stations have shared costs of a permanent camera cable installation in Madison Square Garden since fire ordinances prohibit running camera cables through public areas for each show. Likewise in Washington, the White House, the Senate and House of Representatives are wired for video.

"COMMERCIAL" ELIMINATOR—Invented and perfected by Dr. R. Clark Jones, mathematical physicist of the Polaroid Corp. of Cambridge, Mass., and exhibited earlier this year at New York, a blurb-suppressor, "listens" for a program's pauses and measures their abruptness, remembers how many have passed during the preceding seconds of the program, and makes its decisions to turn off and on the radio or TV set accordingly. It rarely fails, the inventor said, and can even distinguish between singing commercials and other music. This automatic "commercial" silencer was evolved by Dr. Jones from his work on electronic calculators. In its present four-tube form, the device resembles the "works" of a midget home radio. Its selling price if placed on the market was estimated at between $15 and $20. The unit also has other uses, Dr. Jones says, and may become of real importance in adding to our knowledge of the nature of speech and music and the workings of the human brain, for it makes use of five inherent functions of the electronic calculator—it extracts logarithms, integrates values, differentiates, subtracts and can "remember".

TV IN 1961—Envisioning a new expansion of television, Chairman Coy, FCC says: "Today we have 107 stations on the air. In five years there should be 1,500 in operation, in ten years 2,500, and eventually we may have as many as 3,000 stations—bringing television to virtually all the country from virtually all the country."

THE IMPOSSIBLE is that which we have not yet learned to do.—Dr. Willis R. Whitney, GE.

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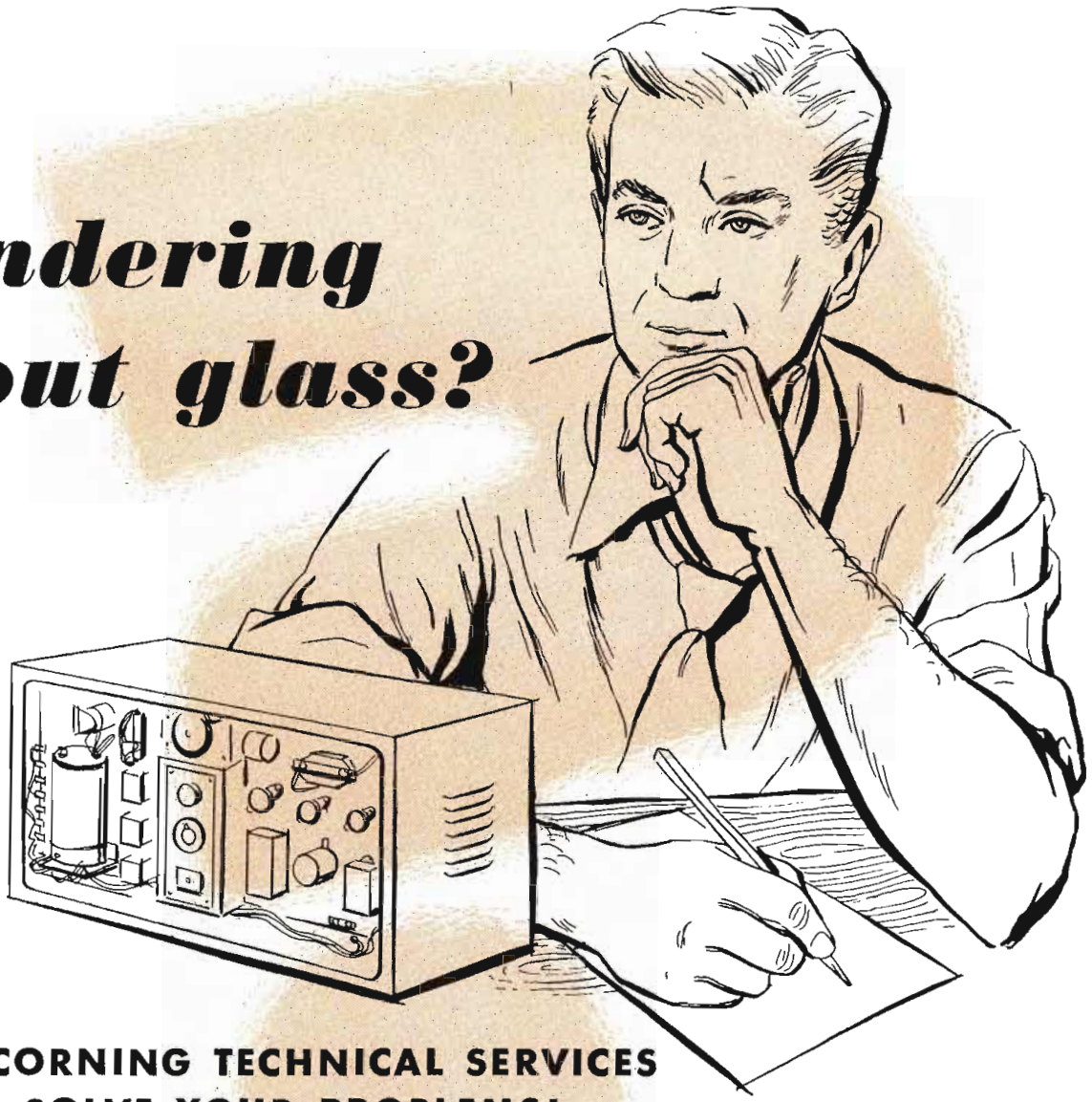
wondering about glass?



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Specialists in product engineering, glass working techniques, and design are ready to go to work for you. And their experience is backed by complete and modern research, pilot plant and manufacturing facilities.

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ELECTRONIC SALES DEPARTMENT — ELECTRICAL PRODUCTS DIVISION

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Electron tubes are the nerve ends of military intelligence—in systems set up and maintained by RCA Service Company field engineers.

Electron Tube with a military mind

With the rapid advance of airplanes, tanks, fast ships, and mechanized weapons of war, a swift, sure means of *communication* and *detection* is as important as are the new weapons themselves. It is provided—by electron tubes and electronics.

So important is this area of military intelligence that RCA Service field engineers—here and abroad—have lifted their efforts to new peaks. Working with our Armed Forces, they install and maintain such *communications systems* as short-wave radio and portable radiotelephones. They work with systems of *detection*, such as radar. They help ships and planes *navigate* with loran and shoran. These engineers are the link between research developments made at RCA Laboratories—and America's military strength.

The number of RCA field engineers has *tripled* since World War II. And they serve where needed, wherever an electron tube's "military mind" can be of military use.

* * *

See the latest wonders of 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, N.Y. 20, N.Y.

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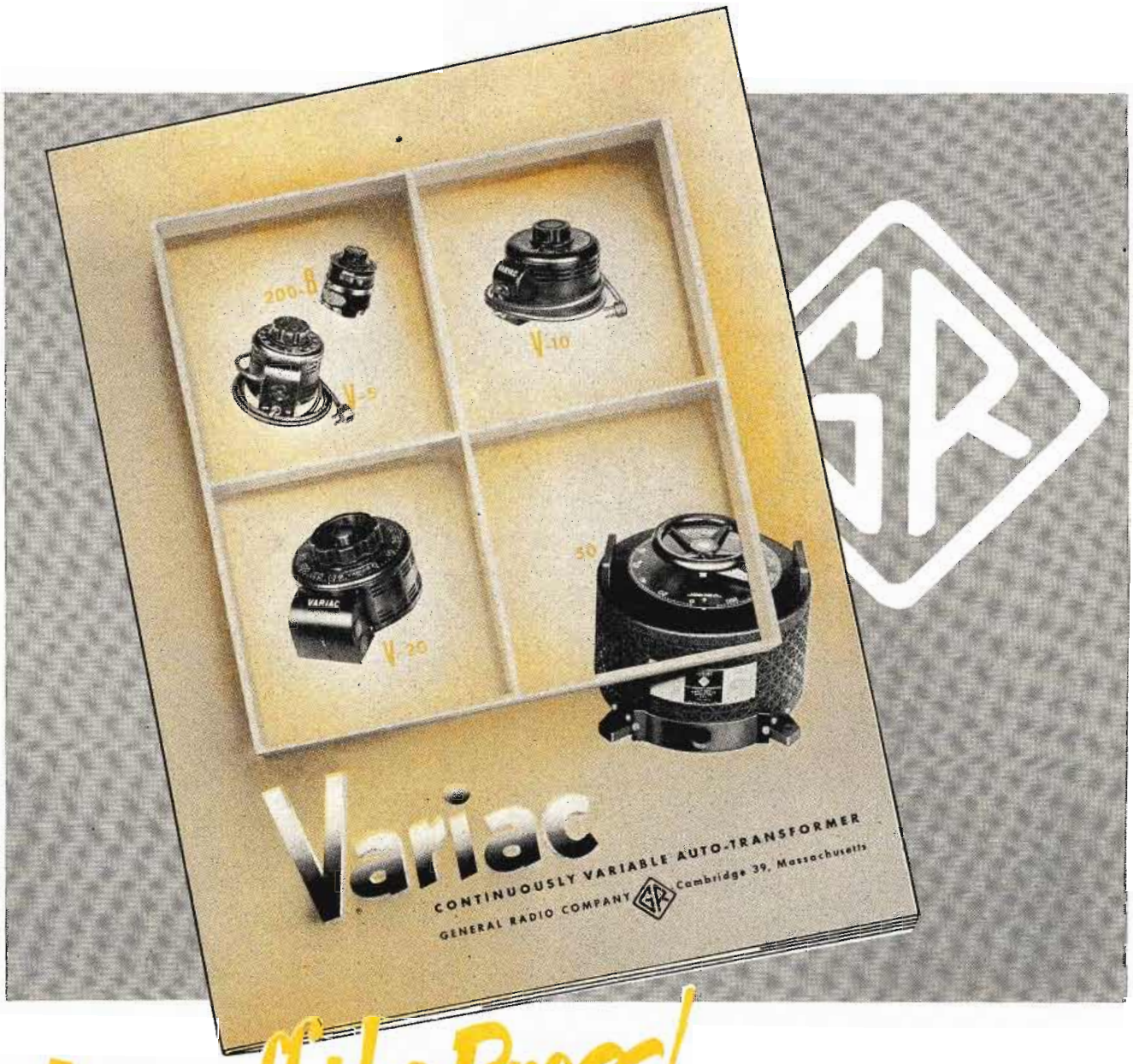

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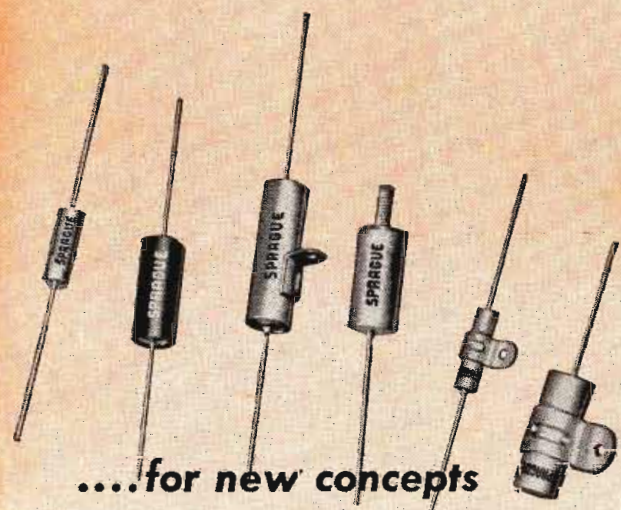
Joint Army and Navy component specifications were never meant to limit engineering progress—and, with Sprague, they most certainly haven't!

The extent of what has been achieved is no better indicated than by the fact that much of Sprague's vast military-use production is based on capacitors, wire-wound resistors and high-temperature wire insulation for which no standard JAN specifications yet exist! These are, in effect, super-JAN—fully approved via waivers to the equipment manufacturers. Such components are being produced and used in ever increasing quantities.

If your problem is one that can be solved by smaller, lighter components or by better elevated temperature performance, chances are excellent that a Sprague application engineer can help you.



....for new concepts of equipment design

Typical of Sprague engineering progress ahead of and beyond JAN limits are these famous subminiature, hermetically-sealed, metal-encased paper capacitors. Far smaller than equivalent JAN styles and available in types for 85°C. and 125°C. operation, these capacitors have helped make possible a long list of military electronic equipment, which never could have met size and weight limitations prior to the development of these capacitors. Sprague Bulletin 213-B gives full technical data.

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PIONEERS IN ELECTRIC AND ELECTRONIC DEVELOPMENT

SPRAGUE ELECTRIC COMPANY • NORTH ADAMS, MASSACHUSETTS

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TELE-TECH

TELEVISION • TELECOMMUNICATIONS • RADIO

O. H. CALDWELL, Editorial Director ★ M. CLEMENTS, Publisher ★ 480 Lexington Ave., New York (17) N. Y.

Government-Industry Planning Needed NOW, for '52

Top Executives and Engineers Must Help in Washington. We Can No Longer Depend on Just "Letting George Do It."

Aside from the international crises that hang over the nation, there are great uncertainties ahead for the radio-TV industry in the near future.

We face a baffling marketing problem for 1952, the solution for which must be found quickly, if full employment and progress are to be assured for the radio-TV industry and all the two million people dependent upon it.

This 1952 problem of our domestic markets can be largely solved by prompt settlement of pending issues of TV allocations, VHF and UHF, and color-television. Clearing of these obstacles must come from Washington, and therefore calls for closest cooperation and planning between the Federal authorities and leaders of the industry.

Washington the Key

This relationship to Washington is three-fold—all added onto a fourth set of complexities which businesses generally are today undergoing:

1. **Radio-TV has the patriotic and priority duty of supplying the vast military needs of Army, Air Force and Navy.**
2. **Radio-TV is "for the duration" under the jurisdiction of the National Production Authority, with control on raw materials.**
3. **The FCC exercises life-and-death control over the stations and channels, present and future, that are vital to radio-TV's existence and growth—(a special added condition to which no other American business is subject!)**
4. **Like other businesses, the radio-TV industry must meet current market conditions of supply and demand, employment, price, shortages and overstocks.**

With most of its problems and uncertainties thus directly based on Washington, it is time for the radio-TV industry to send its top company executives and engineers to the capital city, to confer and plan with the FCC, NPA and military authorities.

The problems of the radio-TV industry should be put squarely before the FCC and members of Congress. This can be done best through close and continuing contacts by industry executives and engineering leaders with the government powers on Capitol Hill and along Pennsylvania Avenue.

A sort of super industry committee might be marshalled for action, made up of company and association presidents, to press for prompt solution of the matters that are holding up radio-TV advances. Already similar industry committees have been appointed for military contacts.

Interpret and Cooperate

Such a top group of industry leaders, working in close and friendly contact with the FCC commissioners and the Congressional committees having radio communication responsibilities, could shape plans that would guarantee industry progress throughout 1952, and beyond.

Already individuals, like the new president of RTMA and a few industry-minded executives, have done brilliant work in interpreting the industry to Washington officialdom.

But a solid phalanx of industry leaders should be working on this task continuously, explaining and interpreting what is needed to keep the radio-TV business vigorous and active, with all its 2,000,000 dependents.

In the past there has been too much of the spirit of, "Oh, well, let George do it."

Top radio-TV executives and engineers should themselves spend much time in Washington from now on.

And start at once!

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The RADARSCOPE Revealing at a Glance

PENTAGON

DEFENSE CONTRACTS FLOWING OUT—With Congressional enactment of the huge appropriations measure for the Armed Services, to provide funds for the 1952 fiscal year which commenced last July 1, contracts amounting to $3.8 billion will flow out to the electronic-radio-radar manufacturing industry and this Fall should take up the slack of unemployment which has plagued the industry during the summer. While the Senate and the House moved slowly in their consideration of the Defense Department funds bill during August and September, the armed services concerned with the procurement of electronics-radio-radar equipment had to hold up the awarding of procurement contracts to prime end-equipment component and tube contractors.

MANPOWER

CREATIVENESS, scientific training and good character are rated as the most important prerequisites for research workers by Dr. E. W. Engstrom, now vice-president in charge of the RCA Laboratories, Princeton, N. J. While the evidence is by no means conclusive, there are indications and experiences, he reveals, to show that the most revolutionary creative thoughts have come to few research workers during their first decade of work. For the average research worker, he said, it seems that his best original and creative work comes before the close of the second decade of activity in the laboratory. "Members of research staffs are not equally creative," says Dr. Engstrom. "In fact, a staff of all highly creative members would be unmanageable. An effective staff is one where all members respond to originality, where all members have some degree of originality and where a portion are highly creative."

Dr. Engstrom also stressed that training is not a substitute for creative ability. He declared that if the research worker's creation is to mature into useful form, however, creative ability must be backed by fundamental knowledge and specific skills. "Perhaps research administrators themselves have not adequately evaluated the importance of character," Dr. Engstrom suggested. "Integrity of purpose in research is vital. Nature is a cruel and exacting taskmaster when it comes to technical or scientific accuracy and honesty." He went on to say that "reliability in prosecuting a work program is rarer than one might think and is richly rewarded." Other qualifications which a research scientist should possess, include perseverance when the going becomes difficult, and determination to overcome obstacles along the way.

As forty TV stations increase their radiated power, J. R. Poppele, vice-president and chief engineer, WOR-TV, New York, and Charles H. Singer, assistant chief engineer, are shown turning up WOR-TV's ERP from 9 kw to 22 kw

REARMAMENT

LETTERS OF INTENT—In spite of Congressional delays, the Air Force Materiel Command's electronics-radio procurement divisions, the Army Signal Corps and the Navy all got readied to launch the awarding of contracts with the dispatching of letters of intent to the manufacturing companies which are selected for the procurement contracts. The $3.8 billion procurement during the remainder of the 1952 fiscal year, ending June 30, 1952, is at approximately the same rate of procurement which was distributed by the Armed Services during the first fiscal year after the start of the Korean war.

Meanwhile, a huge expansion program is underway with tax aid for the industry, production to be specialized on radio communications, radar, loran, sonar, fire-control devices, special fuzes, and ruggedized tubes for military service. Five-year tax write-offs will be offered.

MOBILE

POLICE! Fear that the 41-megacycle intermediate band for TV might be jeopardized by increasing powers of police transmitters in this region of the spectrum, has been relieved following a conference between representatives of the Police Chiefs' Association and TV interests. When the TV interference problem was explained to the police authorities, they readily agreed to recommend only low powers for this region, and gave friendly assurance that no new high-power transmitters will be applied for, that might cause TVI. The chiefs readily recognized that police signals on the TV screens of the local citizenry would cause serious trouble right on their home-town beats!

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UHF

RECENT AIR CRASHES have been attributed by some unofficial observers to unreliability in UHF operation, and in some cases to erratic radar frequency operations. Although many pilots profess to like the UHF omni-ranges, there seems to be a reservation on the part of some of them which prevents unqualified approval. Since the national defense effort depends to a great extent on adequate aeronautical navigation facilities the need is indicated for some more development and test work on these problems of dependable radio operation.

TV MARKETS

TV STATIONS VS. SATURATION—Confirming general observation, recent statistical studies have shown that in markets where there was only one television station, the average TV receiver saturation was 28.7%. The saturation figure goes up to 33% in markets with two stations; to 46.3% in markets with three stations, and climbs even to 59.1% in markets with four or more. Thus it can be seen that with the addition of each station to any given city there is a substantial increase in receiver sales potential. In other words, the more cities or markets which have more telecasting stations the greater will be the markets and sales for the television industry.

PROPAGATION

TROPOSPHERIC INTERFERENCE has continued during recent autumn days, coming in occasionally with its tell-tale Venetian-blind effect often accompanied by sound "gurgles" as the interfering signal fights to take over the FM limiters. Studies of this subject indicate that when such TV DX is experienced we have "ducts" in the upper airstrata. These form when there is humidity of more than a certain degree and also temperature-inversion. If there is a side wind blowing, the "duct" is often blown away! Temperature inversion and duct conditions usually exist over or near bodies of water. One of the worst places is between San Diego and Los Angeles on the Pacific Coast.

RODS & CONES

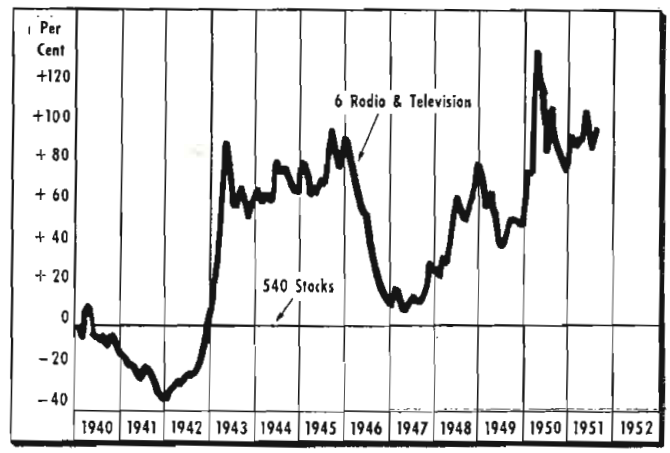
FOUR RETINAL COLORS? The textbooks have long agreed that the human eye can detect only three colors—red, green, and violet; that we have no retinal receptors sensitive to yellow. But now, before the American Association for the Advancement of Science, Dr. L. M. Hurvich of the Eastman Kodak color-control department, Rochester, N. Y., reports experiments indicating that impinging "pure red" on one retina and "pure green" on the other, combine to produce white, while "pure yellow" radiation gave a yellow sensation. He testifies that there is no binocular fusion which creates yellow out of pure green and pure red, but that the eye can see yellow alone, indicating the presence of yellow receptors.

TRANS-CONTINENTAL

THE SUCCESSFUL COMPLETION OF THE coast-to-coast micro-wave and coaxial cable hookup on September 4 marks a milestone in American TV achievement. However, while this is a great engineering accomplishment, it is not very likely that television will soon shift its program focus from New York to the West Coast, despite the prognostications of some authorities. After all, there are more TV stations in the Eastern and Central sections of the country on Eastern and Central Time than there are in the West. The three-hour delay acts to reduce the value of programs from the west to east, except for special events such as the Peace Treaty Conference.

OVERSEAS

BRITISH TV OUTPUT is now running 750,000 sets a year, with radios totaling 1,500,000 for 1951. At the recent Earl's Court radio-TV show in London, a number of English firms showed projection-TV sets but most popular were the 12-in. direct-view sets, selling for $150 to $200. Biggest tube shown was 21-in., in set selling for $800. The projection sets cost about $300 for 19-in. screen or 3x4-ft. wall picture. Highest-price combination radio-TV at the show was ticketed at $2000. Among radio novelties was line of portables covered with bright-colored tartan cloth. British radio-TV output last year totaled a quarter billion dollars—about one-fourth in exports.



Wide swings in the values of radio-TV stocks, as compared to stock-market values in general (here shown as a horizontal line), are revealed by this 12-year chart compiled by Merrill Lynch, Pierce, Fenner & Beane

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DEFENSE CONTRACTS— Survey Reveals Radio-TV Production

316 firms tell what happened to 3,716 Electronic contracts valued at $500 million

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

HOW WERE MILITARY CONtracts, awarded by the Army, Navy and Air Force, distributed throughout the radio-electronic industry during the fiscal year 1950-1951?

How many radio-electronic firms receiving defense contracts employ fewer than 500 people? How many employ more than 500?

How many firms received prime contracts? Subcontracts?

What is the dollar value of radio-electronic equipment contracts let by the Department of Defense during the 1950-1951 fiscal year?

How much of this dollar volume went to prime contractors? How much of this dollar volume went to subcontractors?

These are some of the questions which the radio-TV-electronic industry has been asking in an effort to determine whether or not there has been an equitable distribution of defense work throughout the industry. This information was not available from the Department of Defense and at the suggestion that the answers to the above questions would prove valuable in an analysis of military contracting in the radio-electronic field, TELE-TECH undertook to conduct a comprehensive survey throughout the industry. The results are published here exclusively and for the first time.

Short of a detailed, controlled audit of the radio-electronic industry under formal government authorization, this survey, conducted by the editors of TELE-TECH, offers an accurate analysis of military contracting in our industry during the fiscal year 1950-1951.

The survey covers a detailed study of 306 key firms in 25 states, representing a cross section of the industry.

The survey analyzes distribution of 3,716 prime contracts (it does not include limited contract purchases usually made locally by military posts).

The survey analyzes the military contractual activities of 306 key firms and several thousand subcontractors, and involves nearly $500 millions of expenditures for radio-electronic equipment in the fiscal year 1950-1951. This represents approximately one-third of the estimated monies spent by the Army, Navy and Air Force for radio-electronic equipment during the past fiscal year.

The editors of TELE-TECH believe that the final results can be projected as an accurate picture of military work being performed by the entire radio-electronic industry. No other survey of equal comprehensiveness has been conducted in this industry; no other survey has covered as many firms (306) or involved a comparable dollar volume ($500 million).

The final results indicate that distribution of military contracts throughout the radio-electronic industry is gradually achieving an equitable stage, thus reflecting the determined efforts of the Department of Defense to spread defense work throughout the industry in an effort to take up the slack resulting from supply shortages and curtailed production and also to "preserve" industrial production capacity.

This survey of 306 key radio-electronic manufacturing firms, distributed throughout 25 states, from Massachusetts to California, covered both large and small firms. Eighty-three percent of the firms surveyed employed fewer than 500 people. Seventeen percent employ more than 500.

Of the 306 firms surveyed, 181 or 59.1 percent received prime contracts

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Picture

from the military services. One hundred and twenty-five or 40.9 percent received subcontracts from prime contractors.

Of the total who received prime contracts, 156 or 86.1 percent of the prime contractors subcontracted part of their jobs. Thirteen and nine-tenths percent of the prime contractors did no subcontracting whatsoever. In analyzing the number of firms to whom subcontracting was done, each company surveyed gave the total number of companies to whom they subcontracted. Simple addition disclosed this figure to be 6,771 firms who received subcontracts. Obviously there is considerable duplication since it was not possible to determine how many of the companies receiving subcontracts were being employed by two or more prime contractors.

Of more specific information is the fact that a total of 14,023 subcontracts were awarded by the prime contractors surveyed. This is a ratio of approximately four subcontracts to each prime contract (14,023 to 3,716) analyzed in this survey.

Of the 181 prime contractors, 154 or 85 percent received subcontracts from other prime contractors.

The total dollar value of the 3,716 prime contracts received by the prime contractors responding to this questionnaire is placed at $487,892,-518.

The total dollar value of subcontracts received by these same prime contractors is placed at $146,831,191.

The total dollar value of subcontracts farmed out to other than prime contractors is placed at $191,-968,000.

The total dollar value of all subcontracting is placed at $338,799,191.

It is significant to note that the dollar value of military contracts, as determined by this survey, does not include answers from approximately 14 percent of the firms responding. It is conceivable that had this par-

(*Continued on page* 82)

ANALYSIS of DEFENSE CONTRACTS

Awarded to Radio—TV—Electronic Manufacturers

(Fiscal year 1950-51)

Number of Companies Surveyed	306
Number of States Covered	25
Number of Firms with Less than 500 Employees (83%)	254
Number of Prime Contracts Received	3,716
Total Dollar Value of Prime Contracts	$487,892,518
Total Dollar Value of Subcontracts Received by Prime Contractors	$146,831,191
Total Dollar Value of Subcontracts Received by Other than Prime Contractors	$191,968,000
Total Number of Subcontracts Received from Prime Contractors	14,023
Number of Firms with Prime Contracts (59.1%)	181
Number of Small Firms with Prime Contracts	149
Number of Firms Who Use other Subcontractors (87.1% of all prime contractors)	156
Number of Prime Contracts Received by Small Business	2,424

Data exclusively compiled and published in TELE-TECH, October 1951, by Caldwell-Clements, Inc. 480 Lexington Ave. New York 17, N. Y. PL 9-7880

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"Add-a-unit" Feature of New, Inexpensive,

Designed to reduce the complexity and costs of many be added together to form desired instrument thus enabling

By D. B. SINCLAIR
Chief Engineer, General Radio Co. Cambridge, Mass.

AS the applications of electronics have expanded over recent years, the need for satisfactory test equipment has increased in consonance. In almost any laboratory investigation, nowadays, electronic instruments seem to be involved, and the functions required of these instruments are becoming increasingly complex.

Better accuracy, greater range, and more reliable operation are being obtained than ever before, but the instruments designed to meet these specifications are, at the same time, tending to become more complicated and, as a result, more expensive. Because of their high price, instruments of this kind are purchased only when the importance of the work being done clearly justifies large outlays. There is obviously an additional need for less expensive laboratory-quality instruments that are flexible enough to fill the everyday needs of laboratories operating with restricted funds. The instruments to be described in this paper have been produced with this market in view.

Two fundamental concepts have been kept in mind in designing them. The first of these is that functions that are common to several instruments should not be reembodied in such instruments but should be isolated and packaged separately in individual units. The second is that each unit should be simple, electrically and mechanically. These units plug into one another, connect to one another, or are used with one another to form assemblies and systems of varying complexity.

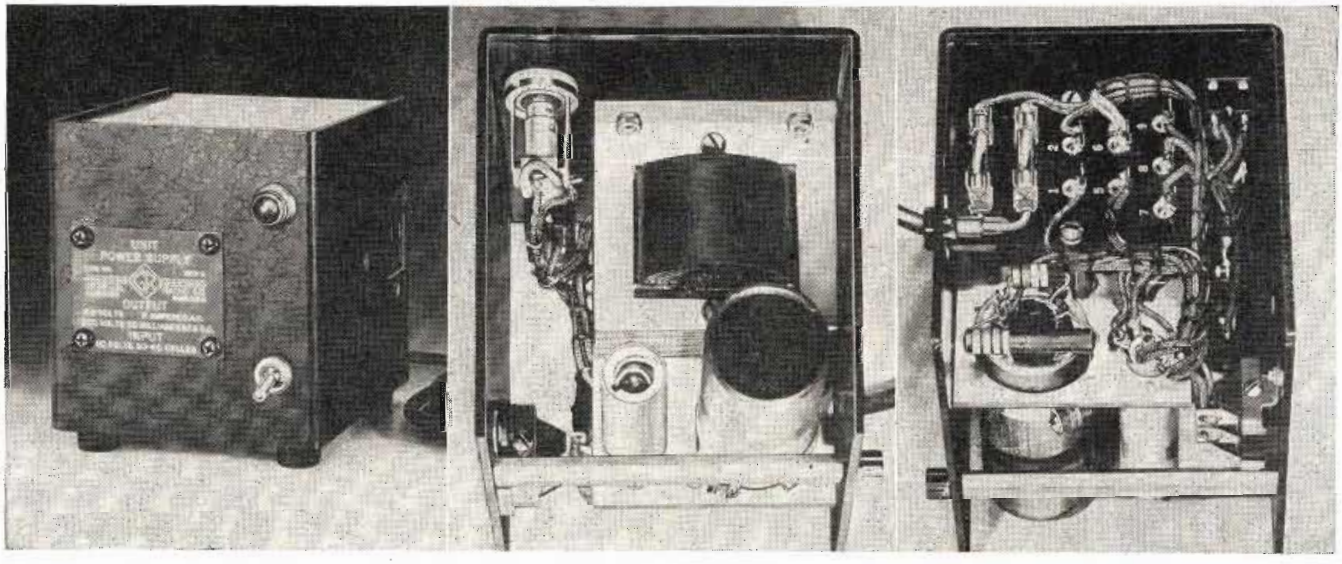
Power Supply

The most universal unit is undoubtedly the power supply, and a good deal of thought has gone into the design of the unit shown in Fig. 1. This unit, rated at 300 volts d-c at 50 ma and 6.3 volts a-c at 3 amperes, carried a Jones plug on one side with which any of the other unit instruments requiring external power can be plugged.

The first feature to catch one's eye is the cabinet. This consists of two U-shaped aluminum pieces, one forming the front panel and the two ends, and the other the top, bottom and back. The first piece is made of 3/16 in. stock and is grooved at top and bottom to accommodate the second piece. This piece is made of 12/32-in. stock and slides in the grooves. It is held in place by pinching the two sides of the first piece together. The simplicity of this assembly, compared with a conventional panel-and-cabinet design is obvious. Instead of five or six pieces, held together with several screws, there are two pieces held together with two screws and a tie-bar. Simplicity leads to economy, and this cabinet has been found inexpensive to produce. Two sizes, the one housing the power supply illustrated, which is approximately a 5-in. cube, and the other having a panel twice as wide, have been found sufficient to house the unit instruments so far developed.

Fig. 2 and Fig. 3 show the general internal construction. The clamps for the transformer have been bent up out of sheet aluminum, and the lower clamp extended to form the shelf on which are mounted the filter condensers and rectifier. The transformer terminal board carries the transformer terminals and the line fuses. The sandwich formed by the transformer assembly is complete in itself, comprising all electrical components but the pilot light, line switch, and Jones plug. It mounts on the panel with four screws. The simplicity of construction, with minimum number of

Figs. 1-3: Front, top, and bottom views of basic power supply unit. At left, Jones socket on right-hand side accepts plug mounted on left-hand side of mating instrument. Thumb screw permits rigid assembly of two units when required. Note simple cabinet form



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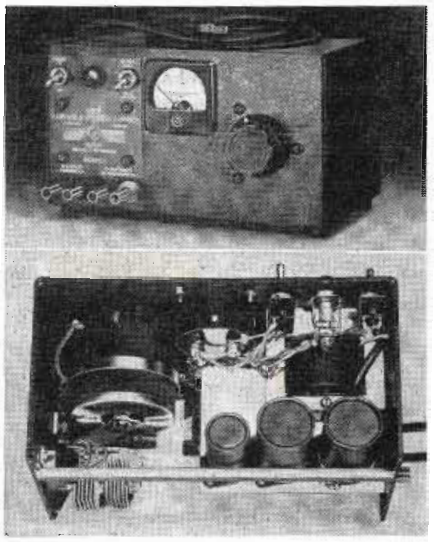
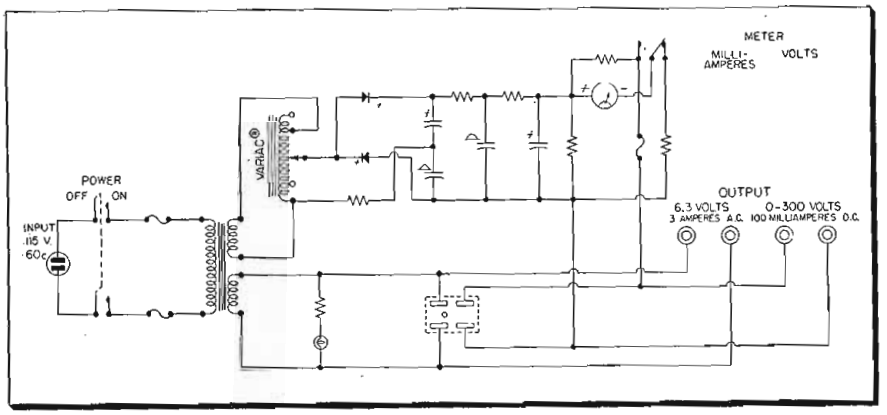
High-Quality Test Instruments

present day measuring equipments, small plug-in units may purchaser to buy only those elements actually needed

PART ONE
OF TWO PARTS





Figs. 4-5: (Left) Top and bottom views of variable type power supply. Unit uses selenium rectifiers and uses voltage-doubler circuit to provide adjustable high voltage dc

Fig. 6: (Above) Schematic of variable power supply. The use of the Variac in the secondary circuit of the transformer makes it possible to obtain a fixed a-c voltage for the heater supply and a continuously variable dc voltage for the plate supply

parts, is again quite evident.

Not so immediately obvious is the almost complete absence of critical tolerances. Except for the the distance between bends in the two cabinet pieces, no dimensions need be closely held, and even these dimensions are readily maintained with a conventional brake. Special tooling is therefore held to a minimum, and large quantity production is not necessary to assure low cost.

Name Plate Economies

Reverting to Fig. 1, it will be noticed that a photo-etched nameplate carries all the instrument information. Since no serial number is included there is no need for additional engraving, and substantial saving is effected at the same time that a maximum amount of information is presented. The name-plates used are made with square corners, so that they can be sheared out in various rectangular shapes without special punches, and the number of holes in them and the numbers of hole sizes are reduced to a minimum.

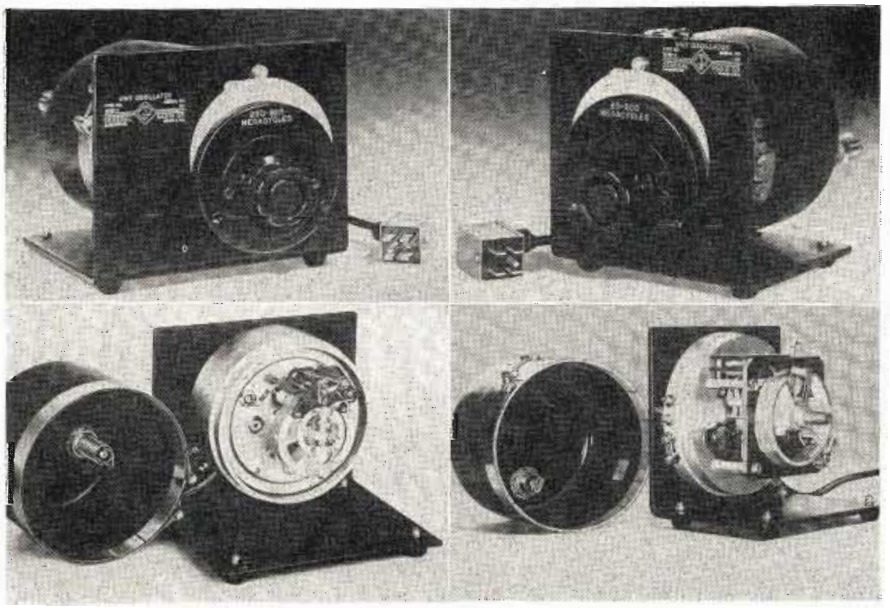
Economies have not been effected at the expense of performance, but some have been obtained by eliminating special features. A permanently attached power cord, for instance, saves the expense of a receptacle and plug; substitution of a single 115-volt primary for two primaries that can be connected for 115-volt or 230-volt operation reduces the transformer cost.

This power supply is small, convenient and inexpensive. Although it is specifically designed to plug into other unit instruments, it is also a good general-purpose bench power supply for experimental use. The construction is well adapted to get rid of heat by conduction of the panel, and the unit can supply 20 watts of heater power and 15 watts of plate power despite its small size.

A more versatile general-purpose power supply is shown in Fig. 4. The same general construction is used, but a meter has been added,

Figs. 7-8: (Left) Front and interior views of unit oscillator covering 250 to 920 MC "Rocket-type" triode is used in butterfly circuit to give output power of 0.2 watt.

Figs. 9-10: (Right) Front and interior views of unit oscillator covering 65 to 500 MC range. A lighthouse tube is used with sliding-contact type butterfly circuit.



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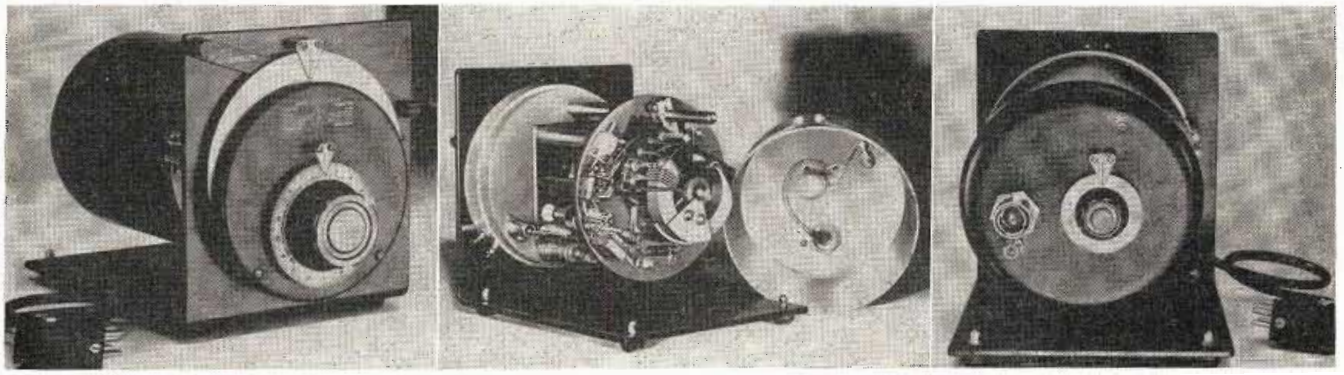


Figs. 11-13: Front, interior and rear view of unit oscillator for 0.5 to 50 MC range. Slanting bar above and behind the dial controls a switch that changes range from 0.5-5 MC to 5-50 MC. Sickles of aluminum and iron dust are ganged to condenser shaft to move in tuning coils and vary the inductance. The small dial visible in the right photograph controls an output potentiometer.

the power output has been increased, and the high-voltage d-c output has been made continuously adjustable.

It is anticipated that this power supply will be used extensively for experimental work in which convenience of attaching wires is important. Binding posts on the front panel have therefore been added in parallel with the Jones plug connections. These are grouped at the left of the panel with all controls requiring identification. It is assumed that the output control knob at the right needs no legend since its setting controls the meter reading and its function is therefore obvious. The name plate is again sheared, with square corners, rather than punched, and is stopped above the binding posts, as shown, to avoid the need for four additional holes. The meter can be switched with the toggle switch to read either current or voltage.

Interior Mounting

Fig. 5 shows the interior of the instrument. The same general construction as that used in the smaller power supply is again evident. The transformer mounts in a bent-aluminum sandwich, one half of which becomes the shelf for mounting the filter condensers, and the transformer terminal board does multiple duty as mounting strip for transformer terminals, fuses, and small components. The two selenium stacks used as rectifiers are mounted to conduct heat readily to the side of the cabinet and to be easily cooled by ventilation through holes punched in the bottom and back of the cover piece.

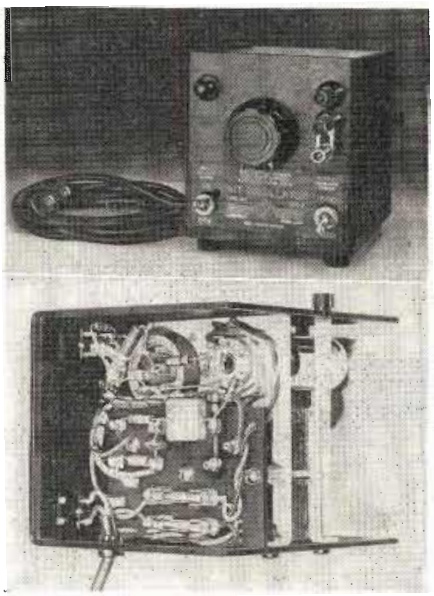
An obvious feature of the design of this power supply is the Variac, adjustable autotransformer, which controls the a-c voltage to be rectified. It is used because it provides a continuous control to zero volts and because, being an autotransformer, it maintains a low source impedance at all settings. It must now be pointed out that there is but one transformer in the instrument, that the Variac used is a standard, 115-volt stock model, and yet that a constant voltage of 6.3 volts a-c and a continuously variable voltage of zero to 300 volts d-c are both obtained. It is clear that some trick or subterfuge must be incorporated and indeed there is. The novel solution to the problem, suggested by Dr. W. N. Tuttle, is shown in Fig. 6.

The power transformer isolates the output voltages from the line, furnishes the 6.3-volt heater supply, and provides a voltage for the Variac augmented to about 1.17 times line voltage. The particular Variac used will stand this voltage, ± 10%, at 60 cps without excessive magnetization current, and will produce an output voltage adjustable between zero and 158 volts. This voltage is then rectified in a voltage-doubler circut to produce the desired d-c output voltage.

In this instrument cooling is again excellent, and outputs of 20 watts heater power and 30 watts plate power can be supplied continuously from a box approximately 5 x 5 x 10 in.

Adequate power supplies now having been provided, a line of oscillators to furnish signal power over a wide range of frequencies is of primary importance.

Figs. 14-15: Front and bottom view of fixed frequency unit oscillator for 400-1000 cps. Unit departs from fundamental unit-line concept by having its own power supply.



Oscillators

The first of these, covering a frequency range from 250 to 920 MC, is shown in Fig. 7. This unit utilizes the well-known butterfly circuit and a disc-seal triode of the so-called rocket type. A cylindrical casting, mounted on the panel, houses the gears that spread the 90° rotation of the butterfly rotor over 270° on the tuning dial, and a spun aluminum can completes the oscillator shielding. Output of about 0.2 watt is obtained through magnetic pickup to the butterfly circuit of a loop mounted in the cover.

The second oscillator, shown in Fig. 8, covers a frequency range from 65 to 500 MC. It is similar in general construction to the higher-frequency model, but the inductance is varied by a sliding contact to provide a very wide tuning range. A lighthouse tube is used to provide about 0.5 watt output.

A novel oscillator to cover the frequencies from 0.5 to 50 MC in two 10:1 ranges is shown in Fig. 9. This oscillator, developed by Mr. E. Kar-

(*Continued on page* 81)

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Audio Problems in Aircraft Communication

High acoustic noise levels and large air pressure variations are major deterrents to good speech intelligibility

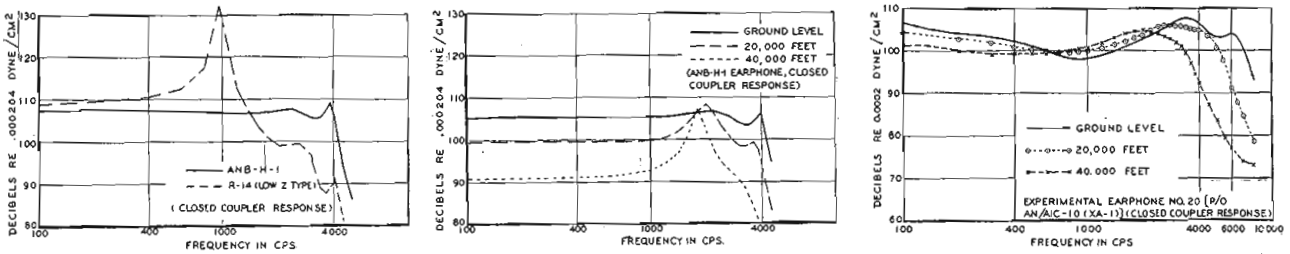


Fig. 1: (Left) Performance of "resonant" and "flat-response" earphones. Fig. 2: (Center) Earphone performance variation with altitude for earlier earphone types. Fig. 3: (Right) Earphone performance variation with altitude, experimental type.

By I. H. BOWKER, *Communication & Navigation Laboratory Air Force Development Force, Wright-Patterson A. F. Base, Dayton, Ohio*

IN speech communication in aircraft, high ambient acoustic noise levels and large variations in ambient air pressure are two major deterrents to good intelligibility. The following are the chief factors involved: the effects of altitude on speaking ability, the effects of altitude on the performance of microphones and earphones, speech-to-noise discrimination at the talker's microphone, noise insulation at the listener's earphones, and the electro-acoustic response characteristics of the microphone, earphone, and intervening transmission link.

It is inherently more difficult to speak at high altitudes than at ground level or low altitudes. Man is accustomed to using air at near sea-level density to operate his speech making machinery — the lungs, larynx, throat, tongue, lower jaw, and lips. And he is accustomed to talking with his lower jaw and lips entirely free from any external restraint. His ability to talk is hindered in two ways at high altitude: first, he has to operate his lungs and larynx with air of much lower density (reduced to 1/5 at 35,000 ft.), and the motion of his jaw and lips is restrained by the presence of an oxygen mask.

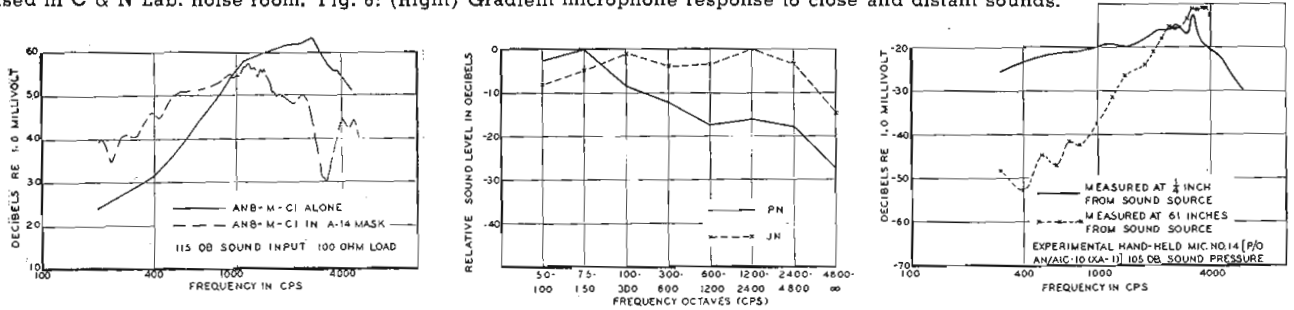
Effect of Lowered Density

The effect of the lowered density is to make it more difficult to produce the sounds that originate in the larynx. The effect of the mask restriction is to make it more difficult to manipulate the lips and jaws properly. The net results are as follows: A man must exert considerably more effort to talk intelligibly, he can say only a few words in one breath, and his voice level is very much reduced compared to his normal speech at ground level. The reduction in average level is approximately 10 to 12 db from ground level to 35,000 ft., for an "average" talker.

Fortunately, the unvoiced sounds, which are the most difficult to understand, are not reduced as greatly as the voiced sounds. On the other hand there is no hearing loss associated with altitude. The sound-pressure sensitivity of the ear appears to be essentially independent of the ambient air pressure. An exception to this is the "blocking" that occurs when the pressure on the two sides of the eardrum fails to equalize during a climb or descent. That occurs when the Eustachian tube, leading from the middle ear to the throat, is swollen and plugged so that the flow of air into and out of the middle ear is restricted.

The effect of altitude on microphone and earphone performance is also of major importance. Any diaphragm-type device is inherently resonant. Old type earphones had resonance peaks and dips (Fig. 1). of 15 to 20 db. in their frequency-response curves. In a modern earphone, the response curve is made nearly flat by a network of inclosures and leakages analogous to reactors and resistors in electrical circuits. But the numerical values of these acoustical reactors and re-

Fig. 4: (Left) Response curves for ANB-M-CI microphones in andout of oxygen mask. Fig. 5: (Center) Aircraft noise spectrums as used in C & N Lab. noise room. Fig. 6: (Right) Gradient microphone response to close and distant sounds.



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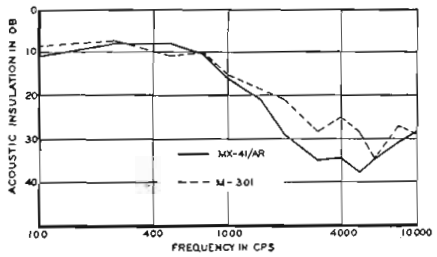

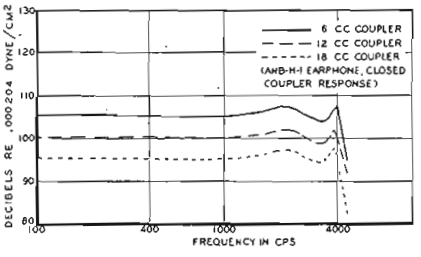

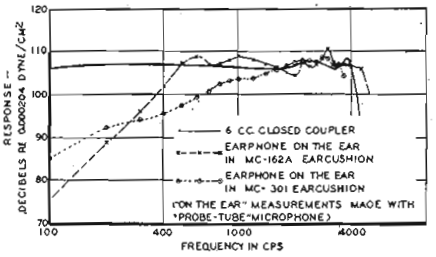

Fig. 7: (Left) Curves illustrating noise insulation afforded by earphone cushions. Fig. 8: (Center) Effect of coupler volume on earphone performance. Fig. 9: (Right) ANB-H-1 earphone response curves, measured on the ear and in a closed coupler.

sistors are functions of the air density, so that the values change with altitude. Also, the diaphragm displacement required to produce a given sound pressure level is inversely proportional to the air density, so that, for a given diaphragm amplitude, the sound output decreases directly as the air density. The net result is a deterioration in both sensitivity and response curve flatness (Fig. 2) with increasing altitude. No earphone in current use, either military or commercial, is sufficiently free from these deficiencies. However, some recently developed aircraft earphones should prove to be adequate in these respects (Fig. 3).

Adequate Air Leakage

Another problem pertaining to altitude is the one of providing adequate air leakage for pressure equalization during rapid changes in altitude. There must be no pockets of trapped air in an aircraft microphone or earphone. In oxygen mask microphones, the breather hole must open to the outside of the mask, to avoid sucking the very wet air from inside of the mask, into the microphone.

Another problem associated with altitude is the reaction of the oxygen mask upon the voice, and upon the microphone characteristics. In general, the presence of the mask gives a muffled character to the voice. That effect can be noticed even on a throat microphone: the voice output of a throat microphone sounds different depending upon whether the talker is wearing a mask or talking into the open air. The general effect of the mask upon the microphone is to amplify the low frequencies and attenuate the highs. That effect is compensated for in the design of oxygen mask microphones: mask microphones have a steeply rising curve (Fig. 4) at the low frequency end, when measured without the mask inclosure.

The overall acoustic noise levels in military aircraft vary from about 85 above standard reference level in fairly quiet airplanes up to 120 db or more in some of the noisy ones. Voice communication in noise levels of that intensity presents difficult design problems to the builder of the microphones and earphones involved. Of course in plane-to-plane radio communication, and in interphone communication within an airplane, the acoustic noise gets into the circuit at two points.

At the talking end of the circuit noise gets into the microphone along with the speech sounds, is amplified in the radio or interphone channel, and is finally transmitted to the ears of the listener by his earphones. Still more noise is introduced directly into the ears by transmission through the earphone cushions because the cushions themselves are far from perfect noise insulators.

There are a number of ways to go about improving the signal-to-noise ratio at the microphone end of the system. The first way used was to make the microphone "close talking". By putting the microphone close to or touching the lips, the highest possible speech level is obtained. A second technique, thought not very effective, is to restrict the frequency range of the microphone so that only the band of frequencies thought to be adequate for speech reproduction, is transmitted. The combination of these two techniques is wholly inadequate for communication in 120 db aircraft noise, inasmuch as the voice level at the lips, even for loud talking, is below that value, and the frequency bands covered by the voice and the aircraft noise are approximately the same (Fig. 5).

A very effective way to gain additional noise reduction is to put a "noise shield" enclosure around the microphone. The oxygen mask constitutes such a "noise shield" for the mask microphone, and does a very effective job of noise attenuation, especially at the higher speech frequencies.

Another very effective technique for reducing noise pick-up by the microphone is to design the microphone in such a fashion that it responds, not to sound pressure, but to the space derivative or gradient of the sound pressure. Inasmuch as sound pressure level decreases inversely with distance from the source, the sound pressure gradient decreases as the inverse square of the distance. Hence, ideally, a gradient microphone is much more sensitive to close sounds than to distant ones (Fig. 6).

If a gradient microphone is used properly (with the sound entrance holes nearly touching the lips) the speech sound source is "close", the extraneous noise is "distant" and the desired result is obtained. In practice, because of the sound wavelengths involved and because of practical limitations on certain critical dimensions of the microphone structure, this process is effective only at the lower speech frequencies, up to about 1500 cps in a good design. Gradient microphones are also referred to as "noise-cancelling" microphones. It is interesting that the gradiant principle is effective at low frequencies while "noise shielding" is effective chiefly at the higher frequencies. Those facts are put to good use in some recently developed aircraft microphones.

Earcushion Design

Noise leakage at the earphone is chiefly a problem of earcushion design, though there may be appreciable transmission of noise through the earphone structure itself, in some cases. Also the manner in which the earphones and cushions are held against the ears and head enters into the problem. The designer's approach is to provide a good fit to the contour of the head so that the chief noise leakage path is through the earphone cushion material, and then to make the sound attenuation through that path as high as possible. I think it is safe to say that a compromise must always

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be made between good noise attenuation on the one hand, and acceptable weight, size, and comfort on the other. The attenuation provided by the earphone cushion is poor at the lower speech frequencies, and improves appreciably for the higher frequencies (Fig. 7).

Of course another way to improve the signal-to-noise ratio at the ear is to provide a stronger speech signal into the earphone. But we are already using levels about as high as the ear can tolerate comfortably, so an increase in overall level would not be tolerable. However, an effective increase is obtained if the 30 db difference in level between the weak unvoiced speech sounds and the strong, voiced, sounds is reduced. Two ways of accomplishing this have been and are being tried. One way is to tilt the overall response curve so that the higher frequency speech sounds are amplified more than the lower frequency sounds. The other way involves the use of diode circuits to provide "speech peak clipping", in which the waveform peaks of the loud speech sounds are clipped off anywhere from 6 to 20 db, accompanied by an equal increase in overall gain.

Tilting and Clipping

While both response curve tilting and peak clipping result in speech that sounds unnatural, each one can result in improved intelligibility if certain other conditions are met. "Tilting" (beyond the microphone) is not desirable unless the distortion components present in the output of the microphone are of very low relative level. That condition is seldom if ever, met with carbon microphones, but it is met with the dynamic microphones which will be used in future aircraft interphone systems. Also, clipping is not desirable or effective unless the output of the microphone is relatively free of noise. Compliance with that condition requires either that the talker be in a quiet location, or that he have a microphone with excellent noise-suppression qualities, if in a noisy location such as an airplane cabin. To date, we have not had microphones with sufficiently good noise exclusion qualities to tolerate an effective amount of clipping. That situation will be remedied in future interphone systems.

Two other problems I shall lump together as "loading". One of those problems has to do with the acoustical load presented to the earphone. The performance of an earphone depends upon the nature of the acoustical load into which it feeds sound energy, in much the same manner as the performance of an electrical circuit is dependent upon the nature of the load into which it feeds. The load presented to the earphone is the enclosure into which it transmits sound energy. The shape, volume, and wall characteristics of that enclosure all have an effect upon the loading (Fig. 8).

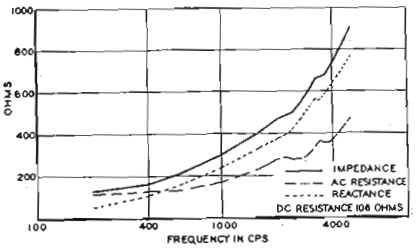


Fig. 10: Impedance characteristic of magnetic diaphragm earphone, type ANB-H-1.

For testing standardization purposes, the performance of an earphone is commonly measured with the earphone loaded by a closed symmetrical coupler having rigid metal walls. One such coupler having specified detailed dimensions and an inclosed volume of 6 cu. cm. is in wide usage, and is commonly referred to throughout the industry as "the 6 cc coupler". A serious drawback to the best of such couplers is that they do a rather poor job (Fig. 9) of simulating the load that exists in practice with the earphone in place in the ear.

The other "loading" problem is concerned with the electrical load which the earphones and their associated interphone station volume controls present to the interphone amplifiers and radio receivers in the airplane. Of course the radio receiver designer would like to design the audio output circuit to feed a fixed resistive load. However, in older type interphone systems the crew station interphone controls connect directly to the audio output lines, and the load on a particular output circuit may vary from one or two headsets up to 15 or more, each in series with a variable resistor station volume control.

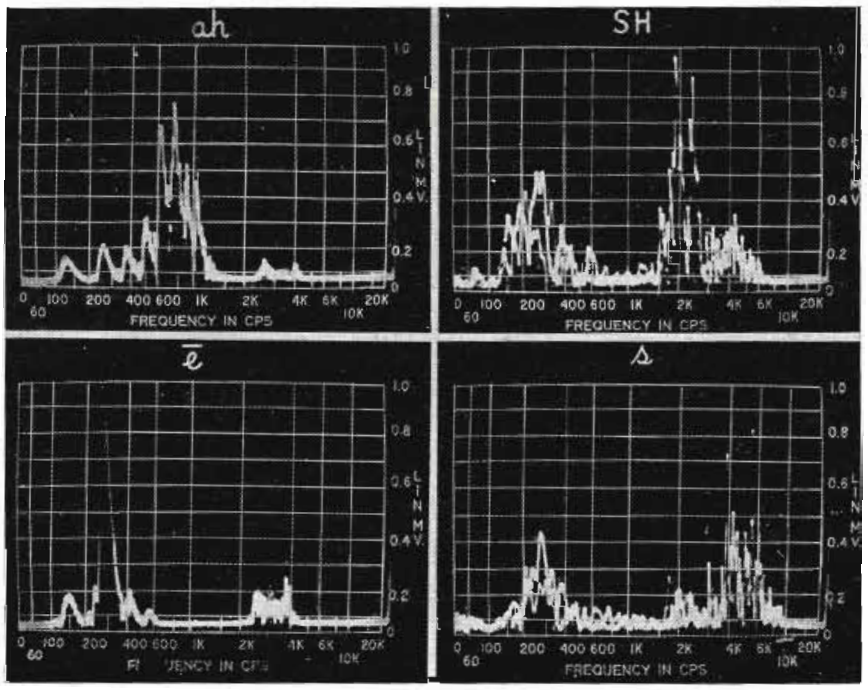
Loud Variations

The output circuits were expected to accommodate the wide variations in load which resulted. Also, our widely used magnetic diaphragm earphones are highly inductive, and that point, also, was expected to be considered in the design of audio output circuits. The impedance of a so-called 600 ohm headset varies from approximately 250 ohms at 200 cps to 1800 ohms at 5000 cps. Both the resistive and inductive components vary over a wide range (Fig. 10).

We found early in World War II that our close-talking aircraft microphones require an external cover of moisture-proof, pliable material, for protection against breath moisture and frost. Our microphones have

(*Continued on page* 87)

Fig. 11: Spectrograms of several speech sounds shown on Panoramic Sonic Analyzer.



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Transcontinental Microwave Relay

Microwave relay transmitting and receiving antennas are at different heights in Creston, Wyoming installation where the TD-2 system crosses the Continental Divide

TD-2 system, costing $40 million, consists of 107 relay munication channels are now functioning and system has

By BERNARD F. OSBAHR
Executive Editor

A REGULAR, two-way coast-to-coast transmission service for TV Broadcasting was made available by the Long Lines Department of the American Telephone and Telegraph Co. on September 28. This new radio relay system was first used for the transcontinental telecasting of President Truman's opening address to the Japanese Peace Treaty Conference held in San Francisco on September 4, while previously, on August 17, the first coast-to-coast telephone call on this system was completed.

Built in about three years (started in 1947) at a cost of $40,000,000, the microwave relay system is 2992 miles long and is composed of 107 stations. The first station along the route is atop the American Telephone and Telegraph building in New York City and the last is on the Pacific Telephone and Telegraph headquarters building in San Francisco. The transcontinental microwave relay system joins the West Coast system at East Bay Hills, California to serve Los Angeles.

The average distance between the microwave relay repeater stations is 28.2 miles, while the actual distances range from 9.3 to 50.1 miles. The tallest tower along the route (exclusive of the AT&T building in New York City which serves as first station 450 ft. high) is at Des Moines, Iowa, where it is 427 ft. to the top of the antennas. The shortest tower is a 2½ ft. platform height (14 ft. to top of antennas) for antennas facing East at Stansbury Island station on the West side of Great Salt Lake in Utah. New York City is the point of lowest elevation, 11.5 ft., while the station atop Mt. Rose, Nevada, is highest with 10,075 ft. of elevation.

Operating Range

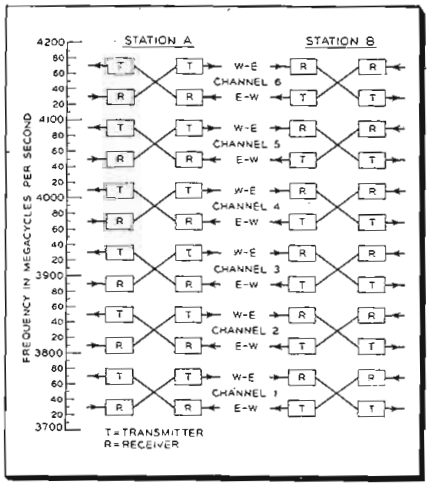
The system is designed to operate in the range of 3700 to 4200 MC and ultimately can provide six two-way microwave relay channels, or a total of twelve communication channels. Two frequencies 40 MC apart are assigned to each channel, and these are used in alternate repeater sections. Thus a channel frequency band transmitted from a station in opposite directions is always 40 MC removed from the frequency band received at that station from opposite directions. This is done to prevent interference feedback around the repeater. In laying out the route of the TD-2 Radio Relay System, as it is called, care had to be taken to avoid overreach interference because the same frequency is received at alternate repeaters. The 10 ft. square one ton must be oriented at least 5° away from a line joining the two antennas in order to achieve a directional discrimination of 50 db. Water or flat lands, like the salt flats of Utah, presented other problems because of the intereference created between the incident and reflected waves in a repeater section, while in some other localities, high prevailing winds required special anchoring of the antennas in spite of their great weight to assure constancy of communication contact.

The antennas used in this system are of the delay lens type. They are designed to produce a plane wavefront by delaying the waves near the center of the antenna relative to those near the edges. The average gain over the 500 MC band relative to an isotropic radiator is 39 db and the major lobe of the directional pattern is less than 2° wide at the half-power points. The maximum response in the direction opposite to that of desired transmission is in the order of 68 db down from the maximum forward response over an angle of ± 40°.

Rectangular brass waveguides are employed to connect the antennas to the radio equipment. These have outside dimensions of approximately 1¼ x 2½ in. and the transmission loss at 4,000 MC is about 1.5 db per 100 ft.

The TD-2 radio relay system utilizes frequency modulation and the input to the frequency modulation transmitting terminal may be either a TV signal or a signal resulting from the combination of hundreds of telephone conversations. The 70 MC FM output of the transmitting terminal is fed to the radio transmitter where it is hetrodyned to the microwave frequency range and amplified to a power level of about ½ watt. This signal is then fed to the appropriate channel branching filter. The combined output of the several branching filters is in turn connected

Diagram showing how the 12 channel frequencies are located between stations



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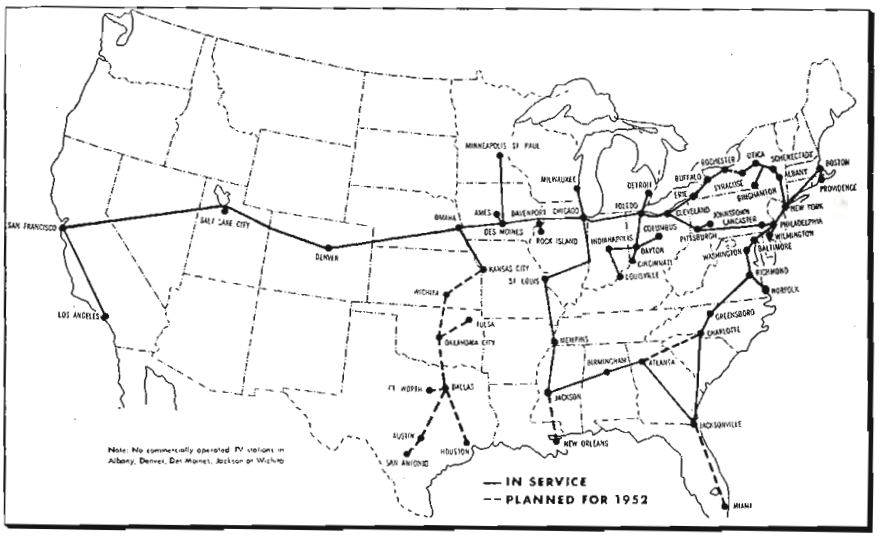
Commences TV Broadcast Operations

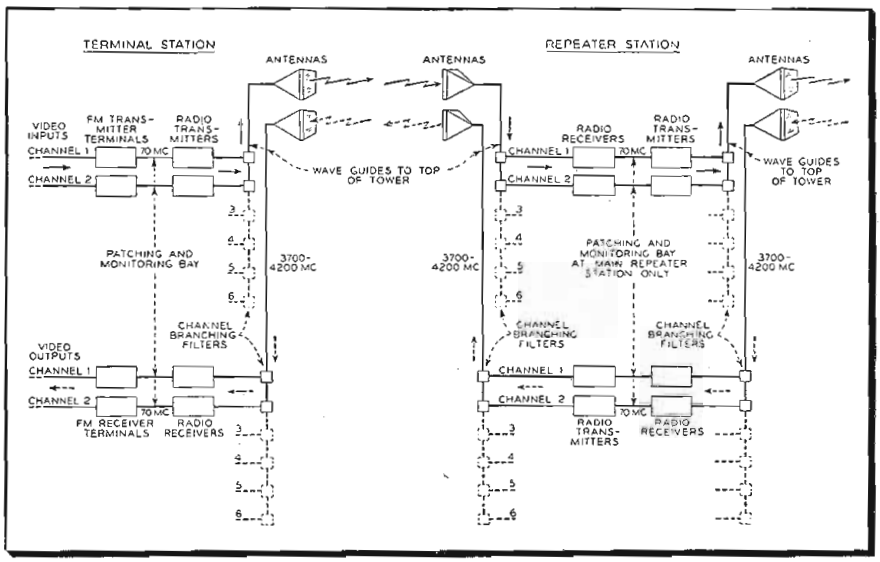
stations spaced across 2992 miles. Two two-way com- maximum capacity of six channels in each direction.

to the transmitting antenna through the aforementioned waveguide.

After traversing the radio path to the adjacent repeater station, the microwave energy is intercepted by the receiving antenna and fed through a waveguide transmission line to receiver branching filters. These filters are similar to those used on the output of the transmitters. After being selected by its appropriate filter, each channel is converted to an i-f of 70 MC and amplified in the radio receiver. At auxiliary repeater stations, the output of the receiver is connected directly to the transmitters while at main stations the connection is made through i-f patching and switching circuits. The frequency of the signal transmitted by the repeater is shifted 40 MC from that received.



Map of present coaxial cable and microwave relay TV intercity connecting routes



Block diagram of radio equipment located in a terminal and in a repeater station

Waveguide and Filter Loss

Over the average 28 mile hop the radio path loss under non-fading conditions is about 138 db. Waveguide loss and filter loss averages 5 db per repeater section. The power gain of the transmitting and receiving antennas totals about 78 db, so that the net overall gain of each repeater under these conditions must be about 65 db. An automatic gain control circuit in the receiver, with a range of about 30 db, keeps the transmitter output power constant by compensating for fading losses and vacuum tube aging. For each broadband channel between New York City and San Francisco, incidentally, approximately 3500 amplifying vacuum tubes are required, of which many are close-spaced triodes—BTL type 1553 or WE type 416A.

Of the 107 stations, 98 are unattended and 9 are located in telephone company buildings. A specially designed alarm system and an extremely reliable power plant makes it possible to operate the stations on an unattended basis. The alarms, remote controls, and maintenance talking circuits are for the most part handled by wire. There are 42 possible alarms, such as station open door, high station temperature, aircraft warning light failure, low repeater output, etc.

Radio relay repeater equipment is designed to operate from storage battery power supplies. 250, 130, and 12 volt sources are required to supply vacuum tube heaters and to obtain required anode voltage. A 24 volt power supply is required for the alarm circuits. The battery supplies are normally connected to the line through regulated rectifiers operating from commercial 60 cycle power. Multiple rectifiers are provided so that when a working unit fails, another automatically takes over.

20 and 30 kw gasoline engine driven generators provide emergency power, the higher power delivering capacity being required at main stations having a large number of branching channels. If a commercial power failure persists for more than 2½ minutes, the engine will start automatically and the generator takes over the battery charging rectifier load after a five-minute warm-up period. Batteries serve a dual pur-

(*Continued on page* 78)

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New York TV Stations Utilize

ERP comparisons for transmitters at the same location but on different frequencies first time. FCC's permission to increase powers adds approximately 10,000 square miles

By JOHN H. BATTISON
Consulting Editor

LATE in 1949 when the announcement was made that WJZ-TV would share the top or the Empire State Building with WNBT, considerable interest in the project was engendered by the television engineering fraternity. Here was a challenge to the ingenuity and resourcefullness of engineers in applying previously known principles of diplexing to *four* carriers from adjacent radiators.

Later, in rapid succession it was announced that WCBS-TV, WABD, and WPIX would also erect antennas on the same tower and plans for a multiple unit transmitting antenna were drawn up (TELE-TECH, p. 34, February, 1951). Then in July of this year it was announced that WATV would probably join the other five telecasters on the top of the highest building in the world. Final authority has been received from the FCC for modification of WATV's construction permit to make this change in location.

As a first step in the ending of the freeze, the FCC recently removed its restriction on the use of maximum power by the existing 107 TV stations. One result of removing the power limitations is that most existing stations can increase the output of their transmitters to the full rated output which is 5 kw for all except community stations.

The removal of the power limitation means that WNBT is now operating from the Empire State Building with 14.5 kw, WJZ-TV is using 17.0 kw from the same location and WPIX is radiating 21.7 also from the new antenna. WABD and WCBS-TV are radiating 14.25 kw and 20.1 kw respectively from their original installations, and WOR-TV is radiating 22 kw.

The factor of greatest interest to both engineers and telecasters in all these power increases is what happens to the service areas of stations when the power is raised. In all cases referred to above the *effective radiated power* (ERP) is used since this is a factor which influences coverage assuming height and frequency are similar. For the first time in television history it is possible to compare the effective coverage of television stations operating with similar high powers and from the same antenna height—within a few score feet, which is negligible at 1400 ft. above sea level.

So far in these tests it has not been possible to obtain comparative coverage maps due to the short time which has elapsed and the fact that there are various methods of expressing service area currently in use. For instance, NBC and CBS use the 0.1 MV/M contour as the limit of service while some other stations use the earlier 0.5 MV/M contour as the measure of service. The FCC has instituted a new grade of service area connotation by labelling the areas grade "A", and grade "B". Also at this time the three stations using the Empire State facilities have not completed full measurements. Probably it will not be until WCBS and WABD join the other stations that a really comprehensive and comparative survey will be made. After all, one field trip would suffice to measure all five, or six, transmitter strengths, and it would result in economy in manpower and effort.

As far as WNBT is concerned, an increase in service area of about 9 miles radius has been obtained with the increase of power to 14.5 kw ERP. This results in adding about 10,000 square miles to the total service area. The antenna was rephased slightly to increase the signal to the nearby areas, but this did not affect the service contour.

The major effect of these power increases has been to extend the service area in all directions and provide a usable signal in areas that before were considered "fringe." In addition, while improving the signal strength more or less uniformly, it has the advantage that at the points where previously there was interference between co-channel stations the signal strength at these points has increased so that even if the interference contour has not moved further away the signal strength, and hence the signal to noise ratio has improved.

Same Coverage Increase

In the case of WJZ-TV with a power increase to 17 kw the 0.5 MV/M contour has moved out to 57 miles and the 0.1 MV/M contour to approximately 75 miles. Probably all the stations on the new tower will experience about the same relative increase in signal strength coverage. In many cases the FCC authorization merely specified that power might be increased to the maximum 5 kw rated output of the transmitter, rather than a definite ERP.

It is quite possible that WNBT experienced the greatest improvement in signal with the power increase since it previously had a very low ERP due to its high antenna and consequent severe limitation to keep

ERP COMPARISON FOR TV STATIONS IN NEW YORK AREA

1. Station	2. Old Power Transmitter	2. ERP	3. Old Transmitter Locations Power under Order 5 Transmitter	3. ERP	4. Power under Order 5 Empire State Transmitter	4. ERP
WABD	4.0 KW-V 2.5 KW-A	14.25 KW-V 9.45 KW-A	same as 2 4 KW Transmitter		5 KW-V 2.5 KW-A	16.7 KW-V 8.4 KW-A
WCBS-TV	3.0 KW-V 2.5 KW-A	13.7 KW-V 10.2 KW-A	5 KW-V 2.5 KW-A	20.1 KW-V 10.2 KW-A	5 KW-V 2.5 KW-A	20 KW-V 10 KW-A
WJZ-TV	0.815 KW-V 0.800 KW-A	3 KW-V 3 KW-A	5 KW-V 2.5 KW-A	17.0 KW-V 9.0 KW-A	same as	(3)
WNBT	1.42 KW-V 1.15 KW-A	5.2 KW-V 4.2 KW-A	5 KW-V 2.5 KW-A	18.3 KW-V 9.2 KW-A	same as	(3)
WOR-TV	2.04 KW-V 2.5 KW-A	9.0 KW-V 11.0 KW-A	5 KW-V 2.5 KW-A	22 KW-V 11 KW-A	.....	.....
WPIX	3.5 KW-V 1.75 KW-A	16.3 KW-V 8.17 KW-A	5 KW-V 2.5 KW-A	26.3 KW-V 13.2 KW-A	5 KW-V 2.5 KW-A	20.8 KW-V 10.6 KW-A
WATV	5 KW-V 2.5 KW-A	30.5 KW-V 15.3 KW-A	same as	(2)	5 KW-V 2.5 KW-A	22.5 KW-V 11.8 KW-A

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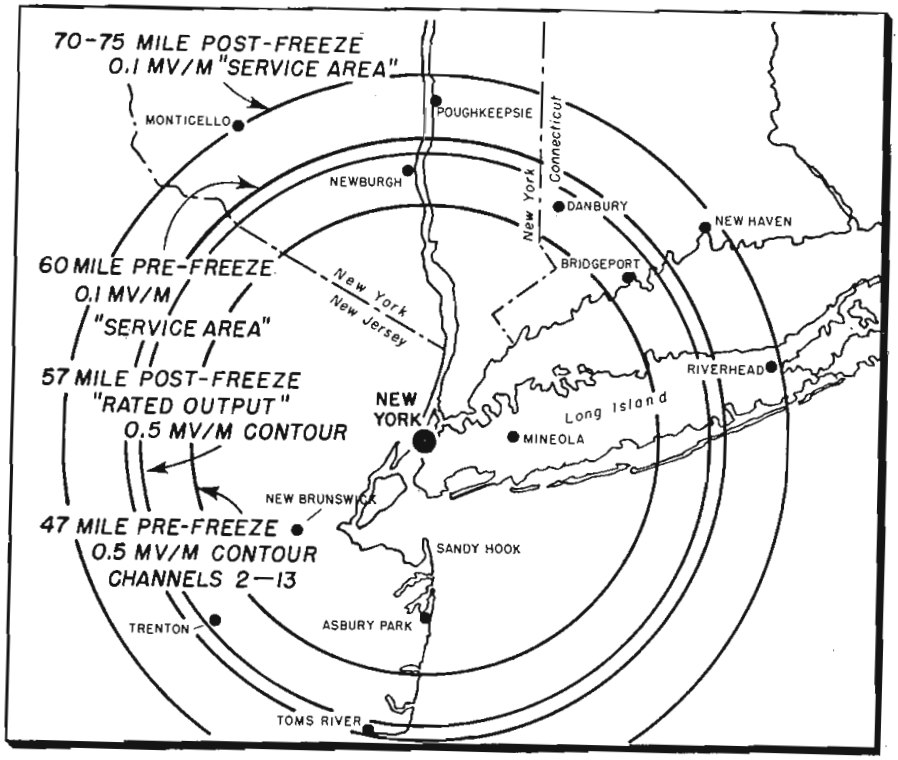
Unique Antenna Installation

now possible for to service area

within the FCC's 50 kw at 500 ft. figure. As reports are received from other stations and final measurements are made it will be interesting to compare the effect of raising the powers of other low power artificially limited stations.

When WATV commences operation from the Empire State Building, it is expected to use a series of dipoles mounted around the base of the tower in much the same manner as WCBS-TV is using at present. Perhaps the results of using channel 13 at this height and with high power will present some extremely interesting phenomena in the field of long distance reception.

The comparison between the Empire State transmissions and those from WOR-TV's antenna in North Bergen may point up the effect of an increase in height, i.e. the difference between the WOR tower and the Empire State Building. However, the effect of frequency will be eliminated since the Empire State Building transmissions occur on frequencies which bracket that of WOR-TV.



Expanding service area as seen by TV stations in New York City during last 3 years

The only revised coverage map thus far available is from WOR-TV and is based on the increase in power and was compiled by means of increased mail response after the event. As soon as WCBS-TV and WABD join the tower it is expected that revised coverage maps will be available.

FCC and Dumont VHF-UHF TV Allocations Compared

The task of radio-station allocation on a nation-wide scale is one calling for great industriousness, ingenuity, effort and patience. In point of facilities made available to the public, however, the new VHF-UHF national TV allocation proposed by the FCC and charted in detail in our map accompanying TELE-TECH for August, 1951, seems to utilize the channels to less advantage than the later allocation developed by Dr. T. T. Goldsmith of the DuMont organization, based on the same engineering standards as the FCC plan. (See July TELE-TECH, pp. 39-64.)

In particular, it appears FCC has not done as good a job as should and could be done in the allocation of multiple services. In contrast, the Du Mont-Goldsmith alternate national plan would give more TV services to more people and make possible the use and sale of substantially more receivers. This plan has been filed with the FCC and is to be considered in current hearings. The question now is: Will the FCC decide to put its own plan into effect or will it approve the superior Du Mont-Goldsmith Plan which will benefit more areas and more people for all time to come! Reproduced below are some examples of how the new plan gives more services to more people.

Since it probably will be a year or two before many UHF stations are established, it is the VHF assignments in which the industry is now most immediately interested. However, the same degree of Du Mont allocation superiority prevails in the assignments of UHF stations.

The difference in the two plans can conceivably mean a difference in TV production and sales in the next few years of several million receivers.

The FCC provides 558 VHF assignments to 342 cities, while Du Mont assigns 655 VHF stations to 375—a plus difference of 97.

The FCC provides a total of 1916 VHF and UHF assignments; Du Mont makes 2129, or 213 more possible stations.

The FCC assigns four or more VHF channels to 21 centers; Du Mont assigns four or more VHF channels to 53.

The FCC assigns three or more VHF channels to 57 centers; Du Mont assigns three or more VHF channels to 70.

The FCC assigns two or more VHF channels to 130 centers; Du Mont assigns two or more VHF channels to 144.

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Photo showing the external appearance of newly designed camera equipment

Simplified Operation

Improved circuits, servo-controlled ing iris, and lens change among the

R. L. GARMAN, *Technical Director*
General Precision Laboratory Inc.,
Pleasantville, N. Y., and

J. E. COPE, *Engineering Mgr.*
Television Division,
Pye, Ltd., Cambridge, England

ALL units in the GPL chain are designed for maximum maintenance accessibility. They feature swing-out chassis, which facilitate inspection or servicing while the equipment is in operation. Chassis in the power unit and sync generator are mounted on standard 19-in. relay rack panels. Plug-in type replaceable electrolytic condensers are used in all units. All components are identified by number, and vinyl color-coded wire is used throughout.

Test jacks are provided for checking voltages. The iris indicating meter on the camera unit can be used as a voltmeter by means of a multiple position switch and test jack provided. Also the waveform monitor in the camera control unit may be used as a test scope. Pin straighteners are another built-in feature of the camera and camera control units. Built-in blowers adequately ventilate all units. Operating controls are designed so that their size, shape and arrangement provide quick touch identification for operating ease. The lenses used on the GPL camera are not 35mm lenses adapted to TV use, but are designed specially for TV, containing built-in iris diaphragms on each lens mounting.

Camera Control Unit

The GPL camera control unit contains some of the image orthicon controls, the picture monitor and controls, the waveform monitor and its controls, the video amplifier, clamping circuits, vertical sweep and shading circuits, and the intercom circuit. Also included are an iris control switch and a meter indicating the lens stop directly in *f* numbers; an overscan switch for the image orthicon; a pre-set target voltage adjustment button; and a waveform monitor calibration button.

Inputs to the Camera Control Unit from the synchronizing generator are horizontal and vertical drive, composite sync, composite blanking.

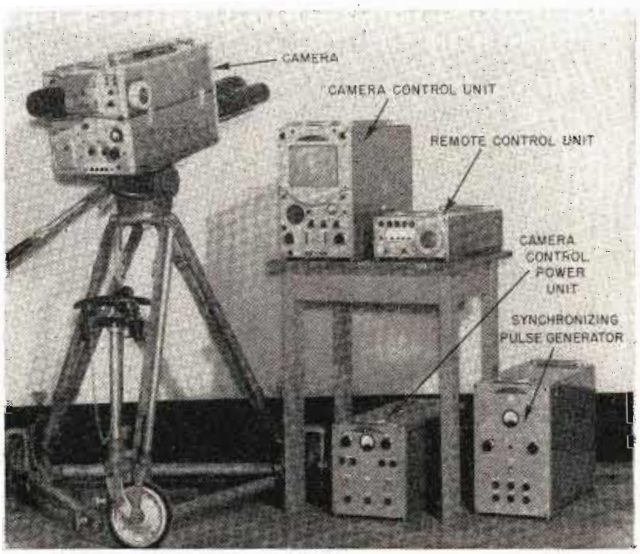
Because of the combination of shunt and series-shunt peaking, CCU Video Amplifier response is flat to 7 MC. Video received from the camera preamp. is clamped, blanking is added, blacks peaks are clipped, and shading is injected. The signal passes from a cathode follower through a crystal diode used for peak white limiting. Bias for this diode is supplied from a dc reference tube, the bias of which in turn is adjusted by a "peak white limiter" control. The signal continues through the "transmit" relay to a mixer, where composite sync may be added if called for by the particular switching arrangement in use. The amount of sync added is determined by a "Sync Amp" control on the CCU. Output is 2 volts, peak to peak, into a 75-ohm line.

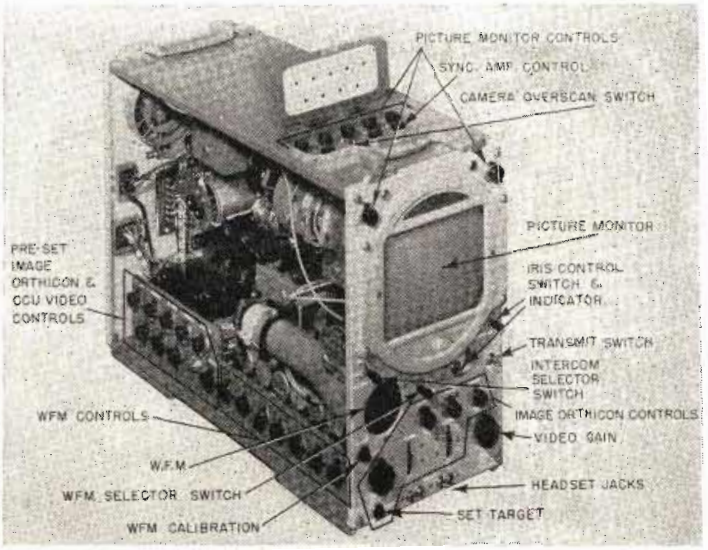
Two parallel output plugs are included on the rear panel of the camera control unit. With slight circuit modification, one plug may be wired to furnish video without sync while the other is furnishing both.

The picture monitor taps the output when the "transmit" switch is in "on" position, so that the operator sees the actual picture being transmitted. In the "off" position, the monitor is tapped ahead of the transmit switch.

The video gain control on the front panel of the CCU is a non-linear type

Fig. 8 (Left) Camera chain with sync pulse generator and remote control unit. (Right) Control layout in camera control unit.





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Keynoted in New TV Equipment

PART TWO OF TWO PARTS

focus, extended remote control facilities, includ-
outstanding features of GPL's latest camera chain.

compensating for the tube characteristics and providing linear control of video output.

Clamping

Horizontal driving pulses are sent from the CCU to the camera, where they are used to generate 6-microsecond target blanking pulses for the image orthicon. The signal is sent back to the CCU, where clamping occurs. Because of the time consumed while the drive pulses travel through the camera cable and the signal returns to the CCU, the clamping pulses must be delayed so that they fall within the blanking time. The clamp pulse in the CCU is generated by feeding the sync pulse into a shorted delay line. The delayed pulse is amplified, clipped, and fed to a phase splitter, providing two clamp pulses of opposite polarity which are then applied to the double diode clamping tube. Double diode clamping assures positive clamping action.

A switch on the front panel of the camera control unit allows the operator to monitor video at ½ field rate or ½ line rate. A third position allows inspection of the sync block. In vertical sync position, vertical drive pulses are used to intensify the beam so that the fast sweep is visible. An astigmatism control on the side panel provides for fine adjustments by controlling the first anode voltage on the monitor tube.

The calibration button on the front panel puts a pre-set voltage on the vertical deflection plates of the waveform monitor. Initial calibration is accomplished by feeding a known reference voltage into a test jack on the CCU rear panel and by a screw driver adjustment of the "Calibrated Voltage Adjustment" control on the side panel.

The waveform monitor may also be used as a test scope by means of a test input jack on CCU rear and a switch located on the side panel.

Vertical sweep for the camera and picture monitor is generated in the CCU by circuits using inverse feedback. This eliminates the necessity for vertical linearity controls.

Intercom Circuits

Intercom operation is controlled by a three position switch on the CCU front panel. In "multiple" position, camera and CCU inputs are fed to the intercom amplifier. Output goes to the headphones and into the director's line. In "normal" position the cameraman's mike is shorted out. In "camera" position, operation is similar to "multiple" except that the director's line is disconnected, providing a private line between camera and CCU. A phantom circuit allows the cameraman to signal the CCU on the intercom wires. A second pair of lines carry program audio to the two units. Cue lights on both camera and CCU are actuated by a signal phantomed in on the program lines.

An overscan switch is provided on the top of the CCU for image orthicon sweep control.

The "set target" button on the front panel allows target voltage on the image orthicon to be adjusted to 2 volts above cut-off.

A 10-position "cable compensation" switch on the side panel of the CCU compensates for increased cable lengths (100 to 1000 ft.) by warping the high frequency response of the amplifier, increasing the delay of the clamp pulses, and boosting ac voltage to the camera.

Camera Control Power Unit

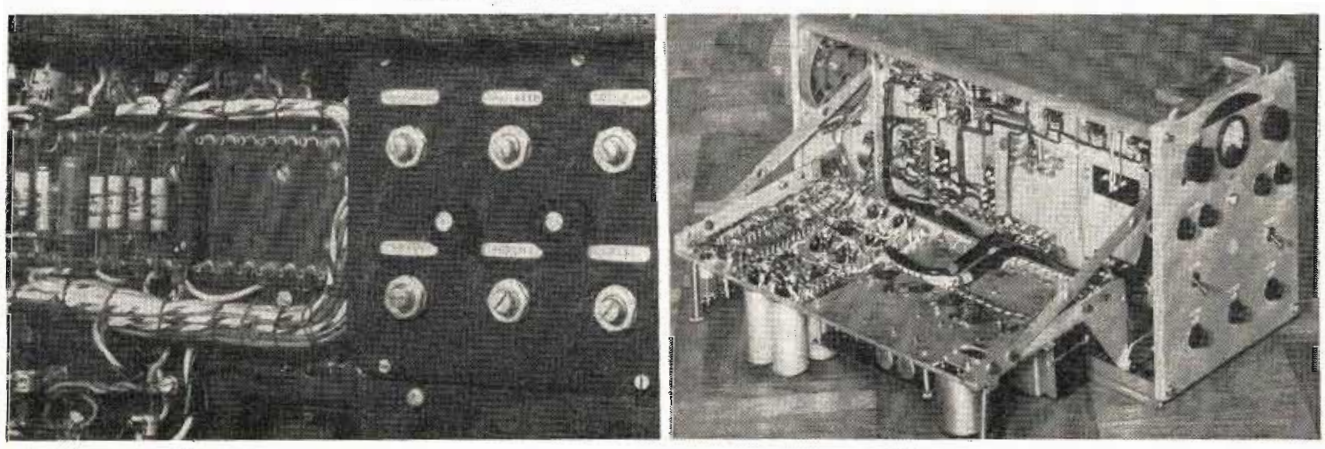
All power for the camera and CCU is furnished by the camera control power unit, which contains the following supplies: 300 volts regulated, 500 ma; +150 volts regulated, 200 ma; +380 volts, 110 ma; —200 volts supply; —150 volt V.R. tube regulated supply; —1½ kv supply.

The primary of one of the power transformers has four taps which are used as auto transformer taps to allow the power unit to operate on a wide variation of line voltage. Taps are selected by a switch on the front panel used in conjunction with the meter and meter switch.

The —1½ kv supply for the second anode of the waveform monitor (in CCU) is obtained from a +500-volt tap on the 300-volt supply transformer and a voltage tripler circuit

(*Continued on page* 68)

Fig. 9: (Left) Closeup view showing some of the details in camera. Visible are pin straighteners, component identification markings and color coded wiring used. (Right) Camera control power unit opened out. Note component layout, wiring, and accessibility.



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Glide Path Cavity Antenna

Horizontally-polarized, zero-drag, 329-335 MC unit receives signals from any forward direction and has a VSWR of better than 5 to 1. Fits into lower lip of air intake

AFTER the scale-model pattern study was completed with satisfactory results, a full-scale mock-up was constructed of those surfaces which are within approximately one wave-length of the cavity antenna location in the lower lip of the air intake. The sectional mock-up is made of wood formers and bulkheads covered with copper and terne-plate sheet metal, and the seams are soft soldered as shown in Fig. 6. The measurements of vswr and radiation efficiency with the full-scale prototype antenna mounted in the sectional mock-up were taken with the mock-up supporting a wavelength above the ground on non-metallic members.

The measurements of vswr on the cable to the cavity antenna were obtained by conventional slotted-line techniques. A length of RG-8/U coaxial cable three feet long was used between the antenna connector and the precision slotted line (manufactured by the Bone Tool & Gage Co.).

The preliminary version of the cavity antenna was constructed within a half-open cylinder, 4 in. in diameter and 7 in. long. It was found that by proper choice of the length of the radiating element, the width of the feeding element, and the position of the feeding-tap, the overall length of the antenna cavity could be reduced by a factor of at least ⅓ and the vswr would be 5 to 1 or better over the required frequency band of 329 to 335MC.

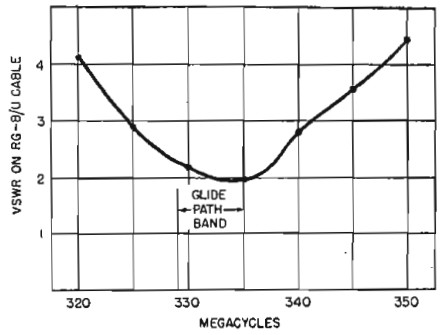
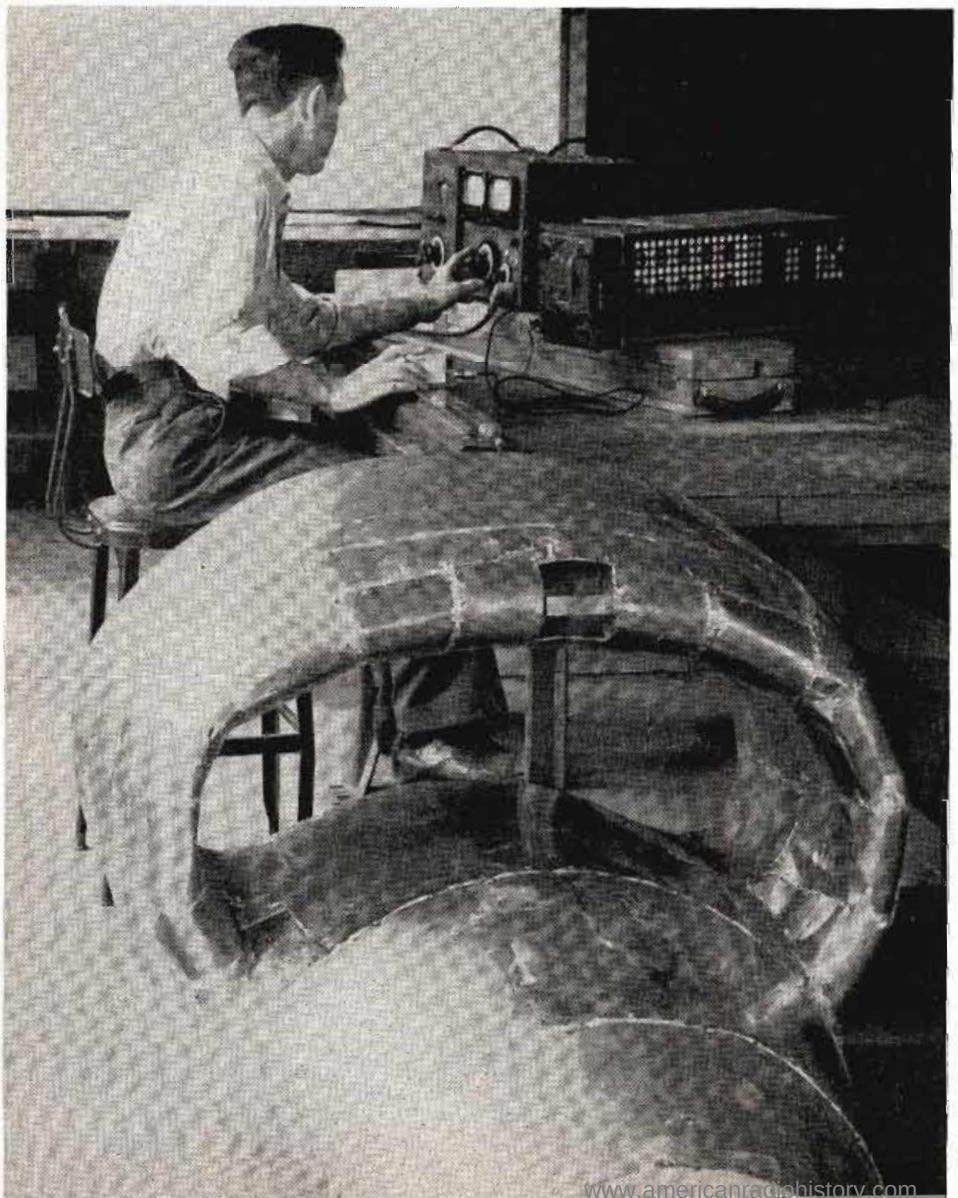


Fig. 7: VSWR of P-702 cavity antenna

Fig. 6: Photograph showing prototype cavity antenna in sectional mock-up



Experimental Model

An experimental-model cavity was next constructed having a length of 4 in. and a semi-elliptical shape that was best suited for installation in the air intake lip. This model antenna was made with a Teflon insulating support for the high-impedance end of the radiating element. This Teflon support was first provided with an adjustable brass slug for varying the end-loading capacity to tune the antenna. It was found that the bandwidth of the antenna was more than the required 6 MC, and it was decided to eliminate the capacity adjustment and make the antenna fixed-tuned. This decision was made after a thorough consideration of the possible variations in the dielectric coefficient of the Teflon material, mechanical tolerances in the construction and assembly of the radiating element, etc.

After the 4-in. long cavity was matched over the required frequency band, a series of measurements was made to compare the radiation efficiency of this cavity antenna to that of a reference half-wave dipole in free space. The radiation measure-

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for Jet Fighter Aircraft

PART TWO OF TWO PARTS

By LOUIS E. RABURN
Senior Antenna Engineer
Electronics Research, Inc.
Evansville, Ind.

ments were made in a cleared area with the antennas located more than one wavelength above the ground and spaced 15 wavelengths apart; a calibrated signal generator and slotted-line set-up was used to feed alternately the cavity antenna on the mock-up and the reference dipole. A conventional slotted-line technique was used to maintain equal power input to each antenna during the comparison process. A directional coupler could also have been used in this case. The receiving antenna system consisted of a half-wave dipole fed by an adjustable balun to reduce the possibility of picking up vertically polarized energy. The output of this balanced antenna was fed into a calibrated receiver.

A comparison of the radiation field strength of the cavity antenna and the reference dipole was made at 329, 332, and 335 MC on the axis of the mock-up for several different heights of the reference dipole. These measurements show that the radiated signal for the cavity was from 1½ to 3½ db greater than for the reference dipole.

Fig. 5 shows that the model measurements predict a field strength of 6 millivolts per meter in the line of flight at one mile range for a one-watt transmitter. This compares to a field strength of 4.35 millivolts per meter at one mile for the same conditions with a half-wave dipole in free space. According to the scale model directivity data, therefore, the directivity gain of the cavity antenna at the intake lip location is about 2½ db more than the half-wave dipole. The good agreement between the full-scale radiation field comparison data and the scale-model directivity gain comparison data shows that the cavity antenna has a radiation efficiency approaching 100%.

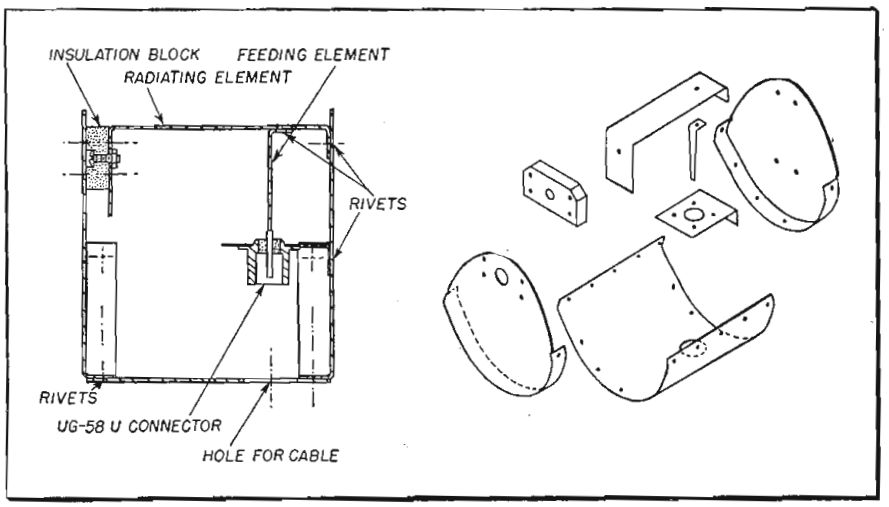

Fig. 8: Sketches of the prototype P-702 cavity antenna

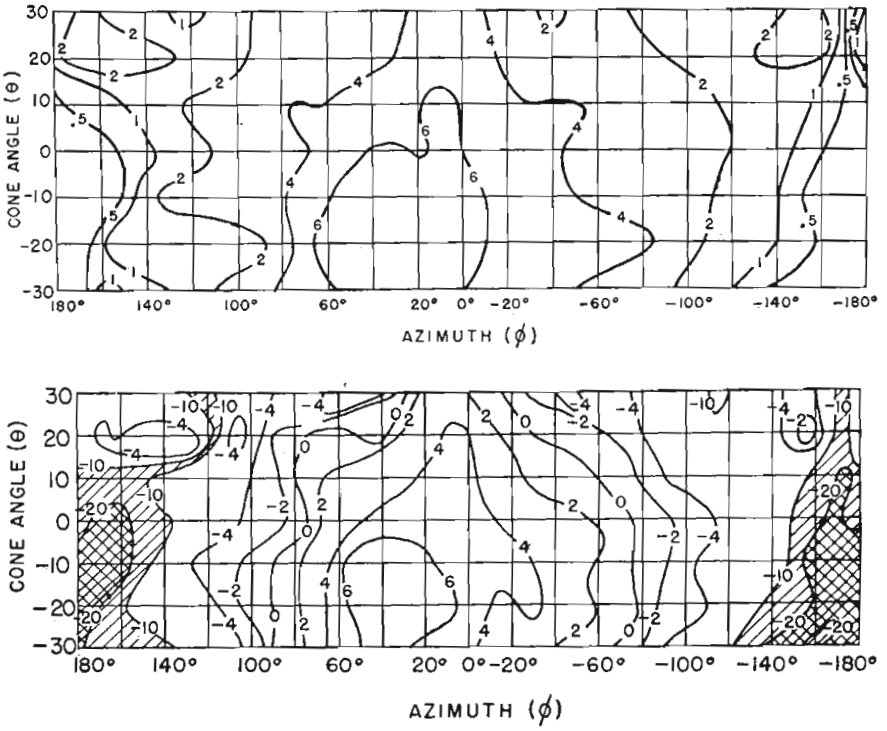

Fig. 9: Comparison of equi-signal and equi-directivity contours. (Above) Field strength in mv/m for transmitting case, at 1 mile with 1 watt transmitter. Required F.S. for 70 μv. to receiver is 1.26 mv/m. (Below) Equi-directivity contours. Directivity compared to isotropic source, true at any range for transmitting or receiving. Required directivity for 70 μv. to receiver is —8.5 db.

Prototype Cavity Antenna

After completion of the adjustments and measurements on the experimental model cavity antenna, a complete set of detail drawings was made for the prototype antenna as shown in Fig. 8 to incorporate a number of changes which were necessitated by aerodynamic considerations. One prototype model antenna was constructed from these drawings and when tested it was found to have very similar electrical performance to that of the experimental model antenna. The prototype cavity is a self-contained unit fully adaptable for mounting in a recessed compartment in the air intake lower lip of the aircraft.

After the cavity has been mounted in the lip compartment, a fiberglas cover is placed over the cavity opening and fastened to the skin of the aircraft in such a manner as to

(*Continued on page* 90)

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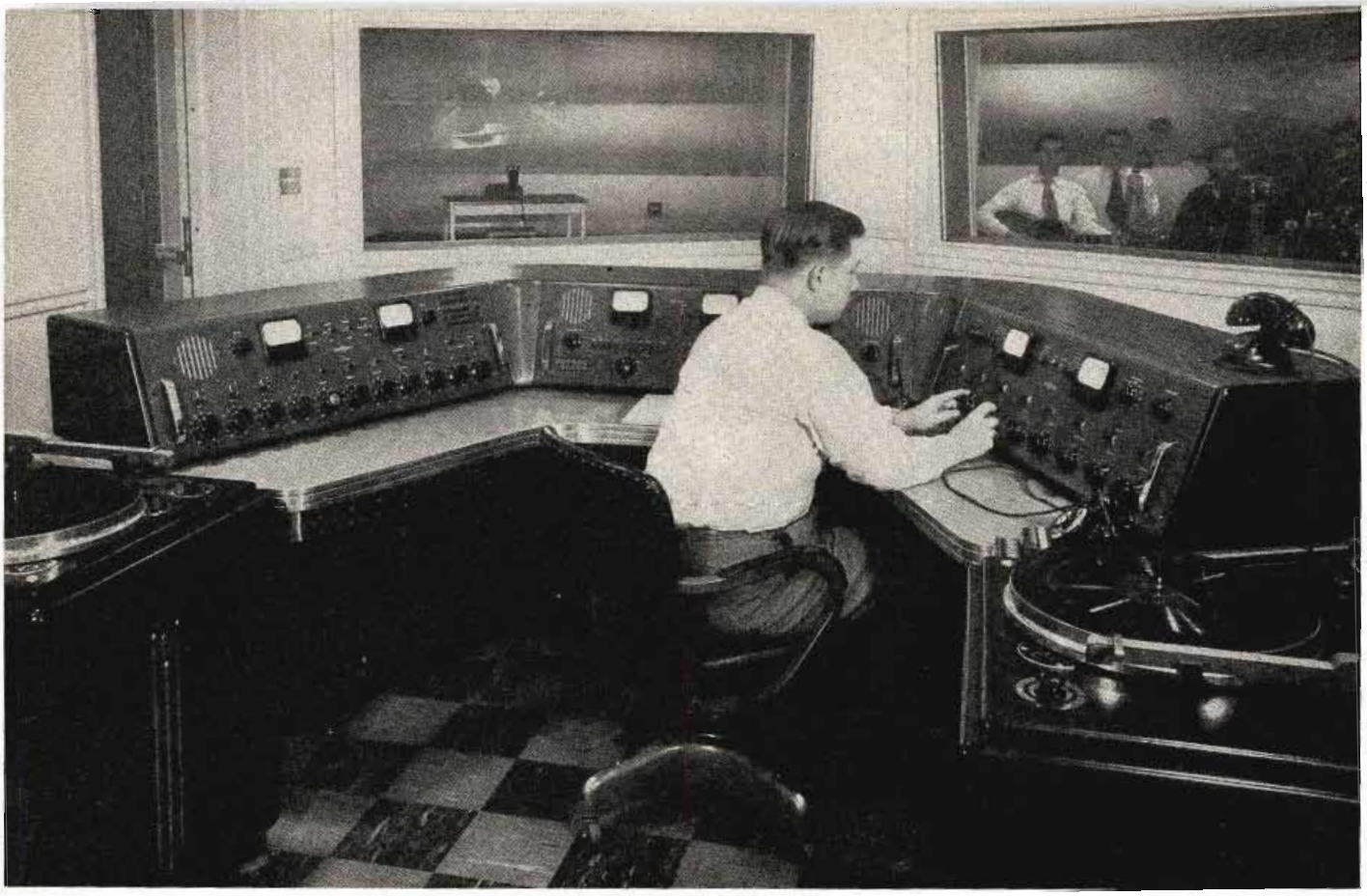

Master Control Room showing Studios "A" (right) and "B". Collins specially-designed and built consoles provide maximum operating efficiency, and are placed so that the operator can cue, "ride-gain" and handle incoming remotes with a minimum of effort

Modern Broadcast Studio Design

By HERBERT G. EIDSON, JR., Chief Engineer, WIS, Columbia, South Carolina

WHEN designing broadcast studios in order to minimize frequency discrimination caused by standing wave systems set up between parallel surfaces in a room, it is desirable to choose major dimensions which are not integral to each other. By proportioning the three major dimensions of a room in the ratio of the cube root of two (or a ratio of multiples of the cube root of two), a good distribution of the natural resonance frequencies is obtained.

For the average size studio the preferred dimensions should be in the ratio of 1 : 1.6 : 2.5. In other words, the major dimensions should be separated ⅓ octave with respect to each other, or otherwise maintain this fundamental ratio. Thus the floor level of the largest studio (Studio "A") was placed 30 inches below that of the main lobby and 18 inches below that of the Main Control Room and Studio "B".

Johns-Mansville engineering was used in the sound treatment of the studios. "Floating" construction was used, and consisted of heavy felt hangers and pads separating the "inner rooms" from the main studio rough walls. Heavy felt blankets were hung from all walls and placed in the ceiling to prevent re-radiation of sound waves coming through the many perforations in some of the walls and ceiling room surfaces.

Two adjoining walls of Studio "A" were treated with convex wood panelling, of random size, constructed of ¼ inch plywood. The axes of the partial cylinders of one wall are mounted at right angles to those of the adjacent wall. Poly-cylindrical diffusers are used sparingly on the ceilings, and constructed of metal grill-work, covered with plaster. The remaining surface of the ceiling is covered with 12 inch squares of perforated metal. The other two walls of the studio are laid with perforated "Transite" which looks like tempered Masonite but is composed of 20% asbestos and 80% cement. This gives the surface around the perforations a high reflective factor for frequencies up to about 5,000 cps. Above this value, room construction has small effect, because air attenuates these frequencies. Some of the lower frequencies pass through the perforations and are absorbed by the felt blankets. The convex panels on the walls provide pleasing resonant re-radiation and sound dispersion over most of the audio spectrum.

The floor in the largest studio was excavated to a depth of about 40 inches and covered with an initial flooring of four inches of concrete. Conventional J-M floor construction

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How WIS remodelled and rebuilt its AM studios and the design features which dictated its construction. Broadcasters who are considering changes within the scope of NPA rules will find valuable constructional and technical data in this article

consisting of a lattice work of steel runners with one layer crossing the other at right angles was used. The top layer is sound isolated from the lower and supported by heavy felt pads. This network is topped by a wire mesh sheet and this in turn supports the "floating" final floor of concrete. With this combination, the average reverberation time is approximately .425 seconds, which is excellent for music and good for speech, when close microphone technique is used for the latter.

Studio "B" is treated similarly to "A" with the exception of the construction of the poly-cylindrical diffusers. These are all made of hard plaster, built up in two layers on a wire mesh frame. The back wall is composed of horizontal diffusers, while the wall next to Studio "A" is made up of columns of vertical diffusers. This separating wall was made 36 in. thick to prevent any possibility of sound leakage from one studio to the other. Concrete-block walls were built to the top ceiling, and an open air-space left between the walls. A two-by-four wood beam was continually swung between the walls as they were being built to ensure that no mortar was left which could connect the walls, thus ruining the sound isolation.

Sound-Proofing the Outlets

All electrical and microphone outlets in the wainscoting were securely fastened in electrical outlet boxes, which were in turn connected to conduit imbedded in the primary floor. All plaster, and/or wood, was carefully scraped away from these boxes and felt wrapped around them to sound isolate them from the wall. If this was not done, the boxes would tie the floating wall to the main concrete building floor, thus destroying the insulation. Special brass outlet plates were constructed, electroplated in chrome satin finish, given a layer of sponge rubber on the back and placed over the outlet boxes.

Lighting in the studios consists of 300 and 500 watt incandescent lamps, with flush mounted lens housing. These boxes, protruding into the area above the false ceiling were heavily wrapped with felt blankets to prevent sound passage. Fluorescent lighting fixtures are used throughout the rest of the building. Cove lighting is provided in the lower lobby and Clients Room.

Sufficient microphone outlets were wired in all studios together with an extra pair of lines terminating on a jack. In the announcer's booth a microphone outlet was installed near the false ceiling and used to feed a very small cable, made up of two # 26 plastic transformer wires threaded into small diameter tinned copper mesh shield. The microphone is suspended from the ceiling by three chrome plated "watch chains" so that it is about six inches above the announcer's table.

All doors used in the studios, proper, are two inch solid wood, finished in maple. Sound locking hardware is used to keep the doors tightly closed. Each door frame is padded with a thin sponge rubber tape to insure tightness. The bottoms of the doors have felt runners within them which are pressed down hard against the floor by a lever when the door is closed.

All studio windows radiating from the main control room, recording room and sub-control room have double glass. To prevent glass resonance, the pane facing the studio is ⅜ in. thick and the one adjacent to it is ¼ in. thick, and spaced approximately 7 in. apart. Each sheet is placed in a felt-rubber runner, mounted in a wooden frame which is felt isolated from the main supporting wall, but connected to the inner "floating" wall.

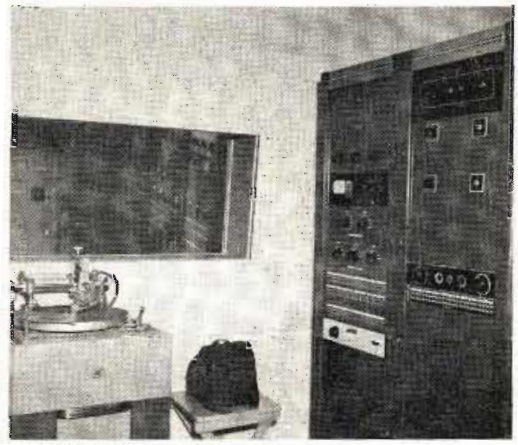
The companion glass sheet is mounted in its own frame also and supported in the same manner. The two sheets of glass are mounted parallel to each other to reduce highlight reflections. Extreme care had to be taken in setting all glass in order to reduce reflections as much as possible. Each pane was held in place while observations were taken from both sides until the optimum slant was found.

The back hallway partially surrounding studio "B" has the ceiling treated with "Acousti-plaster", which has a sound absorbing factor of about 60%. This reduces the possibility of noises from the hallway being heard in the studio.

The time constant of Studio "B" was designed more for speaking types of programs than was Studio "A", so its time contant is lower, that is, 0.35 second. This studio is usable for musical programs, of course, but a slightly higher *TC* is preferred for music only. Studios "C" and "D" have a *TC* of 0.25 seconds. The decay time versus frequency curve in all studios shows a slight rise at the lower frequencies, which is desirable, and a fairly flat response to 5,000 cycles.

All clocks placed in rooms of operation must hold a time accuracy

(*Continued on page* 72)



Recording room showing Presto Disc Recorder and the Collins Speech Racks.

In foreground of tape recording room are two Ampex recorders. At the rear is a Magnecorder PT 6, used for remotes.

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CUES for BROADCASTERS

Practical ways of improving station operation and efficiency

Edited by John H. Battison

Cathode Follower as an Audio Transformer

W. W. WARREN, Chief Engineer, WANE, Fort Wayne, Ind.

MANY small radio stations are faced with problems of entering program circuits or additional feeds to either recording or nemo circuits without causing serious loading. Purchase of expensive quality bridging transformers and amplifiers for each circuit desired is often out of the question because of space limitations. It is also undesirable to "T" or "H" bridge, because the level is reduced to a point where greater amplification is needed.

The use of cathode followers as audio transformers accomplished all to be desired for WANE at an approximate cost of $30.00, and made available twelve isolated circuits. Network, program, and audition circuits are fed to the manager's office, station lobby, shop, recording facilities, and announce studio for cueing purposes. In effect these bus circuits are low level feeds into already existing speaker systems.

The response leaves nothing to be gained, going beyond the audio oscillator range (30 cps to 30 kc). The unusually high amount of grid leak resistance utilizes the highest gain possible from the tube, and allows any number of inputs to be placed in parallel and still not load program circuits. Insertion losses amount to 3 db with use of levels as high as 20 VU above 0 and as low as —30. Stray pickup from high level circuits, and r-f (transmitter being located at studios) was negligible, and kept at a minimum by careful shielding of cables and tubes.

The 6C4 was chosen because its physical size reduces the space required for a maximum number of separate stages.

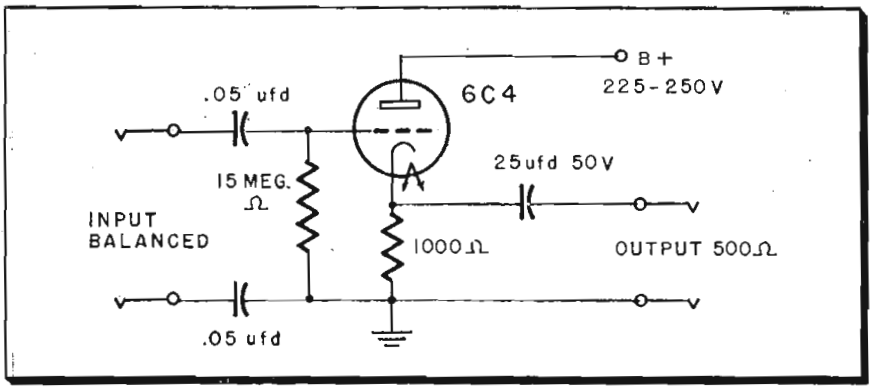
Impedance matching of a 6C4 cathode follower output to the relative audio high impedances (500 ohms) shows that the cathode resistance would theoretically be infinite.

$$R_k = Z_o/(1 - Z_o\ gm)$$

where Z_o is the output impedance across the cathode. Matching 250 ohms requires 550 ohms in the cathode, and 300 ohms output needs 880 ohms cathode resistance. Setting 1,000 ohms as maximum amount of resistance and limiting the plate current, was sufficient to approximate a match at 500 ohms.

The capacitance used in both legs of the input circuit allows the transformation to be used with balanced circuits with observation of polarization unnecessary. However, it was found that if the unbalanced circuit was used (omitting C_2), there is a reduction of extraneous noises on telephone lines. Many other circuits were considered, but the final schematic was used for the sake of simplicity.

Cathode follower circuit bridges additional audio circuits without extra loading



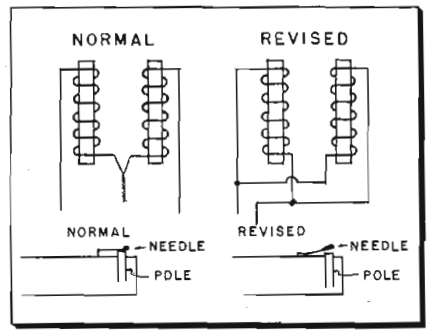
$$$ FOR YOUR IDEAS

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.

Vertical Transcriptions on GE Cartridges

J. L. KLUNGE, WHTC, Holland, Michigan

IN the process of experimenting, I have discovered that changing the leads of an old GE cartridge so that the coils are hooked in parallel instead of series, vertical transcriptions can be played. In the changeover, care was taken to prevent the breakage of the coil wires. Coils should be hooked in parallel aiding, but this is mostly a matter of experimentation. A 3 mil needle was used, but a 2.5 mil needle will work much better as it will ride farther down on the bottom of the groove. We feed this revised cartridge into the normal input for any GE cartridge, with the filter in normal record position. The bass is lacking slightly, but compares favorably with most lateral transcriptions in bass.



G.E. coil connections for vertical records

Tension Adjustments on Tape Recorder Clutch

CECIL TANKERSLEY, WMOG, Brunswick, Ga.

THE tension adjustments for the clutches on the Magnecorder tape recorder, are somewhat critical. The most satisfactory method of obtaining the proper tension is recommended by the manufacturer, with the use of a spring balance attached to a string around an empty spool, and adjusted for a pull of about 4 or 5 inch-ounces.

However, a quick check on the tension can be obtained in the following manner. With the supply spool

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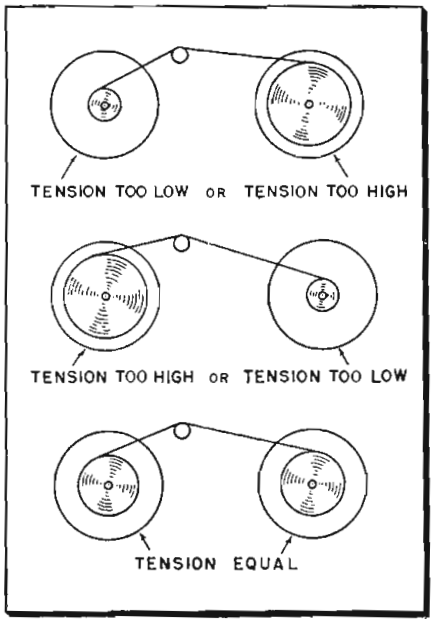


Tension adjustments on clutch

full of tape, and the take-up spool empty, place the tape in the usual position for re-wind. Switch the tape pull mechanism to "normal forward speed." The tape will then be running at a higher than normal speed as there is no friction other than the tape passing over this idler speed roller. Since there is no friction, other than this idler speed roller, the clutch tensions will equalize themselves if properly adjusted. In other words, if all the tape is pulled onto the take-up reel, that is an indication that the clutch tension on the supply reel is too low—or the tension on the take-up reel too high.

If the take-up reel stops before the tape is wound halfway, it is an indication that the clutch tension on the supply reel is too high, or the tension on the take-up reel too low. If, however, the take-up reel stops with the tape equally distributed on both reels, the clutch tension on each reel is equal. This check can be made in a matter of minutes, and will give a true indication as to the relative tension of the clutches.

Correcting Erratic Tape Transport

DON V. R. DRENNER, KGGF, Coffeyville, Kansas

THE Presto PT-900 tape mechanism occasionally develops an erratic tape transport which the maintenance manual and judicious probing fails to rectify. The trouble usually manifests itself as pronounced wow at the start of a tape and slippage off the capstan. The usual adjustment of brake tension, or take-up clutch felt gives no improvement.

The trouble will be found *inside* the take-up clutch drum, and is the result of drying and caking of the grease used to lubricate the brass and aluminum spindles of the take-up clutch assembly.

The clutch assembly is removed from the rear of the unit, by loosening the allen set screws on the centrifical brake and withdrawing the housing carefully. Clean the surfaces with a soft lint-free cloth and carbon-tet, and re grease with a very small amount of extra-heavy wax-free grease, (the white #90 variety).

After reassembly the felt pad tension should be adjusted by positioning the front ring in accordance with the instructions in the maintenance manual.

Additionally, is it a good idea to clean all the rubber idler wheels in the unit with carbon tet, about once each month, since there is a tendency for an oily deposit from the motors to spray on the driving surfaces, despite judicious and careful oiling of the bearings during manufacture.

Battery Conservation System

JOHN M. TIFFANY, Rockville Centre, N. Y.

BECAUSE of the possibility of a loss of ac power supply in certain instances of remote broadcasting, it is necessary to have available a substitute source of power. In times when national restrictions are placed on materials needed for broadcasting, including the batteries which provide a source of power in case of an ac power supply failure, any method of prolonging dry battery life is valuable. During the last war, when batteries were hard to get, a scheme was worked out which resulted in great saving of battery life and, of course, battery cost.

The station had scheduled full coverage of the local major league baseball games played at home. The ac supply at the stadium was unreliable, because it was not unusual for someone who did not realize that the lighting switches controlled the broadcasting power to unwittingly turn off the switches which fed ac to the outlets used for the remote amplifier.

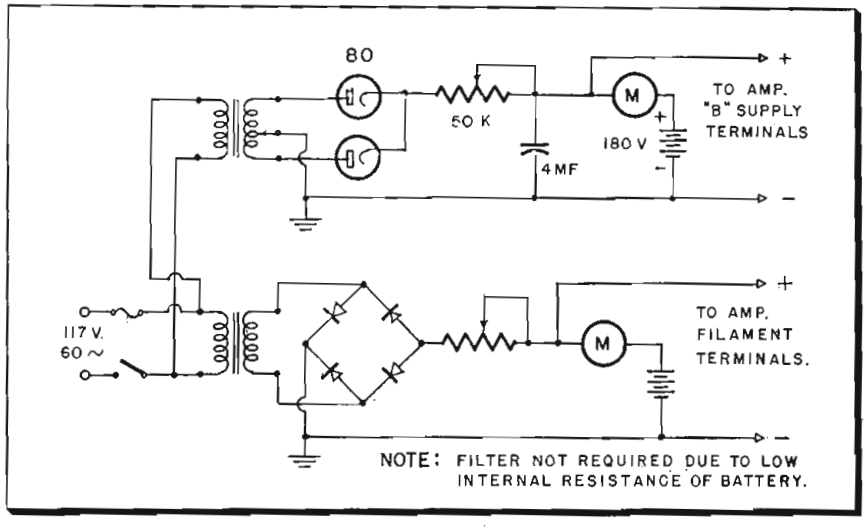
An arrangement was desired which would allow operation from the ac supply when it was available, and yet, in the event of ac power failure would provide uninterrupted operation from dry batteries. Since batteries were scarce, each one had to last as long as possible.

A relay switching scheme could have been used, but the circuit described below was found to be entirely practical in that there were no "hits" or other disturbances when ac power failed, and the amplifier went automatically onto battery operation; one set of both "A" and "B" batteries lasted for the entire baseball season.

The resistors were adjusted so that the meters showed that the ac lines were supplying just a few milliamperes in charging the batteries while providing the full amount of power for the amplifier. As it worked out, the dry batteries had a life about the same as the expected shelf life. The small amount of charging current appeared to have no adverse effect on them.

If there should be another national emergency which would result in a battery shortage like the one during World War II, this plan should be helpful to broadcasters faced with the same problem.

Metal rectifier circuit for charging batteries in remote amplifiers during use



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Ceramic Capacitors in

An analysis of the performance data on new miniature titania and titanate-based

By J. M. BROWNLOW & G. N. HOWATT
Glenco Corp., Metuchen, N. J.

THE basic raw materials for making ceramic plate capacitors are finely ground (through 325 mesh) titanium dioxide, zirconium oxide and the titanate and zirconate salts of barium, strontium, calcium and magnesium. The principal supplier of these materials is the Titanium Alloy Mfg. Co. Wainer and Soloman[1] were first to observe the anamolous high dielectric constant of barium titanate and Titanium Alloys pioneered in the production of the other high dielectric constant raw materials.

For true capacitor miniaturization thin void-free ceramic plates having high voltage breakdown strength are needed. In an effort to find the most satisfactory forming method, a highly specialized continuous extrusion technique was perfected. A void-free slip of the powdered raw materials in an organic suspension is extruded in a thin layer on a moving metal belt. After proper drying, the ceramic film is stripped from the belt and fired to optimum density at 2300 to 2450°F. All the organic binders are burned out and the oxide powders undergo reactions which result in the formation of a dense multicrystalline ceramic sheet. Due to the small amount of glass forming oxides present as impurities in the raw material, glassy phases are also present and aid in making the sheets more dense. This thin sheet technique is capable of producing capacitor plates from .005 to .030 in. thick, having voltage breakdowns of 440 volts/mil for high K barium titanate compositions and 900 volts/mil for titanium dioxide compositions.

Silver electrodes are applied in the form of a silver paint which may be dipped, sprayed, or silk-screened onto the ceramic surface. The silver paint contains a small amount of glass as a bonding agent and when the painted pieces are fired to 1300°F a firmly bonded silver metal electrode is developed which will not become displaced during the life of the capacitor.

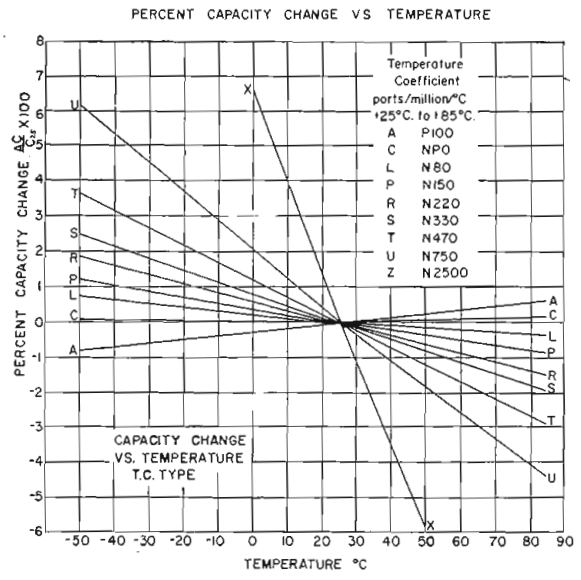
To finish the capacitor, tinned copper leads are attached by soft soldering and the unit dipped in a phenolic resin. The phenolic is cured at about 300°F and the unit vacuum impregnated with a high flow-point wax. This coating prevents shorting to adjacent parts, quenches corona at the electrode edges and adequately seals against moisture.

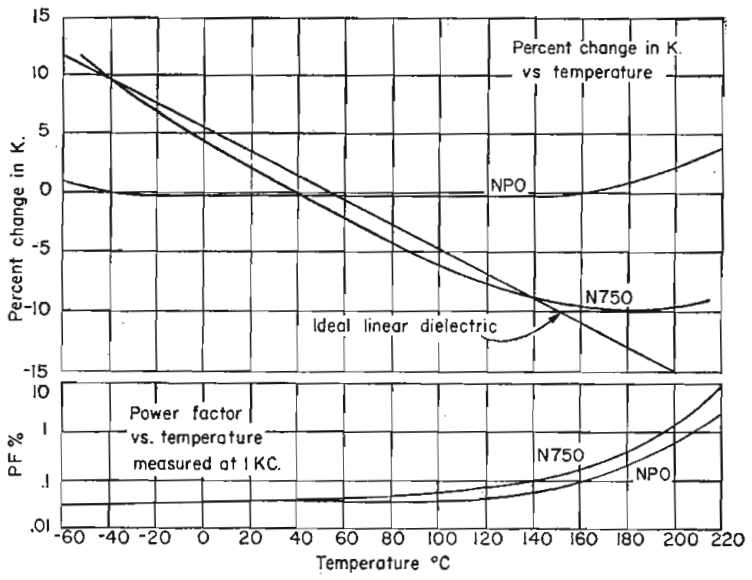
Temperature Compensating Units

Ceramic dielectrics in the temperature compensating, TC type capacitors are based on compositions containing TiO_2, rutile titanium dioxide, which in its multicrystalline ceramic form has a dielectric constant (K) of 100 and a temperature coefficient of capacity of —800 ppm°C (parts per million per degree centigrade). To form a series of dielectrics of lower temperature coefficients and lower K's, TiO_2 is blended with increasing amounts of other oxides having low K's and positive temperature coefficients of capacity.

A wide range of temperature coefficient are available and are listed in Table 1 with the corresponding K's. The manner in which capacity depends on temperature is displayed in Fig. 1 as percent change in capacity as a function of temperature. The curves are not ideal straight lines but show an upward curvature. The higher the TC value

Fig. 1: (Left) Curves showing capacity change vs temperature for TC type capacitors. Fig. 2: (Right) changes in K vs temperature





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Circuit Miniaturization

PART ONE
OF TWO PARTS

ceramic capacitors that are finding ever wider applications in miniature circuits

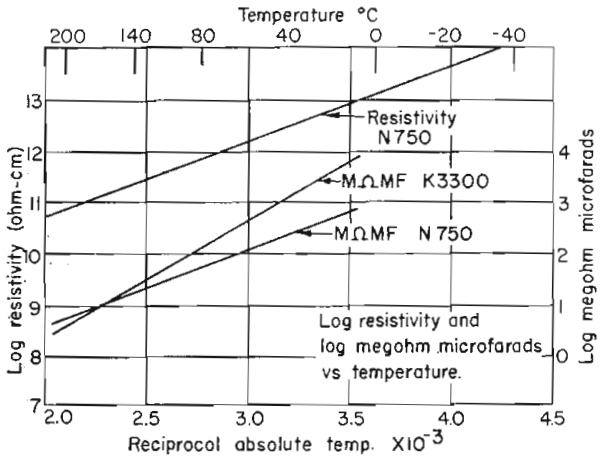


Fig. 3: (Left) Curves showing how the resistivity and the megohm microfarads of N-750 depends on the temperature

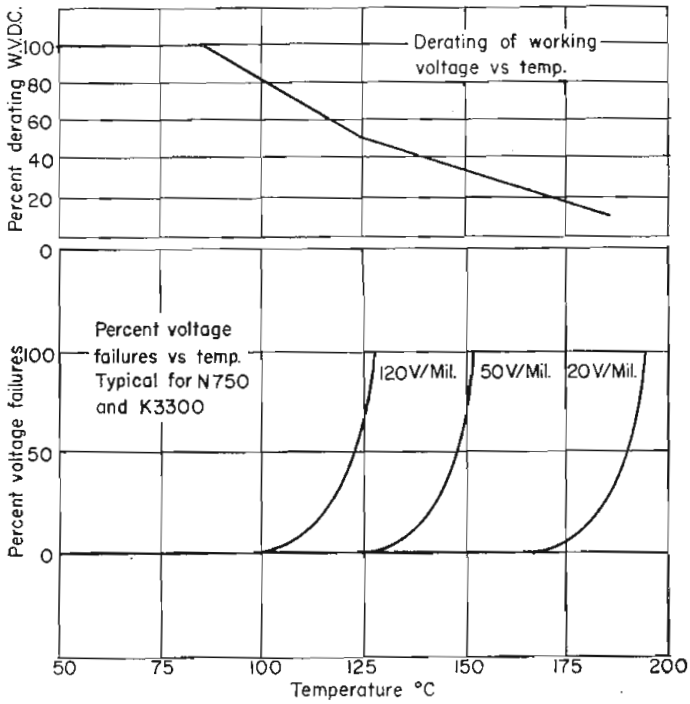


Fig. 4: (Right) Above, working voltage derating curves for operation above 85° C. (Below) Curves for determining high temperature life expectancy at different working voltages.

the greater is the curvature. For this reason a temperature coefficient tolerance is specified for each composition as listed in Table 1. To calculate the temperature coefficient of capacity this formula is used

$$TC = \frac{(PPM/°C)}{60\ C_{25°}}$$

$$= \frac{(C_{85°} - C_{25°}) \times 10^6}{60\ C_{25°}}$$

where

$C_{85°}$ = capacity in mmfd at 85°c
$C_{25°}$ = capacity in mmfd at 25°c taken during temperature run from —55°c to 85°c or from 85°c to —55°c

Size factors for estimating the area of TC type capacitors are also given in table 1. The largest practical size for a finished single rectangular plate capacitor is 8 by 1.0 in. and the capacity corresponding to this area is given for each TC type. Capacity values 5 to 7 times this value are possible with multilayer construction in which several plates are assembled in parallel in one unit.

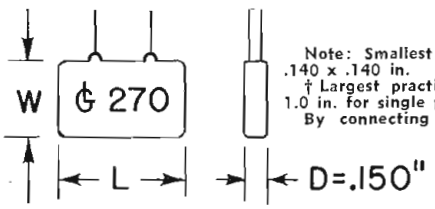
The least stringent temperature requirements for military applications are from —60°C to +85°C. The working voltage of ceramic capacitors is based on 85°C, 1,000 hour tests at 200% of rated working voltage dc. However, cramped spacing in miniature apparatus leads to high ambient temperatures and certain military applications call for operation up to 200°C and occasionally higher. When the temperature of operation reaches 150-200°C titania based capacitors exhibit (1) an increase in power factor, (2) a lowering of insulation resistance, and (3) a tendency to early voltage breakdown. It can be shown that these three types of behavior are due almost exclusively to electronic conductivity in the dielectric.

Fig. 2 is a plot of the change in

(*Continued on page 78*)

TABLE I
TC TEMPERATURE COMPENSATING CERAMIC CAPACITORS

TC Type	Dielectric Constant K	Temp Coeff. of Capacity PPM/°C	Temp Coeff. Tolerance PPM/°C	Size Factors for 500 wvdc R	Max. Capacity* Single Plate 500 wvdc C	Size Factors for 150 wvdc R	Max. Capacity† Single Plate 150 wvdc mmfd C
P100	23	+ 100	± 30	.0036	220	.0020	400
NPO	17	0	± 30	.0048	170	.0030	260
N080	24	— 080	± 30	.0035	230	.0020	400
N150	28	— 150	± 30	.0030	290	.0018	440
N220	31	— 220	± 30	.0028	290	.0017	470
N330	38	— 330	± 60	.0022	370	.0014	570
N470	45	— 470	± 60	.0018	450	.0011	720
N750	85	— 750	±120	.0010	800	.0006	1300
N2500	300	—2500	±400	.00028	2800	.00018	4400



Note: Smallest practical area .140 x .140 in.
† Largest practical area. 80 x 1.0 in. for single plate. By connecting several plates in parallel in multilayered construction, capacities 5 to 7 times larger than single plate values can be obtained in one unit.
* The capacity in micromicrofarads multiplied by the size factor R gives an estimate of the area of a finished capacitor in square inches.

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New Equipment and Components

Branching Networks

Units like the Series 1130 branching networks are used extensively in major broadcasting installations, motion picture

sound studios and as laboratory standards of fixed attenuation. The multiple input and output networks equalize incoming signal levels—in multi-channel mixers and similar broadcast equipment, and combine two or more incoming lines into a single outgoing line, or divide one incoming line into two or more outogoing lines. They may be obtained in either balanced H or unbalanced T circuits. All units are designed for minimum loss. Resistors are of the precision wire wound type with accuracy of ±2%. The maximum level of these pads is ±24 VU. A maximum number of 10 inputs or outputs is available. Almost any standard impedance or loss is available upon request. The multiple networks frequency range is from zero to 50 KC for most values. This range can be extended if necessary.—**The Daven Company, 191 Central Ave., Newark, N. J.**—TELE-TECH

Plastic Rods

High strength plastic rods in fractional sizes are now being molded of Dynakon-F, and corrosion-resistant properties; tensile is 10,000 p.s.i. Arc resistance is 120 seconds ASTM: dielectric strength is 280 volts per mil. Power factor is 2.5. The rods are resistant to acid and mild alkalies as well as to salts and most organic solvents. Among recommended applications are stand-off insulators, tension rods, supports in chemical equipment and structural members in corrosive atmospheres.—**The Dynakon Corp., 5509 Hough Ave., Cleveland 3, Ohio.**—TELE-TECH

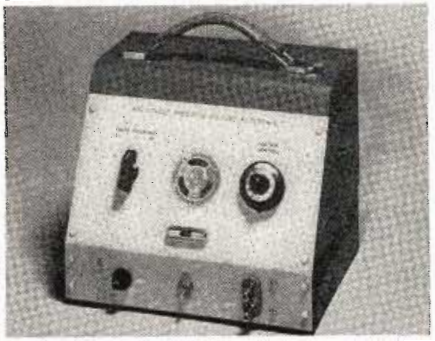
Time Delay Relay

A low-cost time delay relay, known as the Silic-O-Netic time delay relay, utilizing a hydraulic-magnetic operating principle, has only one moving part in the time element which is hermetically sealed and never needs attention. Overall dimensions are only 1⅝ x 2½ x ¾ in. yet rated capacity is 10 amps. at 120 v. ac. Instead of the fixed solid core found in conventional relays, the Silic-O-Netic relay has a sealed tube which extends through and below the relay coil. The

tube, in turn, is filled with a viscosity-stable silicone liquid, and holds a movable iron core. When the coil is energized, the movable core is drawn up into the magnetic field but the rate of rise is controlled by the silicone liquid, introducing a precise time delay. The relay operates on the increased magnetic flux caused as the core reaches the pole piece at the top of the tube. These relays are available with timings up to 4 minutes and there is no appreciable effect on the relay time caused by ambient temperature or position changes normally encountered.—**Heinemann Electric Co., 331 Plum Street, Trenton 2, N. J.**—TELE-TECH

Secondary Standard Cell

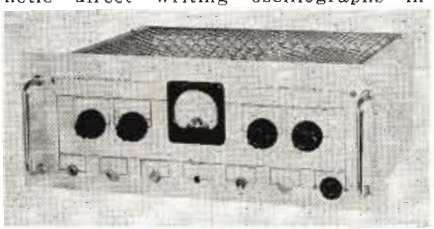
A new, adjustable, all-electronic "secondary cell," operating from ac mains to provide a continuously variable dc sup-



ply over the wide range of 0.0001 to 10 v. has been developed. It is a precision unit designed primarily to work with high impedance devices; for dc amplifier testing, calibration of dc oscilloscopes and vacuum tube voltmeters, and determination of vacuum tube characteristics. Maximum output impedance of the unit is 1,000 ohms, with accuracy maintained at 0.1% of full scale. A multiple-turn potentiometer is provided having divisions of .001 of full scale. The circuit is operable with input voltages of 105-130 v., 50-60 cycles, with full accuracy.—**General Precision Laboratory, Inc., 63 Bedford Road, Pleasantville, N. Y.**—TELE-TECH

DC Amplifier

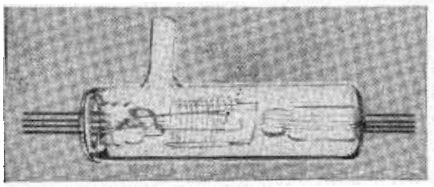
A new direct coupled amplifier has been designed for use with Brush magnetic direct writing oscillographs in



studies of such static or dynamic conditions as strains, displacements, pressure, light intensities, temperatures and ac or dc voltages or currents. Voltage gain of the instrument, approximately 1000 times, is sufficient to give one millimeter of deflection on the oscillograph chart per millivolt input. Effects of power line fluctuation are minimized by novel design features combined with both plate and heater voltage regulation. Zero signal drift amounts to not more than one chart millimeter per hour. When the amplifier is used with the penmotor, the frequency response is essentially linear from dc to 100 cycles per second. The control panel on the face of the unit contains an attenuator with five factor-of-ten positions, gain control, calibrating meter, and controls for determining input voltages. A balancing potentiometer is provided for electrically biasing the oscillograph pen to any position on the chart.—**The Brush Development Co., Instrument Division 28, 3405 Perkins Ave., Cleveland 14, Ohio.**—TELE-TECH

Ionization Guage Tube

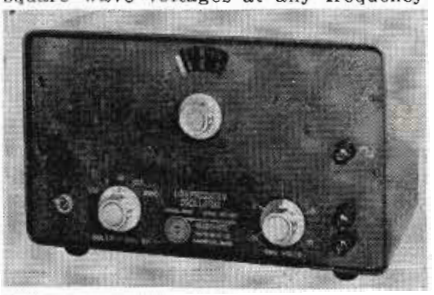
An ionization guage tube, known as the IPG1, has been developed. It features 120 microamps per micron at 5



ma and all tungsten construction insures stable calibration. Tube parts are continually outgassed while in operation and the design permits use of portable amplifier. It adapts itself for use as a Pirani, thereby covering the range of - millimeter to 10^{-8} millimeter.—**Multi-Tron Laboratory, 5522 W. Harrison St., Chicago 44, Ill.**—TELE-TECH

Low Frequency Oscillator

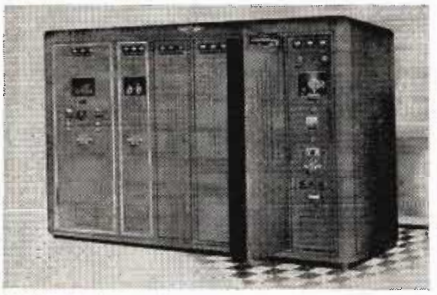
Model 420-A low frequency oscillator simultaneously provides both sine and square wave voltages at any frequency



between 0.35 and 52,000 cps. Special circuitry is employed to eliminate tuning and band-switching transients. The unit features low distortion and hum at any setting of the calibrated output level control and excellent amplitude constancy over the entire frequency range. Other features include fast AVC action, vernier tuning control, and a single scale logarithmic dial.—**Krohn-Hite Instrument Co., 580 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH

Multi-Channel Transmitter

New flexibility in high power simultaneous multi-channel operation is provided by the model T3M. Four or more



transmitting channels are instantly selectable and simultaneous operation of combinations or services can be established by local or remote dialing. The T3M comprises three basic units of matched construction, the r-f unit, the amplifier-modulator unit, and the power supply unit. One r-f unit and a power supply unit compose a complete radiotelegraph transmitter. The addition of an amplifier-modulator unit provides for radiotelephone operation. Each r-f unit is complemented with a frequency shift keyer adapter for simple connection of an F-S keyer. The amplifier-modulator is capable of 100% modulation of the full 3 kw output of any r-f unit.—**Press Wireless Mfg. Co., Inc., Hicksville, N. Y.**—TELE-TECH

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for Designers and Manufacturers

TV Receiving Tube

A low-cost miniature television receiver tube, (6BK7) designed to reduce snow fringe area reception, has a noise

factor of only 7 db as a cascode amplifier at 216 MC. Intended primarily for cascode service in VHF reception, the 6BK7 may also be used as a low-noise first i-f amplifier in UHF. Design features include a shield between the triode sections and high transconductance to improve gain and reduce the noise level.

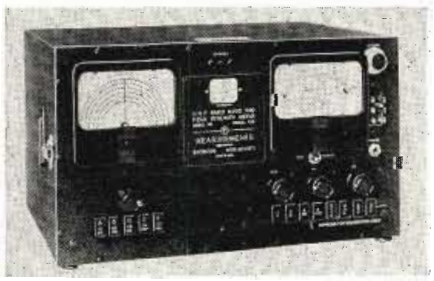
Typical operating conditions include: plate supply voltage, 150 v.; cathode bias resistor, 56 ohms; amplification factor, 40; plate resistance, 4700 ohms; transconductance, 8500 micromhos; plate current, 18 ma.—**General Electric Co., Tube Dept., Electronics Div., Schenectady 5, N. Y.**—TELE-TECH

Closed-Circuit TV Transmitter

A TV closed-circuit transmitter that feeds a group of standard TV receivers without modification of any sort, over a coaxial line, is now available for convenient rack-mounted installation. Operating as a non-radiating transmitter by taking both audio and composite video signals and sending them at carrier frequency of either TV Channel 2 or 3, over a single coaxial line, the Du-mitter is finding many applications such as feeding standard TV receivers as monitors in studios and holding closed-circuit TV sales conferences simultaneously in scattered localities. By connecting suitable distribution pads to the output terminals, up to 25 receivers can be fed from one pair of terminals or up to 125 receivers by using the five terminals provided. Expensive video distribution amplifiers are eliminated. Feed-line terminations are not critical as is often the case with a video distribution system.—**Television Transmitter Div., Allen B. Du Mont Labs., Inc., 1000 Main Ave., Clifton, N. J.**—TELE-TECH

UHF Noise-Field Strength Meter

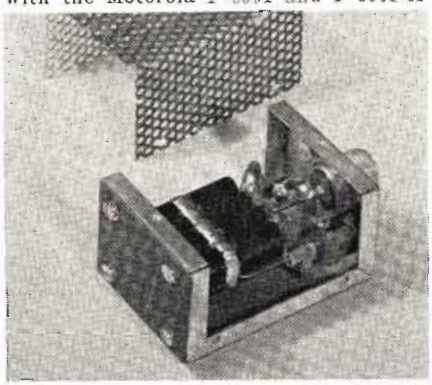
The slide-back technique has been incorporated in the vacuum tube voltmeter circuit of model 58 UHF radio noise and field strength meter. This new feature



facilitates more accurate noise measurements of short pulses having a slow repetition rate, or a random variation in magnitude over a considerable period of time. The slide-back feature is available to purchasers of new instruments at a nominal additional cost. Model 58's already in use may be modified to include this new facility with a special kit containing all necessary components and installation instructions. Instruments may also be returned to the manufacturer's repair department for the modification. Covering the frequency range of 15 to 150 MC, model 58 can be used for measurement of steady carrier voltages or fields; line loss; front-to-back ratios of directional antennas; signal-to-noise ratios of antennas; effectiveness of noise filters and for the investigation of ignition and other types of radio noise.—**Measurements Corp., Boonton, N. J.**—TELE-TECH

Wattmeter

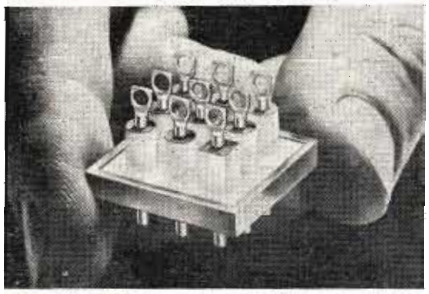
Two small resistive load r-f wattmeters are being manufactured for use with the Motorola P-8501 and P-8501-A



test sets or any 0-50 microammeter. Model P-7280 measures r-f power output from 0-60 watts and is used for testing base stations and mobile unit transmitters. Model P-7208-A measures transmitter power output from 0-2 watts and is recommended for portable unit testing, such as the Handie-Talkie portable radiophone. The output of the transmitter being tested is fed into the wattmeter load, and the suitable indicating device is connected to the jack provided. The calibration chart is used to correlate the power dissipated in the load unit and the meter readings. A hermetically sealed crystal diode and a 1% metalized multiplier resistor are incorporated in the unit.—**Motorola, Inc., 4545 W. Augusta Blvd., Chicago 51, Ill.**—TELE-TECH

Transformer Terminals

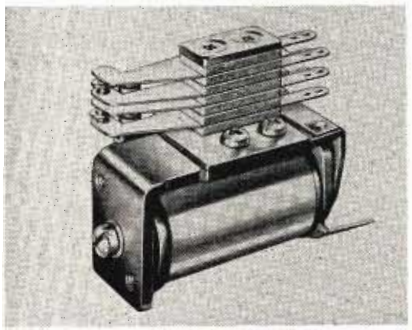
Utilizing an exclusive method of producing a fused hermetic seal between fluorocarbon resins and metals, one to



nine-pin "Chemelic" transformer terminals are being manufactured for hermetically sealing AF, AG, AH and AJ size transformer cases in specification MIL T-27. The fluorocarbon-metal hermetic seal structure is micro-crystalline in nature and the seal gradually changes from a pure fluorocarbon resin to a pure metal. Due to the characteristics of Teflon and the nature of this seal, these terminals withstand severe mechanical shock and vibration, and thermal shock. There is no strain point as with a fused glass or ceramic-metal seal. Assembly is facilitated because there is no danger of breakage and there is complete absence of dc plating. These terminals are serviceable at temperatures from —150°F to +525°F without change in electrical characteristics. Because of zero water absorption, they are unaffected by extreme humidity. **United States Gasket Company, Teflon Products Division, Camden 1, N. J.**—TELE-TECH

Relay

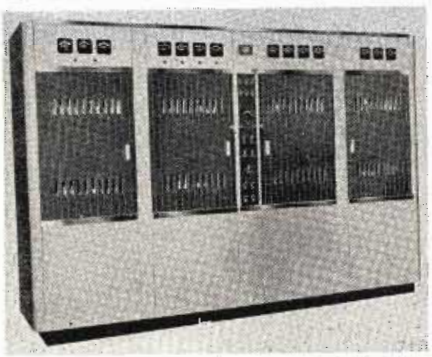
Type KX relay is a refinement of the small type K to provide increased sensitivity and operating range in the same-



sized unit. The new KX provides a slightly longer coil than the K which can be safely wound to a maximum resistance of 800 ohms. A slight change in the design and suspension of the armature permits this additional winding space without adding materially to the over-all length of the relay. Type KX is interchangeable with the type K for mounting. **C. P. Clare & Co., 4719 W. Sunnyside Ave., Chicago 30, Ill.**—TELE-TECH

Broadcast Transmitters

Two new and extremely economical AM radio transmitters, the BTA-5G and the BTA-1CG, with a frequency range



of 535-1620 KC and output ratings of 5 kw and 10 kw respectively are now in production. In each type, the entire transmitter, excepting the high-voltage plate transformer, is housed in four lightweight cabinets installed side-by-side on two 4-in. wire troughs which run the full length of the transmitter. Other features include two oscillator units, each of which maintains its frequency within ±5 cps. Front-panel oscillator switching permits quick selection of the auxiliary oscillator. The plate circuit of the final stage is tuned by a variable vacuum capacitor. Absence of air-dielectric capacitors in the equipment reduces the risk of arc-over due to dust collection. All r-f stages are designed for class C operation. Low audio distortion at frequencies from 50 to 10,000 cps is achieved at all percentages of modulation.—**Radio Corporation of America, RCA Victor Div., Camden, N. J.** TELE-TECH

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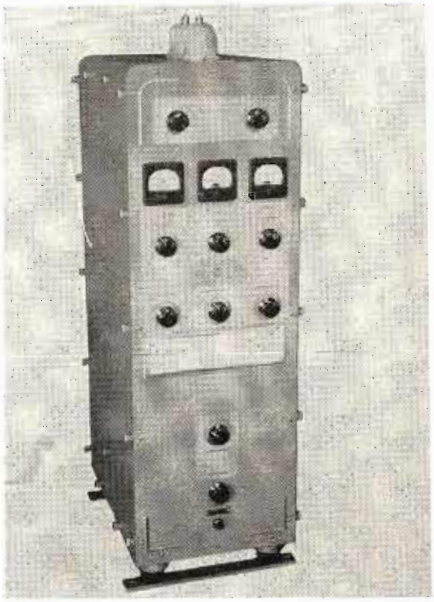
Transmitter

A long-range transmitter, designed as a companion installation to Radiomarine's model ET-8010E intermediate-frequency transmitter, employs crystal frequency control using the new type R-6 crystals, for greater stability and minimum tolerances. The model ET-8019E is designed to cover a continuous frequency range of 2-22.4 MC. Provision is made for 10 crystals, although 25 output frequencies may be obtained from only 6 crystals. In the design of this equipment, full advantage is taken of the efficiency of modern beam vacuum tubes, together with simplified controls, minimum space requirements and coverage of all assigned high-frequency bands for marine radiotelegraph service.—**Radiomarine Corporation of America, 75 Varick Street, New York 13, N. Y.**—TELE-TECH

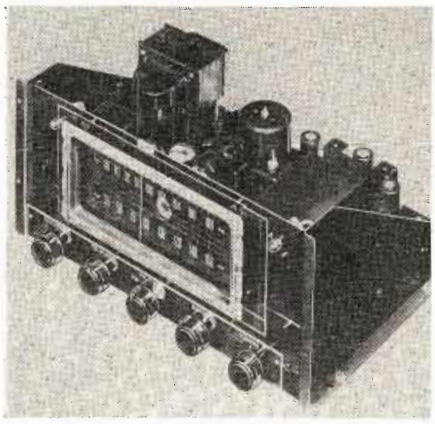


Portable Equipment Handle

A new lightweight portable radio weighing only 5 lbs. and designed to facilitate tuning in both upright and lying down position, features an extruded Lucite (acrylic) handle. The handle, which swings out of the way is composed of the following parts: extruded plastic tube, color matched with the control knobs (dark green as well as fawn); die-cast and plated brass pieces serving as hinges for the handle and as end pieces for the Lucite tube.—**Anchor Plastic Co., Inc., 533-541 Canal St., New York 13, N. Y.**—TELE-TECH

AM-FM Tuner

A dual circuit, 14-tube AM-FM tuner which uses a new low distortion AM detector has been developed. Harmonic distortion at 400 cps is .45%; at 400 cps it is .8% with 100% modulation. A null T type 10 KC filter is included; zero at 9 KC and 47 db at 10 KC.—**Sargent-Rayment Co., 212 Ninth St., Oakland 7, Calif.**—TELE-TECH

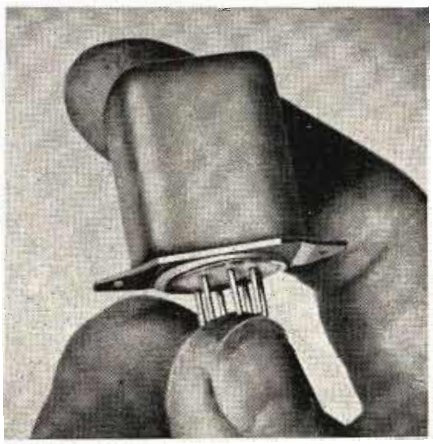


Insulation

Quinterra type 3, an asbestos-base, silicone-treated, high temperature electrical insulation is now being offered for service at a temperature of 180° C. Silicone-treated Quinterra type 3 is used for both inter-layer and wire wrapping insulation. It is adaptable to a wide range of electrical devices including air cooled, inert gas, and silicone filled transformers. Some of the advantages it offers are savings on materials, a greater factor of safety and the opportunity for more compact design. It maintains a dielectric strength of at least 350 VPM under continuous exposure to class H maximum temperature of 180° C. Furthermore, this dielectric strength remains practically constant even under continuously high humidity since Quinterra type 3 has high moisture resistance. When silicone-treated, it is uniform in both texture and thickness. Thus winding dimensions can be predicted accurately. It is extremely flexible for easy handling during application and very resistant to cracking or crazing. It is supplied in the form of sheets, rolls and tapes. Widths can vary from ¼ to 36 in. and will be factory cut to specification. Available thicknesses are from 3 to 9 mils.—**Johns-Manville, 22 E. 40th St., New York 16, N. Y.**—TELE-TECH

Relays

For maximum protection against pressure and temperature variations, dust, humidity, and other conditions, the series 5000 line of sub-miniature, anti-vibration relays is now available in hermetically-sealed containers. Developed to meet the exacting space and performance requirements of military aircraft, rockets, guided missiles, radar, radio, and telemetering devices, the sealed relays weigh less than .93 oz., and occupy less than .860 cu. in. of space. A miniature seven pin plug-in base permits easy mounting in standard seven pin miniature tube sockets. If additional fastening stability is desired, the relays are available with flanges for mounting with #6 screws. A solder lug seal is available in place of the plug-in base when desired.—**Neomatic, Inc. 11632 San Vicente Blvd., Los Angeles 49, Calif.**—TELE-TECH

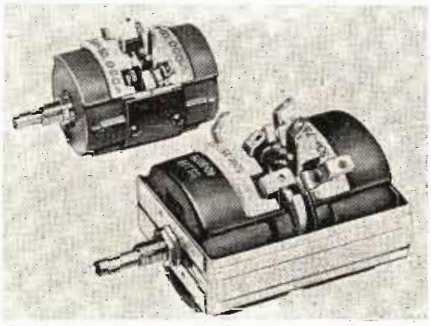


High Voltage Probe

A new high voltage probe, known as model 999, has multiple insulation: two areas of air insulation; plastic inside insulation and an outside plastic insulation which protects against voltage breakdown. Construction is mechanically shockproof for it incorporates a double spring suspension system, stainless steel springs and fibre cushions in order to maintain vertical and horizontal shock resistant characteristics. Tips are interchangeable and include an alligator clip plus the conventional probing type. There is also no chance of cable high strains or snagging with the swivel lead connection and special fixed slip-ring arrangement. In addition, it also has interchangeable resistors for use with any VTVM or 20,000 ohms per volt meter; three large flash guards as an additional safety measure; and it is housed in a sturdy, non-porous shell.—**Precise Development Corp., Oceanside, N. Y.**—TELE-TECH

Power Rheostats

Designed and engineered to meet the need for more versatile application of power rheostats, several new models are now available as dual units with single hole mounting. All metal construction provides maximum heat dissipation, black anodized aluminum die-cast frame, metal winding core, stainless steel insulated shaft, and copper graphite brushes insure long life and low contact resistance. These are available in exceptionally high resistance ranges within ± 5% up to 50,000 ohms in the 25 watt size, and 75,000 ohms in the 50 watt size. Linear and non-linear windings over this range can be maintained with ± 1%.—**Industrial Div., Sec. II, De Jur-Amsco Corp., Long Island City, N. Y.**—TELE-TECH



16mm Camera

The versatile new 16mm Auricon Super-1200 sound-on-film camera combines three separate finder systems with a completely quiet-running film mechanism. No blimp or other soundproof enclosure is required. The three finders consist of an instant ground-glass focusing telescope system which looks through the camera lens and shows the exact frame and focus of the picture being shot with any focal length lens; a studio finder showing a large and brilliant upright image, correct right to left for use with 17mm wide angle up to 2-in. semi-telephoto lenses; and a telephoto finder system which shows a brilliant and magnified image for telephoto lenses up to 12-in. focus with matching finder objective lenses carried on the lens Turret. In addition to the three finder systems, the camera has 1200-ft. film capacity for up to 33 minutes of continuous talking pictures, and a variable-shutter for fades and exposure control—**Berndt-Bach, Inc., 7377 Beverly Blvd., Los Angeles 36, Calif.**—TELE-TECH

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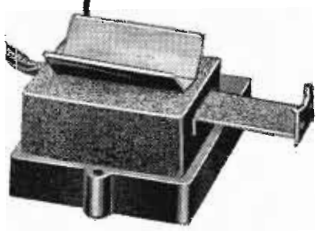

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7th Annual NEC Scheduled for Oct. 22-24 in Chicago

Dr. W. R. G. Baker, vice-president General Electric Co. and chairman NTSC, and Adrian Murphy, vice-president Columbia Broadcasting System, will be featured speakers at luncheons during the seventh annual National Electronics Conference to be held at the Edgewater Beach Hotel, Chicago, Oct. 22-24.

More than 2,000 engineers are expected to attend the conference, at which 76 technical papers will be presented during 19 sessions. About 60 exhibits will be set up at the hotel by radio-TV manufacturers to show latest advances in equipment.

E. H. Schulz, electrical engineering chairman at Armour Research Foundation of Illinois Institute of Technology, is 1951 president of the conference.

A representative list of technical papers to be presented follows:

TUBE DEVELOPMENTS

"Frequency Control of Modulated Magnetrons by Resonant Injection Systems" by L. L. Koros, Radio Corporation of America, Camden, N. J.

"The Effect of Long Transmission Lines on Klystron Oscillators" by Jona Cohn, Motorola Inc., Chicago, Ill.

"Analysis of Modulated Electron Beams" by W. W. Cannon, University of Illinois, Urbana, Ill.

"A High-Voltage Cold-Cathode Rectifier" by E. G. Linder, E. G. Apgar, RCA Laboratories, Princeton, N. J., J. H. Coleman, Radiation Research Corp., West Palm Beach, Florida.

INFORMATION THEORY

"Pulses and Transients in System Analysis" by M. Levy, Defense Research Board, Ottawa, Canada.

"Information Aspects of Periodic Radio Systems" by H. C. Harris, W. E. Budd, and M. Leifer, Sylvania Electric Products, Inc., Bayside, N. Y.

"A Non-Linear Statistical Filter" by A. W. Sullivan and J. M. Barney, University of Florida, Gainesville, Fla.

"Generalized Concepts for the Efficient Utilization of Radar Information" by H. Briskin, H. C. Harris, and H. R. Holloway, Sylvania Electric Products, Inc., Flushing, N. Y.

AUDIO SYSTEMS

"A Selective Automatic Phonograph Mechanism" by J. C. Kiefer and A. L. Bodoh, J. P. Seeburg Corporation, Chicago, Ill.

"Horn-Loaded Loudspeakers" by D. J. Plach and P. B. Williams, Jensen Mfg. Co., Chicago, Ill.

"Wear of Phonograph Needles" by B. B. Bauer, Shure Bros. Inc., Chicago, Ill.

"An Electronic Music Box" by E. L. Kent, C. G. Conn, Ltd., Elkhart, Ind.

SIGNAL DETECTION

"Synchronous Detection of Amplitude-Modulated Signals" by J. P. Costas, General Electric Co., Syracuse, N. Y.

"The Application of Nonlinear Elements in AF and RF Circuits" by H. E. Hollmann, U. S. Naval Air Missile Test Center, Point Mugu, Calif.

"Second Detector Signal-to-Noise Improvement" by L. S. Schwartz, Hazeltine Electronics Corp., Little Neck, N. Y.

"Input vs. Output Signal-to-Noise Characteristics of Linear, Parabolic and Semi-Cubical Detectors" by A. H. Schooley and S. F. George, Naval Research Laboratory, Washington, D. C.

HIGH-FREQUENCY MEASUREMENT

"A Sweep Frequency Method of Q Measurement for Single Ended Resonators" by E. D. Reed, Bell Telephone Laboratories, Inc., New York, N. Y.

(*Continued on page* 70)

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Let's be HONEST with the American Public and ourselves about UHF

A message from Sarkes Tarzian, president of Sarkes Tarzian, Inc., the largest producer of switch-type tuners.

"You can fool some of the people all of the time and all the people some of the time, but you can't fool all the people all the time."
—ABRAHAM LINCOLN

● In the early days of commercial Television (1946-47) even the major manufacturers of receivers thought that a 7 to 9 channel tuner was sufficient to take care of reception in any area. They maintained the distributors and dealers could easily retune or change strips to suit their own needs.

We believed *then* that since 13 channels were available for Television, tuners should be designed and built to use the FULL RANGE of Television frequencies. We built only tuners then—as we are building now—to take care of *all* channels. It was only a matter of a year or two until all manufacturers were doing the same thing . . . providing FULL RANGE coverage.

Today, we have a similar problem facing the industry. The FCC has indicated that the frequency range from 470 megacycles to 890 megacycles (UHF) will be opened shortly for about *seventy* new Television Channels. These, of course, in addition to the twelve now available for VHF. This allocation will allow several thousand more Television stations to operate all over the United States.

Is the Television industry going to face this challenge honestly and courageously? Is it going to design and manufacture Television sets so that the AMERICAN PUBLIC—in the years to come—can get FULL RANGE Ultra High Frequency when it wants it?

Or, is the industry going to temporize . . . be opportunistic . . . and *insinuate* it has the answer to UHF through *single* channel strips? Wherein, each time the set owner adds a UHF channel strip in his tuner he loses the possible service of a VHF channel!

Is the industry going to live up to its responsibility and provide for FULL RANGE UHF? Or, is it going to try to avoid immediate engineering and manufacturing problems (which it must eventually face) by just providing LIMITED RANGE receivers now . . . letting the public, distributors and dealers "hold the bag" in the future?

We believe the logical—and honest—approach to the UHF problem is to design and produce VHF tuners now that easily—and at nominal cost—may have added to them at a later date FULL RANGE (70 Channel) coverage whenever the customer wants UHF service.

We have such a VHF Tuner available *now* to the industry. It's the Tarzian TT16. Cost of this tuner to the manufacturer is about the same as that for the regular VHF Tuners in general use now. However, by using the TT16 Tuner the manufacturer can honestly show his customer that the set *is designed* for FULL RANGE UHF Service. Cost-wise, the manufacturer is ahead, because the TT16—which includes this added feature—costs no more than regular VHF Tuners. We estimate that the additional cost to the set owner for FULL RANGE UHF Service will be less than the cost of adding 2 or 3 channel strips . . . piecemeal.

The manufacturer, by adopting this policy of producing sets which now—or later—can have incorporated FULL RANGE UHF Service, enjoys these advantages:

1—He has a distinct competitive advantage over other manufacturers who do not follow this plan and can offer only *partial* UHF.

2—He eliminates future problems and headaches for himself, his distributors, and the dealers by giving the buyer FULL RANGE Service once and for all.

3—He contributes his efforts towards placing UHF Television on a sound basis. By giving the buyer what he rightfully expects, he gains the confidence of his customer . . . adds prestige and value to his product, and his own name on that product.

So, let's be honest with the AMERICAN PUBLIC and OURSELVES about UHF, and provide for FULL RANGE UHF Service NOW.

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WASHINGTON
News Letter

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

BRIGHTER PRODUCTION OUTLOOK — Even though the big push in military procurement is currently at an annual rate of $3.8 billion, the complex types of electronic and radar equipments which are needed by the military services are such that they cannot be manufactured in normal mass-production fashion. This has resulted in a situation of radio-TV set and parts manufacturers' being able to utilize only half of their present huge plant capacities in both defense and non-defense production. Unemployment has occurred substantially, due to this situation. But the outlook is that subcontracing processes are being steadily enlarged and improved so the entire industry should get back to normal production capacity in the next few months, according to estimates from Pentagon sources.

GREATEST ADVANCE—Scientific and technological advances, particularly in the field of radio-electronic applications in the military arts, are opening a new door to scientific warfare not even imagined in World War II. This was the opinion of Senator O'Mahoney, who headed the Senate Appropriations subcommittee which drafted the $56 billion armed services funds bill for the 1952 fiscal year. His view about the radio-electronic industry making the greatest contribution to America's defense efforts and superiority in the electronic industries being a decisive factor in modern warfare, was substantiated by one of the leaders in the industry, Dr. Allen B. Du Mont, in a recent address.

DR. A. B. DU MONT COMMENTS. On the occasion above referred to, Dr. Du Mont cited the fact that electronic apparatus on planes for some of the present-day military aircraft is so intricate that it is more expensive than the entire cost of the plane itself during the last war. For example, it might be noted the larger radar equipments cost $400,000 and upwards for each installation,—some 350 separate components being used. Of the current military electronic equipment not more than 20% can be manufactured under a mass production or line-assembly process.

COMPATIBLE COLOR-TV PROGRESS—Achievement of compatible and uniform standards for monochrome and color television which is the task of the National Television Systems Committee, chairmanned by Dr. W. R. G. Baker, General Electric Co., is felt by FCC leading engineers to be nearing consummation as the result of field tests by the NTSC during the latter part of September. The laboratory demonstrations of the equipment developed by General Electric, Hazeltine, RCA and Philco were regarded as excellent by the top-flight FCC engineering observers, with fine progress toward compatibility, good detail and resolution and avoidance of interference in the 6-megacycle band tests.

PRESIDENTIAL RADIO ADVISER ON JOB — Haraden Pratt, one of the nation's outstanding radio engineers and former president of the Institute of Radio Engineers who was awarded the IRE Medal of Honor in 1944, has commenced his new public service assignment of Telecommunications Adviser to President Truman in Washington. His responsibilities include carrying out planning and executive functions required by the President's power to assign frequencies for government use and control of radio operation in event of a national emergency.

UMPIRE BETWEEN IRAC AND FCC — White House Adviser Pratt will supervise the allocation and division of frequency space between government and non-government users of radio. He is also charged with advising the President on legislation and policies concerned with electronic and radio problems. Mr. Pratt, who has spent a lifelong career in radio communications and who has been vice-president and chief engineer of the American Cable & Radio Corp. (MacKay, IT&T) was given the Presidential assignment because his reputation in radio engineering circles is universally regarded with the highest esteem.

MOBILE RADIO VITAL—The importance of mobile radio services in civil defense emergencies—especially the police and fire radio systems, taxicab and railroad services—is well recognized by the Federal Civil Defense Administration and its communication chieftain, Col. William M. Talbot in recent addresses. FCC Commissioner E. M. Webster and FCC Safety and Special Radio Services Bureau Chief E. L. White likewise gave full recognition to the mobile radio services for the vital character of their operations. Because of the significant role of mobile radio it is believed that this field will suffer very little, if at all, from material and equipment shortages unless the war situation worsens.

National Press Building
Washington, D. C.

Roland C. Davies
Washington Editor

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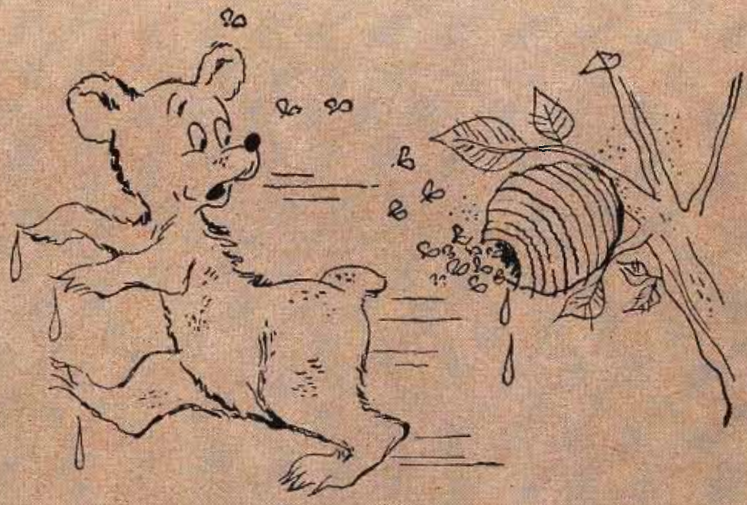

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Your employees, like those of the Radio Corporation of America and many other companies will join by the hundreds or thousands because they, too, are eager to contribute to the strengthening of America's defenses while they build their own security. Make it very easy for them—through the automatic Payroll Savings Plan.

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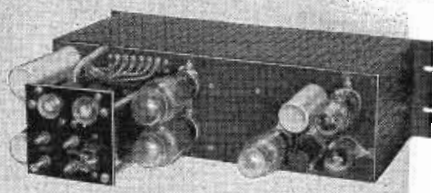

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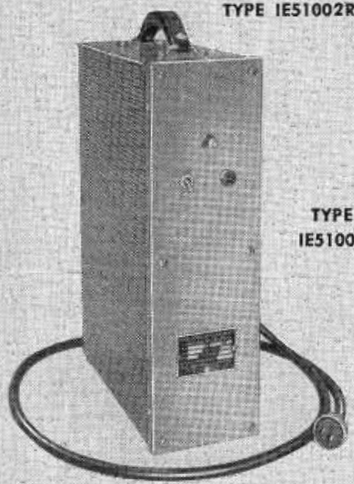

TYPE IE51005

TYPE IE5101R

TYPE IE5101

Manufacturers faced with the need for increased production and lower costs are becoming extremely conscious of the importance of maintaining constant voltage to electrical apparatus. The Superior Electric Company's line of STABILINE Automatic Voltage Regulators offers equipment to suit the needs of each application. Two types are available: Type IE (Instantaneous Electronic) and Type EM (Electro-Mechanical).

STABILINE Type IE is a completely electronic unit with no moving parts . . . is used where instantaneous and extremely close correction is required. It maintains a constant output voltage regardless of line variations at no load, full load or any intermediate load. The output voltage is held to within ± 0.1 volts of nominal for wide line variations; within ± 0.15 volts of nominal for any load current change or load power factor change from lagging .5 to leading .9. Maximum waveform distortion never exceeds 3%.

Standard models are available in cabinets or for relay rack mounting in numerous ratings as listed below. In the event you have a special requirement involving other frequencies or ratings, SECO voltage control engineers will study your specific problem and make recommendations without obligation.

INSTANTANEOUS ELECTRONIC CABINET MODELS

Input Voltage Range	Output Voltage Range	Frequency In Cycles	Load Range In Amperes	Load Power Factor Range	Rated Output KVA	Type
95-135	110-120	60 ± 10%	0 - 2.2		0.25	IE51002*
195-255	220-240	60 ± 10%	0 - 1.1		0.25	IE52002*
95-135	110-120	60 ± 10%	0 - 4.5	.5 lagging	0.5	IE51005*
195-255	220-240	60 ± 10%	0 - 2.2		0.5	IE52005*
95-135	110-120	50 ± 10%	0 - 4.5		0.5	IEL51005*
195-255	220-240	50 ± 10%	0 - 2.2		0.5	IEL52005*
95-135	110-120	60 ± 10%	0 - 8.5	to	1.0	IE5101*
195-255	220-240	60 ± 10%	0 - 4.5		1.0	IE5201*
95-135	110-120	50 ± 10%	0 - 8.5		1.0	IEL5101*
195-255	220-240	50 ± 10%	0 - 4.5		1.0	IEL5201*
95-135	110-120	60 ± 10%	0 - 22.0		2.5	IE5102*
195-255	220-240	60 ± 10%	0 - 11.0	.9 leading	2.5	IE5202*
195-255	220-240	50 ± 10%	0 - 11.0		2.5	IEL5202*
95-135	110-120	60 ± 10%	0 - 43.5		5.0	IE5105
195-255	220-240	60 ± 10%	0 - 22.0		5.0	IE5205

*** Also offered in rack models.**

REMEMBER, STABILINE TYPE EM (ELECTRO-MECHANICAL) UNITS ARE ALSO AVAILABLE. RATINGS FROM 2 TO 100 KVA. LITERATURE ON REQUEST.

There's a STABILINE Automatic Voltage Regulator for every need. Send today for literature and specific information. Write The Superior Electric Co., 1710 Church St., Bristol, Conn.

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POWERSTAT VARIABLE TRANSFORMERS • VOLTBOX A-C POWER SUPPLIES • STABILINE VOLTAGE REGULATORS

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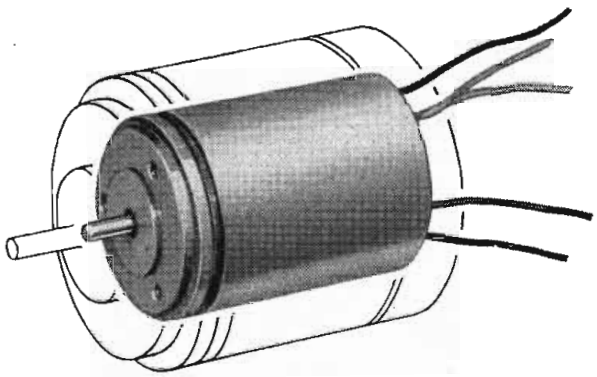
ECLIPSE-PIONEER

Announces the New Line of

PYGMY SYNCHROS



Size of pygmy as compared to AY-200 series outline

Eclipse-Pioneer has added a tiny new member to its great family of famous Autosyn* synchros. It's the new AY-500 series, a precision-built pygmy weighing only 1¾ oz. while scaling only 1.278" long and .937" in diameter (the same diameter, incidentally, as a twenty-five cent piece). Its accuracy and dependability are assured, thanks to Eclipse-Pioneer's 17 years of experience and leadership in the development of high precision synchros for aircraft, marine and industrial applications. For more detailed information on the AY-500 and other E-P Autosyns, such as the remarkably accurate AY-200 series (guaranteed accuracy to within 15 minutes on all production units), please write direct to Eclipse-Pioneer, Teterboro, N. J.

*REG. TRADE MARK BENDIX AVIATION CORPORATION

LOOK FOR THE PIONEER MARK OF QUALITY REG. U.S. PAT. OFF.

Typical Performance Characteristics

	One AY-201-3 Driving		One AY-500-3 Driving
	One AY-500-3 Control Transformer	Two AY-500-3 Control Transformers	One AY-500-3 Control Transformer
INPUT			
Voltage	26-volts, single-phase	26-volts, single-phase	26-volts, single-phase
Frequency	400 cycles	400 cycles	400 cycles
Current	88 milliamperes	110 milliamperes	55 milliamperes
Power	0.8 watts	1.2 watts	0.9 watts
Impedance	105+j280 ohms	100+j220 ohms	290+j370 ohms
OUTPUT			
Voltage Max. (rotor output)	17.9 volts	16.2 volts	14.1 volts
Voltage at null	40 millivolts	40 millivolts	40 millivolts
Sensitivity	310 millivolts/degree	280 millivolts/degree	245 millivolts/degree
Voltage phase shift	23 degrees	26 degrees	44 degrees
System accuracy (max. possible spread)	0.6 degrees	0.6 degrees	0.75 degrees

Other E-P precision components for servo mechanism and computing equipment:

Servo motors and systems • rate generators • gyros • stabilization equipment • turbine power supplies • remote indicating-transmitting systems and special purpose electron tubes.

For detailed information, write to Dept. B

ECLIPSE-PIONEER DIVISION of

TETERBORO, NEW JERSEY

Bendix AVIATION CORPORATION

Export Sales: Bendix International Division, 72 Fifth Avenue, New York 11, N. Y.

TV Equipment

(*Continued from page* 49)

which uses selenium rectifiers.

All voltages and currents may be monitored by means of the meter and meter switch located on the front panel.

Two cooling blowers are incorporated in the power unit maintaining operating temperatures well within proper operating limits.

3-Unit Chain

Where sync is already available, the GPL camera, camera control unit, and camera power unit make up a complete basic broadcast chain. Due to streamlining and simplification, this chain is equally convenient in the studio and in the field. The addition of the GPL portable video switcher provides fades, mixes, and dissolves—permitting a full range of studio effects in any location. The switcher also has provision for injecting program audio into the intercom line at a controlled level when single headphones are used.

The GPL portable sync generator with built-in power supply provides maximum circuit reliability. Designed with binary counting circuits and with pulse width determined by a delay line, it requires no operator adjustment.

Coming Events

October 2-4—Association of American Railroads, Communications Section, Annual Convention, Chateau Frontenac Hotel, Quebec, Canada.

October 8-10—URSI-IRE Professional Group on Antennas, Fall Meeting, Cornell Univ., Ithaca, N. Y.

October 15-19 — SMPTE Semiannual Convention, Hollywood-Roosevelt Hotel, Hollywood, Calif.

October 22-24—Seventh National Electronics Conference, Edgewater Beach Hotel, Chicago, Ill.

October 25-26—IRE National Professional Group for Vehicular Communications, Sheraton Hotel, Chicago, Ill.

October 29-31—1951 Radio Fall Meeting, RMA of Canada, RMA Engineering Dept., and the TRE, King Edward Hotel, Toronto, Canada.

November 1-3—The Audio Fair, Sponsored by the Audio Engineering Society, Hotel New Yorker, New York City.

November 16-17—IRE Conference on Instrumentation, Kansas City Section, Hotel President, Kansas City, Mo.

November 29-December 1—Joint Engineering Tube Equipment Council, First General Conference, Seaview Country Club, Absecon, N. J.

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This new Clarostat chart shows you at a glance the correct resistor or control for your particular application. Photograph, detailed drawing, brief specifications and type designation, for each item. You'll find a reproduction of this chart in the 1951 Electronic Buyer's Guide. If you want one for your wall or desk, write us on your business letterhead.

CLAROSTAT MFG. CO., INC.
DOVER, NEW HAMPSHIRE

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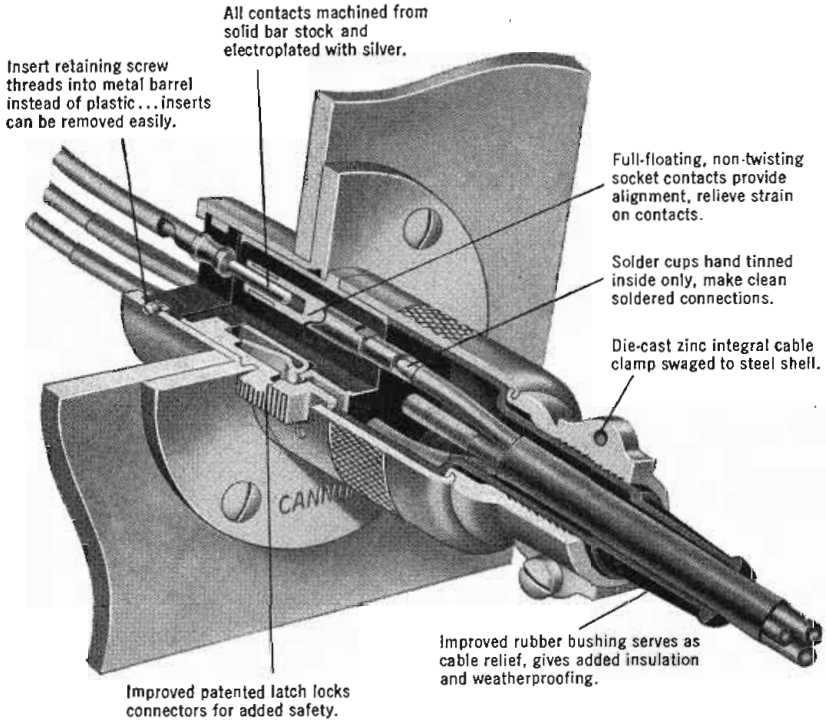
Here's why those in the know —demand

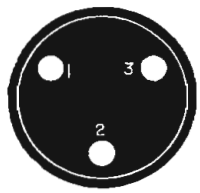
CANNON PLUGS



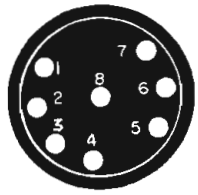
If you talk to sound technicians anywhere you'll find Cannon Type P connectors are the accepted standard of quality... taking a beating day in day out where frequent changes in circuits are required on all kinds of jobs up to 30 amp. capacity.

The close attention to important details called out in the above illustration is typical of the care used in the design and construction of all Cannon Plugs—the world's most complete line.

The above type series is distributed through selected franchise distributors. The line is fully described in the Type P Bulletin. Engineering bulletins describing each of the many basic types of Cannon Plugs will be sent on request.



P-3



P-8

Type P insert arrangements include 2-3-4-5-6 and 8 contacts. All contacts are 30 amp. capacity except those in P-8 layout which are 15 amp. Full scale layouts, front view pin insert, engaging side, shown at right.

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NEC Program

(Continued from page 62)

"A Recording Broadband Waveguide Reflectometer" by R. E. Henning and A. L. Witten, Sperry Gyroscope Co., Great Neck, N. Y.

"Measurement of the Relationship Between Baseband and Radio-Frequency Amplitude in FM Systems" by J. P. Schafer and L. E. Hunt, Bell Telephone Laboratories, Inc., New York, N. Y.

"Charts for Coaxial-Line Probe Measurements" by P. H. Smith, Bell Telephone Laboratories, Inc., Whippany, N. J.

CIRCUIT ANALYSIS

"Graphical Analysis for Circuits Containing Overdriven Vacuum Tubes" by R. J. Parent, University of Wisconsin, Madison, Wisconsin.

"Effect of Noise on the Frequency Stability of a Linear Oscillator" by Robert Lerner, Worcester Polytechnic Institute, Worcester, Mass.

"A Simplified Method for Measuring the Attenuation of Balanced Transmission Lines" by R. C. Powell, National Bureau of Standards, Washington, D. C.

"Narrow-Band Spectrum Analysis of a Pulse-Position-Modulated Signal" by Laurance H. Lloyd, Air Materiel Command, Dayton, Ohio.

UHF TUBE DEVELOPMENT

"Recent Developments in Traveling-Wave Tubes for Communication Purpose" by J. H. Bryant, T. J. Marchese, H. W. Cole, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"High-Transconductance Tubes for Broad-Band Telephone System Uses" by G. T. Ford and E. J. Walsh, Bell Telephone Laboratories, Inc., New York, N. Y.

"Low-Noise Traveling -Wave Tube" by A. G. Peifer, P. Parzen, and J. H. Bryant, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"Transmission-Line Tubes" by V. J. Fowler, University of Illinois, Urbana, Ill.

TELEVISION

"An Economical Sync-Clipper of Unusual Noise Immunity" by M. Marks, Zenith Radio Corp., Chicago, Ill.

"A Summary of Recent Advances in 'Dot-Sequential' Color TV Systems" by B. D. Loughlin, Hazeltine Electronics Corp., Little Neck, N. Y.

"A High Output, Constant Impedance, Second Detector for Television Receivers" by W. K. Squires, Sylvania Electric Products Co., Buffalo, N. Y.

"Television Pre-Amplifiers" by G. H. Fathauer, Dage Electric Co., Indianapolis, Ind.

"A Sweep-Frequency Generator for the UHF Television Band" by J. A. Cornell, Radio Corporation of America, Camden, N. J.

"Ultra-High Frequency Television Monitor" by F. D. Lewis, General Radio Company, Cambridge, Mass.

"The Vidicon, A Small Television Camera Tube" by B. H. Vine, R. B. Jones, and F. S. Veith, Radio Corporation of America, Camden, N. J.

COMPONENT MEASUREMENT AND ASSEMBLY

"Shaping of Non-Linear Resistor Characteristics" by J. J. Baruch, Massachusetts Institute of Technology, Acoustics Laboratory, Cambridge, Mass.

"New Development in the Auto-Sembly-Technique of Circuit Fabrication" by S. Danko, Signal Corps Engineering Laboratories, Ft. Monmouth, N. J.

"Machines for Printed Circuits and Pattern Deposition" by G. B. Devey, Mech-Tronic Equipment Co., Silver Spring, Md.

"Techniques in Measurement of Several Components" by I. Bady, Signal Corps Engineering Laboratories, Ft. Monmouth, N. J.

MICROWAVES AND PROPAGATION

"Shunt Conductance of a Wave-Guide-Fed Slot" by H. J. Venema, General Electric Company, Syracuse, N. Y.

"The Radiation Resistance of a Small Loop Antenna Over a Conducting Plane" by R. M. Powell, Naval Ordnance Laboratory, Silver Spring, Md.

"An Energy Detector for Microwaves" by A. B. Bronwell, Northwestern University, Evanston, Ill. and Howard Burroughs, Motorola, Inc., Chicago, Ill.

"Electromagnetic Propagation in Two-Dielectric-Layered Parallel-Plane Wave Guides" by J. Van Bladel, Manufacture Belge de Lampes Electriques, Brussels, Belgium, and T. J. Higgins, University of Wisconsin, Madison, Wis.

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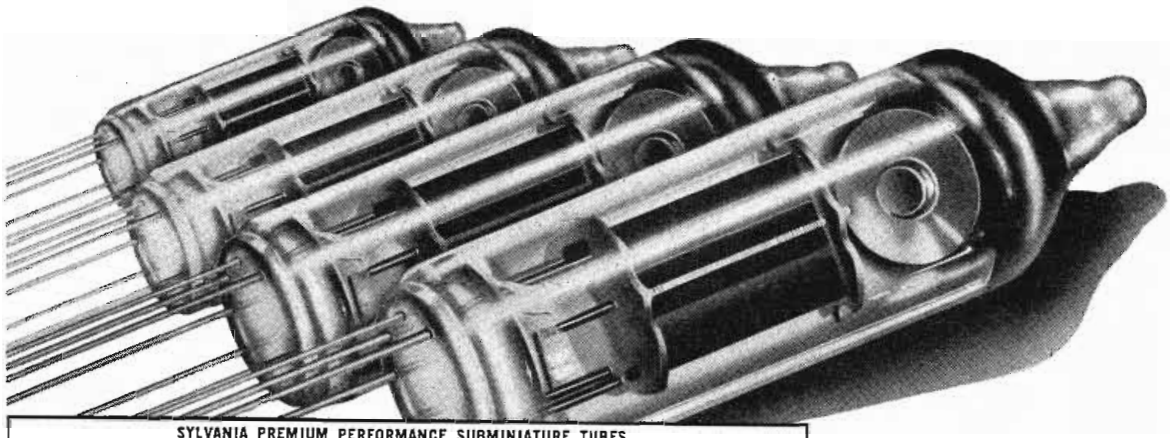
SYLVANIA OFFERS A COMPLETE LINE FOR GOVERNMENT CONTRACTORS



SYLVANIA PREMIUM PERFORMANCE SUBMINIATURE TUBES
*Armed Services Preferred Types

Type	Description	Ef (Volts)	If (ma)	Eb (Volts)	Ec2 (Volts)	gm (μmhos)	μ	Po (Watts)
PENTODES								
5636	Pentode Mixer	6.3	150	100	100	1250 (gc)		
*5639	Video Pentode	6.3	450	150	100	9000		1.0 (RL=9000Ω)
*5840 (5901)	Sharp Cut-off UHF Pentode	6.3	150	100	100	5000		
*5899 (5900)	Semi-remote Cut-off UHF Pentode	6.3	150	100	100	4500		
*5902	Audio Beam Power Pentode	6.3	450	110	110	4200		1.0 (RL=3000Ω)
*5905	Sharp Cut-off UHF Pentode	26.5	45	26.5	26.5	2850		
*5906	Sharp Cut-off UHF Pentode	26.5	45	100	100	5000		
*5907	Remote Cut-off UHF Pentode	26.5	45	26.5	26.5	3000		
*5908	Pentode Mixer	26.5	45	26.5	26.5	1000 (gc)		
*5916	Pentode Mixer	26.5	45	100	100	1280 (gc)		
TRIODES								
*5718 (5897)	Medium Mu UHF Triode	6.3	150	100		5800	27	0.9 (500 Mc Osc)
*5719 (5898)	High Mu Triode	6.3	150	100		1700	70	
5977	Medium Mu Triode	6.3	150	100		4500	16	
5987	Low Mu Power Triode	6.3	450	100		1850	4.1	
*5904	Medium Mu UFH Triode	26.5	45	26.5		4700	20	0.06 (400 Mc Osc)
6021	Medium Mu Double Triode	6.3	300	100		4800	35	
6111	Medium Mu Double Triode	6.3	300	100		4750	20	
6112	High Mu Double Triode	6.3	300	100		1850	70	
DIODES								
*5641	Single Diode	6.3	450	930 peak inverse plate volts 50 ma dc output				
*5647	Single Diode (T1)	6.3	150	460 peak inverse plate volts 10 ma dc output				
*5896	Double Diode	6.3	300	460 peak inverse plate volts 10 ma dc output per plate				
*5903	Double Diode	26.5	75	460 peak inverse plate volts 10 ma dc output per plate				
6110	Double Diode	6.3	150	460 peak inverse plate volts 4.4 ma dc output per plate				
GAS TUBES								
5643	Tetrode Thyratron	6.3	150	Average Anode Current = 22 ma Peak Anode Current = 100 ma				
*5644	Voltage Regulator	—	—	Operating Voltage = 95 volts Operating Current = 5-25 ma				

Long life . . . fatigue tested . . . High "g" vibration tested . . . Impact resistant . . . stabilized by burn-in period.

Twenty-five different types of Premium Performance Subminiature Tubes are now offered by Sylvania.

All are cathode types and are suitable for use in military communications equipment operating up to 400 mc. Engineered to function under severe conditions of vibration, shock, and high temperatures, they are excellent for rugged duty in guided missiles as well as in military signal equipment, fire control, etc.

Manufactured with either long or short leads in circular arrangement. At present, available only on DO or CMP rated orders. For complete data concerning characteristics and applications, mail the coupon now!

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Test, Grade, or Match Resistors

"as fast as you can pick 'em up!"

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with the new Clippard PR-5 RESISTANCE COMPARATOR

Just place the "unknown" resistance across the terminals of this precision, production Clippard tester. Even unskilled operators can process up to 17 resistors (of all types) *per minute.* Working to an accuracy of better than ±1% through the entire range of 100 ohms to 100 megohms, the PR-5 is a companion instrument to the famous PC-4 Automatic Capacitance Comparator. With it, radio, electrical, resistor manufacturers and large part jobbers save time and money and assure unerring accuracy of inspection.

Completely self-contained, the PR-5 requires no outside attachments other than the Standard Resistor against which unknowns are checked. Operates on 110 Volt—60 Cycle AC. Range: 100 ohms to 100 megohms; reads deviation from standard on any of three scales: —5% to +5%, —25% to +30% or —50% to +100%. Size: 18" x 12" x 12". Weight: approx. 32 lbs. For complete details, write for Catalog Sheet 10-TT.

Clippard

INSTRUMENT LABORATORY INC.

1125 Bank Street • Cincinnati 14, Ohio

MANUFACTURERS OF R. F. COILS AND ELECTRONIC EQUIPMENT

Studio Design

(*Continued from page* 53)

variance of no greater than two seconds in any one hour, while clocks placed in offices can vary as much as plus or minus 30 seconds in any one hour. In the studios proper are located eight accurate self-winding clocks, and throughout the rest of the building are placed 26 electric synchronous clocks which can be set on any hour by pushing a button on the control board in the Main Control Room. One of each type clock[1] is mounted in this room so that comparison can be made by the control operator.

Two quality 15 inch speakers are mounted in the ceiling above the operator's head in the main control room, one for program monitoring and the other for audition monitoring. Speakers of the same type are also used in the ceiling infinite baffle in the recording room. This type of mounting is inexpensive, neat appearing, completely out-of-the-way, and gives excellent performance. A 15 inch speaker is used for monitoring in the Sub-Control Room. Ten inch speakers are mounted in the ceilings of all studios for talk-back cueing. In some of the offices on the first and second floor are also mounted ten inch speakers in a similar manner.

A selector switch, with "L" pad volume control, allows all speaker positions to select "off", "air" and "audition" at will. These selectors present a constant load of 500 ohms at all positions, so that no variation in volume level or program quality is experienced at one station when others are selecting. The building speaker system is fed by two 12 watt audio amplifiers through a 500 ohm balanced shielded line, and no cross-talk is observable. The regular program monitoring speaker in the main control room is fed by a 10 watt amplifier, which also drives all the smaller speakers in the studios. The second speaker in control has a separate 10 watt amplifier. Each of the two speakers in the recording room also have separate 12 watt amplifiers.

The lobby speaker is also mounted in the ceiling and kept at very low level most of the time. The announcer's booth also has a selector switch panel but its output feeds earphones instead of a loudspeaker. There is, however, a speaker mounted in the ceiling for normal cueing and talk-back.

The control room is large and arranged so that all normal opera-

[1] Western Union and IBM.

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CARLOS L. DODD
CHIEF ENGINEER WFAA-TV, DALLAS, TEXAS
TRANSMITTER—DUMONT 5 KW, CHANNEL 8.

From WFAA-TV, More Proven Performance of the Eimac 3X2500A3

Station WFAA
RADIO SERVICE OF THE DALLAS MORNING NEWS

September 28, 1950

Eitel-McCullough, Inc.
San Bruno, California

Gentlemen:

I thought you might be interested in knowing that we are using EIMAC 3X2500A3 tubes in the finals of our high channel TV transmitter and we are very happy with their performance. In fact, we have yet to experience a tube failure since we went on the air. Tube cost is low and maintenance problems are minimized when using this dependable air-cooled tube.

It is a pleasure for me to recommend your fine product.

Sincerely yours,
Carlos L. Dodd
Carlos L. Dodd,

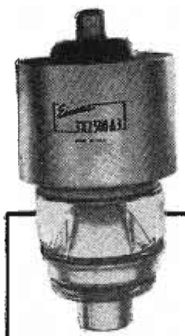
The Eimac 3X2500A3 is one of the outstanding vacuum tube developments made during recent years. Consistent performance, long life, and low cost account for its filling the key socket positions in many important recently designed equipments.

The 3X2500A3 is a compact, air-cooled triode. Its coaxial construction results in minimum lead inductance, excellent circuit isolation, and convenience of use with coaxial plate and filament tank circuits. For AM service it is FCC rated for 5000 watts per tube as a high-level modulated amplifier. It has comparatively low plate-resistance, high transconductance, and will provide effective performance over a wide range of plate voltages at frequencies extending well into the VHF.

Reports from many engineers, like Mr. Dodd of WFAA-TV, confirm the outstanding transmitter performance, simplified maintenance, and low tube replacement cost made possible through the use of the Eimac 3X2500A3. Consider this unequalled triode for your applications . . . complete data are free for the asking.

ALMOST A YEAR AGO...

this ad first appeared. Today WFAA and Eimac are still proud of their 3X2500A3 performance. A few weeks ago the first tube was removed from service (7000 hrs.). The other three are still providing top-notch performance.



EITEL-McCULLOUGH, INC.
SAN BRUNO, CALIFORNIA

*COMPLETE DATA AVAILABLE FREE

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

the 3X2500A3 is another Eimac contribution to electronic progress.

Follow the Leaders to Eimac TUBES The Power for R-F

269

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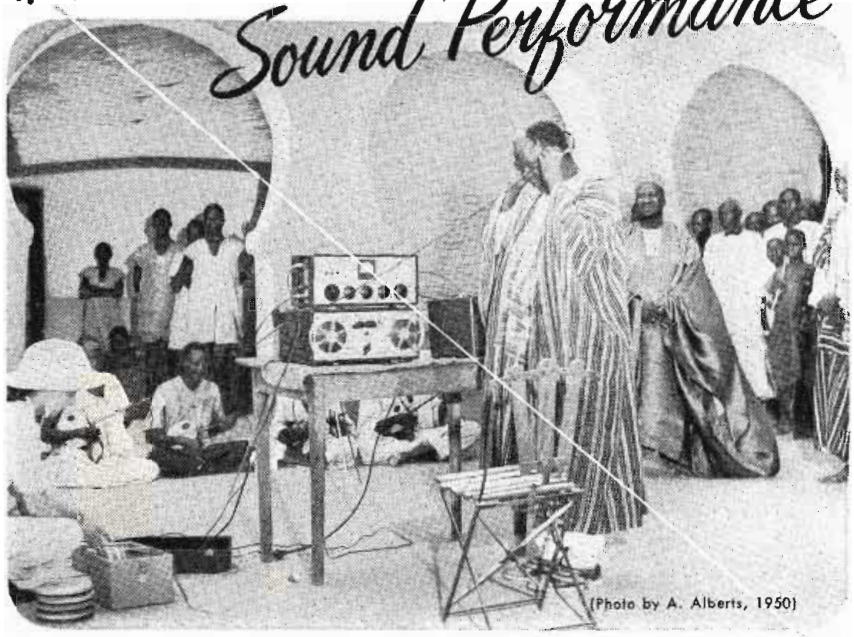
* MAGNECORDER *Sound Performance*



. . from "Studio A" . . . to TIMBUKTU! *

The famed traveler, Art Alberts, recently used Magnecord Tape Recorders in his search for African tribal music — never before recorded. His Magnecorders underwent 140 degrees temperature, relative humidity ranging from 8 to 99, and 5,000 miles of grueling, jouncing desert and jungle trails. Operating perfectly all the way, Magnecorders brought home faithfully accurate reproductions from the court of the Mossi Emperor, south of Timbuktu.

Whether in Timbuktu or in Studio A at KRSC, Seattle, Wash., Magnecorders handle delayed programs and "on location" recordings with constant dependability. Easy portability, precision and fidelity make Magnecorder the first choice of radio engineers everywhere.

MORE FEATURES
PT7 accommodates 10½" reels and offers 3 heads, positive timing and pushbutton control. PT7 shown in console is available for portable or rack mount.

GREATER FLEXIBILITY
In rack or console, or in its really portable cases, the Magnecorder will suit every purpose. PT6 is available with 3 speeds (3¾", 7½", 15") if preferred

HIGHER FIDELITY
Lifelike tone quality, low distortion, meet N.A.B. standards — and at a moderate price PT63 shown in rack mount offers 3 heads to erase, record and play back to monitor from the tape while recording

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360 North Michigan Avenue
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Send me latest catalog of Magnecord equipment.

Name.....

Address.....

City.....Zone.....State.....

CONSERVE VITAL MATERIALS

(*Continued from page 72*)

tions can be handled from this point. When unusual programs requiring long rehearsal times are to be aired, the sub-control room is used. Main Control has an excellent view of activities in the announcer's booth and studios "A", "B" and "C". The left section of the control board handles all three turntables, remote programs, remote tape recording and reproduction, studio "B" microphones, talk-back, and speaker, announcer's booth microphone, *TB* and speaker.

Mercury switches are mounted immediately below the desk for controlling the motors of the turntables. Three pushbuttons are mounted on a level with, and on the extreme left of, the desk for control of the two tape recorders which are located in the recording room. A row of pushbuttons is built in this control panel but only two are used at present. One is marked *"Building Clock Set"*, and the other *"Announcer Call"*. The former sets all electric clocks and the latter excites seven musical buzzers located in different points of the building.

The center panel of the control board contains three program amplifiers for the three program channels with buttons for directing any incoming program into any, or all, channels. Also herein are located the talk-back microphone to the studios and sub-control, and the talk-back speaker, both mounted behind a vertical bar grill.

The right panel contains VU's and switches with controls for studios "A" and "C", which this panel faces. Talk-back controls as well as an extra volume control and switch, are also mounted on this panel. Two telephones are to the extreme right of the operator in this position, one for outside and inner-building communication and the other a direct wire to the transmitter.

Four speech racks contain preamplifiers, intermediate amplifiers, power supplies, 36 relays, two receivers (these control lamps in the center panel, indicate FM or AM carrier failure, equalizers, and approximately 850 jacks.

Each turntable employs two reproducing arms, one for transcriptions and one for records.[2] One of the table record arms is modified for LP reproduction. A small push-button is flush mounted on each table and actuates the transcription cueing relays. Thus, by keeping a given push-button depressed, a transcription or

[2]RCA Universal Arms are used for transcriptions. GE Arms are used for records. GE variable reluctance heads with diamond .003 inches stylus.

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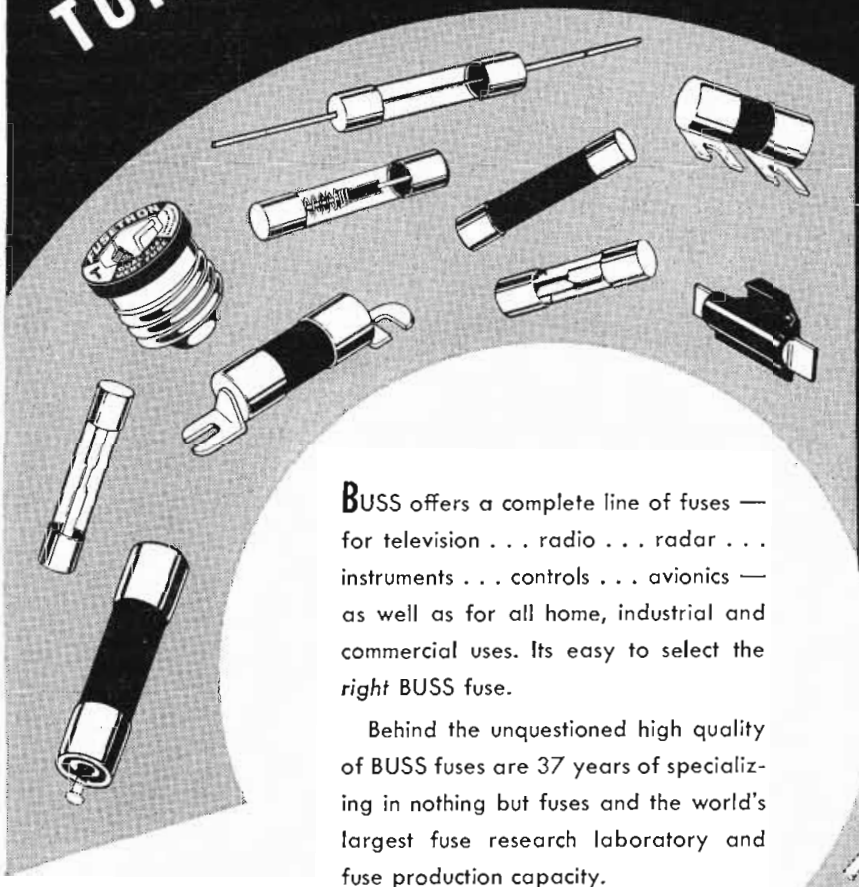
—when your problem is Electrical Protection



BUSS offers a complete line of fuses — for television . . . radio . . . radar . . . instruments . . . controls . . . avionics — as well as for all home, industrial and commercial uses. Its easy to select the *right* BUSS fuse.

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Submit sketch or description showing type of fuse contemplated, number of circuits, type of terminols, and the like.

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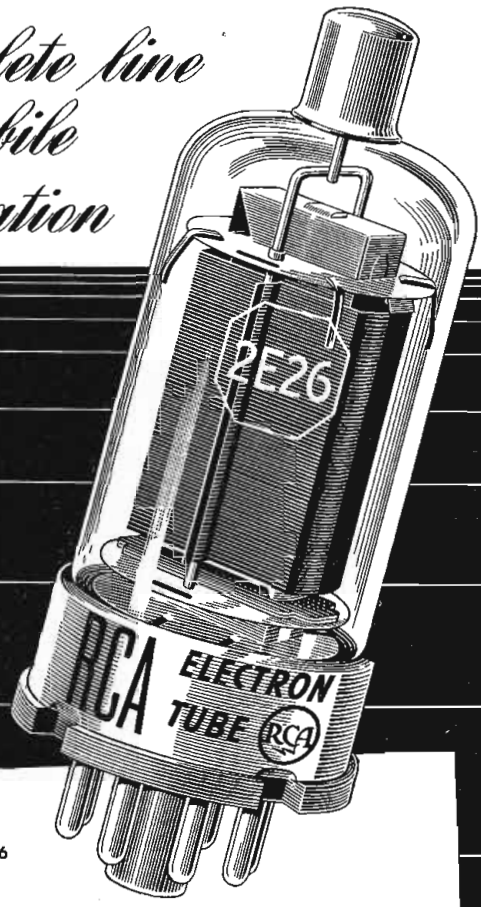
the complete line for mobile communication



A majority of commercial mobile transmitters come equipped with the RCA-2E26

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The reliability of RCA tubes is your best insurance against service failure in mobile equipment.

RCA's unparalleled research facilities, engineering background, and manufacturing experience contribute to the dependability and operating economy of every RCA tube you buy.

For data on any specific tube type, see your RCA Tube Distributor, or write RCA, Commercial Engineering, Section 57JQ, Harrison, N. J.

RCA **RADIO CORPORATION of AMERICA**

ELECTRON TUBES **HARRISON, N.J.**

(Continued from page 74)

record can easily be "cued up". When the cue button is released, the output of the selected arm is ready to be played on the air.

Inner-connecting wires between turntables, control board console, six speech racks, and units in recording room are laid in sub-floor level ducts 8 in. deep and 12 in. wide. These ducts are molded into the concrete and, in exposed places, are covered with $\frac{3}{16}$ in. iron covers. The edges of these covers are stripped in brass, having the same thickness as the asphalt tile flooring. Thus continuity of tile pattern remains unbroken by iron covers containing matching tile. A one foot trench was left behind the main four speech racks. This greatly increased the ease of initial wire pulling and terminal soldering in the racks. This is covered with the same material as the rest of the ducts.

Recording Room

There are three tape machines, one wire recorder and one disc recorder. The main tape recorders are remotely controlled from main control or can be operated in the recording room. The third tape machine is normally set up for use in this location but is portable and can be taken out at a moment's notice. The wire recorder is also portable. The disc machine is stationary and used only in this room. There are two speech racks containing booster amplifiers, monitor amplifiers, equalizers, and two switching selector panels for the two tape recorders and the one disc machine. Any program on any channel, or special line, or output of any recorder or turntable, can be switched to any of the three recorders. Each of the two monitor speakers can be switched to check any originating program.

One of the spare offices was left without ceiling sound absorbing material so that it could be utilized as an echo chamber. As there is no furniture in the room, and all walls and ceiling are hard plaster, the time constant is high—about three seconds. With a microphone placed in one corner of the 11 x 12 foot room, and a good speaker mounted in an enclosed cabinet in the opposite corner, a very pleasing echo is obtained. By controlling the addition of the echo to the original signal, any desired degree of "spaciousness" can be achieved.

This room contains a conventional single channel control board and monitor amplifier to drive the speaker mounted overhead and the speaker in studio "D", which this control

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room overlooks. This remote studio is used for rehearsing, and special feeds to the FM transmitter. It is well suited for running disc-jockey type programs where the announcer wishes to handle his own "platters". It contains two turntables and a microphone so that complete programs can be originated. Talk-back facilities are provided between this control room and main control and studio "D". Any program can be patched to this room for re-transmission to either transmitter, building speaker audition system, or any other point desired.

Utility Electronics Expands

Utility Electronics Corp., manufacturers of military communication and test equipment, has moved to an enlarged plant at 231 Grant Ave., East Newark, N. J.

Organized three years ago as a producer of military electronic equipment, Utility has expanded from an organization consisting of about 100 to its present employment of nearly 700 in the last year. The new location, with a total floor space of 135,000 sq. ft., includes a greatly expanded engineering group equipped with modern communication test apparatus. This engineering group has been specializing in miniaturization techniques in connection with large military contracts for the highly compact and portable "Handie Talkies" and "Walkie Talkies".

The production floor space has been tripled over that held a year ago and as a result of this expansion, production of power supplies, test equipment, police radio sets, and the like, has been steadily increasing in line with the requirements of the expanded military program.

New Book on Universe, Light, and Magnetism

Edwin Y. Webb Jr., Chief of Research and Development, Signal Corps Intelligence Agency, Department of the Army, Washington 25, D.C., has recently published a 105-page book entitled the "Orgin of the Universe and the Secret of Light and Magnetism."

In his book Mr. Webb, who recently headed the division of the Office of Technical Information, views the ether surrounding the earth and other planets in our galaxy as a vast electric field. This field acts as the medium which transmits light and other electromagnetic waves.

Another chapter deals with the origin of sideband frequencies in modulator circuits, and the belief here is that the sidebands are generated in output transformers rather than being created by vacuum tubes. The text is principally non-mathematical. Cost of the book is $5.00 and the volume may be obtained by writing directly to Mr. Webb at 5511 Hawthorne Pl., N.W., Washington 16, D. C.

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RCA-5820 and RCA-5826 image orthicons . . . for outside and studio use, respectively . . . are seasoned veterans. Both tubes feature the same spectral response—approaching that of the eye . . . exceptionally high sensitivity . . . and better than 500-line resolution capability.

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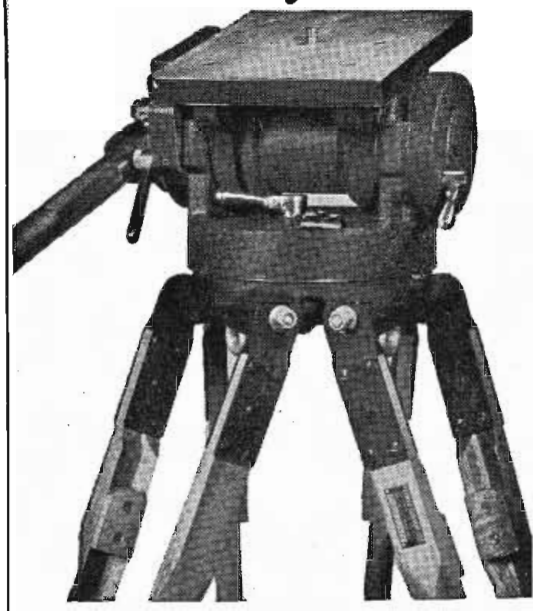

This tripod was engineered and designed expressly to meet all video camera requirements. Previous concepts of gyro and friction type design have been discarded to achieve absolute balance, effortless operation, super-smooth tilt and pan action, dependability, ruggedness & efficiency.

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3-wheel portable dolly with balanced TV Tripod mounted.

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Quick-release pan handle adjustment locks into position desired by operator with no "play" between pan handle and tripod head. Tripod head mechanism is rustproof, completely enclosed, never requires adjustments, cleaning or lubrication. Built-in spirit level. Telescoping extension pan handle.

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Annual Banquet, Thursday Evening, November 1st.

Microwave Relay

(*Continued from page 45*)

pose in this case; that of supplying power to the equipment during an interval of about 7½ minutes on a commercial power failure, and that of carrying the load in the event the gasoline engine fails to start.

With the completion of the East coast to West coast TD-2 radio relay system, the Bell System in six years has made available a network of more than 23,500 miles of intercity television channels connecting cities in the East, South, Middle West and now the West Coast. Including the present coast-to-coast links, there are approximately 14,500 miles of radio relay channels and 9,000 miles of coaxial cable channels serving the nation's television audiences. Additional thousands of miles of channels are expected to be available in late 1952 which will permit adding Miami, New Orleans, Tulsa, Oklahoma City, Ft. Worth, Dallas, San Antonio and Houston to the rapidly expanding nationwide network.

REFERENCES

1. Metallic Delay Lenses, W. E. Kock, Bell System Technical Journal, Vol. 27, No. 1, Jan. 1948, p. 58-82.
2. New Triode for 4,000 MC Operation, J. A. Morton, R. M. Ryder, Tele-Tech, April, 1949, p. 32, 33, 62, 64.
3. Coaxial Cable Joins East Mid-West TV Networks, R. Hertzberg, Tele-Tech, February, 1949, p. 18, 19, 20, 55.
4. 14 Cities in East and Mid-West Added to Microwave Relay and Coaxial Cable Network, Tele-Tech, October, 1950, p. 33, 58, 59.
5. A Broad Band Transcontinental Radio Relay System, T. J. Grieser, A. V. Peterson, Electrical Engineering, Sept., 1951, p. 810-815.

Ceramic Capacitors

(*Continued from page 57*)

K and the power factor with temperature from —60°C to +220°C for a NPO and a N750 composition. At about +120°C the curve begins to exceed the temperature coefficient tolerance actually changing sign above 200°C for N750. The power factor is less than 0.1% up to 85°C and begins to increase rapidly with temperature above 120°C.

At 25°C the N750 dielectric has a resistivity of 8×10^{13} ohm-cm or expressed in another way 800 megohm microfarads (M MF). The manner in which the resistivity and the megohm microfarads of N750 depends on temperature is shown in Fig. 3 which is a plot of the log resistivity and of the megohm microfarads against the reciprocal of absolute temperature. The other TC types have higher resistivity values the lower the TC value and their temperature characteristics are nearly parallel to that of N750. The leakage resistance at any temperature is obtained by dividing the

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megohm microfarad value by the capacity in microfarads.

Electron conduction accounts for the decrease in resistivity with increasing temperature and this conductivity depends exponentially on the inverse of the absolute temperature as Fig. 3 indicates.

It is known that TiO_2 can be made an electronic semiconductor by chemical reduction at moderate temperatures, 600°C, in an atmosphere of hydrogen. Even under oxidizing firing conditions TiO_2 ceramics can have a trace of oxygen deficiency and can behave as semiconductors at temperatures around 100°C. This semiconducting effect is overcome to a large extent by proper chemical addition agents. Nevertheless, electrons are mobilized at higher temperatures and under applied electric fields. These electrons migrate in the field direction and pile up at crystal boundaries giving rise to interfacial polarization. This conduction process accounts for the increase in power factor, and decrease in resistivity and increase in K above 120°C.

Life test failures can also be attributed to this process. It seems that under life test conditions the applied field slowly removes oxygen from the ceramic, thereby making more electrons available for conduction. A runaway condition can be initiated in this fashion leading to higher currents and, if the applied field is high enough, voltage breakdown.

The lower limit of dielectric thickness for a given voltage rating is determined more by the life test performance at 85°C than by the voltage breakdown at 25°C.

For operation above 85°C the rated working voltage must be derated according to Fig. 4a.

In order to determine the high temperature life expectancy of a capacitor working at a certain voltage, the results of accelerated 250 hour life tests are helpful. In Fig. 4b are plotted the percent voltage failures against temperatures for three different field strengths.

The TC type dielectrics have lower power factors and are essentially constant K form 60 cps to 10,000 MC. They have very high self-resonant frequencies (200-300 MC) due to their simple, one-piece construction; limiting factors are lead length, size and orientation in the circuit.

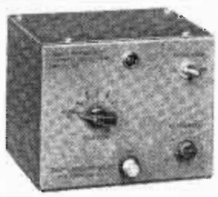
Temperature compensating ceramic capacitor specifications will be described in Part Two.

(1) Wainer, E. "High Titania Dielectrics." Trans. Electrochem. Sec., 89, 331 (1946).

Part Two will appear in November.

The New CREST MODEL 50

Multi-Frequency Crystal Oscillator



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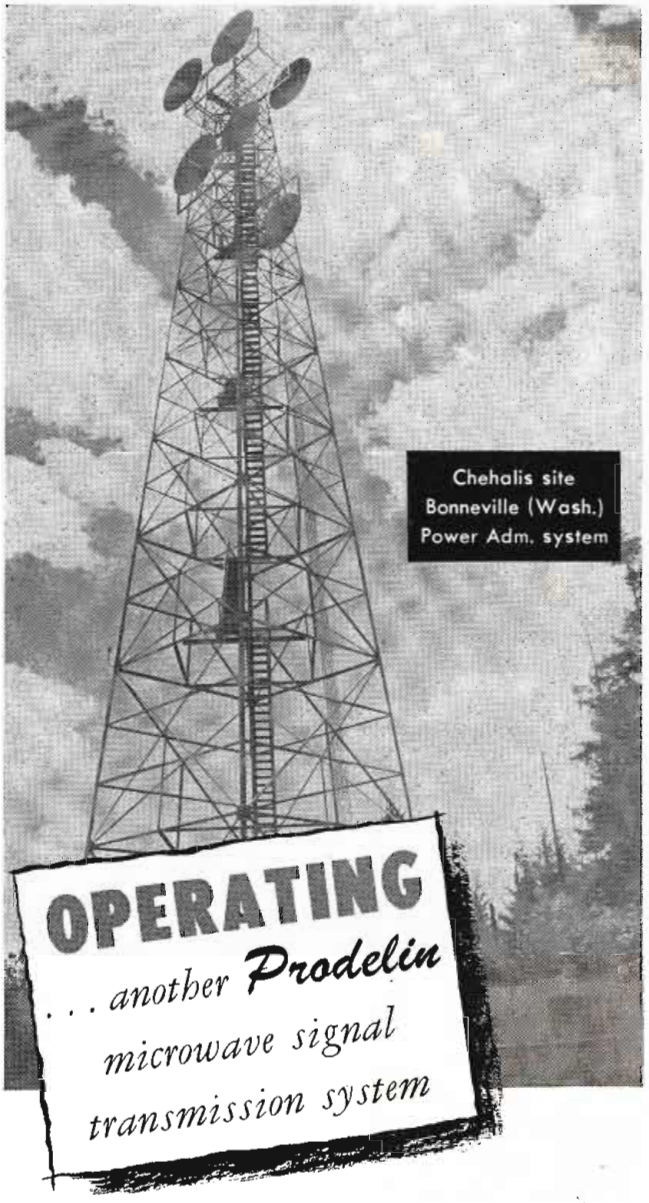

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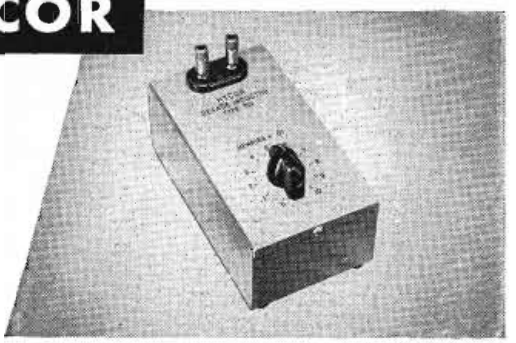

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Test Instruments

(*Continued from page* 40)

plus, is still in experimental form, but it is expected to be commercially produced. It is a conventional Hartley-type oscillator using a type 6AQ5 power pentode, in which the inductance is made variable as well as the capacitance to produce 10:1 frequency ranges instead of the usual 3:1. Variation of inductance is obtained with sickle-shaped slugs, one of which is made of iron dust and the other of aluminum. They are directly mounted on the condenser shaft so that, when the capacitance is a maximum, the iron-dust sickle is completely in the coil. As capacitance is diminished, the iron-dust sickle leaves the coil and the aluminum sickle enters it. At minimum capacitance, the aluminum sickle is completely in the coil. Each coil is switched into same position relative to sickles when selected for corresponding tuning range.

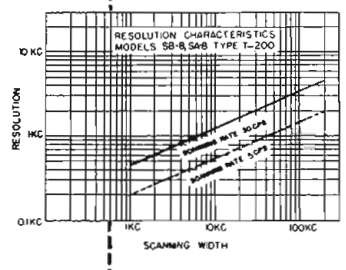
Finally, Fig. 13 shows a very simple two-frequency oscillator for 400 and 1000 cycles. This oscillator is intended as a modulating source for the high-frequency oscillators and as a general-purpose laboratory oscillator for bridge measurements. It furnishes almost 0.2 watt to an 8000-ohm load.

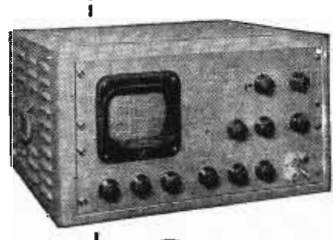
Its most striking feature is that it violates the fundamental concept of the unit line by incorporating its own power supply. This was justified as an economy because a transformer winding is used as the tuning inductance of a Hartley circuit, and an output coupling coil can be used to isolate the output terminals from any direct connection to the oscillator. A type 117N7-GT diode-pentode tube is therefore used as a voltage-doubler working directly off the line without fear of cross-up of grounds on load and ac line.

The inside view shows the construction which is nearly identical to that of the power supply first described. The sandwich mounting of the transformer on the left-hand wall is clearly visible, and the use of the transformer terminal board as mounting plate for fuses and small components is strikingly illustrated. It is interesting to note, incidentally, that the small thyrite piece is used from grid to ground to limit the oscillator amplitude. The third-harmonic limiting resulting from the symmetrical current-voltage characteristic contributes to the low oscillated distortion and helps maintain output stability as line voltage is varied.

Part Two will appear in November.

when MAXIMUM SIGNAL RESOLUTION IS A "MUST"...SO ARE





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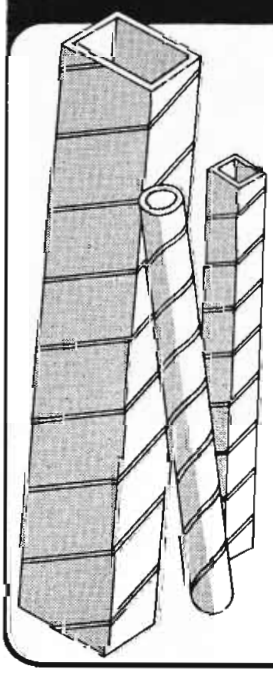

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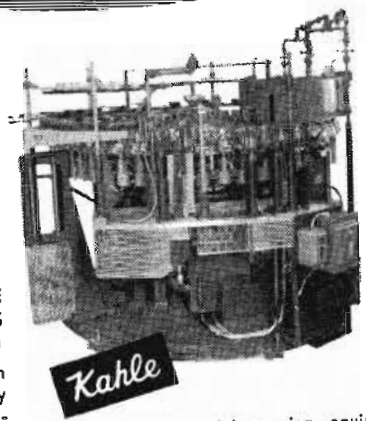

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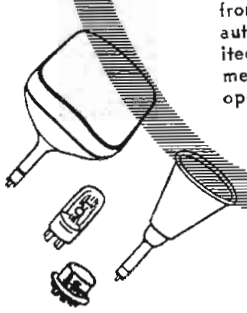

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1317 Seventh Street, North Bergen, New Jersey

Defense Contracts

(Continued from page 37)

ticular question been answered 100 percent, the dollar value of all contracts would have been increased considerably.

In an effort to determine the attitude of the industry towards advertised bidding and negotiated contracting, we are able to come up with the following information:

Firms favoring advertised bidding	20.4%
Firms favoring negotiated bidding	55.7%
Firms who are amenable to both	12.6%
No answer	11.3%

The conclusions which can be drawn from this survey are that subcontracting represents approximately 69 percent of military production with a dollar value equal to 2/3 of the total expenditure for military equipment.

Small firms who received prime contracts represent 48.7 percent of all firms surveyed.

There are definitely a number of firms in this industry who have not succeeded in obtaining defense prime or subcontracts, although their number is gradually diminishing.

Stepped-up procurement actions by the Army, Navy and Air Force for the fiscal year 1951-1952 give signs of engaging some of the firms not now engaged in military work so that the nation's limited military activity will eventually be well distributed throughout the radio-electronic manufacturing industry.

Survey Questions

The following questions were contained in TELE-TECH's special questionnaire mailed to selected, key radio—TV — electronic manufacturers in an effort to determine defense contract trends and contract awards among small and large firms:

1. Does your firm have fewer than 500 employees; more than 500?
2. How many government prime contracts have you received since June, 1950?
3. Do you subcontract to others?
4. To how many different firms do you subcontract?
5. How many subcontracts have you received from other prime contractors?
6. What is the total dollar value of prime contracts received?
7. What is the total dollar value of subcontracts received?
8. What is the total dollar value of subcontracting to others?
9. Do you favor advertised or negotiated bidding?

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News of MANUFACTURERS' REPS

A. J. Warner, 5022—29th Ave., S., Minneapolis, 17 Minn., has been appointed factory representative for the **Cinema Engineering Co.,** Burbank, California, for Minnesota, North and South Dakotas, Nebraska, Iowa and northwest Wisconsin.

Helipot Corp., So. Pasadena, Cal., has appointed **Cossor (Canada) Ltd.,** as representatives in the Dominion. Cosser maintains headquarters in Halifax, Nova Scotia, with branches in Ottawa and Toronto, Canada.

Empire Devices, Inc., Bayside, N. Y., has appointed **Carl A. Stone,** Los Angeles, to represent it in California, Arizona and New Mexico. Factory makes impulse generators and signal strength meters.

General Transformer Corp., Chicago, has appointed **Marshank Sales Co.,** Los Angeles, to represent it in California, Arizona and Nevada, for manufacturing accounts only.

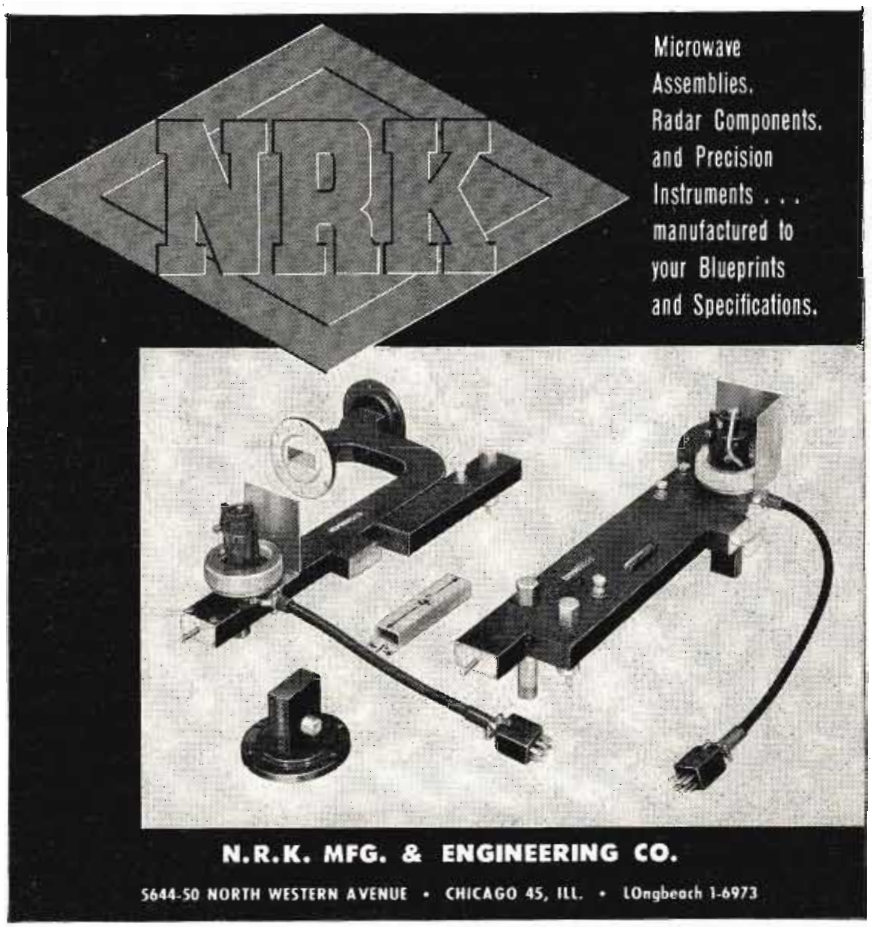
Berlant Associates, Los Angeles, manufacturers of the Concertone magnetic tape recorder, have announced the appointment of **Vern Maynard** as representative for eleven Western states with headquarters at 6274 W. Manchester Blvd., Los Angeles, Calif., and **John Maynard** as representative for Texas, Oklahoma, Arkansas and Louisiana, with headquarters at 4507 Shenandoah, Dallas 5, Texas.

George K. Haydu, president of **Haydu Bros.,** manufacturers of cathode ray tubes, receiving tubes, and precision parts, has announced the appointment of **Harry Finkelstein,** owner of the **Hy-Art Company,** as their national sales representative. His offices are located at 136 Liberty Street, New York City.

Perlmuth-Coleman and Associates, 1335 South Flower St., Los Angeles 15, Calif. have added **Ken Johnson** to their sales staff, thus making a total of seven salesmen and engineers calling on the radio-TV-electronic distributors and manufacturers in the California area.

New EDI Line of Selenium Rectifiers

The MINISEL line, a new line of subminiature selenium rectifiers, has been developed by the Electronic Devices, Inc., Precision Rectifier Division, 429—12th St., Brooklyn 15, N. Y. It consists of tiny selenium rectifiers in ratings up to 20 MA D.C. output and 25,000 V A.C. input per single stack and features a variety of constructions for military and commercial applications. Special constructions allow for hermetic sealing and fungus proofing.



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with X-VAR

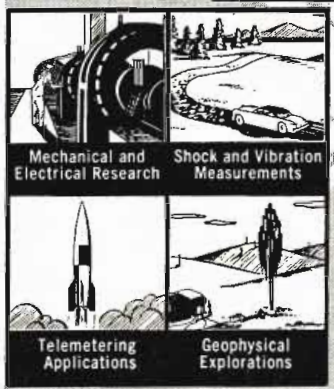
X-VAR is non-corrosive, non-creeping — leaves wire ready for soldering. Now in use by leading manufacturers of electrical products. *Write for FREE SAMPLE for testing.*

FIDELITY CHEMICAL PRODUCTS CORP.
475 Frelinghuysen Avenue, Newark 5, New Jersey

8 TRACK

SHOCKPROOF MOBILE RECORDER FOR INDUSTRY & SCIENCE

PLAYBACK ANALYZER



Ampex specializes in designing and manufacturing custom-built recording equipment to meet your requirements. A few of the many proven applications are illustrated.

AX-49

PRECISION PERFORMANCE

AMPEX

Magnetic Tape **RECORDERS**

AMPEX ELECTRIC CORPORATION
Redwood City . . . . California

Unrivalled for AUDIO & INSTRUMENTATION Recording

AMPEX Performance Includes . . .
- STANDARD MODELS to 80,000 cps
- CUSTOM-BUILT MODELS to 100,000 cps
- LOW FLUTTER MODELS less than 0.1% *PEAK-TO-PEAK!*
- LOW FREQUENCY MODELS 0 to 5,000 cps (FM System)

AMPEX RECORDERS are available with 1 to 14 tracks using ¼" to 1" tape.

PERSONAL

James M. Valentine, formerly television engineering manager of ABC's central division, has been named an assistant division head in charge of television field engineering at Federal Telecommunication Laboratories, Inc., Nutley, N. J.

Albert M. Pichitino is the new chief engineer of the E. F. Johnson Company of Waseca, Minn. He was formerly chief of the Electronic Laboratories of Franklin Institute, Philadelphia.

Julius Dorfman has been named to handle equipment sales of receiving tubes and TV picture tubes in the New York area for the Raytheon Manufacturing Co. He was recently chief commercial engineer of the National Union receiving tube division.

Joseph Racker, formerly chief engineer of Associated Electronics Co. and more recently of International Telephone & Telegraph Co. has formed his own organization to provide a radar consulting and editing service. The Joseph Racker Co. is located at 67 West 44th Street, New York 18, N. Y.

William W. Paul has been appointed manager of the engineering department of Eureka Television & Tube Corp., Hawthorne, N. J., manufacturers of cathode-ray tubes and electronic products.

Dr. Edward U. Condon, noted nuclear physicist and chairman of the U. S. Senator's Advisory Committee on Color Television, has been appointed director of research and development of Corning Glass Works. Dr. Condon resigned, effective September 30, as director of the National Bureau of Standards in Washington, D. C.

Richard Hodgson, president, Chromatic Television Laboratories, Inc., and director of television development for Paramount Pictures Corp., has been named a consultant to General Hoyt S. Vandenberg, chief of staff, U.S. Air Forces, on research and development.

John A. Van Auken has been appointed to the post of vice president in charge of sales for Utility Electronics Corp., East Newark, N. J. Mr. Van Auken was formerly connected with the electronics dept. of the General Electric Co., Syracuse, N. Y., where he held the position of sales manager, army equipment section, Government Division. In his new

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position, Mr. Van Auken will handle all commercial contacts for the company including sales, publicity and advertising.

Dr. Ivan A. Getting, a distinguished scientist and formerly professor of electrical engineering at the Massachusetts Institute of Technology, has been elected vice president, engineering and research, of Raytheon Mfg. Co., Waltham, Mass. An outstanding authority on radar, Dr. Getting for the past year has held the post of chief scientist of the U.S. Air Force. During World War II he headed a laboratory which developed the SCR-584, an automatic radar control for anti-aircraft guns.

R. M. Combes has been appointed chief engineer of the development Laboratories of Pacific Div., Bendix Aviation Corp., and will be in charge of the newly acquired Plant 3 of the company in Burbank, Calif., where the laboratories are located.

South American Stations Buy Television Equipment

Important steps in the development of South American television were taken recently when the International Standard Electric Corp., an affiliate of I. T. & T., completed negotiations for the sale of complete TV broadcasting stations to companies in Buenos Aires, Argentina and Sao Paulo, Brazil.

Equipment for both stations will be supplied by Federal Telecommunication Laboratories, Inc., Nutley, N. J. Featured in the Buenos Aires installation are Federal's new 5-KW transmitter for operation on channel 7; a unique 8-bay triangular loop antenna, which will increase the ERP of the new station to approximately 40 kilowatts; and Federal's recently-developed television flying spot scanner.

The Brazilian outlet's new equipment includes a complete television transmitter and portable television microwave link which will be installed in a de luxe Telecruiser remote pickup coach for on-the-spot news coverage.

Video Levels in TV Broadcasting

An article by J. H. Roe entitled, "Video Levels in TV Broadcasting" which appeared in the August issue of TELE-TECH referred to Standard 50 IRE 23.31-Television. The correct price for reprints of this standard, which may be purchased from the IRE, 1 East 79th St., New York, N. Y., is $.70.

Wide Band
UNIVERTER
for complete frequency coverage
when used with the
FM-AM SIGNAL GENERATOR

The UNIVERTER Type 207-A provides a continuous extention of the frequency range of the 202-B FM-AM Signal Generator down to 0.1 mc. The two instruments may be used over a continuous frequency range of 0.1 mc. to 216 mc. The Univerter Type 207-A subtracts 150 mc. from a signal obtained from the 202-B and provides outputs between 0.1 mc. and 55 mc. without change of signal level. Negligible spurious signals are introduced and modulation of the signal is unaffected. Small incremental changes can be made in frequency to allow the study of band pass characteristics of very narrow band receivers. A regulated power supply prevents change of gain or frequency with line voltage.

SPECIFICATIONS (*When used with 202-B*)

FREQUENCY RANGE: 0.1 mc. to 55 mc. (0.3 mc. to 55 mc. with 200 kc. carrier deviation).

FREQUENCY INCREMENT DIAL: Plus or minus 300 kc. calibrated in 5 kc. increments.

FREQUENCY RESPONSE: Flat within ± 1 db over frequency range.

FREQUENCY ADJUST: Front panel control allows calibration with 202-B output.

OUTPUT: Continuously variable, at XT jack from 0.1 microvolt to 0.1 volt across 53 ohms by use of 202-B attenuator.

HIGH OUTPUT: Uncalibrated approximately 1.5 volts from 330 ohms into open circuit.

DISTORTION: No appreciable FM distortion at any level. No appreciable AM distortion at carrier levels below 0.05 volt and modulation of 50%.

SPURIOUS RF OUTPUT: At least 30 db down at input levels less than 0.05 volts.

Write for complete information

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AMPERITE

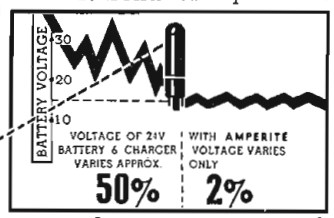
THERMOSTATIC METAL TYPE
Delay Relays

PROVIDE DELAYS RANGING FROM 1 TO 120 SECONDS

FEATURES: — Compensated for ambient temperature changes from —40° to 110° F . . . Hermetically sealed; not affected by altitude, moisture or other climate changes . . . Explosion-proof . . . Octal radio base . . . Compact, light, rugged, inexpensive . . . Circuits available: SPST Normally Open; SPST Normally Closed.

PROBLEM? Send for *"Special Problem Sheet"*

Regulators



Amperite REGULATORS are the simplest, lightest, cheapest, and most compact method of obtaining current or voltage regulation . . . For currents of .060 to 6 Amps. . . . Hermetically sealed; not affected by altitude, ambient temperature, humidity.

Write for 4-page Illustrated Bulletin.

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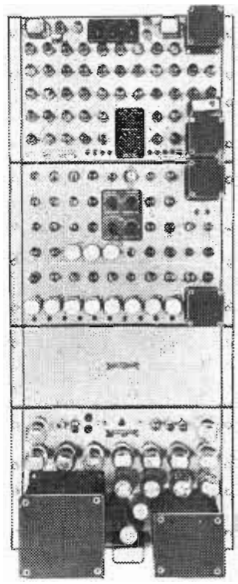
COLOR TV

SYNC SIGNAL GENERATOR TYPE 2201

(field sequential system for CBS color)

for Broadcasting and Production Testing



- All binary dividers. No blocking tube or locked oscillators
- Camera color drive pulse provided to operate studio camera equipment—absolutely stable under all operating conditions
- Meets all RTMA and FCC specifications with margin to spare
- Gating pulse to blank out two color fields—will produce any one of three colors
- Built-in bar and dot generator for checking sweep linearity

Price $2150.00 FOB Plant. Cabinet extra

Write for further technical details on 2201 Sync Generator and 2301 Color Monoscope.

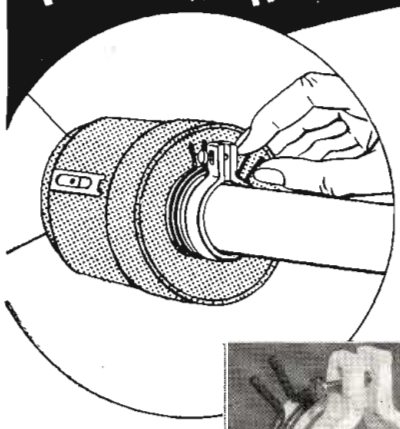
TIC Manufacturers of a complete line of TV and Radar Test Equipment

Tel-Instrument Co. Inc.

50 PATERSON AVENUE • EAST RUTHERFORD, N. J.

FOR PERFECT PICTURE CENTERING IN ELECTRO-STATIC TUBES

Use the **NEW** PERFECTION *Kine-Center*



Here is the simplest of all centering devices for the new electrostatic tubes. It is also the most efficient and positive—as your own tests will prove.

- **Quickly Mounted.** Slip the Kine-Center over the tube neck and tighten the holding screw. It stays firm. No wobble. No wiggle.
- **Finger-Tip Control.** Picture is centered by rotating the two rings either independently or together.
- **Positive Centering.** Once adjusted, the rings stay put.
- **No Distortion of Focus** as with many other centering devices.

MORE EFFICIENT

Rings are closer to deflection yoke (the most effective operating area) and to the tube neck. They are stabilized magnetically

Write today for specifications and prices!

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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 and equipment. 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 Aug. 2 to Sept. 6.

Antennas

Dresser Equipment Co., Columbus, Ohio; Folland Mfg. Co., Springfield, Mass.; Globe Corp., Aircraft Div., Joliet, Ill.; Phoenix Electronics, Inc., Lawrence, Mass.

Batteries

Bright Star Battery Co., Clifton, N. J.; Burgess Battery Co., Freeport, Ill.; Thomas A. Edison, Automotive Div., West Orange, N. J.; General Dry Batteries, Lakewood, Ohio; General Motors Corp., Delco-Remy Div., Anderson, Ind.; Gould National Batteries, St. Paul, Minn.; P. R. Mallory & Co., Tarrytown, N. Y.; Marathon Battery Co., Wausau, Wisconsiu; National Carbon Div., Union Carbide & Carbon Corp., N. Y. City; Willard Storage Battery Co., Cleveland, Ohio.

Cable Assemblies

American Phenolic Corp., Chicago, Ill.; Ansonia Electric Co., Ansonia, Conn., Graybar Electric Co., Phila., Pa.; Brad Harrison Co., Oak Park, Ill.; Stuart F. Louchheim Co., Phila., Pa.; Rome Cable Corporation, Rome, N. Y.; John A. Roebling's Sons, Trenton, N. J.; Simplex Wire & Cable Co., Cambridge, Mass.; Whitney Blake Co., New Haven, Conn.

Capacitors

Glenco Corp., Metuchen, N. J.; Pyramid Electric Co., North Bergen, N. J.; Radio Condenser Co., Camden, N. J.; Sarkes-Tarzian, Inc., Bloomington, Ind.; Underwood Electric & Mfg. Co., Chicago, Ill.; Western Electric Co., N. Y. City.

Coils and Transformers

A. C. Transformer Corp., Newark, N. J.; Federal Telephone & Radio Corp., Clifton, N. J.; Hammarlund Mfg. Co., N. Y. City; Radio Corp. of America, Camden, N. J.; Sola Electric Co., Chicago, Ill.; Standard Electrical Products, Dayton, Ohio; Thermador Electrical Mfg. Co., Los Angeles, Calif.; Westinghouse Electric Co., Philadelphia, Pa.

Crystal Units

Rex Bassett, Inc., Fort Lauderdale, Fla.; Midland Mfg. Co., Kansas City, Mo.; Reeves Hoffman Corp., Carlisle, Pa.; Polytech Devices, Elizabeth, N. J.; Radio Corp. of America, RCA Victor Div., Camden, N. J.; Sherold Crystal Corp., Kansas City, Mo.; Standard Piezo Co., Carlisle, Pa.; Sylvania Electric Co., Boston, Mass.

Electron Tubes

American Television Co., Chicago, Ill.; Bomac Labs., Beverly, Mass.; General Electric Co., Schenectady, N. Y.; Hytron Radio & Electronic Corp., Salem, Mass.; Eitel-McCullough, Inc., San Bruno, Calif.; Lansdale Tube Co., Lansdale, Pa.; Lewis & Kaufman, Inc., Los Gatos, Calif.; National Union Radio Corp., Orange, N. J.; Pacific Electronics, Los Gatos, Calif.; Pioneer Electronics Corp., Santa Monica, Calif.; Raytheon Mfg. Co., Waltham, Mass.; Radio Corp. of America, Harrison, N. J.; Sylvania Electric Products, Inc., New York, N. Y.; Tung-Sol Lamp Works, Newark, N. J.; Victoreen Instrument Co., Cleveland, Ohio; Western Electric Co., New York City.

Magnetrons

Amperex Electronic Corp., Brooklyn, N. Y.; Federal Telephone & Radio Corp., Clifton, N. J.; Sarkes-Tarzian, Inc., Batavia, Ill.

Resistors

Bellaire Electronics, Brooklyn, N. Y.; Clarostat Mfg. Co., Dover, N. H.; Herbach & Rademan, Phila., Pa.; P. R. Mallory & Co.,

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Indianapolis, Ind.: Sprague Electric Corp., Adams, Mass.: Stackpole Carbon Co., St. Mary's, Pa.; Ward-Leonard Electric Co., Mt. Vernon, N. Y.; Western Electric Co., N. Y. City.

Relays

Allied Control Co., N. Y. City: General Electric Co., Phila., Pa.; Guardian Electric Mfg. Co., Chicago, Ill.; North Electric Co., Galion, Ohio; Potter & Brumfield, Princeton, Ind.; Sigma Instrument Co., Boston, Mass.

Radio Equipment

Allied Control Co., N. Y. City: General Rochelle, N. Y.; Admiral Corp., Chicago, Ill.; American Machine & Metals, Inc., Sellersville, Pa.; ARF Products, River Forest, Ill.; Belmont Radio Corp., Chicago, Ill.; Cincinnati Electronics Co., Cincinnati, Ohio; Collins Radio Co., Cedar Rapids, Iowa; Emerson Radio & Phonograph Corp., New York, N. Y.; Federal Mfg. & Engineering Corp., Brooklyn, N. Y.; Federal Telephone & Radio Corp., Clifton, N. J.; Fisher Research Laboratory, Palo Alto, Calif.; The Hallicrafters Co., Chicago, Ill.; Harvey-Wells Electronics, Southbridge, Mass.; Lavoie Laboratory, Morganville, N. J.; Motorola, Inc., Chicago, Ill.; Olympic Radio & Television, L. I. City; Raytheon Mfg. Co., Waltham, Mass.; Remler Co., San Francisco, Calif.; Radio Receptor Co., Brooklyn, N. Y.; Radio Corp. of America, RCA Victor Div., Camden, N. J.; Schuttig & Co., Washington, D. C.; Sentinel Radio Corp., Evanston, Ill.; Sylvania Electric Products, Buffalo, N. Y.; Western Electric Co., N. Y. City; Wilcox Electric Co., Inc., Kansas City, Mo.

Radar & Radiosonde

American Measuring Instrument Corp., New York, N. Y.; Bendix Aviation Corp., Bendix Radio Div., Baltimore, Md.; Gibbs Mfg. & Research Corp., Janesville, Wisc.; Gilfillan Brothers, Los Angeles, Calif.; Johnson Service Corp., Milwaukee, Wisc.; Radio Corp. of America, Camden, N. J.; Standard Coil Products Co., Inc., Los Angeles, Calif.

Audio in Aircraft

(*Continued from page 43*)

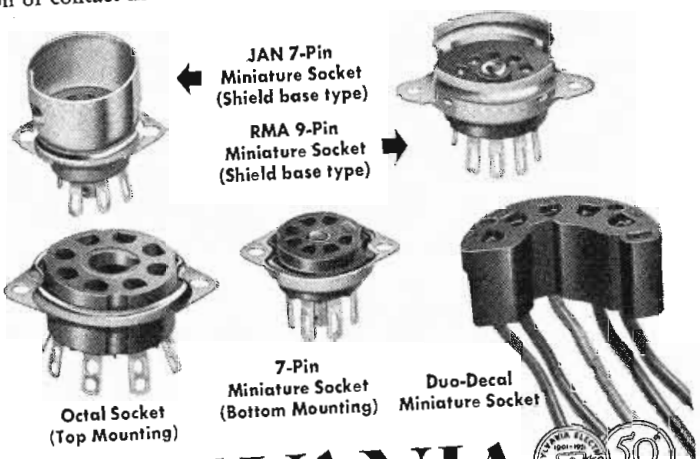
had internal moisture barriers for many years, but an internal barrier is not enough. Moisture can enter the grid holes, and frost can plug up the grid holes, in spite of any internal protection. We had complaints of microphones frosting over and becoming inoperative, and many other complaints of moisture damage, until the external covers were put into use. The first covers used, on our T-17 handheld microphones, were ordinary refrigerator bowl covers bought at a local department store, tested in cold chambers at AMC, then flown to Alaska to fill an urgent demand for something to alleviate the microphone freezing problem there. The refrigerator bowl covers took care of that particular complaint, and we have used very similar covers ever since, on all close-talking microphones. It was found that these covers also served another purpose, as a breath-blast shield.

The cover prevents the generation of the raspy noise which results when the breath of the talker impinges upon the edges of the grid holes of an uncovered close-talking microphone. There is something of an acoustic problem associated with these covers, in that they must not introduce appreciable attenuation. Also, objectionable resonances are

Sylvania Offers FULL-LINE of High Quality Sockets

Sylvania now offers a full line of sockets for military and civilian requirements, manufactured in accordance to JAN and RMA specifications. Available in General Purpose and Low Loss Phenolics and Steatite, with any combination of contact materials.

Available types include 7- and 9-pin Miniature, Turret, Octal, Duo-Decal, etc., sockets. For complete descriptions write today for new illustrated catalog to: Sylvania Electric Products Inc., Dept. A-1210, Parts Sales Division, Warren, Pa.



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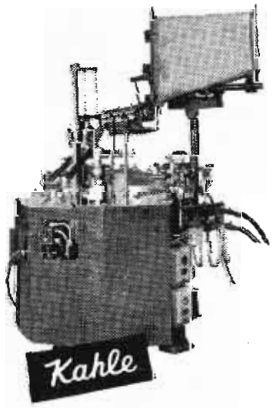
RADIO TUBES; TELEVISION PICTURE TUBES; ELECTRONIC PRODUCTS; ELECTRONIC TEST EQUIPMENT; FLUORESCENT TUBES, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS; TELEVISION SETS

Kahle

SPECIALISTS IN HIGH-SPEED
electron tube machinery

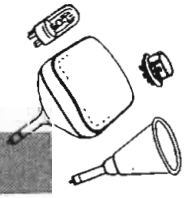
Kahle's 20 years of experience eliminate trial orders and experimental set-ups. Standard toolings for all tube manufacturing eventualities *already* have been tested and approved. This means that Kahle can assemble machines for everything from sub-miniatures to largest TV picture tubes to your exact specifications . . . *at lower costs!*



#1902 AUTOMATIC BULB MAKING MACHINE for producing SUB-MINIATURE round bulbs with molded shoulder, construction and tabulation. 12 index positions, 24 heads. Capacity: approximately 2400 per hour.

Machinery for all types of electron tubes and related glass products.

Consultations invited. Write today for our new catalog with complete details.



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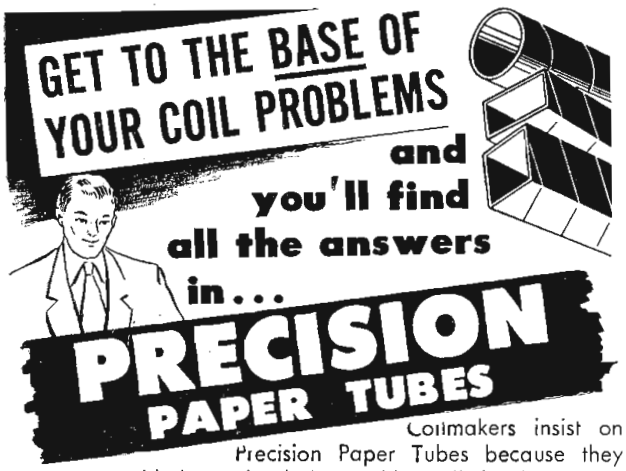

PRECISION PAPER TUBES

Coilmakers insist on Precision Paper Tubes because they provide better insulation and heat dissipation, greater moisture resistance—combine unusual strength with light weight. All this due to Precision's spiral winding and heavy heat-treated compression.

Further, they're available in round, square, oval, rectangular or any shape, length, ID or OD. Made to your exact specifications, of finest dielectric Kraft, Fish Paper, Cellulose Acetate or combinations. Ask us to make up a free sample for you!

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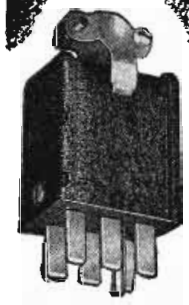
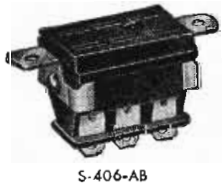
FOR PUBLIC ADDRESS, RADIO, and kindred fields, specify JONES 400 SERIES PLUGS AND SOCKETS of proven quality!



P-406-CCT



S-406-AB

Double Contact Area

Phosphor bronze knife-switch socket contacts engage both sides of flat plug contacts.

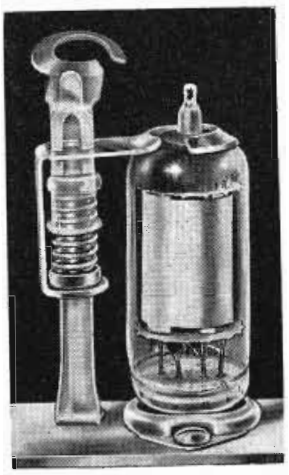
Socket contacts phosphor bronze, cadmium plated. Plug contacts hard brass, cadmium plated. Insulation molded bakelite. Plugs and sockets polorized. Steel caps with baked crackle enamel. 2, 4, 6, 8, 10, 12 contacts. Cap or panel mounting.

Information on complete line, in Jones Catalog 18: Electrical Connecting Devices, Plugs, Sockets, Terminal Strips. Write

Jones

HOWARD B. JONES DIVISION
CINCH MANUFACTURING CORPORATION
CHICAGO 24, ILLINOIS
SUBSIDIARY OF UNITED-CARR FASTENER CORP.

New BIRTCHER TUBE CLAMP FOR MINIATURE TUBES



POSITIVE PROTECTION AGAINST LATERAL AND VERTICAL SHOCK!

The New Birtcher Type 2 Tube Clamp holds miniature tubes in their sockets under the most demanding conditions of vibration, impact and climate. Made of stainless steel and weighing less than ½ ounce, this New clamp for miniature tubes is easy to apply, sure in effect. The base is keyed to the chassis by a single machine screw or rivet . . . saving time in assembly and preventing rotation. There are no separate parts to drop or lose during assembly or during use. Birtcher Tube Clamp Type 2 is all one piece and requires no welding, brazing or soldering at any point.

If you use miniature tubes, protect them against lateral and vertical shock with the Birtcher Tube Clamp (Type 2). Write for sample and literature!

Builder of millions of stainless steel locking Type Tube Clamps for hundreds of electronic manufacturers.

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PROVIDES QUALITY CABLES FOR MOBILE COMMUNICATION!

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and
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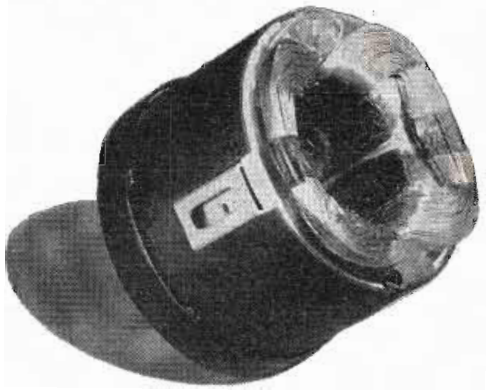

PRIME and SUB-CONTRACTORS are invited . . . to send specifications for quotation, or for information on our facilities.

Our new, enlarged plant enables us to add customers who need deflection yokes or other electronic components for military and manufacturing operations.

We invite your inquiries.

Tel-Rad Mfg. Co., Inc.

RADIO and TELEVISION COMPONENTS
7 Madison Street, Fennimore, Wisconsin
PHONES: Office 270 — Purchasing Dept. 271

(*Continued from page* 87)

introduced if the cover is stretched tight across the face of the microphone, and that must be avoided.

Next, a few words about freqency range. It has been determined experimentally that voice transmissions require a frequency band of at least 250 to 6000 cps for maximum intelligibility. It is easily shown that there are (Fig. 11) speech frequencies of appreciable amplitude throughout that band. In telephone sysem practice, a voice transmission band is limited to approximately 300 to 3000 cps. That particular band, and other bands even narrower, have often been loosely described as covering the "speech range". Actually, however, important information which is required for discriminating between consonants such as T and P, S and F, D and B, is found only at frequencies higher than 3000 cps.

The absence of that information is not too objectionable under quiet-to-quiet communication conditions; however, its absence under severe noise constitutes a severe hazard to already difficult communication conditions. Our war-time development audio items and circuits were designed to have a speech transmission band of 300 to 4000 cps. Future aircraft communication systems very likely will utilize the entire "speech band" of 250 to 6000 cps.

The "proof of the pudding" in the field of aircraft interphone systems is a "talk-out test" under aircraft noise and altitude conditions. To get comparable numerical data from such tests, the talking and listening is done in a systematic fashion in so-called "articulation tests". In an articulation test, a "caller" reads a list of selected single-syllable words over the communication system being tested, and each of a group of listeners writes down the words as he understands them. The percentage of words recorded correctly by the listeners is the articulation score for the test. Of course the articulation testing is done with the talker and listeners subjected to the desired noise and altitude conditions.

Two rather unique facilities are maintained in the Communication and Navigation Laboratory at Wright-Patterson AFB, solely for the purpose of evaluating the performance of aircraft communication equipment under aircraft noise and altitude conditions. One of these facilities is a 13 x 20 foot "noise room". The other is a two-man altitude chamber. In each of these, we are able to simulate very closely the noises found in the cabins of our

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for CIVIL DEFENSE and commercial application

the NEW LINK
PACK
SETS
for FM 2-way radio-telephone portable operation.
TYPE 3035-25-50 Mc
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A new and greatly improved portable assembly, incorporating several new features, is now in production at the LINK plant. These new Pack Sets are especially recommended for Civil Defense planning. They are ideal for fire and police service and other emergency work. Public utility companies, pipe line groups and other organizations who use field crews constantly, will find these new units extremely practical for communication between crews and base station or vehicle location. These Pack Sets also are recommended for use by Forestry and Conservation groups.

For details, please write to Dept. A. M.

LINK Radio Corporation
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(*Continued from page* 89)

military airplanes. It has become standard practice at Communication and Navigation Laboratory, to run articulation tests on experimental and production sample microphones, headsets and interphone systems at noise levels of 120 db (both jet and propeller-driven aircraft noise) and at altitudes from ground level to 35000 ft., using these two test facilities. The knowledge we have gained from such testing has been and will continue to be of major importance in the improvement of aircraft voice communication equipments. The following articulation scores are representative of the data obtained in tests at Communication and Navigation Laboratory:

	JN	PN
Reference System*	46.1%	56.6%
New Audio System#	76.4%	80.9%

Explanation: JN = Noise spectrum representative of jet aircraft. PN = Noise spectrum representative of propeller-driven aircraft. Above scores are for 120 db noise level at ground altitude.

* The "Reference System" is the best current standard interphone system, using ANB-M-C1 microphone in A-14 oxygen mask, HS-33 headsets with "doughnut" ear cushions, and AM-26A/AIC interphone amplifier. #Equivalent "Research Model" of Interphone Equipment AN/AIC-10.

CAVITY ANTENNA (*Continued from page* 51)

maintain the aerodynamic contour of the air intake lip. This fiberglas cover has a slight capacity shunting effect and the prototype antenna was designed for best results with a fiberglas cover ⅛th in. thick. As shown in Fig. 7, the vswr of the prototype antenna with the fiberglas cover in place is better than 2.5 to 1 throughout the required frequency band and better than 5 to 1 throughout a 10% frequency band.

Fig. 1 shows the final model of the glide path cavity together with its fiberglas cover. This model was constructed by North American Aviation, Inc., using aircraft production techniques. The fiberglas cover is molded to the correct airfoil contour and it is sprayed with Gaco compound to reduce erosion of the fiberglas surface.

In conclusion, one point of nomenclature which we have used deserves some emphasis. In Fig. 5 the radiation pattern of the cavity antenna is shown for the case of transmission with a one-watt transmitter. Since this antenna is used only for receiving and not transmitting signals, the nomenclature with equi-signal contours appears inappropriate. For this reason, it is proposed that the patterns of both receiving and transmitting antennas be shown by plotting contours of equal directive gain.[3] If the directive gain is expressed as a decibel ratio compared to the isotropic source, the equi-directivity contour plot shown in the bottom of Fig. 9 results. This set of equidirectivity contours differs in shape from the equi-signal contours shown in the top of Fig. 9 only because the two sets of contours are not for equal pattern magnitudes. For example, the 6 mv/m equi-signal contour would be an equi-directivity contour of 4.9 db.

The glide path cavity antenna described in this paper has unusually good patterns and vswr characteristics, and gives a received signal that is 2½ db greater than a dipole. It is easy to construct, assemble and service and does not cause any increase in the aerodynamic drag. For these reasons it is considered to be a good antenna for this application, but since it has not yet been flight tested in accordance with AMC specifica-

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tions, it is not yet approved by the Air Materiel Command for Air Force usage. A similar type of antenna has been mounted on another type of aircraft at a location outboard on the leading edge of the wing with nearly as good results. Considerable credit should be given to Ben Zieg of Electronics Research, Inc., for the construction of the mock-up and model antennas described in this paper. Appreciation is also expressed to North American Aviation, Inc. for permission to publish this paper.

1. Kees and Gehres, "Cavity Aircraft Antenna", Electronics, P. 78, Jan. 1947; Montgomery, B., "Improvements in 75-mc Aircraft Marker Systems," Proceedings N. E. C. 1946, P. 133.
2. Terman, "Radio Engineers Handbook, First Ed., P. 783, McGraw-Hill Company, New York, N. Y.
3. "Standards on Antennas; Modulation Systems, Transmitters", P. 2, 1948 Printing, Institute of Radio Engineers.

APPENDIX

CALCULATIONS OF SIGNAL STRENGTH AT GLIDE PATH RECEIVER INPUT — The calculations necessary to determine the signal strength which the cavity-type glide path antenna in the aircraft delivers to the glide path receiver will be shown as a matter of general interest. The calculations are considered to be quite accurate except for the usual inaccuracies introduced by the average propagation characteristics given in the book "Propagation Curves" NDRC Report No. 966-6C by Bell Telephone Laboratories. General propagation data of this type may have high average accuracy and still introduce considerable errors for special cases of terrain soil conditions, meterological conditions, etc.

The USAF specification requires a minimum signal of 70 microvolts at the receiver terminals when the aircraft is 10 miles out on the glide path and at an altitude of 2,000 ft. It is assumed that there is 30 ft of RG-8/U cable between the antenna and the receiver in the aircraft, and it is also assumed that the vswr on the receiving cable is 5 to 1.

The AN/CRN-2 glide path transmitter has a normal power output of 20 watts. It is assumed that the transmitting antenna is connected to the transmitter with 30 ft of RG-8/U cable and that the vswr on the cable is 2 to 1. It is also assumed that the average height of the two transmitting antennas is 12½ ft and that the radiation patterns of the two transmitting antennas in the horizontal plane have very little back radiation, giving a directivity gain of 3 db. The calculations will be made for the case of propagation over good soil, however, the difference in the case of sea water or poor soil is only a few db.

1. **The transmitter power factor compared to kw** = —17 db
2. **Cable loss factor** = —1.5 db
3. **Reflection loss factor** = —10 log $(1 + 2)^2/(4 \times 2)$ = —0.5 db
4. **Assume the average height of the two transmitting antennas is 12½', giving a directivity factor** = +2.5 db
5. **Assume the pattern of the transmitting antenna has very little back radiation, giving a directivity factor** = +3 db
6. **The field intensity factor given on page 64 of the "Propagation Curves" book is** = 82 db/μv
7. **Therefore, the field strength at the aircraft** = +68.5 db/μv
8. **This is a field strength** = 2620 μv/meter
   For comparison purposes, assume the receiving antenna at the aircraft is a half-wave dipole (HWD) in free space.
9. **The effective height of HWD** = 0.29 meters
10. **The open circuit signal of HWD** = 2620×0.29 = 760 μv
    The directivity of HWD compared to an isotropic antenna of unity directivity in all directions is 1.28.
11. **The open circuit signal with isotropic antenna** = 760/1.28 = 595 μv
12. **Signal across matched load, (accounting for re-radiation)** = 298 μv
13. **Cable loss factor** = —1.5 db
14. **Reflection loss factor** = —10 log $(1 + 5)^2/(4 \times 5)$ = —2.5 db
15. **Signal to receiver for isotropic antenna** = 298 μv (—4 db) = 188 μv
16. **Required minimum signal is 70 μv, so isotropic antenna signal to receiver is 188/70 or 2.69 times minimum.**
    When the isotropic antenna is driven by a one watt transmitter, it radiates a field strength of 3.4 millivolts per meter at one mile. This case is directly comparable to the equi-signal contours in Fig. 5 for the glide path cavity.
17. **The contours in Fig. 5 which would give the minimum signal of 70 microvolts are therefore equal to 3.4/2.69** = 1.26 mv/m

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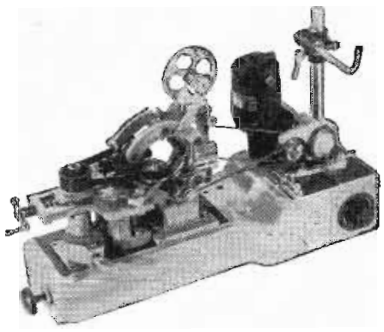

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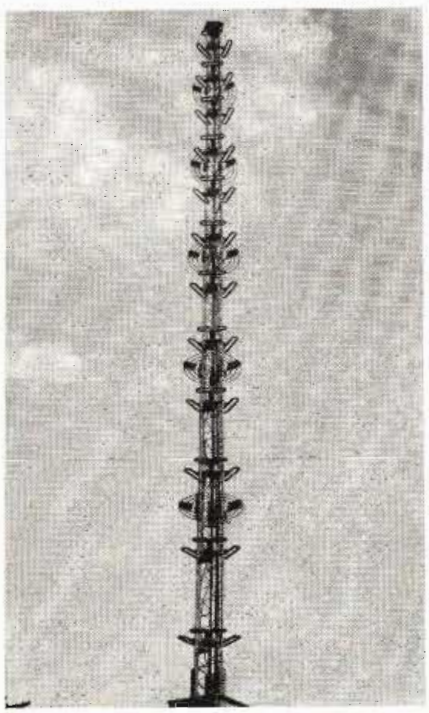

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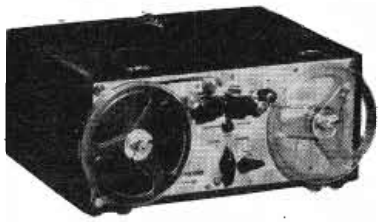

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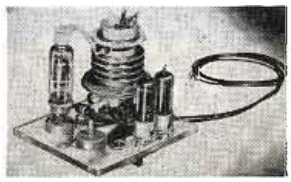

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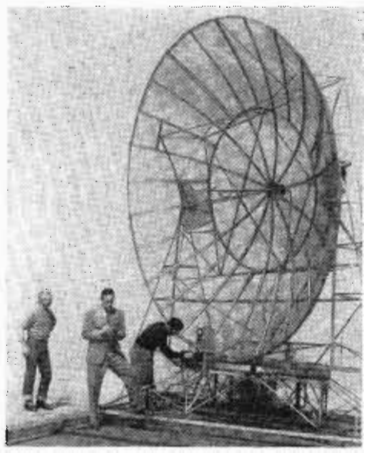

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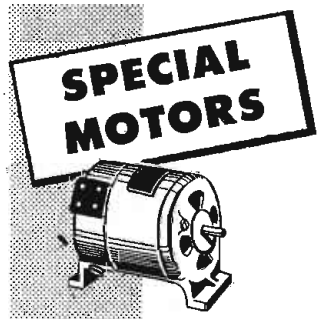

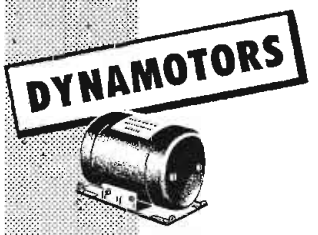

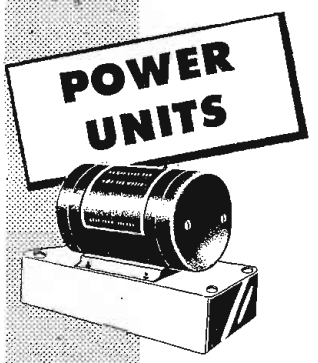

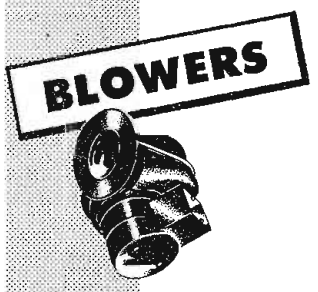

THIS EQUIPMENT IS THE FINEST AVAILABLE, BUILT BY LEADING MANUFACTURERS AND UNCONDITIONALLY GUARANTEED BY WELLS. MANY TYPES NOT LISTED ARE IN STOCK. SEND US YOUR REQUIREMENTS FOR IMMEDIATE QUOTATION.

MANUFACTURER	TYPE OR NO.	VOLTAGE	RPM	DIMENSIONS	SPECIAL INFORMATION
Stewart Warner	.....	6VDC	....	2¼"x2¾"	¼"x½" Lg. shaft
John Oster	B-9-2	12VDC 1.4A	5600	2¼"x3¾"	¼"x3/16" Lg. shaft. Shunt Wd.
General Ind.	62800	13VDC 9A	6800	2⅛"x4"	¼"x¾" Lg. shaft. 1/12 HP
Emerson	D-26-BT	24VDC 24A	100	2¼"x5½"	160 Ft.-Oz. torque
Redmond	7-N	24VDC .96A	6000	2¾"x3¼"	Complete blower assembly
F. A. Smith	40H	115VAC 60 Cy	....	6"x5½"x5"	100 CFM blower ($12.95)
Western Elect.	FL	115VAC 400 Cy	6700	3¼"x4"x4½"	25 CFM blower
Signal Elect.	D-4272	24VDC .66A	2100	2¼"x2⅞"	¼"x1" shaft. 1/190 HP
General Elect.	5 BA50MJ64	24VDC 13A	....	3⅞"x7½"	Shunt wound
Stromberg	D-4496	24VDC .45A	....	2½"x3⅛"	¼"x¾" shaft. .003 HP
Amglo	.....	24VDC	....	1½"x2⅛"	Telephone ringing circuit motor
John Oster	A-16B-26R	26VDC	....	1½"x2⅛"	3/16"x5/16" shaft. Series Rev.
John Oster	DEST-8-1R	27VDC 1.4A	3800	2¼"x4⅝"	⅜"x¾" shaft. 1/40 HP
Delco	5069267	27.5VDC .25A	6000	1⅝"x2½"	¼"x1⅛" shaft. 1½ Oz-In Tq.
Western Elect.	KS5996-L04	28VDC	....	2"x2⅛"	5/16"x7/16" shaft. Series Rev.
Bendix	MO5B	28VDC 1.75A	3200	1½"x2½"	¼"x1⅛" shaft. Series Rev.
Bendix	E-11500-I	28VDC 1A	9000	1½"x2½"	¼"x1⅛" shaft. Series Rev.
Fractional Mtrs.	SH-280	28VDC 3.1A	3900	3¼"x5½"	¼"x⅝" shaft. Used in ART 13
Electrolux	20100	28VDC .1A	....	2"x2 15/16"	5/32"x⅝" shaft. 20 Deg. rotation
John Oster	A-21-E-12R	28VDC .4A	....	1½"x2⅜"	3/16"x⅜" shaft. Series Rev.
Emerson	D-26-BV	28VDC 3.1A	3900	2½"x3½"	¼"x⅝" shaft. 1/20 HP
Electrolux	16876	28.5VDC 1.8A	2200	3¾"x5"	¼"x1¼" shaft. 1/35 HP
Western Elect.	KS 9303	50-60VAC 175 Cy	....	2½"x3½"	.....
General Elect.	2J1H1	57.5VAC 400 Cy	....	2¼"x3¾"	Selsyn differential
General Elect.	2J1G1	57.5VAC 400 Cy	....	2¼"x3½"	Selsyn transmitter
General Elect.	5BN38HA10	80VDC .25A	3000	2⅞"x5½"	¼"x¾" lg. shaft
General Elect.	2J1F1	115VAC 400 Cy	....	2¼"x3"	Selsyn generator
Diehl	11-1	110VAC 60 Cy	....	4"x5¼"	Synchro repeater selsyn
Bendix	.....	110VAC 60 Cy	....	3¼"x5½"	Synchro differential selsyn
Bendix	.....	110VAC 60 Cy	....	3¼"x5½"	Synchro transmitter selsyn

MANUFACTURER	TYPE OR NO.	INPUT	OUTPUT	DIA.	LGTH.	SPECIAL INFORMATION
Eicor	ML3415-254	27.5VDC 1.5A	250VDC .060A	4"	8⅜"	With bracket mounting
Eicor	ML3412-42	13.8VDC 2.45A	220VDC .070A	3⅜"	5¼"	No mounting
Western Elect.	DM53AZ	14VDC 2.8A	220VDC .080A	2¾"	4½"	With base plate
Westinghouse	1171187A	27VDC 1.4A	285VDC .060A	2⅛"	4½"	No mounting
General Elect.	5DY82AB52	27VDC 1.5A	285VDC .060A	2¾"	4½"	No mounting
Western Elect.	1171091B	27VDC 1.6A	285VDC .075A	2¾"	4½"	No mounting
Redmond	5047	27VDC 1.75A	285VDC .075A	2¾"	4½"	No mounting
Eicor	ML3415-254	27.5VDC 1.5A	100VDC .150A	3½"	5½"	With base plate
Eicor	ML3420-194	27.5VDC 4.0A	325VDC .200A	3⅜"	6½"	With base plate
C.Q.R.	355D2BA	27.9VDC 1.25A	220VDC .070A	3⅜"	5⅜"	No mounting
Continental	DM310A	28VDC .5A	100VDC .01A	2¾"	4½"	No mounting
C.A.Y.	DM32A	28VDC 1.1A	250VDC .060A	2¾"	4½"	With base plate
Pioneer	PE86M	28VDC 1.25A	250VDC .060A	2¾"	4½"	With base and filter
Bendix	DA-1A	28VDC 1.6A	230VDC .100A	3⅜"	5½"	No mounting
Redmond	DM5 3A	28VDC 1.4A	220VDC .080A	2¾"	4½"	With base plate
Redmond	5056	28VDC 1.4A	250VDC .060A	2¾"	4½"	With base plate
Eicor	ML-3420-90	28VDC 3.3A	400VDC .125 A	3½"	6½"	With base plate
Continental	DM33A	28VDC 5A	575VDC .160A	3½"	7½"	Cont. duty. No mounting
Winco	41S6	13VDC 13A	250VDC .060A	4"x	8⅜"	With base plate
		13VDC	300VDC .225A	....	....	Intermittent
Continental	DMX310A	12VDC 2.8A	150VDC .100A	2¾"	4½"	Cont. Duty. No mounting
Airs	VA 137	115VAC 60 Cy	90-135VAC 7.6A	3¾"	5¾"	⅜"x1" Shaft. Ind. Volt Reg.
				DIMENSIONS		
Pioneer	PE 55	12VDC .16A	500VDC 0.2A Cont.	7¼"x12⅛"x13½"		Pwr. Unit W/DM 19G DYN, Filter and Mounting
Westinghouse	PE 94C	28VDC 10.5A	300VDC .260A 150VDC .010A 14.5VDC 10A	8¼"x6½"x12½"		Pwr. Unit W/DA3A DYN, Filter and Mounting

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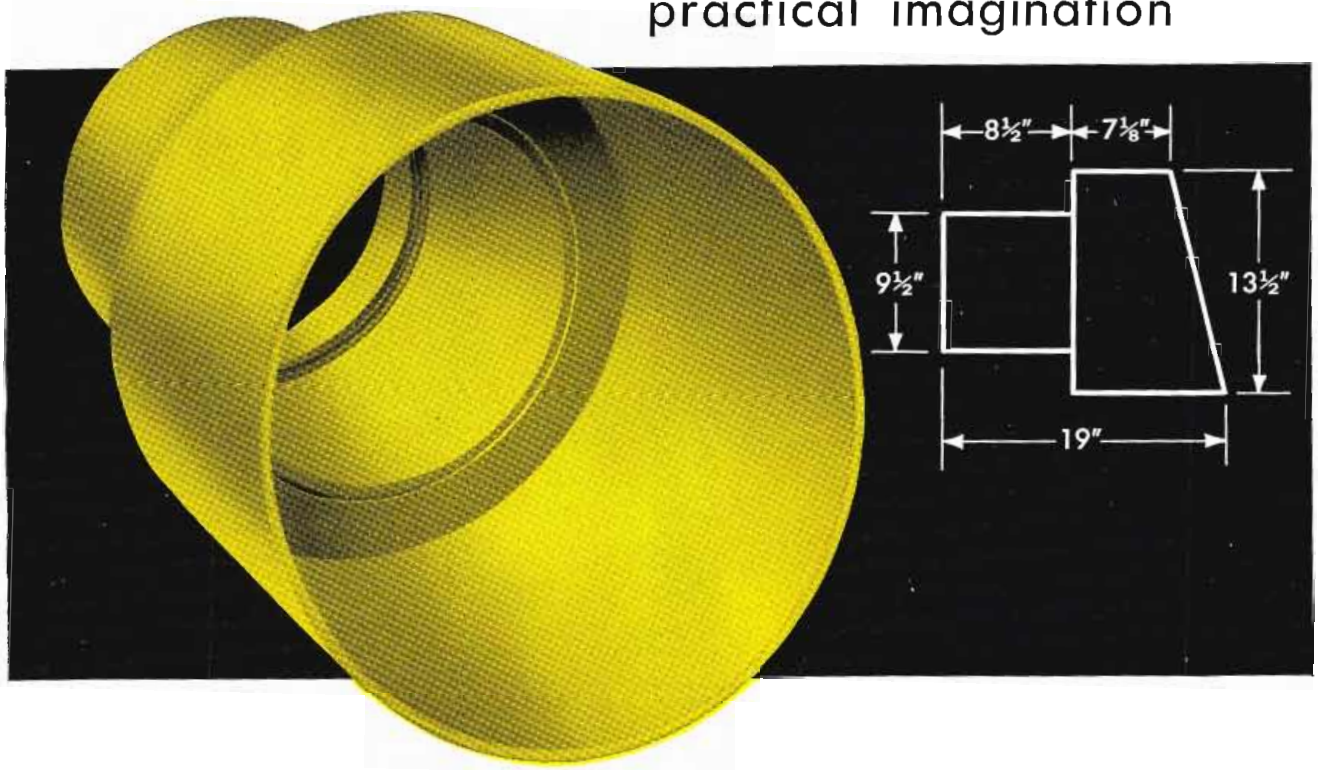

"welded" assembly makes large plastic parts practical and economical

Look at this large, laminated plastic part. It is 19" long with two concentric diameters of 13½" and 9½" connected by a flat ring. Think of the cost of molds for making such a piece—and then consider the fact that only a few such parts are required. The cost would be prohibitive.

It is on problems like this that Continental-Diamond's knowledge of plastics and their fabrication pays off for you. C-D engineers took two Dilecto tubes of the required diameters and wall thicknesses and then cut a ring from a sheet of Dilecto to just fit the O.D. of the smaller tube and the I.D. of the larger.

These three parts were then literally "welded" together into a strong, low cost part. The material used to do the "welding" is one of the compounds developed by C-D in their vast experience of fabricating parts of Fibre, Vulcoid, Celoron, Micabond, Dilecto and combinations of all of them.

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Three RCA "Pencil" Triodes

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...for UHF services up to 3000 Mc

THE THREE "PENCIL" TRIODES illustrated are significant examples of RCA's pioneering leadership in the development of special tube types for specialized applications. These triodes feature a double-ended coaxial-electrode structure in which plate and cathode cylinders extend outward from each side of the central grid flange. This unusual construction results in minimum transit time, low lead inductance, and low interelectrode capacitances. One type employs cylindrical resonators which are integral with the tube.

RCA-5794 is a fixed-tuned oscillator triode especially designed for radiosonde applications. It has two resonators, one of which is attached between grid and cathode and the other between grid and plate. The latter is tuned to 1680 Mc by means of an adjustment screw. The useful power output is approximately 500 milliwatts.

RCA-5675 is a medium-mu triode for use in grounded-grid circuits up to 3000 Mc. As a local oscillator, it is capable of delivering a power output of 475 milliwatts at 1700 Mc, and about 50 milliwatts at 3000 Mc. The tube is less than 2¼" long with a diameter, except for the grid flange, of only ¼ inch.

RCA-5876 is a general-purpose, high-mu triode intended particularly for use in grounded-grid service as an rf amplifier, if amplifier, or mixer tube in receivers operating at frequencies up to about 1000 Mc; as a frequency multiplier up to 1500 Mc; and as an oscillator up to 1700 Mc. It may also be used as a low power rf amplifier in mobile transmitters, and in class C service will deliver a useful power output of 5 watts up to 500 Mc.

For complete technical data on any of these RCA "pencil" triodes, write RCA, Commercial Engineering, Section 57JR, Harrison, New Jersey, or your *nearest* RCA field office.

FIELD OFFICES: (EAST) Humboldt 5-3900, 415 S. 5th St., Harrison, N. J. (MIDWEST) Whitehall 4-2900, 589 E. Illinois St., Chicago, Ill. (WEST) Madison 9-3671, 420 S. San Pedro St., Los Angeles, Calif.

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