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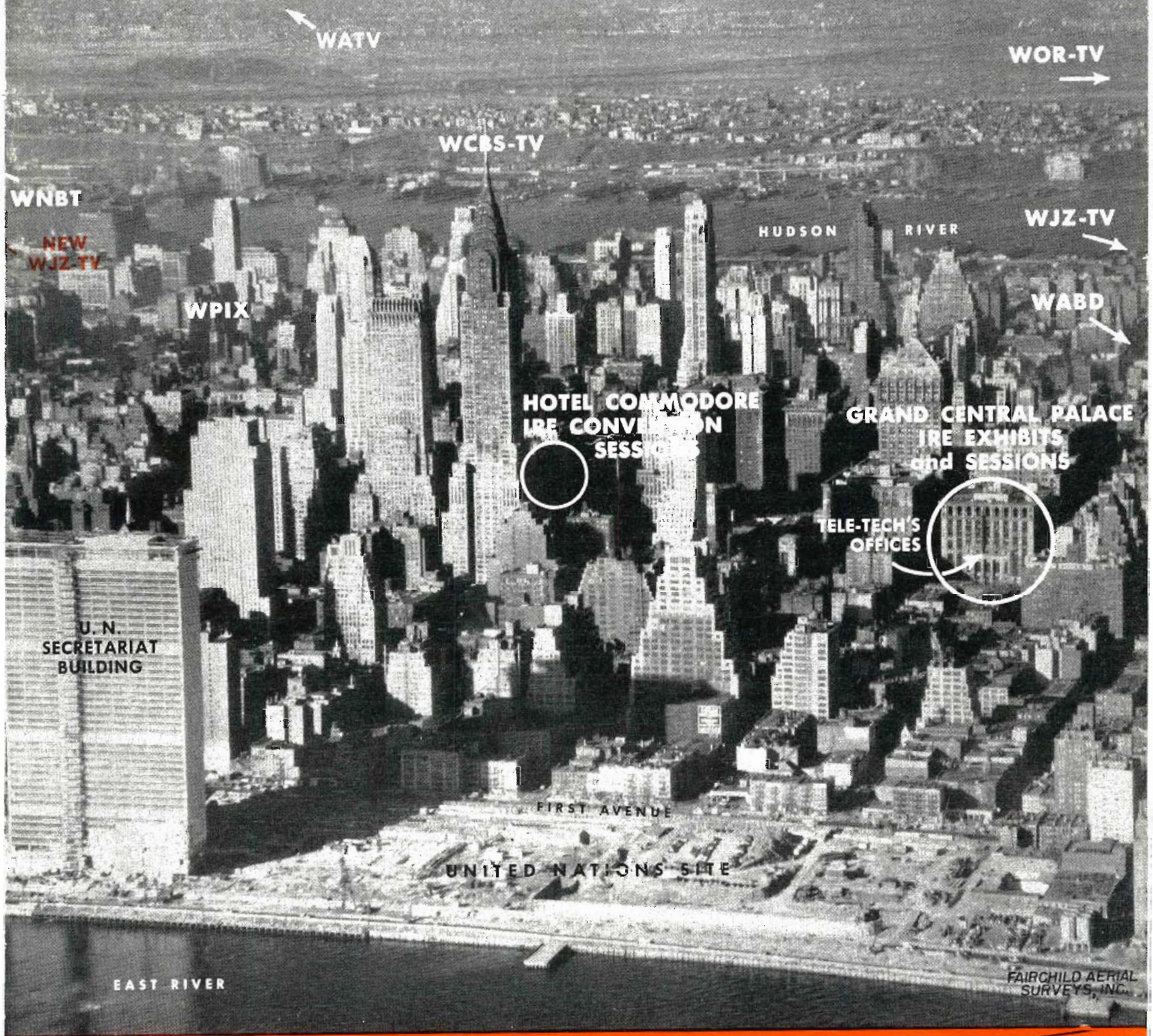

Centers of radio-engineering interest in New York this month, as viewed across United Nations new site, 3 blocks from IRE Convention halls (see page 21)

How RMA Engineering Committees Co-operate

Testing Audio Transformers With Square Wave Inputs

March • 1950 CALDWELL-CLEMENTS, INC.

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

•

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Research, design and production of special types
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Installation, operation and maintenance of telecommunications equipment in the fields of

BROADCASTING • RECORDING
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MARCH, 1950

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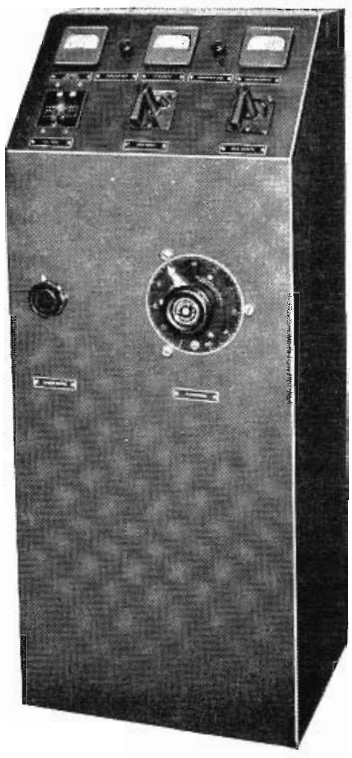
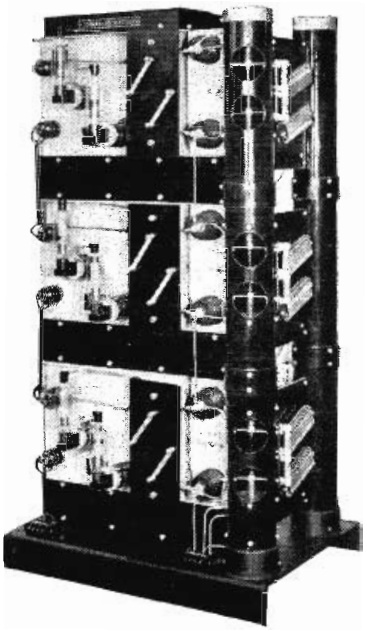
Tele-Tech*, March 1950, Vol. 9, No. 3. 40 cents a copy. Published Monthly by Caldwell-Clements, Inc. Publication office, Orange, Conn. Editorial, Advertising and Executive Offices, 480 Lexington Ave., New York 17, N. Y. M. Clements, President; Orestes H. Caldwell, Treasurer. Subscription rates: United States and Possessions, $3.00 for one year, $5.00 for two years. Canada, $4.00 for one year, $6.00 for two years. All other countries, $5.00 for one year, $7.00 for two years. Please give title, position and company connection when subscribing. Entered as second class matter June 9, 1947 at the post office at Orange, Conn., under the act of March 3, 1879.

Printed in U. S. A. *Reg. U. S. Pat. Off.



Control panel for use with cascade rectifiers.



This cascade rectifier, 60 inches high, delivers 105 kv, 10 milliamps d-c. Consists of three basic Kenotron-tube rectifier units.

Now SMALL RECTIFIERS FOR DC VOLTAGES up to 135 KV

New, within the last year, is this small cascade-type rectifier for generating smooth high d-c voltages. Suitable for laboratory and factory for testing and as power supply. Features: versatility, reliability, reasonable price and long tube life with much lower cost of replacement tubes. The rectifiers can be furnished for single-phase operation from 115- or 230-volt, 50- or 60-cycle power supply.

Basic unit is a 35 kv, 32 ma (continuous) rectifier, with necessary transformers mounted in an oil-filled steel tank. Each unit is 34″ wide, 25″ deep and 21″ high. Up to four units can be stacked, giving d-c voltages up to 135 kv. Output voltage ripple, peak to peak, will not exceed 0.1% per milliampere.

A CONTROL PANEL can be supplied which will provide smooth output voltage control over the complete range from zero to maximum. Accuracy of output volrage, with this panel, is ±5 per cent of full scale; accuracy of current indication, ±2 per cent. Overcurrent protecrion is included.

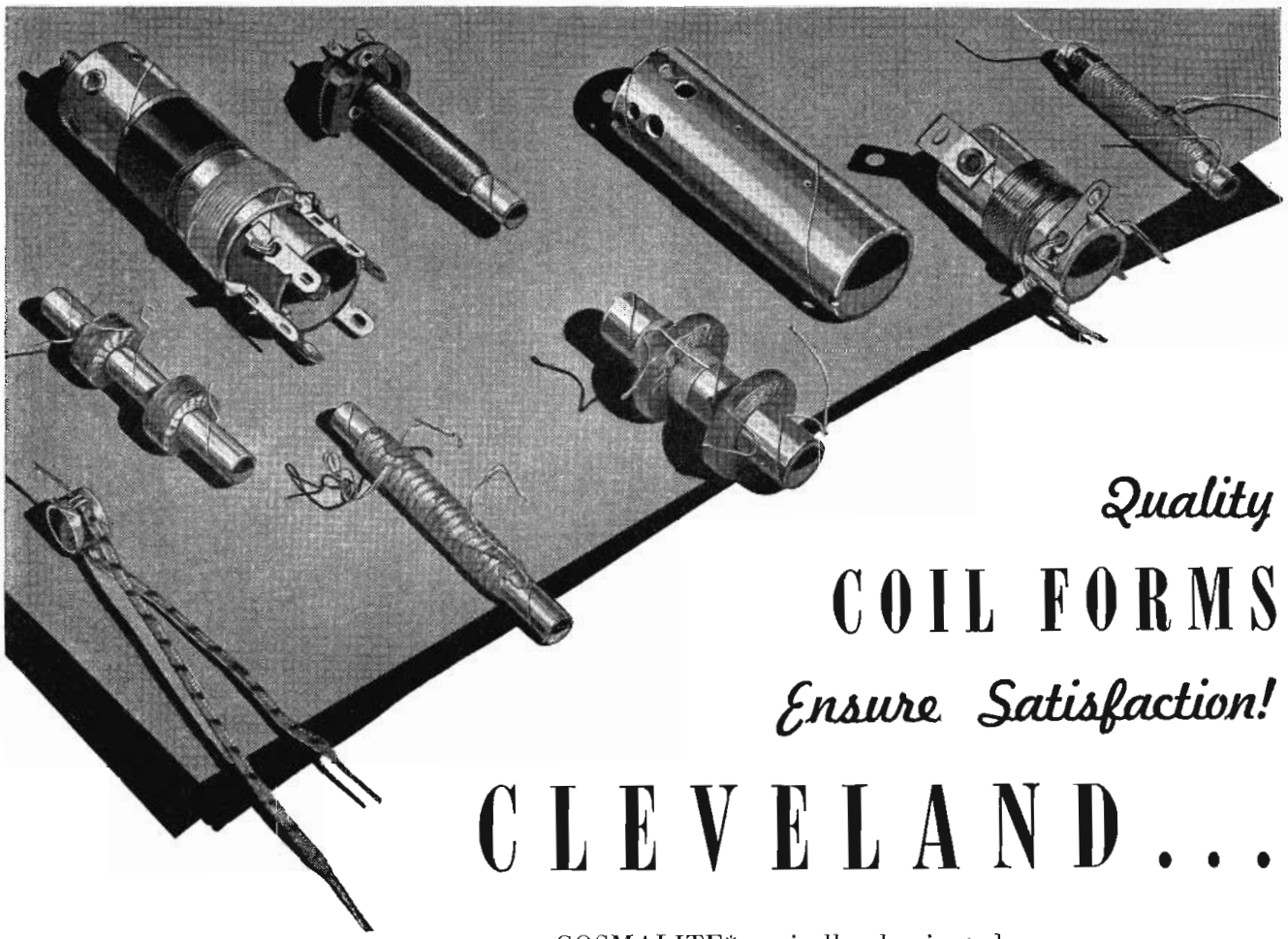
SUITABLE FOR INTEGRAL MOUNTING. Because of its small size, this rectifier can often be mounted within the enclosure housing your own product. Such integral mounting is usually preferable from all standpoints—lowers cost, saves space, and improves appearance of the entire assembly.

STANDARD UNITS, IN REGULAR PRODUCTION. These cascade rectifiers are built up of standard units that are in regular production. They can be shipped on shorter schedules than are normal for this general class of equipment. *Apparatus Department, General Electric Co., Schenectady 5, N. Y.*

For prices and specific information, address inquiries to our nearest office, or to General Electric Company, Transformer Sales Division, 42-356, Pittsfield, Mass.

GENERAL ELECTRIC

401-55



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COSMALITE* spirally laminated paper base phenolic tubes are engineered and produced for those who must have quality performance with attractive prices and quick deliveries.

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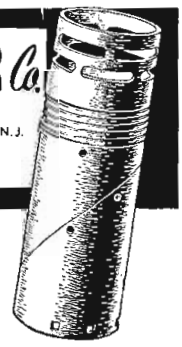

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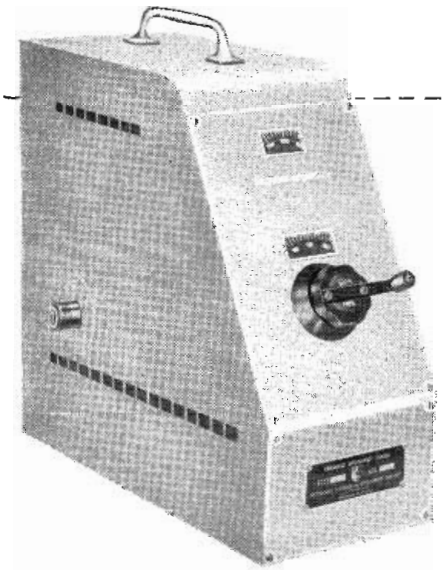

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The expansion of television program transmission into the realm of distributed circuits has made it possible for PRD to apply its microwave "know-how" to the development of test equipment for the important new UHF-TV band.

First of a whole series soon to be offered, the instruments illustrated embody features essential to the rapid and accurate determination of receiver characteristics in the laboratory or on the production line.

See these instruments at our booth at the 1950 IRE Show. Our catalog of Microwave Test Equipment may also be had upon request; for full information write to Dept. E-6.

Polytechnic RESEARCH & DEVELOPMENT COMPANY, Inc.

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TELE-TIPS

RESONANCE IN BUSINESS—One thing about this radio business, nothing is static, even as to company listings. The number of still-active receiver companies that saw the start of broadcasting can be counted on one hand.

Of those that drop out of the game, we have heard remarks at their passing,—"They were too far ahead of the game," and of others "They just could not keep up with the times". It would seem that management would do well to study the laws of resonance, so that the "leading current" characteristics of capacitive-minded personnel can be balanced by the "leading potentials" from the inductive contingent.

(And incidentally the operation should be set up so that high impedances by series resonance conditions are avoided.)

HALL OF FAME for immortals who have contributed most to radio, is being considered by the Radio Pioneers. Fifty niches would be set up in some appropriate New York City location, to be filled by the year 2000, and candidates would be limited to those deceased two years before being placed in nomination. Radio Pioneers' past-presidents and current officers would comprise election committee.

SEALED-UNIT COMPONENTS—Ever stop to think why most radios, TV sets and related communication equipment consists of plug-in components and soldered connections? Obviously, because frequent breakdown and replacement is taken for granted. Too bad we can't make them to stand up longer under the operating conditions for which they were intended so that, like a sealed-unit refrigerator (just to take one example from another field) they could be constructed as if they were here to stay.

NO INTERFERENCE—RCA engineers have made measurements and reported to the FCC that co-channel and adjacent-channel interference in connection with color TV is no worse than with monochrome. This means that allocation problems for the two services should be the same, thus removing the last barrier to the lifting of the "freeze."

CERAMIC TUBES—According to GE's W. C. White, many tubes of the future will doubtless be encased in ceramic envelopes which have much lower dielectric-loss factors than any kind of glass has at high frequencies.

FEEDBACK PUZZLES—Early radio circuits had definite input and output circuits and were usually understandable. An inventor seemed to be getting somewhere when more came out of a system then went in. But, now-a-days, with all the feedback loops that enter the picture, especially in some fields of control, the "gosinta" end is so mixed up with the "gosouta" part that one hardly knows where to start!

HOT PICKUP!—A phonograph needle in contact with a record groove where the average playing area of contact of the needle point is under pressures of from 25,000 to 6,000 lbs./sq. in. (assuming a flat of .0015 to .003 in. on both sides of the point and pickup pressure of 1½ oz.) is actually subject to friction-generated temperatures in the order of 2000° F. to 1000° F. reports A. J. Olsen of Permo.

(*Continued on page 8*)

MADE POSSIBLE WITH . . .

Equipment by

RADIO Link CORP. — VETRIC A AFFILIATE

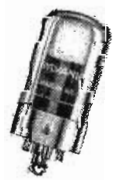
Link Radio and VETRIC

Tubes by

SYLVANIA ELECTRIC

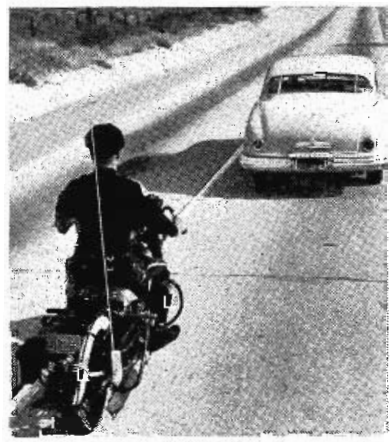
The long arm of the Law is just that much longer through the combined skill of Link-Vetric and Sylvania. In designing this compact two-way radio for the Los Angeles Motorcycle Police, one quality was paramount . . . faultless performance under the toughest conditions. Nothing must fail when the call comes through!

Link-Vetric uses Sylvania low-drain miniature tubes because every step in their manufacture is quality controlled, ensuring longer life under the most adverse conditions. From Regular Glass Tubes to the famous Lock-ins . . . from Miniatures to tiny Sub-Miniatures, Sylvania tubes give the perfection that can *really* take punishment. Sylvania Electric Products Inc., Emporium, Pa.



SYLVANIA ELECTRIC

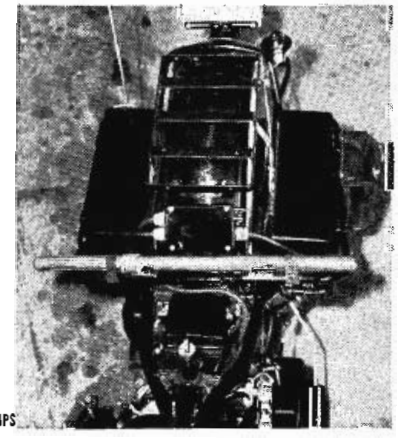
RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, SIGN TUBING, WIRING DEVICES; LIGHT BULBS; PHOTOLAMPS



Highway bumps and rutted by-ways often have to be taken at high-speed. Sylvania tubes defy sudden shock, constant vibration. Maintenance work cut to a minimum.

• • •

Neatly installed either side of the rear fender, the two-way radio keeps patrolmen in constant touch with headquarters. All police calls are urgent calls . . . absolute reliability is essential. Sylvania tubes are chosen wherever necessity demands the highest standards.



TELE-TIPS (Continued)

COMMERCIAL equipment using transistors has not been made available to the public but engineers who have followed up on this development would not be unduly surprised at such an introduction this year.

FIDO-FIDELITY!—Present trend toward high-fidelity audio equipment has just about reached the point where tones are produced which only dogs can hear.

QUIET TV—Latest wrinkle on the part of one TV manufacturer is the inclusion of an audio "squelch" circuit on deluxe models. The circuit acts to mute the audio system while the receiver is being tuned from one TV channel to another, and thus free the listener from annoying static or switching noise crashes, rushes, and hisses.

FCC Authorizations: 150,000 Stations, 589,000 Operators

As 1950 opened the FCC had more than 742,000 outstanding radio authorizations of all kinds. This was an increase of 65,000 during the calendar year 1949.

Total authorizations on its records included nearly 149,000 non-broadcast stations, over 4,100 broadcast stations, and almost 590,000 radio operators. There were net decreases in certain services—including 178 FM and 13 TV authorizations—but broadcast authorizations collectively gained 43. Non-broadcast services had an aggregates growth of over 13,000 stations, while radio operator authorizations increased by 52,000. Amateurs accounted for more than 84,000 stations and 83,000 operators.

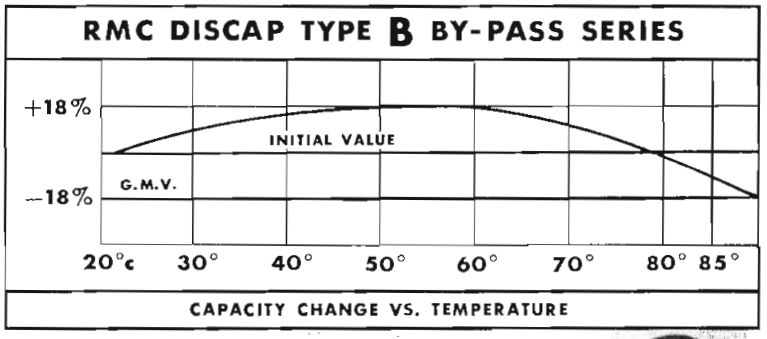
A comparative breakdown of authorized radio stations and operators is shown. However, station figures do not include associated land mobile units. A station is defined as a separate license or construction permit authorization. For example, 65 mobile taxicab units operating on one license are counted as one station.

	Jan. 1,'49	Jan. 1,'50	Increase
BROADCAST:			
AM	2,127	2,234	107
FM	966	788	(-178)
TV	124	111	(-13)
Experimental TV	182	215	33
Educational	50	72	22
Facsimile	2	0*	(-2)
International	37	37	0
Remote Pickup	574	649	75
Other	40	39	(-1)
Totals	4,102	4,145	43
NONBROADCAST:			
Aeronautical	25,716	25,513	(-203)
Marine	18,256	22,390	4,134
Public Safety	5,316	6,242	926
Industrial	3,661	5,167	1,506
Land Transport	3,506	3,497	(-9)
Amateur	77,338	84,394	7,506
Miscellaneous	1,747	1,626**	(-121)
Totals	135,540	148,829	13,289
RADIO OPERATORS:			
Commercial	366,000	393,470	27,470
Amateur	76,666	83,208	6,542
Special Aircraft	94,752	113,028	18,276
Totals	537,418	589,706	52,288
GRAND TOTALS	677,060	742,680	65,620

* FM broadcast stations may now render commercial facsimile service.

** Includes 213 citizens, 490 experimental and 923 commercial radio stations.

RMC DISCAPS



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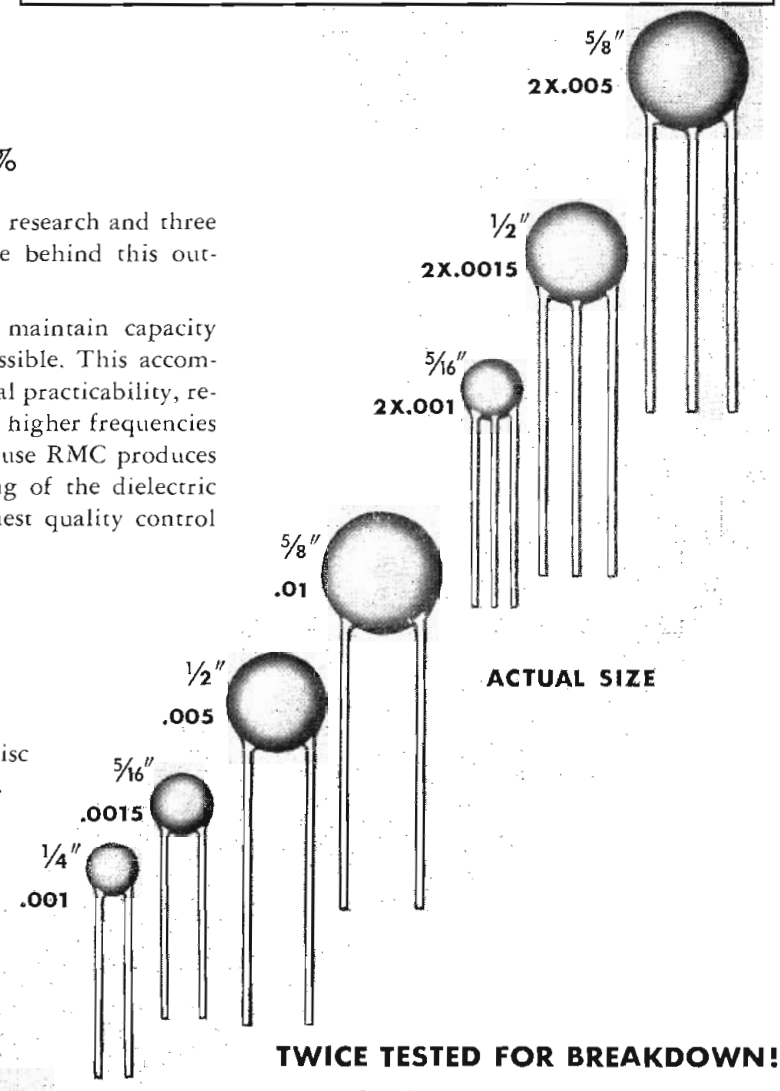
More than eight years of intensive engineering research and three years of successful commercial production are behind this outstanding RMC achievement.

Type B Series DISCAPS were developed to maintain capacity much nearer initial values than heretofore possible. This accomplishment, in small size condensers that have real practicability, results in a decidedly more effective by-pass at the higher frequencies encountered in TV and FM applications. Because RMC produces the complete condenser, even to the processing of the dielectric element itself, it is possible to exercise the finest quality control through every phase of manufacturing.

The Newest Development in Ceramic By-Pass Condensers

Type B Series DISCAPS are the smallest disc ceramics available. 1000 mmf. and 1500 mmf. DISCAPS are actually less than one-half the size of competitive condensers.

Improved processes of dielectric element impregnation and outer casing insulation are exclusive with DISCAPS. Their low self inductance, low power factor and moisture impervious characteristics place them in a class alone. Approval by leading makers of TV sets and tuners as well as manufacturers of specialized high frequency equipment is proof of their superiority.



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Every DISCAP Condenser is checked twice in production to eliminate the possibility of failure in service. All DISCAPS are rated at 600 V.D.C. and tested at 1200 V.D.C. Yes, DISCAPS are definitely better...they will save you money, too!

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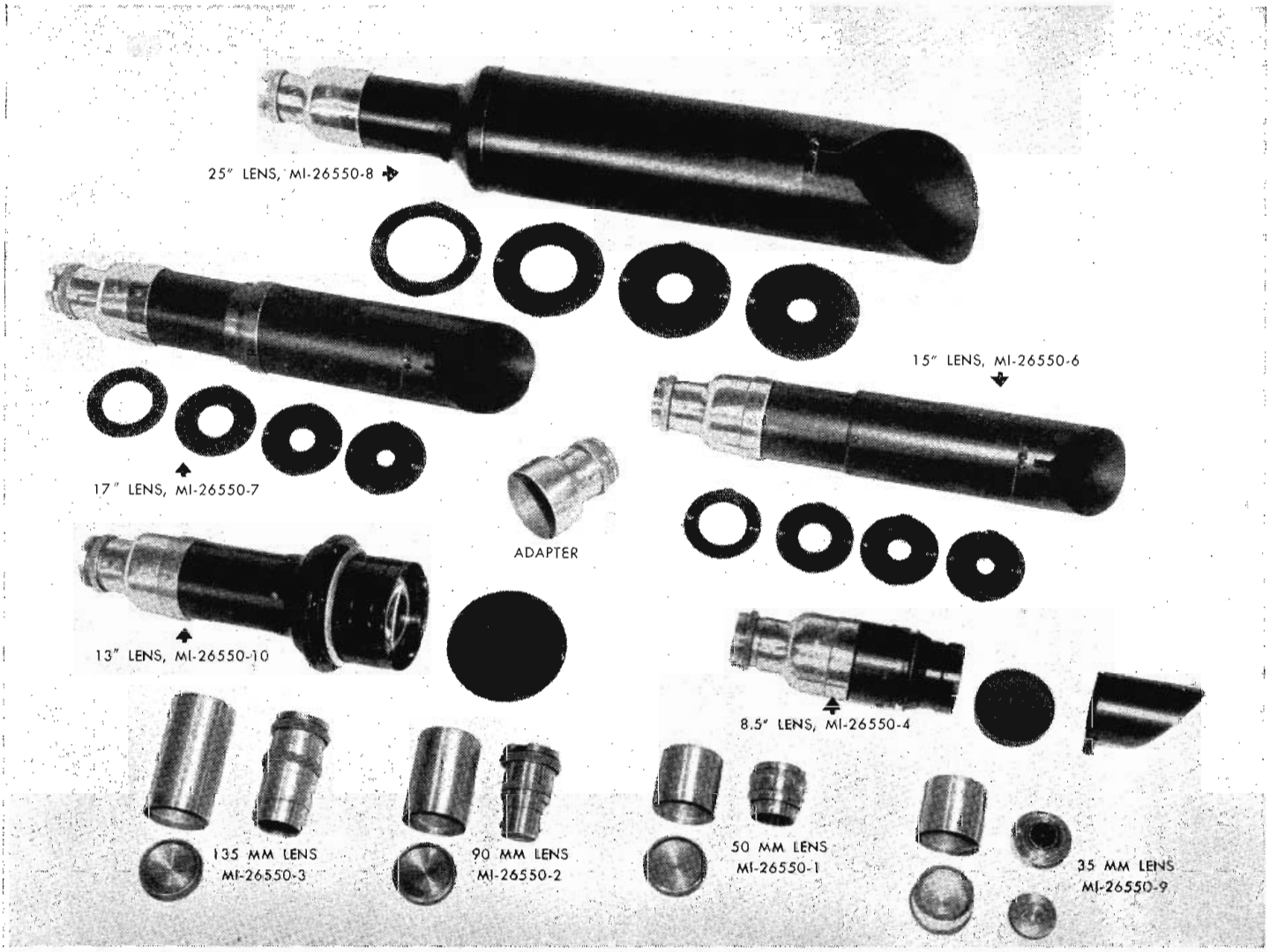

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90mm	studio and field	f/3.5	19°	MI-26550-2
135mm	studio and field	f/3.8	13°	MI-26550-3
8½"	studio and field	f/3.9	8°	MI-26550-4
13"	studio and field	f/3.5	5°	MI-26550-10
13"	field	f/5.0	5°	MI-26550-5
15"	field	f/5.0	4.5°	MI-26550-6
17"	field	f/5.0	4°	MI-26550-7
25"	field	f/5.0	2.75°	MI-26550-8

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Designed specifically for quick interchange in the 4-position turrets of RCA cameras, these lenses give the cameraman a wide choice of sizes, speeds, and focal lengths for wide-angle, telephoto, and ultra-speed pick-ups.

The complete line includes: (1) special, long "telephoto" types using a high-quality doublet lens (achromat) with removable, lightweight fixed-stops; (2) standard Ektar, or studio-type lenses, complete with diaphragm and depth-of-field scales—and with threaded stainless-steel barrels for accommodating sunshades and standard filters (available extra). All lens mounts contain light baffles to cut glare. All lens surfaces are chemically treated to insure clearer, higher contrast picture reproduction.

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RCA can ship any lens in the line—immediately, from stock. Ask your RCA Broadcast Sales Engineer for the new low prices. Order from him, or direct from Dept. 87C, RCA Engineering Products, Camden, New Jersey.

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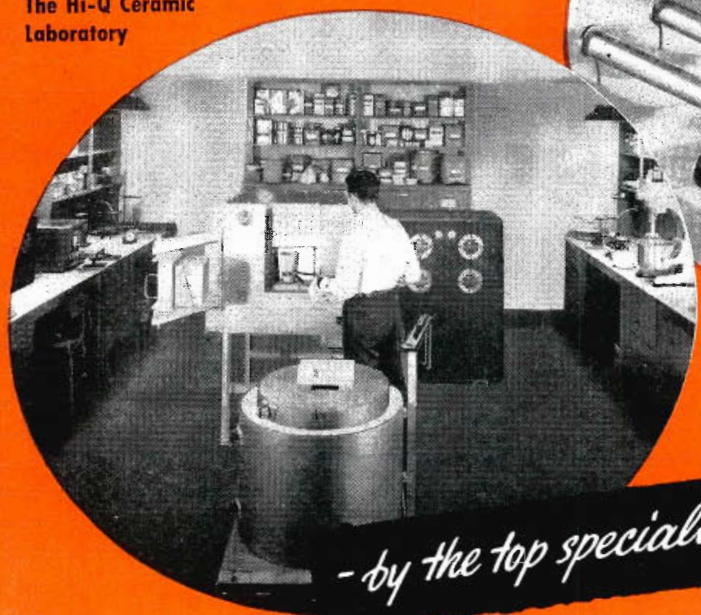

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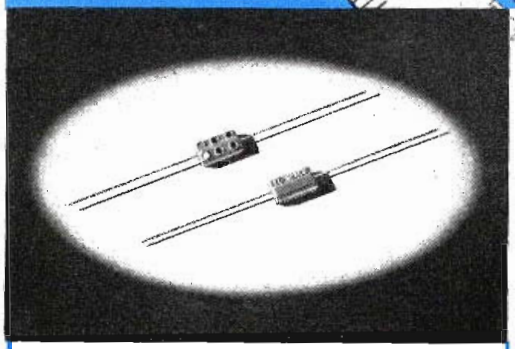

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For Television, Radio and other Electronic Applications
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2 — 525 mmf. cap. at 300v DCw
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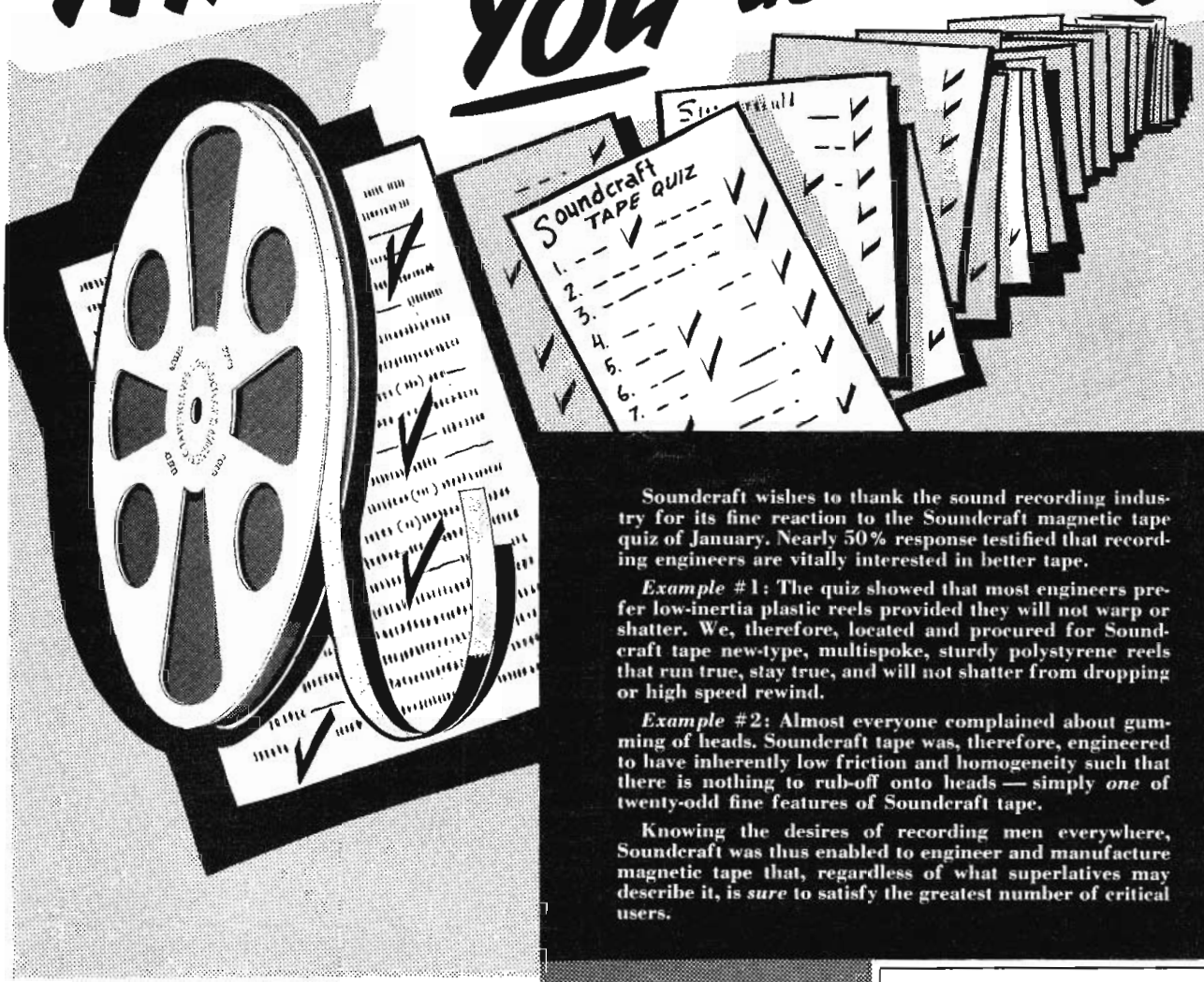
Here's THE MAGNETIC TAPE YOU asked for!



Soundcraft wishes to thank the sound recording industry for its fine reaction to the Soundcraft magnetic tape quiz of January. Nearly 50% response testified that recording engineers are vitally interested in better tape.

***Example* #1: The quiz showed that most engineers prefer low-inertia plastic reels provided they will not warp or shatter. We, therefore, located and procured for Soundcraft tape new-type, multispoke, sturdy polystyrene reels that run true, stay true, and will not shatter from dropping or high speed rewind.**

***Example* #2: Almost everyone complained about gumming of heads. Soundcraft tape was, therefore, engineered to have inherently low friction and homogeneity such that there is nothing to rub-off onto heads — simply *one* of twenty-odd fine features of Soundcraft tape.**

Knowing the desires of recording men everywhere, Soundcraft was thus enabled to engineer and manufacture magnetic tape that, regardless of what superlatives may describe it, is *sure* to satisfy the greatest number of critical users.

Reeves Soundcraft tape is a new companion product to Reeves Soundcraft discs and styli.

"20 years with sound recording media."

Gentlemen: Date: NOW

Please send us OUR free sample of Soundcraft tape (200 ft. on 5" reel). We now use_____ brand and type #_____

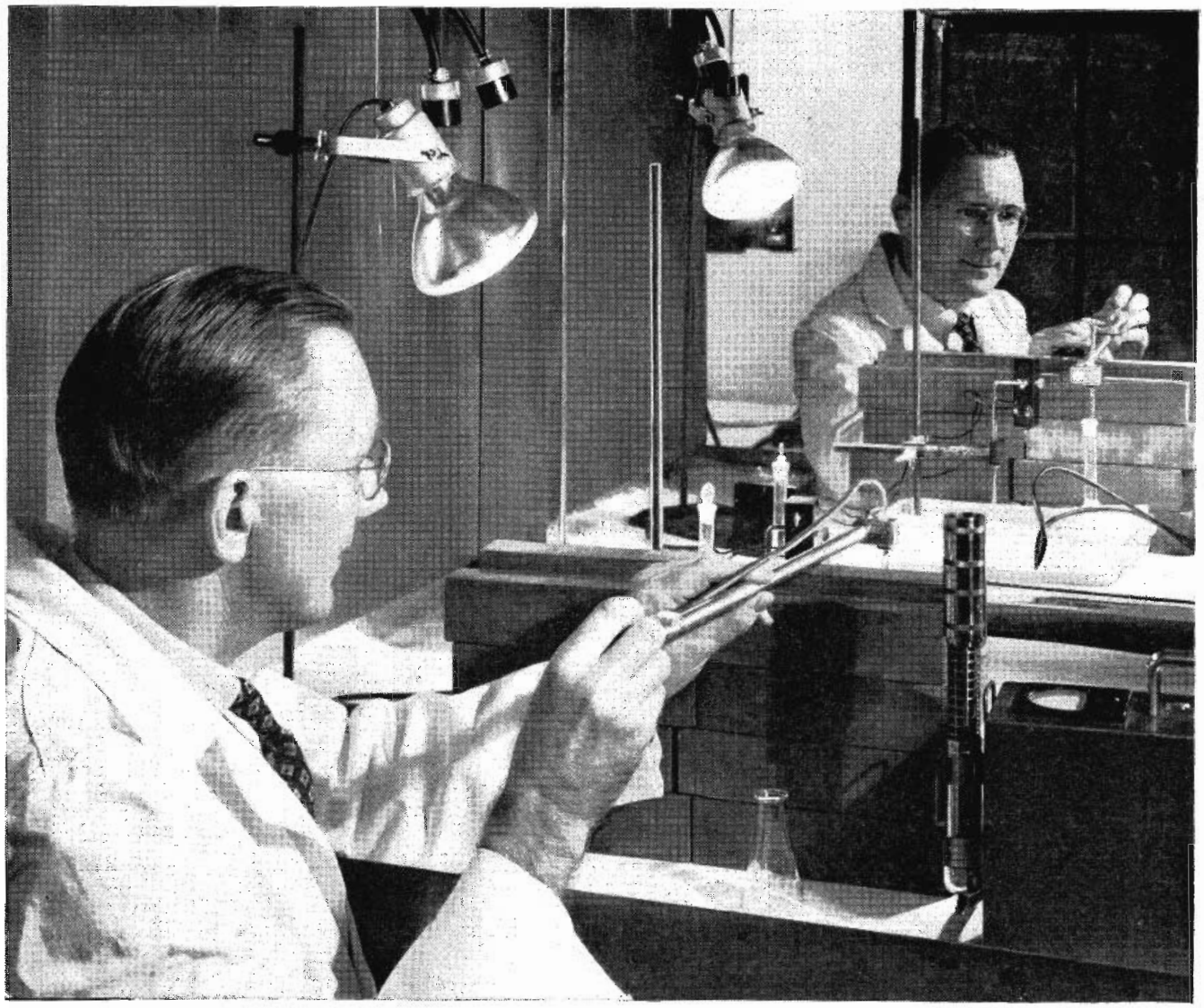
YOUR NAME_____

ADDRESS_____

←Mail—now—to

REEVES Soundcraft CORP.

35-54 36th STREET, LONG ISLAND CITY 6, N. Y.



IT'S DONE WITH MIRRORS!

Protected by a wall of lead bricks and using a mirror to guide his instruments, this Bell Laboratories scientist is preparing a solution of a radioactive isotope, for use as a tracer to study materials for your telephone system.

Bombardment by neutrons turns some atoms of many chemical elements into their "radioactive isotopes"; these are unstable and give off radiation which can be detected by a Geiger counter. Chemically a "radioactive isotope" behaves exactly like the original element. Mix the two in a solution or an alloy and they will stay together; when the Geiger counter shows up an isotope, its inactive brother will be there too. Minute amounts beyond the reach of ordinary chemical methods can be detected — often as little as one part in a billion.

The method is used to study the effect of composition on the performance of newly developed germanium transistors — tiny amplifiers which may one day perform many functions which now require vacuum tubes.

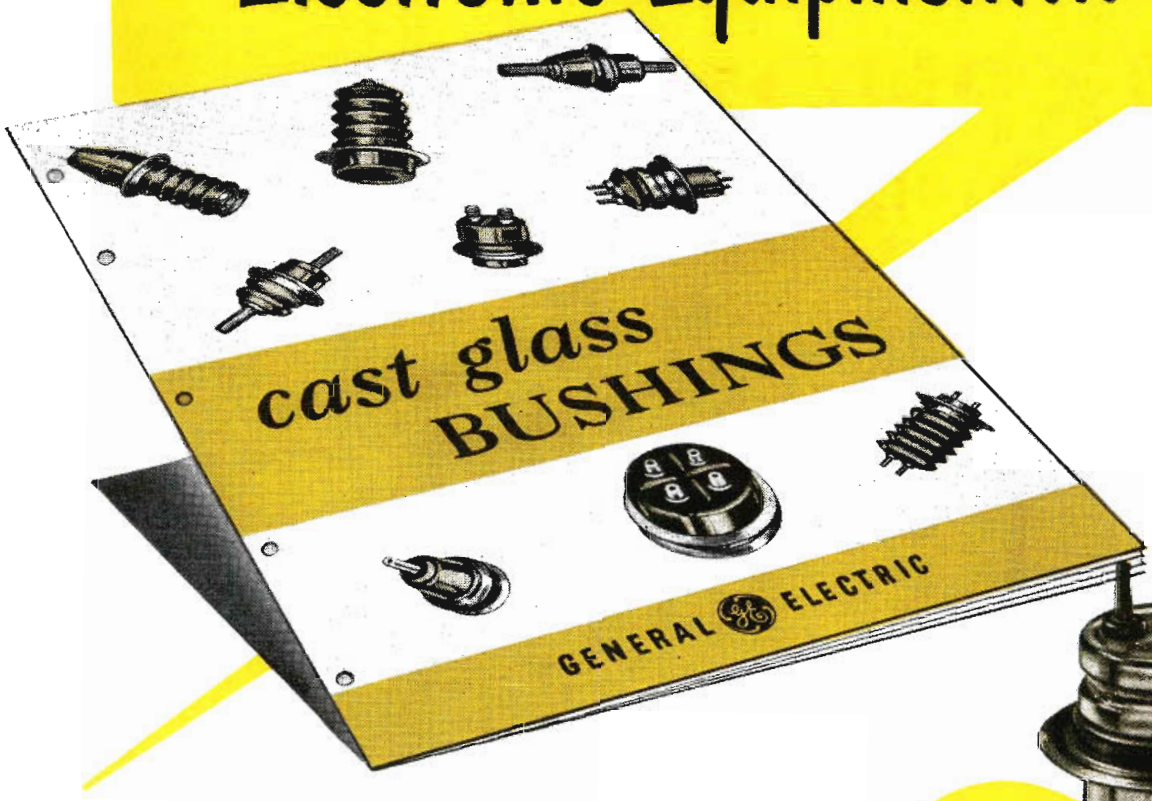
It enables Bell scientists to observe the behavior of microscopic impurities which affect the emission of electrons from vacuum tube cathodes. It is of great help in observing wear on relay contacts. And it may develop into a useful tool for measuring the distribution and penetration of preservatives in wood.

Thus, one of science's newest techniques is adopted by Bell Laboratories to make your telephone serve you better today and better still tomorrow.

BELL TELEPHONE LABORATORIES

EXPLORING AND INVENTING, DEVISING AND PERFECTING, FOR CONTINUED IMPROVEMENTS AND ECONOMIES IN TELEPHONE SERVICE.

If you manufacture Electronic Equipment...



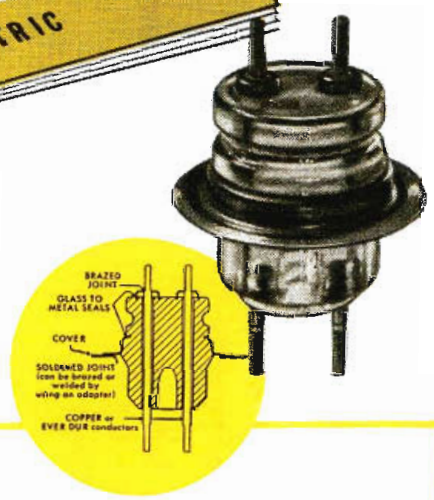
you'll want this bulletin on glass bushings

General Electric is now offering to other manufacturers the cast glass bushings it has used so successfully on many types of electrical equipment.

These bushings are cast of a stable, low-expansion glass. Metal hardware is a special nickel-alloy steel, fused to the glass in casting. Bushings can be attached directly to the apparatus without gaskets—by soldering, welding or brazing.

The resulting joint between bushing and equipment is permanent, vacuum-tight, and of high mechanical strength. It is especially desirable for equipment subject to vibration, shock, attack by fungus growth or severe changes in temperature. It eliminates moisture problems and often permits more compact, light-weight design of equipment.

Our bulletin, GEA-5093, contains a complete listing of standard designs now available—giving withstand voltages, current ratings and physical dimensions. A copy of this bulletin is yours for the asking. Just write *Apparatus Department, General Electric Company, Schenectady 5, New York.*



Class bushings are currently available to meet dry, 60-cycle, flashover values of from 10 to 50 kv, and in current ratings of 25 and 50 amperes (large sizes up to 800 amperes). They may be single or multi-conductor and can be provided with a top flange to permit mounting tube sockets directly on the bushings. Diameters range from 1⅝ to 3⅜ inches and weight from 2½ oz. to 4 lb.

GENERAL ELECTRIC

401-57

a "live wire" for hot spots

Vitrotex* Magnet Wire with Glass Fiber Insulation withstands temperatures of 130°C.

Highly Flexible . . . Amazing Space Factor — made possible by insulation of alkali-free glass, the insulation that's soft as silk and strong as steel!

High Dielectric Strength and Smooth Surface . . . resists moisture, acids, oils and corrosive vapors!

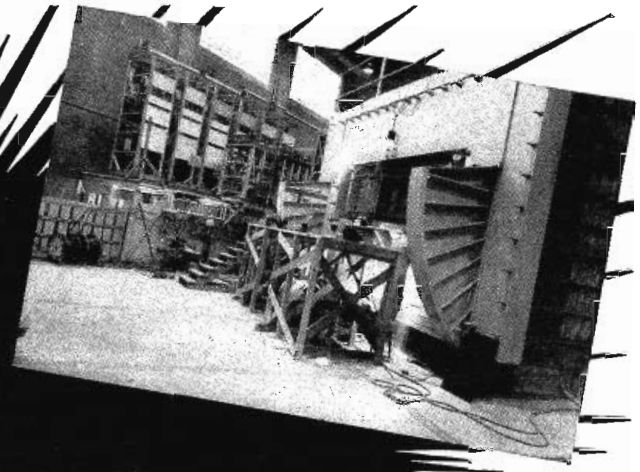
Vitrotex Windings Give Tighter, Safer Coils — for operation in confined spaces under high heat!

Ask the Anaconda Sales Office nearest you for complete information on the entire ANACONDA *Magnet Wire Line. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y., or 20 N. Wacker Drive, Chicago 6, Ill.*

*Reg. U. S. Pat. Off. 50322

The right wire for the job ANACONDA® **WIRE AND CABLE**

ATOM SMASHING with AEROVOX CAPACITORS



Aerovox Series '26 oil-filled stack-mounting capacitors. One or more units can be conveniently banked in series or parallel. Voltage ratings up to 150,000 D.C. Max. per unit.

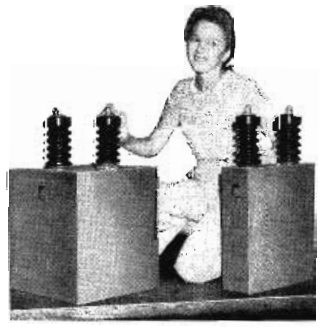
● This Atomic Age calls for huge capacitor banks in atom-smashing installations. Typical is the betatron installation at the University of Illinois, Urbana, Ill., with a capacitor bank totaling 12,960 mfds. made up of 648 units each rated at 20 mfds. 6000 volts D.C. Sufficient energy is stored in this capacitor bank to lift a 3000 lb. car 57 ft.!

Aerovox *engineering* and *experience* were important factors in the special design and processing required for the manufacture of these capacitors. Such skill is applied to *all* Aerovox production, regardless of type or size. *Every design is given individualized attention.*

Because of outstanding experience with oil-filled capacitors, together with production facilities difficult to duplicate elsewhere, Aerovox is meeting the rigid requirements of atom-smashing installations.

. . .

Likewise for other high-voltage needs such as deep-penetration X-ray, radio transmitting, high-voltage testing, carrier-current coupling, and electronic laboratory equipment, Aerovox offers the widest choice of tried-tested-proven capacitors backed by *application engineering second to none.*



Aerovox Series '20 steel-case oil-filled capacitors. Voltage ratings up to 50,000 D.C.W. Also dual units of 25,000 v. (12,500-12,500) for voltage doubler circuits.

● ***Try Aerovox first! Our engineers will gladly share their high-voltage capacitance "know-how" with you in solving your particular problem.***

AEROVOX capacitors

FOR RADIO-ELECTRONIC AND INDUSTRIAL APPLICATIONS

AEROVOX CORPORATION, NEW BEDFORD, MASS., U.S.A.

SALES OFFICES IN ALL PRINCIPAL CITIES • Export: 13 E. 40th St., New York 16, N. Y.

Cable: 'ARLAB' • In Canada: AEROVOX CANADA LTD., HAMILTON, ONT.

NO FLUX CORE SOLDER CAN BE NON CORROSIVE

BUT-
Super Flow SOLDER
IS LESS CORROSIVE THAN ANY OTHER SOLDER FLUX NOW NATIONALLY ACCEPTED (MINIMAL CORROSIVE)

What does this mean?

1 All solder fluxes must be corrosive to a certain extent.

2 Since there are no standards for evaluation of corrosive properties of solder fluxes in the industry, making the term non-corrosive meaningless.

Why is Super Flow less corrosive?

1 Because the rosin base is synthetic and of *controlled* purity.

2 Because the activator is stable and of *controlled* purity.

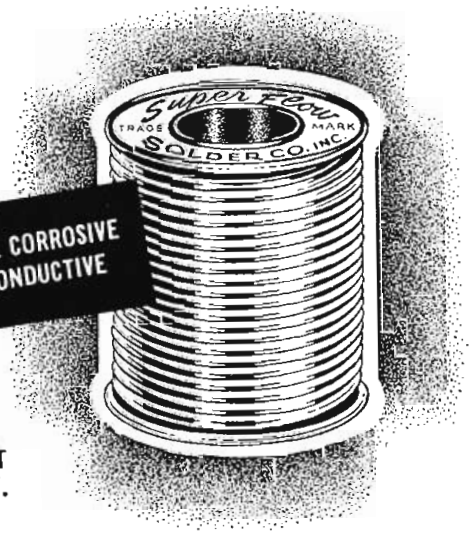
3 Because 1,000 hour laboratory humidity tests prove the difference.

4 Chemical analysis for the elements of corrosion (Nitrogen and Halides) micro - controlled, prove Super Flow Solder to be "minimal corrosive."

5 Less corrosive than regular rosin core solder.

Super Flow offers to the Electronics Industry a "minimal corrosive" high speed solder flux.

For information, samples, labaratory demonstration, or dealer information write to Super Flow Solder Co., Inc., 90 State St., Albany, N. Y.



MINIMAL CORROSIVE
NON CONDUCTIVE

Super Flow

SOLDER CO. INC. 90 STATE STREET ALBANY, N. Y.

See us at the I.R.E. Show in New York City on March 6, 1950

TELE-TECH
Formerly ELECTRONIC INDUSTRIES
TELEVISION • TELECOMMUNICATIONS • RADIO

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

UN's Big Plans for Radio

Radio engineers will be holding sessions along Lexington Avenue in New York this month. But if, between meetings, they will step three blocks east, they will find the great new United Nations site, as pictured on our front cover. And although the UN site and building are impressive, even more tremendous will be the part radio and electronic communication devices are scheduled to play in the worldwide operations of UN, in the world's search for an enduring peace.

Already constructed of the $65,000,000 group is the Secretariat building, to include latest methods of multi-lingual communication, estimated at over $2,000,000. Translation circuits, facsimile, telephone teletype and television services will connect all important centers.

On the roof will be the antenna of an FM transmitter for local dissemination of UN programs which are also to be carried by the international and national services. If, and when, the television freeze is lifted, plans call for the erection of a UHF television station here which will serve the New York area. For North American coverage the coaxial cable and microwave relays will be used.

★ ★ ★

The radio side of UN's worldwide activities will be carried on by high-power high-frequency transmitters. The presently used "Voice of America" transmitters will be replaced by two 100 to 200 kw transmitters operated by the UN, and capable, by the use of strategically positioned relay stations, of serving adequately any country in the world. It is probable that the relays will be in the Hawaii and Tangier, or Azores, areas. The experience of the US forces during the second World War has shown that a similar chain of stations near the equator provides alternate East-West paths in the event of atmospheric storms.

The world-wide radio system, estimated to cost $8,000,000 to $10,000,000, will include medium frequency transmitters located in the signatory countries which rebroadcast the programs of the high-frequency originating stations. At present this is done by stations leased or lent by the radio organizations of some of the participating countries. Unfortunately it is not always possible to ensure first class reception conditions under these arrangements and the new UN system envisaged should render greatly improved service.

Television, on the international side, will have to depend on film for contacts with foreign countries. The Conference Building will have radio, television and film studios for session reporting and program creation, and the commercial facilities of networks and kinescoping companies will be used to make video recordings. The existing UN film department will continue to make films, which, of course, will be both telecast and shown in motion picture theatres.

★ ★ ★

The United Nations is being provided with splendid buildings and rich facilities for carrying on its world deliberations.

But for UN's larger usefulness, and even more important than its buildings or its physical assets, — radio men can take pride in the fact that radio and the diversified uses of electron tubes are bound to become the strong right arm of UN in its work for world peace!

The RADARSCOPE — Revealing at a Glance,

RE-ARMAMENT

REVIEW MOBILIZATION PLANS—The "interim" plan for the mobilization of the electronics-radio manufacturing industries, to be put into effect at once in the event of a definite threat of war or upon the outbreak of war, was the subject of a review in mid-February by Federick R. Lack, chairman of the Electronic Equipment Industry Advisory Committee to the Munitions Board, who is a Western Electric vice president, with the Munitions Board's Communications-Electronics Committee. Another subject of review for refinements and strengthening was the projected long-range mobilization plan which would go into effect after a war has got underway.

FCC OUTLOOK

SUPER FREQUENCY-CONTROL BOARD—The most important proposal in the House bill to revise the communications act, sponsored by Rep. Sadowski, (D. Mich.) who heads the House Interstate Commerce subcommittee on the FCC, is the creation of an independent five-member Frequency Control Board to handle the apportionment of frequency assignments and renewals between government and non-government private radio services. The House subcommittee had planned to start its hearings late in February. At the same time, FCC Commissioner E. M. Webster, noted for his standing as a radio engineer both with the FCC and as chief of Coast Guard communications, pointed out in an address before the Armed Forces Communications Association in New York that the United States has no group which can work out a national frequency allocation position in dealing with foreign nations. Rep. Sadowski, in explaining the aims for the new Frequency Control Board, disclosed that the Interdepartment Radio Allocation Committee (IRAC) which recommends the government frequencies to be used by the military services and other government departments to the President, had never been given formal official status by a Presidential Executive Order.

New multi-channel magnetic-tape recorder by Brush Development Co., Cleveland, Ohio, shows great promise as means of discovering reasons for airport mishaps. Equipment, capable of recording 14 channels simultaneously, makes possible exact record of all communication between pilots and control tower operators. Three 7½-ft. relay racks house the three tape transport mechanisms, master control panel, amplifiers, playback and speaker unit. Each tape reel runs four hours and automatically starts second reel before finishing.

AUDIO

TAPE RECORDING—The advances of magnetic tape as a versatile and economical medium for professional recording are becoming more and more evident daily. Worthy of particular note is the fact that most disc recording studios today are tape recording the selection first, and later re-recording from the tape onto the master. Reasons for this practice include: ability to minimize "re-take" costs for poor starts, and "freezing" or nervousness by artists through tape erasing feature; ease of choosing "best performance" for re-recording to disc from several recorded on the same tape; ability to edit tape and obtain desired frequency accentuations or frequency responses. Tape also permits making a complete recording in sections, each section being made when it is most convenient for the concerned talent to be present, and later combining the sections for transcribing onto a master disc. Look to TELE TECH next month for some interesting professional tape recording statistics now being compiled.

MATERIALS

PORCELAIN BOTTLES—Many construction methods in radio tubes result from carrying along lamp-factory technics, where metal elements were built up from small tabs of metal and bits of wire welded together by hand, and glass envelopes and seals were used without question. Glass has never been extensively employed in other radio equipment for insulation, and at the presently-used frequencies has high losses. Furthermore the dielectric strength of glass decreases greatly at higher temperatures, so that tube failures occur at a power level well under that which other parts of the tube will stand. German scientists produced many tubes using ceramic envelopes. No unusual constructional technics were needed in making these containers, but a series of new sealing materials and lead conductor alloys were, of course, needed. Several forms of metal-ceramic fused bonds have now been developed. For example, Alsimag 243, being tried in many tube laboratories, has a loss factor almost one decimal order smaller than typical glasses.

TELEVISION

PIONEERING AT BRIDGEPORT—The pros and cons of UHF versus VHF, will receive a thorough going over in the coming months, as more information becomes available on the results of RCA-NBC's experiment at Bridgeport, Conn. It may well be that Bridgeport will acquire the same significance for the television world as Poldhu set the stage for Marconi and radio. Although this is not the first UHF experiment it *is* the first to carry the full *commercial* program of a VHF station and presume to offer *program service*. Results to date seem to indicate that the problems involved are not as great as were at first expected and many cases of good reception are reported. It may be that the disastrous television freeze can be lifted sooner as a result of this pioneer work.

UHF RECEIVERS

WHAT'S AHEAD FOR DESIGNERS—Now that UHF television broadcasts are underway experimentally at Bridgeport, Conn., and since there appears to be every likelihood of the FCC lifting the "freeze" during 1950, readers might find the following list of features that can be expected to characterize future UHF receivers interesting: Most popular types of receiving antennas are expected to be the well known, Yagi, the single Dipole or the "bow-tie". Transmission line impedance will probably be dropped to 72 ohms because of the bad weather effects suffered by 300 ohm ribbon at frequencies involved. Turrets and cavities are looked to as most popular tuner types, while the receivers themselves use the intercarrier system to minimize the effects of oscillator drift. There is every possibility that receiver intermediate frequencies will be upped appreciably to reduce spurious response effects and obviate the need for double superheterodyning. Finally, power supplies will be designed for better regulation characteristics, again to keep frequency drift at a minimum.

MICROWAVES

BETTER TV QUALITY—Microwaves continue to assert their importance to television and radio. The additional microwave-relay link system soon to be completed between New York and Chicago will provide sorely needed facilities for the transmission of higher quality television signals than is currently possible with the 2.5 MC coaxial cable. The decision of the FCC in compelling telephone companies to allow the interconnection of station-owned microwave equipment to telco lines is another step towards the full utilization of microwave service. Out in the West & Midwest new television stations connect with the coaxial line by the use of privately owned, or rented equipment. Although 7,000 MC is still the most popular band for TV, remote use manufacturers are now showing interest in the other assigned frequencies for this operation, such as 2,000 MC and 13,000 MC.

INDUSTRIAL TV

Washington medics inspect stomach interior by television. Col. W. L. Norvell hooked Remington-Rand's Vericon industrial-TV equipment onto gastroscope introduced into patient's innards. Many other surgical and industrial uses foreseen

MOBILE

$5 MILLION POLICE MARKET—Approximately 13,000 police cars have yet to be licensed for radio communications, according to GE figures. Majority of these cars will be licensed within three years if present rate continues. During 1950 police departments will spend $5,450,000 on radio equipment. There was an increase of 16% in licenses granted during 1949 as compared to 1948.

Five thousand police radio licenses have been granted in the United States and the total number of licensed vehicles for two-way radio police now approximates 40,000. Currently 11 state police organizations are licensed to use over 300 mobile units in their respective systems. One of the largest systems operated by the New York State Police, includes several hundred two-way mobile units in patrol cars, plus land stations and remote control units at key points.

MANUFACTURERS

HOW COMPETITORS CO-OPERATE for greater economies and efficiencies in the radio-TV industry, working through the engineering groups and committees of the RMA, is strikingly shown in diagrams and text on the three following pages. Here a listing of what may be considered as routine matters presents a remarkable summary of accomplishments. A simplified report on a number of the important RMA technical committees, using a breakdown that is rearranged somewhat from their own listings, is given on the accompanying chart—see next page.

How Competitors Co-operate in RMA

Survey of Standardization and Planning Activities Carried On by Engineering

BROADCASTING SYSTEMS PLANNING

In any communication system many alternate and sometimes equally useful operating methods are possible, but only one can be adopted to insure public utilization. The ideas and developments of many individuals and organizations are studied, tested, and evaluated and the best system standardized, after which the engineering cooperation of all groups is obtained to perfect the details.

Before any communication system standard can be set up many technical details are examined by RMA task groups made up of engineering experts, not only from RMA member companies but also others who are interested in the problem. In some cases many elaborate cooperative experimental programs are set up and the results carefully evaluated before a single standard is established for the industry.

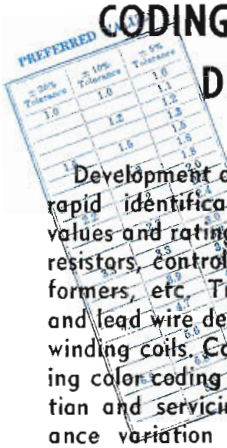
SYSTEMS ENGINEERING PRACTICES

After the basic plan has been established, many operating practices must be set up before the system can be fully utilized. For example considering the television system standards: Carrier levels, frequency control requirements synchronizing pulse details, ospect ratio, color systems, flicker, studio technics and facilities, relay problems and network connection details, studies of problems relating to allocation matters must all be warked out and information relating to their utilization must be made available to all concerned. Similar activities in fields of A-M and F-M broadcasting, facsimile, short-wave reception and problems dealing with industrial and natural sources of interference, etc., have been carried on. Recent standards, for example have been issued for audio facilities for broadcasting and commercial sound sytems after surveys of industry needs.

SYSTEM ENGINEERING PRACTICES

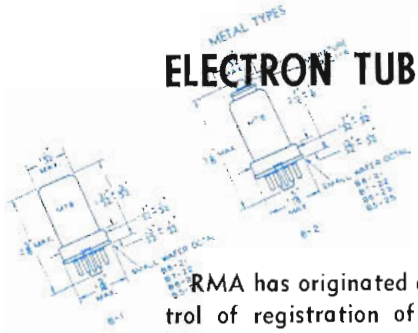
SPONSORED BY RMA

MARKING CODING DETAILS DESIGNATIONS



Development of color codes for the rapid identification of component values and ratings; for application to resistors, controls, capacitors, transformers, etc. Transformer terminal and lead wire designations for multi-winding coils. Cable and chassis wiring color coding for rapid identification and servicing coding of resistance variation tapers for variable controls, panel and terminal board designations and arrangements, code marking of pilot lamps, marking of ceramic capacitors. Listing of preferred value series and talerances.

ELECTRON TUBE ENGINEERING



RMA has originated and long carried on the control of registration of tube type designations to avoid duplication. Publication thru JETEC of critical characteristic data on all registered tubes electric characteristic as to mechanical dimensions, basing, terminals, nomenclature, etc. Codification of cathode ray tubes as to phosphors, sizes, basing, electrical characteristics, safety hazards and socket dimensions. Interchange of information relating to packaging, packing, shipping methods and practices.

for Greater Industry Economies

Committees of the Radio Manufacturers Association ***(See also following page)***

SPECIFICATIONS DETAILS & TESTING METHODS

To insure that test data is useful to both manufacturer and user and to avoid rerunning tests standard methods and test equipment have been selected by engineers from both groups covering both components and finished equipment.

For example the RMA has had sampling procedures worked out. Temperature rise limits defined. Overload limitations established. Receiver test setups described. Test equipment essentials described to permit duplication. Test specifications studied relating to temperature, humidity, salt spray, shock hazards, vibration, tropicalization, etc.

CIRCUIT COMPONENT STANDARDIZATION

Since all communication systems and electronic devices are constructed from different combinations of simple components, a single part may serve in many ways. The complete codification of the characteristics and capabilities of all components permits proper selection, operation and promotes interchangeability. These matters are handled by the many service committees of the RMA made up of technical representatives from manufacturers of essentially all components finding use in electronic equipment.

APPARATUS MANUFACTURING STANDARDS

SPONSORED BY RMA

EQUIPMENT ASSEMBLIES & ACCESSORIES

In addition to the standardization of components the interconnection of complete assemblies is frequently necessary. Therefore studies have been made of the general requirements relating to; receiving antenna characteristics, dipoles and transmission lines; specification of apartment house and multiple installation antenna characteristics; reports on standards for phonograph record changers, records, pick-ups and needles; details of wire and tape recorders, remote amplifiers, sound reinforcing amplifiers, PA systems and accessories, battery and mobile power sources, and others. In fact in all radio fields, general standards of good engineering practices have been planned by RMA committees and publicized. For example, in the broadcast field details of antennas, transmission lines, S-T links, fidelity; frequency stability, modulation control methods have been promoted.

ELECTRICAL & PHYSICAL PROPERTIES OF APPARATUS

Standardization of mounting dimensions. Simplifications of threads, screws, nuts, washers, etc., by preferred listings. Listing of methods which insure accessibility, interchangeability and simplify replacement in servicing. Results: Reduction of spare parts and replacement stock requirements in manufacturing plants and in the field. Elimination of unnecessary close production tolerances in dimensions wherever possible.

HOW COMPETITORS CO-OPERATE (Continued)

RMA and IRE engineering committees compile and adopt radio-component standards for greater manufacturing economies

THE radio-communications industry in the US alone has grown during the past half century so that it exceeds the 2½ billion dollar per year level. Because of several factors that are unique in this field its processes have been extended to practically all other present-day activities in industry, commerce and art.

Any survey of the reasons for this growth would show that no small part has been due to the wholehearted cooperation of competing manufacturers in promoting technical standards and practices through industry organizations. The present trend toward an even more rapid expansion in fields that heretofore have been only side issues will require even closer cooperation between these engineering study and task groups. This operation provides an example of how American industry shares its technical knowledge without surrendering the advantages of competition which it needs, in order to keep alive.

While many organizations have had a part in this work, the Radio Manufacturers Assn., and the Institute of Radio Engineers have been particularly effective in securing this inter-industry cooperation. Many projects have been specifically undertaken by active groups in these Associations organized as committees composed of members from highly-competitive companies for the sole purposes of bettering the systems and products.

Industry Problems

Before taking up the specific fields where this activity has been particularly effective, a short description will follow of some of the unusual problems with which this industry has to cope.

Unlike most other large manufacturing operations, the radio industry mainly utilizes vast numbers of small components: Tubes, sockets, resistors, capacitors, etc. A small shop with even one employee has access to the same parts (at not greatly different prices) as does the largest manufacturer with production covering acres of space. Basic mounting cabinets, panels, racks, etc., in standard forms are available or can be readily fabricated in small shops should a special form be desired. However complete or even partial acceptance of these standards is entirely optional. But their utility is so apparent that they are almost universally observed.

The components themselves are usually the product of either a small specialty manufacturer or a former small producer who has grown large by his having developed a better item or one that is produced by application of unique manufacturing principles so that more economical, consistent and reliable units result.

Thus instead of a few manufacturers of radio-electronic equipment we find thousands. A small need—a temperature control for a special annealing furnace, the specialty of a small shop—buys essentially the same parts that are used in a large number of other radio products having sales possibly in the millions. FM radio receivers, television receivers, public address amplifiers etc., use essentially the same general components used in regular radio receivers, so that any component manufacturer is assured a large customer patronage if he can produce a superior item.

It will be seen that the matter of interchangeability in every respect is of extreme importance. This starts with uniformity in thinking, that is, in completely defining all the terms that are used in the specifications. This part of the job is handled in IRE committees. With such a start, where everybody talks the same language, a producer and his engineers can readily specify their needs. He knows that most of the items will have standard dimensions and can be mounted with simple known procedures.

He can be sure of its capabilities, its tolerances, and how much of a load can be safely applied, since these and other matters have been settled according to industry standards. Such codes of production standards and listings of accepted practices in engineering design have been built up over this last quarter century of radio progress entirely by cooperation across the whole industry.

All physical dimensions, designation codes, value and tolerance listings and details pertaining to interchangeability in manufacturing have been handled by the Radio Manufacturers Association. Engineering and theoretical definitions of terms, characteristics as they relate to technical literature of research and engineering and the basic methods of measurements and other matters relating to the profession of radio engineering usually fall to the standards groups of the Institute of Radio Engineers. Definitions and physical descriptions as they relate to manufacturing and production needs are handled by RMA.

From the Constitution of the

RADIO MANUFACTURERS ASSOCIATION

1317 F St., NW, Washington 4, D. C.

"The objects of the Association shall be: To foster, encourage and promote laws, rules, regulations, customs and practices which will be for the best interest of the public and the radio and electronic industry."

IRE Organized Before RMA

The IRE was organized many years before the RMA, since in the early days all equipment items were special and standardization could not take place until the engineering and theoretical aspects of the problems were studied and answered.

However, the RMA was formed soon after the hectic period following the advent of broadcasting to make faster progress in standardizing the basic elements and materials used in all types of radio equipment. Another objective was to present a united central clearing house for the industry as to the public's needs, governmental assignment of frequencies. In addition the establishment of an information center relating to foreign markets, transportation methods, tax and depreciation problems, for facilitating inter-company cooperation for the development of large military projects, and numerous other objectives was undertaken.

These facilities have increased each year, in spite of the intense competition that exists between the member companies. Theories and engineering practices are the problems of individuals so that the IRE, developed to promote these objectives, is composed of individuals. On the other hand the RMA is concerned with the completed products of the industry and the materials and components used in their fabrication. Membership is confined to companies. For this reason the great variety of activities of the RMA are hardly known to most individuals, even those who may have served on one of the many technical committees set up to solve specific problems.

WTTG Field Strength Survey

Results of comprehensive field intensity measurements using continuous radial recording method shows correlation between predicted and measured values

By ROBERT P. WAKEMAN

Allen B. DuMont Laboratories, Inc. Research Div., Passaic, N. J.

DURING July and August 1949 a field intensity survey was made of the service area of WTTG, Washington, D. C., to determine if the station was providing satisfactory coverage from its new location. In the case of this survey continuous readings were taken rather than clusters as had been done previously.

Eight approximately equi-spaced radials were laid out emanating from the WTTG transmitter. The azimuths were selected from a consideration of population densities and the availability of roads suitable for mobile measurements. In particular, roads running in the same general direction as the radials were considered first.

At the starting point of each radial the Measurements Corporation M-58 field strength meter was set up to feed the Esterline Angus milliammeter recorder. The speed of the bus was kept at twenty to twenty-five miles per hour and frequent check points were marked simultaneously on a topographic map and on the recording tape.

The tape on the Esterline Angus recorder was run at a speed of 5 in./mile. The time constant of the equipment was 0.3 sec.

The bus was equipped with two antennas, one omni-directional, at twelve feet, and a Brach Duoband at twenty-eight feet. At several check points on each radial comparative measurements were made on Brach antennas at twelve and twenty-eight foot heights. It was found that, statistically, a linear height gain relationship exists. (This is in accord with the conclusions of the Ad Hoc Committee).

The antenna used for the mobile recordings consisted of a pair of crossed dipoles cut for channel 5. Prior to the survey, this antenna was tested at its 12-foot height and at its mounting at the rear end of the bus and was found to have a very satisfactory omni-directional characteristic.

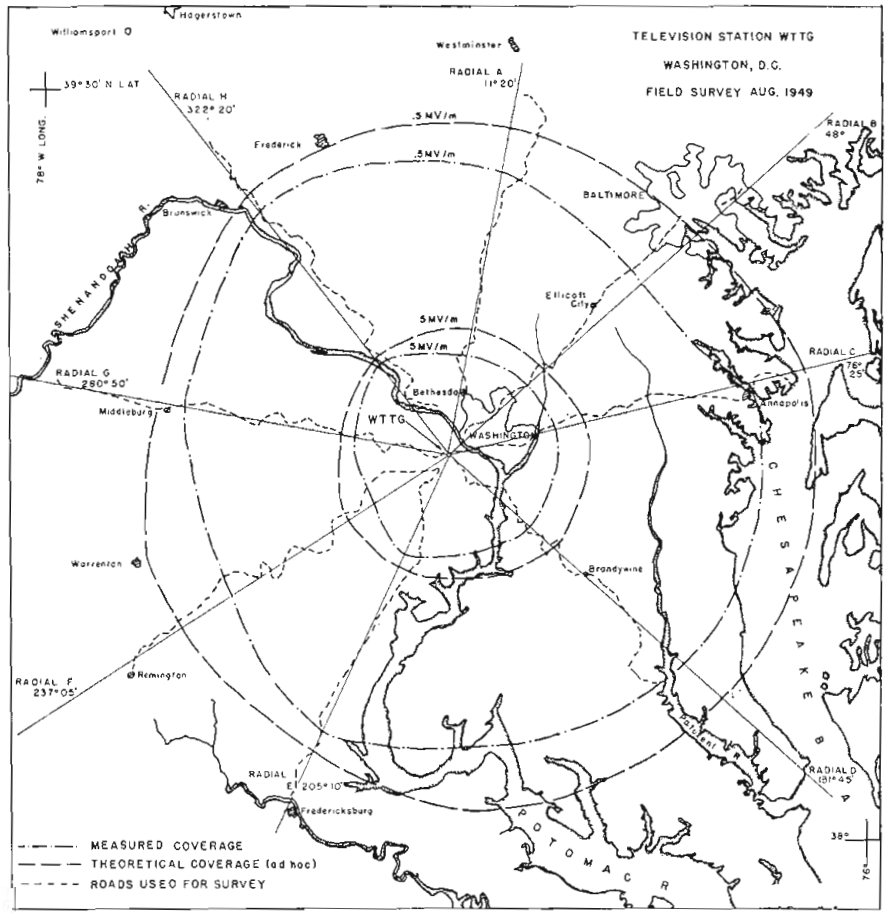


Fig. 1: Outline map of the Washington area indicating the eight radials followed and theoretical and measured contours. The contour bulges along water routes are normal

Types of Video Modulation

The two types of video modulation encountered during these tests, test pattern and program caused a variation of less than 5% in the received fields. This factor was therefore excluded from the calculations.

During the tests, the measuring equipment in the Du Mont bus was checked against the measuring equipment in use at the Federal Communications Commission Field Laboratory at Laurel, Md. Excellent corelation with a variation of less than 5% was obtained between the measured fields on the two sets of equipment.

During the entire survey the transmission line voltage at the transmitter was monitored with a diode rectifier and an Esterline-Angus Recording meter. An analysis of the tape indicated that no significant variations occurred in this voltage at any time when measurements were being taken.

Fig. 1 is an outline map showing the Washington area, the location of the radials, the routes traversed by the mobile unit and the theoretical 5 mv/m and 0.5 mv/m contours. Also shown on this figure are

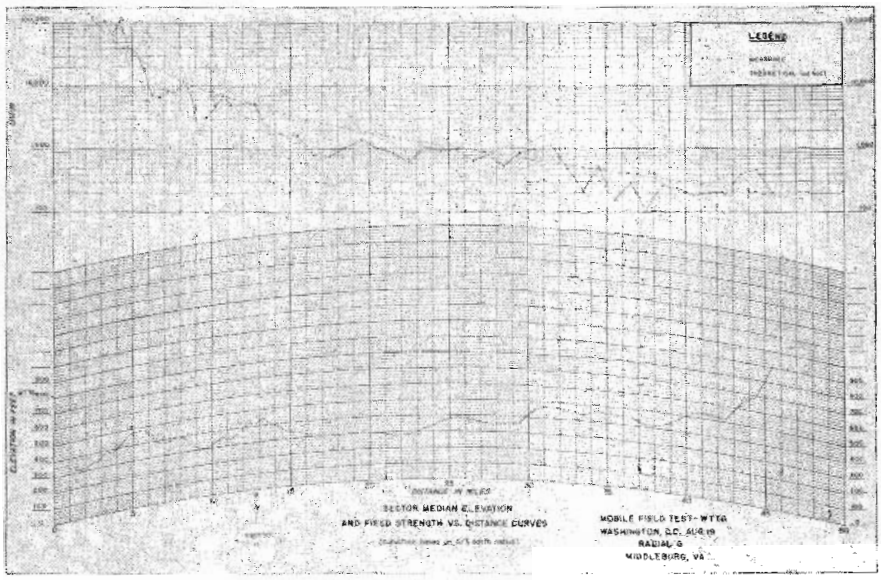


Fig. 2: Chart used to calculate median elevation and field strength vs. distance for the measurement route followed on radial G. A planimeter was used to find mean values

the curves obtained from the mobile measurement data. Using the charts, one of which is shown in Fig. 2, the deviation in db (.1" = 1 db) from the Ad Hoc theoretical value at each of the section midpoints was tabulated for each radial. These deviations were added and then divided by the applicable number of points, thus giving a db figure equal to the mean deviation of the measured data to the corrected theoretical. In every case the deviation was

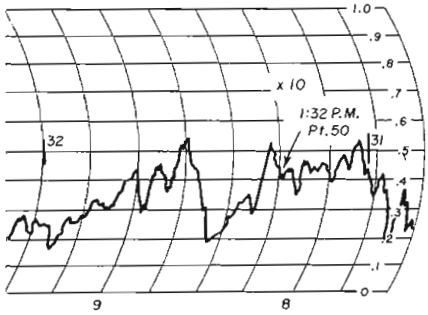


Fig. 3: Section of Esterline Angus tape shows check marks on 31-32 mi. section of radial G

negative and ranged from −1.4 db on Radial H to −6.3 db on Radial B. The average of the eight radials was found to be −4.1 db.

Fig. 2 is a detailed study of Radial G. The abscissa indicates air line distance from the WTTG transmitter to the sector midpoint The lower ordinate indicates the mean elevation of the sector above mean sea level and the upper the mean field strengths in microvolts per meter, theoretical and measured.

The tape, having been noted with frequent check points, was marked off in half-mile sectors for the first 15 miles and one-mile sectors out to the end of each radial. The mean ma. reading for each sector was obtained through the use of a planimeter. Curves were constructed from the calibration of the Esterline Angus recording tape with the M-58 Field Strength Meter. The linear height gain factor, the peak to average factor for the M-58, and the conversion factor of the microvolts received at the antenna terminals to microvolts per meter were then applied to give the final microvolt per meter readings shown on the charts.

Topographical maps were used to find the airline distance from each sector midpoint to the WTTG transmitter. The mean elevation of each sector was obtained from the map and plotted on the charts.

Fig. 3 is a sample copy of a sector of an original tape recording. On this sector were recorded a check point, the M-58 scale factors, the mileage, the date and the time at which the vehicle passed the check point. This is the 31-32 mile sector on Radial G.

Sample Computations

In order to obtain a suitable conversion factor from ma. on the recording tape to microvolts per meter at a height of 30 ft., the following procedure was followed. The ma. readings were converted into microvolts at the receiver terminals. At several locations, where a minimum amount of reflection was experienced, the field strength was obtained by measuring the voltage received on a standard dipole and dividing this value by λ/π (the effective length of a half wave dipole). In each case the field strength was then compared to the voltage measured on the omni-directional antenna. The average ratio thus obtained was: $\bar{E} = 1.09\ e$ where; $\bar{E}$ = Field Strength in Microvolts per meter; e = Voltage received at receiver terminals.

As has been reported previously, the relationship between voltages measured on the M-58 and RMS sync peak voltages entails the use of a 1.33 factor.

A factor of 2.5 was employed to convert from the twelve foot height at which the measurements were made to the thirty foot height on which the theoretical curves are based.

The final conversion factor was, therefore, obtained as follows:

$\bar{E}\ (p,30) = 1.09 \times 1.33 \times 2.5 \times e = 3.64\ e$; $\bar{E}\ (p,30)$ = Field Strength

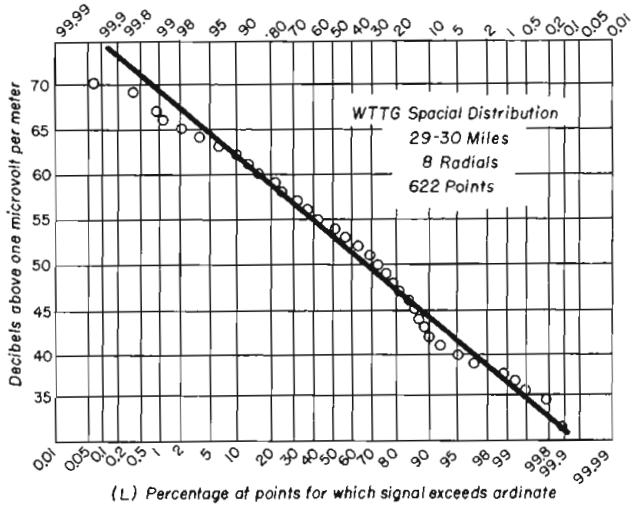


Fig. 4: Chart showing percentage of points on the eight radials where the field strength is greater than that normally expected from the theoretical curve. Inspection shows that the distribution is well in accordance with the predicted figures. The large sample used in preparing this curve reduces the risk of excessive errors. Average variation is −5 to −7 db.

of sync peaks at 30 feet in microvolts per meter; e = Voltage at receiver terminals in microvolts.

As an example the mean field strength of the sample portion of recording tape, 31-32 miles on Radial G, was found as follows:

The air line distance to the sector midpoint was 31.5 miles and the mean tape reading for this sector 0.37 ma. From the M-58 vs. Esterline Angus tape calibration and the $\times 10$ attenuation factor of the meter, it was found that 320 μv existed at the receiver terminals. The final field strength for this sector was therefore:

$320 \times 3.64 = 1170$ μv/m

μv factor field strength

The data were analyzed as follows. The one-mile sections of the recorder tapes taken on the 8 radials between 6 and 7 miles from the transmitter were divided into very small sub-sections (approximately 75 points for each one-mile sector). The field strength was then read for each of the approximately 600 points (for 8 radials) located at a

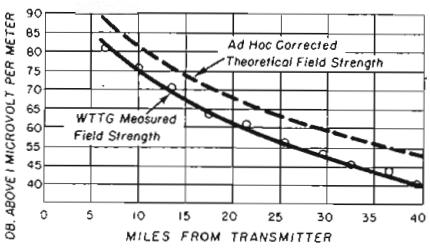


Fig. 5. Comparison of Ad Hoc theoretical curve and measured WTTG field strength

distance of 6 to 7 miles from the transmitter. These measurements were converted to db's above 1 microvolt per meter and plotted on arithmetic probability paper. This same procedure was carried out for 9 other representative distances from the transmitter, the farthest being 39-40 miles. Also from the data, the mean value and the standard deviation were computed for each distance. The straight line shown on each of the distribution graphs represented a normal distribution having the mean value and standard deviation computed from the data taken at that distance. Examination of these charts indicated that the distribution approximates normal. Figs. 5 and 6 show the median value versus distance from the transmitter and standard deviation versus distance from the transmitter respectively. The dashed curve on the first of these two graphs is the theoretical smooth earth curve as corrected in accordance with the Ad Hoc report. Examination of this graph indicates that the measured median values vary from 5-7 db below this theoretical value.

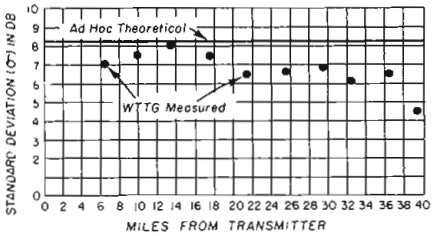


Fig. 6. Standard theoretical Ad Hoc deviation compared with measured field strength

Final Graph

The final graph showing the standard deviation as a function of distance indicates a systematic decrease in this parameter with increasing distance from the transmitter. Principally because of lack of evidence to the contrary, the Ad Hoc Committee was forced to assume that no such systematic variation existed. The horizontal dashed line on this curve shows the standard deviation as predicted in the Ad Hoc report. The fact that all points lie below this predicted value may be due to the relative flatness of the terrain in the Washington vicinity, but it seems quite probable that the decrease with distance is significant and possibly warrants consideration in the study of interference problems.

The planimeter method of analysis employed for Fig. 2 yielded the mean or average value of field strength in in μv/m for each sector. This is the value plotted on the chart, Fig. 2. In the case of Fig. 4, however, the individual readings were converted to decibels above one μv/m. As was shown in the Ad Hoc report, the spatial distribution, when the field strengths are expressed in decibels, is approximately normal. In such a distribution, the mean (average) value and the median (that value exceeded by half the measurements) are the same. Consequently the 50% values shown on the charts in Fig. 4 are the median values of field strength at the several distances. An idea of the relationship existing between the mean value and the median value may be obtained by comparing Fig. 2 with the final curve of Fig. 6. The mean deviation of the entire data from the theoretical value was −4.1 db. Although the complete data were not analyzed for Fig. 4, the sample was very large and there is no reason to believe that a larger sample would affect the results perceptibly. As shown the median values differ from the theoretical by −5 to −7 db. Thus the median is somewhat smaller than the mean value. This is to be expected since the logarithm of the average is always equal to or greater than the average of the logarithms.

(*Continued on page 70*)

NBC Installs Rear Projection Process Screen

The National Broadcasting Company has installed a new rear projection process screen equipment in its New York studios. Previously the use of movies for background projection on television stages was fraught with difficulties. Film normally runs at 24 frames per second, and television has a frame rate of 30 frames. Thus standard movie projectors had to be speeded up to prevent the formation of shutter bar lines on the television screen. It also necessitated the making of special 30 frame per second film so that the increased speed would not result in abnormally fast action on the screen and precluded the use of library stock footage.

The new equipment utilizes a 16mm Holmes Projector Co. movement specially made for 3-2 projection, i.e. the normal television film projection sequence, in which one frame is exposed three times and the next twice. This converts the film 24 frame speed to 30 for TV scanning. A picture as large as 9 by 12 feet can be obtained from the equipment using a 30 amp. arc lamp with a throw of about 18 feet, and smaller ones can be produced by using a 2000 watts incandescent light source.

The superior results obtained by this equipment are due in no small part to the Trans Lux screen. This is a screen specially produced for rear projection where there is a large amount of "spill" light, or high ambient lighting. The screen is made of plastic and somewhat directional within an arc of about 45 each side of the normal to the screen. This of course results in a light gain which improves screen lighting and contrast, however, a highly directional screen cannot be used since camera shot angles are not fixed, and it might be necessary to shoot from a very wide angle with consequent loss of light.

The screen is tinted, and in fact is somewhat black in appearance. This is the feature which increases its resistance to spill ambient light and of course improves contrast considerably. Operation is similar to the black screen kinescopes in which dark picture areas remain black, and only the parts where highlights appear are illuminated.

IRE Convention and

Four-day gathering, scheduled for March 6-9,

COMMUNICATIONS PAPERS

MONDAY, MARCH 6

Symposium: Industrial Design

"Evolution and Growth of Industrial Designing"—John Vassos, Designer, New York, N. Y.

"Procedure in Industrial Designing"—Clyde Peterson, Westinghouse Electric Corporation, Sunbury, Pa.

"Cost Reduction Possibilities in Industrial Design"—W. B. Donnelly, General Electric Company, Syracuse, N. Y.

"Sales Attitude Towards Industrial Design"—E. P. Toal, North American Philips Company, New York, N. Y.

Applications of Semi-Conductors

"Transistor Trigger Circuits" — Herbert J. Reich and Peter M. Schulteiss, Yale University, New Haven, Conn.

"Mathematical Theory and Applications of Silicon Crystals for Mixing and Harmonic Generation at Microwave Frequencies"—P. D. Strum, J. W. Kearney, and J. C. Greene. Airborne Instruments Laboratory, Mineola, L. I., N. Y.

"Considerations in Low Noise Figure Microwave Receiver Design"—M. T. Lebenbaum and P. D. Strum, Airborne Instruments Laboratory, Mineola, L. I., N. Y.

Systems I—Communication Theory

"Representations of Speech Sounds and Some of their Statistical Properties"—Sze-Hou Chang, George E. Phil and Martin W. Essigmann, Northeastern University, Boston, Mass.

"Speech Transmission Through Restricted Bandwidth Channels"—M. J. DiToro, W. Graham, and S. Schreiner. Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"Application of Communication Theory to Periodic Radio Systems"—M. Leifer and N. Marchand, Sylvania Electric Products Inc., Bayside, L. I., N. Y.

"Some Aspects of Data Transmission over Narrow Band Communication Circuits"—Millard M. Brenner, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"The Statistical Properties of Noise Applied to Radar Range Performance"—S. M. Kaplan and R. W. McFall, General Electric Co., Scheneetady, N. Y.

Quality Control

"Accelerated Life-Testing of Vacuum Tubes"—Jerome Rothstein, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Statistical Evaluation of Life Expectancy of Vacuum Tubes Designed for Long-Life Operation"—Eleanor M. McElwee, Sylvania Electric Products Inc., Kew Gardens, L. I., N. Y.

'Application of Statistics to Acceptanee Specifications"—B. Koslow, Allen B. DuMont Laboratories, Inc., Clifton, N. J.

"Statistical Methods in Research and Development"—L. Lutzker, Allen B. DuMont Laboratories, Inc., Passaic, N. J.

"Statistical Engineering of Tolerances" — Eugene D. Goddess, Sylvania Electric Products Inc., Boston, Mass.

TUESDAY, MARCH 7

Symposium: Engineering for Quality in TV

"Top Management Evaluates Quality in Terms of Sound Engineering"—Allen B. DuMont, Allen B. DuMont Laboratories, Inc., Passaic, N. J.

"Statistics—A New Tool for the Planning and Analysis of Laboratory Experiments"—Enoch B. Ferrell, Bell Telephone Laboratories, Inc., New York, N. Y.

"Specification for Quality of the Visual Output of Picture Tube Screens"—A. E. Martin, Sylvania Electric Products Inc., Bayside, L. I., N. Y.

"The Importance of Practical Design and Specifications for Effective Production and High Quality"—J. Manuele, Westinghouse Electric Corporation, East Pittsburgh, Pa.

Antennas I

"Waveguide Applications of Artificial Metallic Dielectrics"—W. E. Kock, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

"The Effects of Anisotropy in a Three-Dimensional Array of Conducting Discs." — Gerald Estrin, University of Wisconsin, Madison, Wis.

"A Study of Single-Surface Corrugated Guides" Walter Rotman, Air Force Research Laboratories, Cambridge, Mass.

"A Study of the Current Distribution on the Helix."—James A. Marsh, Ohio State University, Columbus, Ohio.

"Diffracted Beams in Metal Lenses."—Albert E. Heins, Carnegie Institute of Technology, Pittsburgh, Pa.

Systems II—Transmission Systems & Relays

"Signal Corps High-Frequency Radio Communication Research and Development."—John Hessel and H. F. Meyer, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Military Single Sideband Equipment Development."—R. A. Kulinyi, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Radio Relay Design Data 60 to 600 Mc."—R. Guenther, Signal Corps Engineering Laboratories. Fort Monmouth, N. J.

"Multiplex Microwave Radio Relay."—D. D. Grieg and A. M. Levine. Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"Cross Talk in Frequency and Phase-Modulated Radio Relays Used in Conjunction with Multi-channel Telephony Equipment."—Saul Fast, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Measurements

"Oscillographic Presentation of Time Delay and Distortion in Broad-Band FM Systems."—A. R. Vallarino, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"Rockets Range Instrumentation."—E. R. Toporeck and F. M. Ashbrook, U. S. Naval Ordnance Test Station, Inyokern, Calif.

"New Test Equipment for the UHF Television Band"—John Ebert and H. A. Finke, Polytechnic Research and Development Company, Inc., Brooklyn, N. Y.

"Direct Reading Phasemeter"—L. H. O'Neill and J. L. West, Columbia University, New York, N. Y.

"Measuring Procedure for Radiotcletype Converters"—H. C. Hawkins, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Television I—Transmission Systems

"5 Kw Visual and 2.5 Kw Aural Television Amplifiers"—P. Breen, Allen B. DuMont Laboratories, Inc., Passaic, N. J.

"Design Considerations in TV Transmitters"—L. Pollack, E. Bradburd and I. Krause, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"Widcband RF Problems in TV Transmitters"—E. Bradburd and L. Pollack, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"The Vidicon—A New Photoconductive Television Pickup Tube"—P. K. Weimer, S. V. Forgue, and R. R. Goodrich, RCA Laboratories, Princeton, N. J.

"Industrial Television System"—R. C. Webb and J. M. Morgan, RCA Laboratories, Princeton, N. J.

Passive Circuits—Filter Circuits & Variable Networks

"Frequency Analysis of Variable Networks"—Lotfi A. Zadeh, Columbia University, New York, N. Y.

"Distortion Bandpass Considerations in Angular Modulation Systems"—Albert A. Gerlach, Illinois Institute of Technology, Chicago, Illinois.

"Concerning the Lowest Possible Unloaded Q's Which Can Be Used in Multiple Resonant Circuit Filters"—Milton Dishal, Federal Telecommunication Laboratories, Nutley, N. J.

"Tunable Microwave Waveguide Filters"—W. Sichak and H. Augenblick, Federal Telecommunication Laboratories, Nutley, N. J.

"Filters for Television Interference"—A. M. Seybold, Radio Corporation of America, Harrison, N. J.

Antennas II

"On the Relation Between the Geometry and the Impedance Characteristic of Typical Radiating Systems"—T. H. Crowley and V. H. Rumsey, Ohio State University, Columbus, Ohio.

"A Method for Studying the Response of Loops to the Electromagnetic Field"—Beverley C. Dunn, Jr., Harvard University, Cambridge, Mass.

"Measurement of the Radiation Efficiency of Elliptically and Linearly Polarized Antennas"—John Rowen, Ohio State University, Columbus, Ohio.

"Broad Band Unidirectional Antenna 50 to 170—Mcs"—V. J. Colaguori and R. Guenther, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Antenna System for Very High Frequency Radio Ranges and Direction Finding"—F. J. Lundberg and F. X. Bucher, Federal Telecommunication Laboratories, Nutley, N. J.

Systems III—Modulation Systems & Band-Width Requirements

"Product Phase Modulation and Demodulation"—D. B. Harris and D. C. McCoy, Collins Radio Co., Cedar Rapids, Iowa.

"Some Novel Methods for the Generation of PCM"—N. R. Castellini, D. L. Jacoby and B. Keigher, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"A High-Capacity Matrix-Commutated Radio Telemetering System"—J. P. Chisholm, E. F. Buckley, and G. W. Farnell, Massachusetts Institute of Technology, Cambridge, Mass.

"Techniques for Closer Channel Spacing at VHF and Higher Frequencies"—Charles F. Hobbs and Walton B. Bishop, Air Force Research Laboratories, Cambridge, Mass.

Symposium: Television

"A round-table discussion will be held on current television developments, including the following tentative subjects"

"a. UHF Allocations"—J. D. Reid, Crosley Division of Avco Manufacturing Corp., Cincinnati, Ohio

"b. Black and White versus Color"—T. T. Goldsmith, Jr., Allen B. DuMont Laboratories, Inc., Clifton, N. J.

"c. Color in General"—D. B. Judd, National Bureau of Standards, Washington, D. C.

"d. The RCA Color System"—E. W. Engstrom, RCA Laboratories, Princeton, N. J.

"e. The CBS Color System"—P. C. Goldmark, Columbia Broadcasting System, New York, N. Y.

"f. The CTI Color System"—D. K. Lippincott, Color Television Inc., San Francisco, Calif.

"g. Compromises Necessary for a Color System to Fit a 6 Mc Band"—A. G. Jensen, Bell Telephone Laboratories, Inc., Murray Hill, N. J.

WEDNESDAY, MARCH 8

Television II—UHF & Color TV

"A 1 kw UHF Television Transmitter"—T. M. Gluyas, Radio Corporation of America, Camden, N. J.

Radio Engineering Show

will include presentation of 169 papers

"A Super-gain UHF Television Transmitting Antenna"—O. O. Fiet, Radio Corporation of America, Camden, N. J.
"Design of a Hybrid Ring Diplexer for Ultra-High-Frequency Television Use"—W. H. Sayer and J. M. DeBell, Jr., Allen B. DuMont Laboratories, Inc., Passaic, N. J.
"Construction and Operation of an Experimental UHF Television Station"—Raymond F. Guy and Frederick W. Smith, National Broadcasting Co., New York, N. Y.
"Electro-Optical Filters for Color Television"—Victor A. Babits and H. Frank Hicks, Jr., Rensselaer Polytechnic Institute, Troy, N. Y.

Electron Tubes I—Theory & Design

"Monoformer"—A. C. Munster, Philco Corp., Philadelphia, Pa.
"A New Type of Frequency Control Tube"—R. W. Slinkman, Sylvania Electric Products Inc., Emporium, Pa.
"MIT Electrostatic Storage Tube"—S. H. Dodd, H. Klemperer, and P. Youtz, Massachusetts Institute of Technology, Cambridge, Mass.
"Performance and Analysis of a Transverse Current Traveling-Wave Amplifier and Limiter"—L. W. Field, Stanford University, Stanford, Calif.
"An Experimental Electron Tube Using Space-Charge Deflection of the Electron Beam"—J. T. Wallmark, RCA Laboratories, Princeton, N. J.

Active Circuits I—Amplifiers

"The Analysis and Design of a Band-Pass Distributed Amplifier"—V. C. Rideout and T. P. Tung, University of Wisconsin, Madison, Wis.
"An Investigation of the 400-Megacycle Amplifier Performance of the Type SN-973R Subminiature RF Pentode"—Norman B. Ritchey, Sylvania Electric Products, Inc., Kew Gardens, L. I., N. Y.
"An Extension to Stagger-Tuned Amplifier Design"—Joseph M. Pettit, Stanford University, Stanford, Calif.
"Ultra-High Gain Direct-Coupled Amplifier Circuits"—W. K. Volkers, Consulting Engineer, Scheneetady, N. Y.
"Analysis and Design of Self Saturable Magnetic Amplifiers"—S. Cohen, Sperry Gyroscope Co., Great Neck, L. I., N. Y.

Symposium: Basic Circuit Elements

"Performance and Measurement of Capacitors"—H. T. Wilhelm, Bell Telephone Laboratories, Inc., Murray Hill, N. J.
"Behaviour of Resistors at High Frequencies"—G. R. Arthur, H. L. Krauss, and P. F. Ordung, Yale University, New Haven, Conn.
S. E. Church, Bell Telephone Laboratories, Murray Hill, N. J.
"Inductors, Their Calculation and Losses"—Robert F. Field, General Radio Co., Cambridge, Mass.
"Transformer Performance and Measurements"—Reuben Lee, Westinghouse Electric Corporation, Baltimore, Md.

Television III—Receivers

"Use of Miniature Pentode RCA-6CB6 in Television Intermediate-Frequency Amplifiers"—W. E. Babcock, Radio Corporation of America, Harrison, N. J.
"Noise Suicide Circuit"—Harold E. Beste and George D. Hulst, Allen B. DuMont Laboratories, Inc., Passaic, N. J.
"Quality Rating of Television Images"—P. Mertz, A. D. Fowler, and H. N. Christopher, Bell Telephone Laboratories, Inc., New York, N. Y.
"Television Image Reproduction by Use of Velocity-Modulation Principles"—M. A. Honnell and M. D. Prince, Georgia Institute of Technology, Atlanta, Ga.
"Design of Printed-Circuit Television Tuner"—D. Mackey and E. J. Sass, Radio Corporation of America, Camden, N. J.

Active Circuits II—General

"Frequency Modulation Interference"—L. B. Arguimbau, Massachusetts Institute of Technology, Cambridge, Mass.
"The Theory of Amplitude Modulation Rejection in the Ratio Detector"—B. D. Loughlin, Hazeltine Electronics Corp., Little Neck, L. I., N. Y.
"An Improved Method of Frequency Conversion"—Vernon H. Aske and J. Grund, Sylvania Electric Products Inc., Kew Gardens, L. I., N. Y.
"Common Frequency Carrier-Shift Radiotelegraph Converter"—R. R. Turner, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.
"A Simple Crystal Discriminator for FM Oscillator Stabilization"—J. Ruston, Allen B. Du Mont Labs., Inc., Passaic, N. J.

Raymond Guy, President of IRE, 1950

Electron Tubes II—Theory & Design

"A New 'Soft Structure' for Rugged Receiving Tubes to Improve Resistance to Shock and Electron Emission"—George W. Baker, Kip Electronics Corp., New York, N. Y.
"Hydrostatic Pressure in an Electron Gas: Its Application to Electron Beam-Electromagnetic Wave Interaction"—P. Parzen and L. Goldstein, Federal Telecommunications Laboratories, Inc., Nutley, N. J.
"High Voltage Regulation by Means of Corona Discharge Between Coaxial Cylinders"—S. W. Lichtman, Naval Research Laboratory, Washington, D. C.
"Thyratron Grid Emission and the Trigger-Grid Thyratron"—L. Malter and M. R. Boyd, RCA Laboratories, Princeton, N. J.
"High-Intensity Pulse Distribution Tube"—P. M. G. Toulon, Consulting Engineer, Neuilly-on-the-Seine, France.

Transmission & Antennas

"Surface-Wave Transmission Lines"—G. Goubau, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.
"Frequency-Modulation Distortion in Linear Systems Having Small Sinusoidal Irregularities in Transfer Characteristics, with application to Lossless Waveguides"—F. Assadourian, Federal Telecommunication Laboratories, Inc., Nutley, N. J.
"The Representation, Measurements and Calculation of Equivalent Circuits for Slots in Rectangular Wave guide"—J. Blass, L. Felsen, H. Kurss, N. Marcuvitz, and A. A. Oliner, Polytechnic Institute of Brooklyn, Brooklyn, N. Y.
"Dielectric Tube Antenna"—R. E. Beam and D. G. Harman, Northwestern University, Evanston, Ill.
"Measurement of Current and Charge Distributions on Antennas and Open-Wire Lines"—D. J. Angelakos, Harvard University, Cambridge, Mass.

THURSDAY, MARCH 9

Audio—Transducer Design

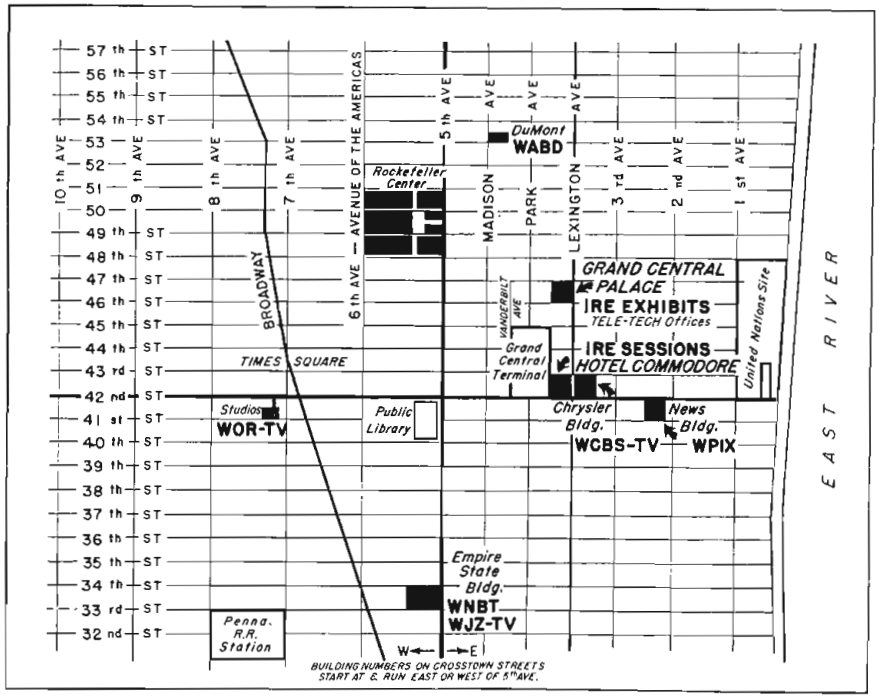
"Sound System Design for Reverberant Auditoriums"—L. L. Beranek, W. H. Radford, and J. B. Wiesner, Massachusetts Institute of Technology, Cambridge, Mass.
"High-Efficiency Loudspeakers for Personal Radio Receivers"—H. F. Olson, J. C. Bleazey, J. Preston, and R. A. Hackley, RCA Laboratories, Princeton, N. J.
"A Review of Direct Radiator Loudspeakers"—F. H. Slaymaker, Stromberg-Carlson Co., Rochester, N. Y.
"Loudspeaker Housings"—Willard F. Meeker, Stromberg-Carlson Co., Rochester, N. Y.
"A Miniature Condenser Type Microphone"—John K. Hilliard, Altec Lansing Corporation, Hollywood, Calif.

Electron Tubes III—Power Tubes

"Development of 10 cm High Power Pulsed Klystron"—M. Chodorow, E. L. Ginzton, I. Neilsen, and S. Sonkin, Stanford University, Stanford, Calif.

(*Continued on page 70*)

Streetmap of Midtown Manhattan shows points of major interest to IRE Convention visitors

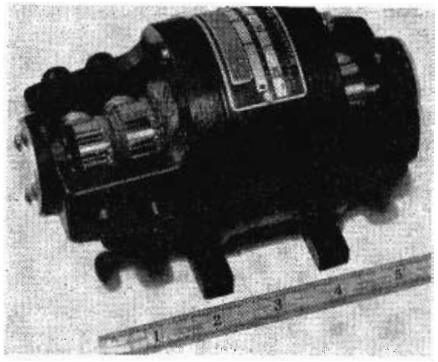


IRE Convention Exhibits

Previews and descriptions of new components, units, and parts that

Inductor Alternator

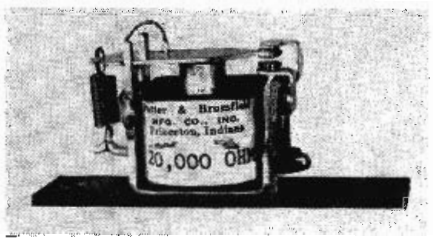
The Carter inductor alternator provides 400 to 800 cps ac power up to 100 watts capacity from dc battery supply. With filter, this new



model measures 9¾ in. long, 4½ in. in diameter and is 7½ in. high. Weight is 21 lbs. No ac slip rings or brushes are necessary because ac is obtained on inductor principle. The ac rotor uses no permanent magnets, thus insuring maximum output in stray ac fields. — **Carter Motor Co., 2644 North Maplewood Ave., Chicago 47, Ill.** — TELE-TECH

Relays

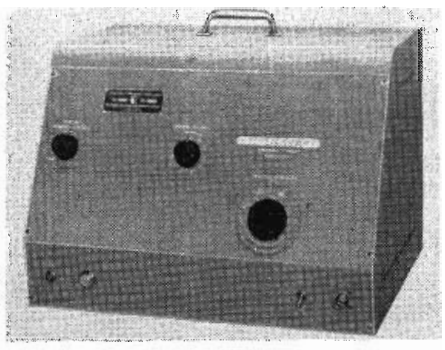
The Potter & Brumfield plate circuit relays have been redesigned to include molded bakelite coil bobbins with solder terminals



on the coil periphery. This provides breakdown insulation up to 2500 v. RMS and the added space in the bobbin allows windings up to 40,000 ohms. The LC series requires only 90 milliwatts for reliable operation and the 3/16 silver contacts are rated at 5 amps. The relay base is designed for either rivet or screw mounting. —**Potter & Brumfield, Inc., Princeton, Ind.** -TELE-TECH

UHF Sweep Frequency Oscillator

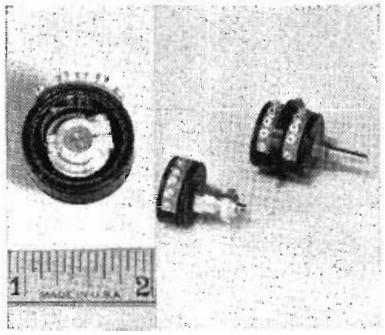
Type 901 UHF sweep frequency oscillator has been designed specifically for coverage of the new television band. Other instru-



ments on display will include a universal power bridge and broadband microwave signal generators, in addition to operating test benches in various waveguide sizes.—**Polytechnic Research & Development Co., 202 Tillary St., Brooklyn 1, N. Y.**—TELE-TECH

Miniature Potentiometers

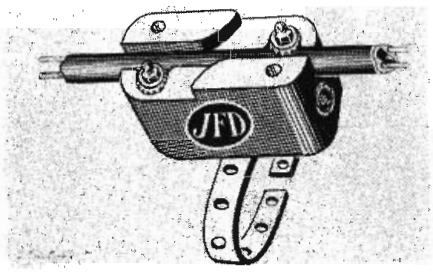
High precision miniature potentiometers have been developed (⅞ in. in diameter and ⅜ in. in depth), which include all of the



features of precision potentiometers of regular dimensions and are available in resistance ranges of 100 to 25,000 ohms. Accuracy of total resistance may be specified as close as ±1%, and linearity to ±0.8% of total resistance required. Several potentiometers may be ganged together with adjusting clamp ring to permit individual phasing.—**Technology Instrument Corp., 1058 Main St., Waltham 54, Mass.**—TELE-TECH

Lightning Arrestor

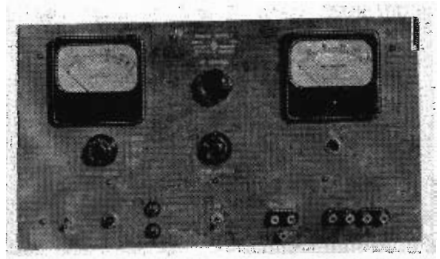
Model AT163 twin lead lightning arrestor is a special design for accommodating heavy twin lead and tubular twin lead transmission



lines. All requirements of Underwriters' Laboratories, National Board of Fire Underwriters and National Electric Code, for outdoor antenna installations are met. No wire stripping or scraping is necessary. A heavy-duty mounting strap is included to permit direct attachment to masts when required. Discharge contacts are sealed in rare gas tubes to dissipate static charges. Glazed porcelain construction resists temperature and humidity changes.—**JFD Manufacturing Co., Inc., 6101 Sixteenth Ave., Brooklyn 4, N. Y.**—TELE-TECH

Power Supply

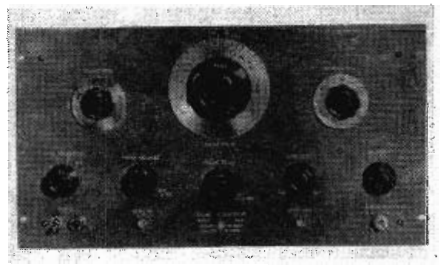
A low cost power supply providing a variable plate and bias supply voltage and known as the -hp-model 712A, provides variable dc



voltages from 0 to 500 v. at 200 ma., with 0.5% regulation. It also makes available 0 to 150 v. for bias use, plus 10 amps. ac at 6.3 v. Meters are provided to monitor voltages and currents. List, $250, f.o.b. Palo Alto.—**Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Calif.**—TELE-TECH

Pulse Generator

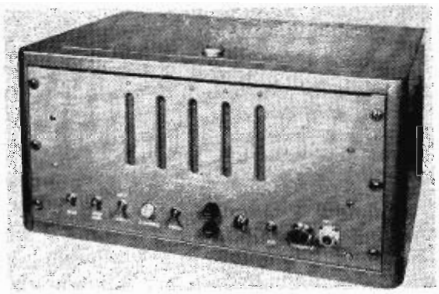
Model 212A general purpose pulse generator has been designed for testing "fast" circuits, as well as checking other generators, r-f circuits, and peak-measuring equipment. It has a fast pulse rise and decay time (0.02 μsec.), high power (50 watts) pulse, and a continuously variable pulse length, 0.07 to



10 μsec. A low internal impedance of 50 ohms or less insures a pulse shape virtually independent of load. This low impedance also makes it possible to deliver accurate pulses at some distance from the instrument, if transmission lines are properly terminated. The instrument has a repetition rate continuously variable from 50 to 5,000 pulses per sec., and pulse rate can be controlled internally or from an external synchronizing source. Continuously variable synchronization pulses are available either in advance or following the main pulse.—**Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Calif.**—TELE-TECH

Events Unit-Time Meter

The combination of an electronic counter and an accurate time base has produced an instrument which automatically measures



the number of events occurring during a specific time interval and presents the result in direct reading numerical form. Known as model 554 Events-Per-Unit-Time Meter, it has a range of zero to 100,000 events per sec. These events may be any physical, optical, or electrical occurrence that can be translated into changing voltages. The unit consists of an input circuit, an electronic gate which is opened and closed by crystal-controlled time base, and a series of electronic counters. The illuminated panels of the 5 decimal counting units are read directly in events-per-unit-time.—**Berkeley Scientific Co., Sixth & Nevin Ave., Richmond, Calif.**—TELE-TECH

Medium—Mu Double Triode

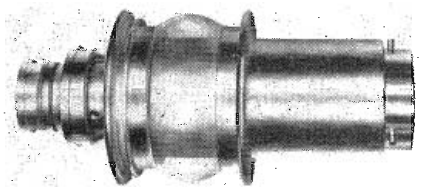
Having electrical characteristics very similar to the popular miniature type 12AU7, the CK5873 medium-mu double triode may be used in most 12AU7 applications without changing circuit values, providing the operating conditions are within the CK5873 design ratings. Utilizing an 8-pin subminiature button base, the CK5873, with a maximum length of 1.5 in. and a maximum diameter of 0.400 in., lends itself to compact and light weight equipment design.—**Raytheon Manufacturing Co., Newton, Mass.** — TELE-TECH

Herald New Equipment

manufacturers will present to the industry for the first time

High Power Triode

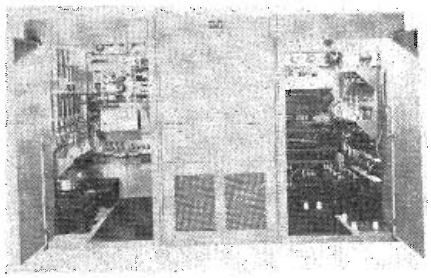
The ML-354, a compact, super-power water and forced-air cooled triode for operation up to 110 MC in FM, AM, and television, is



provided with coaxial filament, grid, and plate seals, making it ideally suited to cavity-type circuits. All electrodes mount directly from heavy copper cylinders, resulting in a structure which is far superior, electrically and mechanically, to conventional water-cooled electron tube design. Large diameter seals give increased strength and freedom from excessive heating at electrode contacts. —**Machlett Laboratories, Inc., Springdale, Conn.**—TELE-TECH

Broadcast Transmitters

Featuring a completely new tube complement used for the first time in 5 to 10 kw broadcast transmitters, the BC-5B and BC-



10B commercial broadcast transmitters provide more satisfactory service from the standpoint of noise and distortion as well as a generous reduction in tube and operation costs. Appropriate directional phasing equipment is supplied as an adjunct. Additional features include diaphragm type air control to power amplifier and modulator tubes; a new and more extensive supervisory control system, complete dead front operation allowing control of all major and minor circuits without accentuating door interlocks; and cubicle design permitting adding additional cubicles as required.—**Gates Radio Co., Quincy, Ill.** TELE-TECH

Cathode Ray Oscillographs

Model 303 is a medium-priced, 10-MC oscillograph intended primarily for quantitative and qualitative investigation of signals containing high frequency components. Displays of the type 303 emphasize such features as the excellent response characteristics of the 10-MC vertical amplifier; vertical deflection factor of 0.1 v./in., with 2½ in. of undistorted deflection; driven and recurrent sweeps, continuously variable in duration from 0.1 sec. to 5 μsec.; sweep expansion; a built-in signal delay line; and a built-in voltage calibrator.

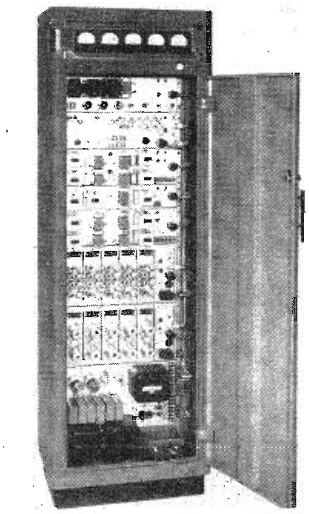
Replacing model 248-A, the new 294 is a high-voltage, 15 MC oscillograph, designed for the detailed analysis of high frequency signals. The bandwidth of its vertical amplifier extends to 15 MC, and a pulse having a rise time of 0.01 μsec. or less will appear at the output of the amplifier with a rise time of no more than 0.03 μsec.

A built-in signal delay line affords sufficient time to the sweep to start before the signal is applied to the vertical deflection plates. Driven sweeps are continuously variable in duration from 100,000 to 2 μsec., and recurrent sweeps are continuously variable in frequency from 10 to 200,000 cps.

Both X and Y axes on the 304-H oscilloscope are equipped with highly stable, high-gain ac and dc amplifiers, which have negligible microphonics and drift. Both driven and recurrent sweeps, continuously variable in frequency from 2 cps to 30 KC are provided and sweeps of much longer duration, down to 10 sec. or more are possible by attaching capacitance externally at the X-input terminals.—**Allen B. DuMont Laboratories, Inc., 1000 Main Ave., Clifton, N. J.**—TELE-TECH

Microwave Relay Equipment

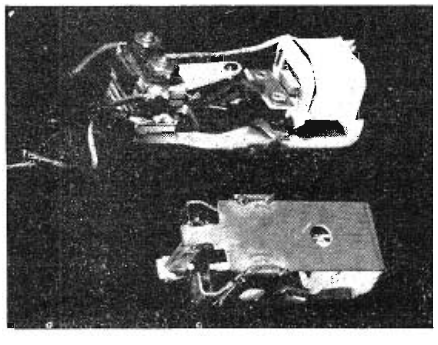
Flexibility and traffic-bearing efficiency are the keynotes of a recently-developed microwave point-to-point relay system which in-



cludes multiplexed radio channels capable of transmitting and receiving telephone, telegraph, teletype, telemetering and supervisory control signals over a cross-country microwave relay circuit. The basic system will operate on any one of the 15 channels allocated in the 6575-6875 MC band. Standard systems are set up for 1 to 5 and 5 to 10 channel operation. A standard 10-channel model can transmit and receive up to 10 normal voice circuits or 100 teletype circuits or 400 remote supervisory control functions or innumerable combinations of these. —**Motorola, Inc., 1545 West Augusta Blvd., Chicago, Ill.**—TELE-TECH

Vibrator

Characteristics of the new Aerovox vibrator are such that noise is minimized and sticking points and no-starts are eliminated.



A welded steel box frame supports all fixed and moving parts in place of the usual pillar support and screws holding the elements of the conventional vibrator. Only non-varying mica insulation is used. No run-in is required. Heat generation is low enough to sustain operation at 185° F.—**Aerovox Corp., New Bedford, Mass.**—TELE-TECH

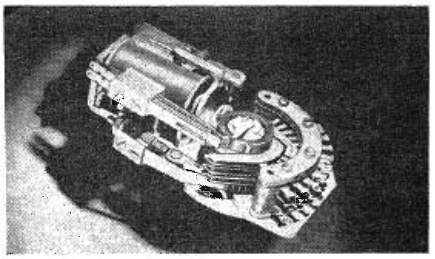
Variable Data Plotter

A new two-dimensional recorder has been developed which differs from recorders presently on the market in that it has the ability to plot one variable as a function of a second variable rather than one variable

as a function of time or the rotation of a drum. Its accuracy is 1/10 of 1%. In order to be able to realize this accuracy on the final graph, the graph has to be approximately 30-in. square. It is useful in plotting electron tube characteristics, temperature-pressure curves, or any application where the functions may be represented by varying dc voltages.—**Electronic Associates, Inc., Long Branch, N. J.** TELE-TECH

Miniature Rotary Switch

Type 44 miniature rotary stepping switch is compact, lightweight and accommodates from one to six 10-point bank levels. Each



bank level has a corresponding wiper level and the entire wiper assembly is driven by a ratchet wheel with 33 teeth. This provides 10 "on the bank" positions followed by one "off the bank" position for each one third revolution of the wiper assembly. When wipers are properly arranged, the contact bank levels can be used independently for 10-point operation, or in groups of two for 20-point operation, or in groups of three for 30-point operation.—**Automatic Electric Sales Corp., 1033 West Van Buren St., Chicago 7, Ill.**—TELE-TECH

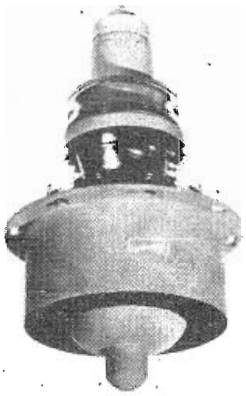
Plastic Insulated Wire

A new tinned-conductor, with an insulation wall of stabilized vinyl dielectric, has been approved by Underwriters' Laboratories for 105° C. continuous operation under 600 v. rating. This new high-heat resistant conductor is free-stripping. Manufacturer claims that insulated wire inventory problem is solved economically by virtue of the fact that consumers of hook-up wire and lead wire need only stock one type of plastic insulated wire for all purposes.—**William Brand & Co., 276 Fourth Ave., New York 10, N. Y.** —TELE-TECH

IRE EXHIBITS (Continued)

High Power Triodes

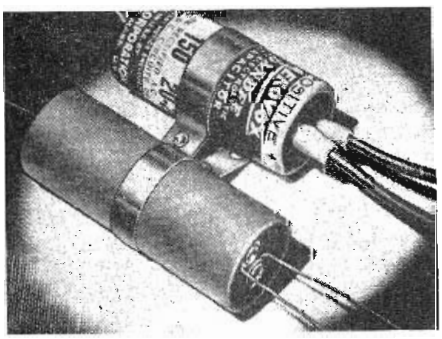
The cathode of recently-designed water and air-cooled general purpose triodes capable of delivering high power at vhf is a rugged



unipotential thoriated tungsten element. The ability of thoriated tungsten filaments to take abuse and operate at high frequencies has now been extended to a unipotential cathode surface. Hot filament within the cylinder is operated at a potential below cathode and ground potential, allowing electrons from the hot filament to bombard and heat the unipotential cathode surface. Water-cooled type designation is 3W10000A3; air-cooled version (illustrated) is 3X10000A3. They carry a maximum plate dissipation rating of 10 kw. The 4x150G is an extremely compact UHF tube which is similar to the Eimac 4X150A but is capable of performance at higher frequencies. It offers unusual general performance at a frequency of 1000 MC as a CW amplifier, oscillator, or frequency doubler, and at frequencies as high as 1500 MC in pulse service. Plate, screen, grid and cathode are concentric cylindrical terminals for low lead inductance and simplicity of insertion in coaxial cavities.—**Eitel-McCullough, Inc., San Bruno, Calif.**—TELE-TECH

Capacitor Lead Insulation

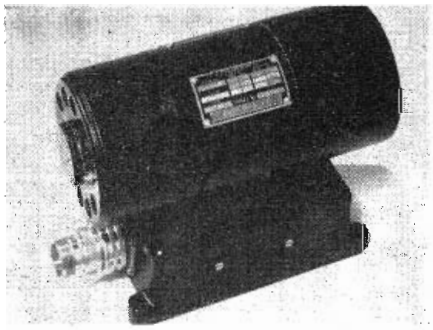
The insulation of terminals and leads, in addition to the recently-developed stud terminal construction, rounds out the advanced



design of the PRS multi-section Dandees or midget-can electrolytic capacitors. The accompanying illustration contrasts the conventional dual-section bare-pigtail midget-can electrolytic with the new insulated terminal insulated-pigtail Dandee. The insulated pigtail is firmly crimped by the stud terminal, and an insulating sleeve slips over the terminal.—**Aerovox Corp., New Bedford, Mass.**—TELE-TECH

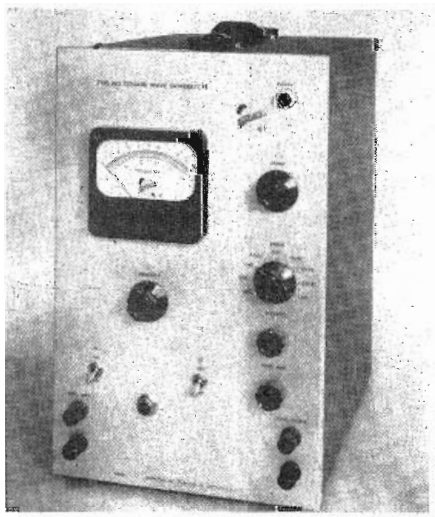
Mobile Generator

Ideal for small mobile transmitters, or research and development projects, the Carter Multi-Magmotor incorporates an Alnico permanent magnet field construction which reduces its size and weight and increases overall efficiency. An important feature of the new unit is the flexibility of input and output voltage arrangements. Facilities are provided for 1, 2, or 3 dc inputs or 1, 2, or 3 dc outputs or any combination not exceeding 4-commutator design. All windings are insulated from each other and the frame. Exceptionally small, measuring 6-in. long (for 2 outputs as shown), the Multi-Magmotor has a diameter of 3½ in. and weighs approximately 5 lbs. Inputs from 5.5 to 115 v. dc can be accommodated. Output voltages as high as 400 v. are produced. Frame capacity is approximately 50 watts continuous, 75 watts intermittent.—**Carter Motor Co., 2644 North Maplewood Ave., Chicago 47, Ill.**—TELE-TECH



Square Wave Generator

Continuously variable in frequency from 25 cps to 1 MC, type 105 square wave generator provides a signal for testing the amplitude

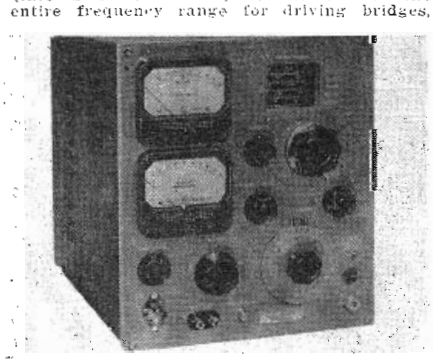


and phase response of amplifiers and filters having pass bands of a few cps to 20 MC.

Maximum current capability is 160 ma to output load. When used with the 93 ohm output cable (furnished with instrument) approximately 15 v. is available. List, $395. f.o.b. Portland.—**Tektronix, Inc., 712 S. E. Hawthorne Blvd., Portland, Ore.**—TELE-TECH

VHF Signal Generator

Model 608A vhf signal generator (10 to 500 MC) has a master oscillator power amplifier circuit and a directly calibrated output from 0.1 μv. to 1 v. for measuring gain, selectivity, sensitivity or image rejection of receivers, i-f amplifiers, broad band amplifiers or other vhf equipment. The 1-v. output (into a 50 ohm load) is useful over the entire frequency range for driving bridges,



slotted lines, antennas, filter networks, etc. The output circuit is directly calibrated in volts and dbm for fast reading. No charts are necessary.—**Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Calif.**—TELE-TECH

Wire Recorder Converters

Housed in the same container as the original 110RT15, two new wire recorder converters (110WR15A and 110WR15B) will operate all types of recorders with the same results as though the units were connected to the ac power line. Both converters are rated at 115 v. dc input, 115 v., av output, sine-wave 60 cps at 150 watts. The "A" model is switched manually and the "B" model has Phantomswitch and input line filter.—**Cornell-Dubilier Electric Corp., South Plainfield, N. J.**—TELE-TECH

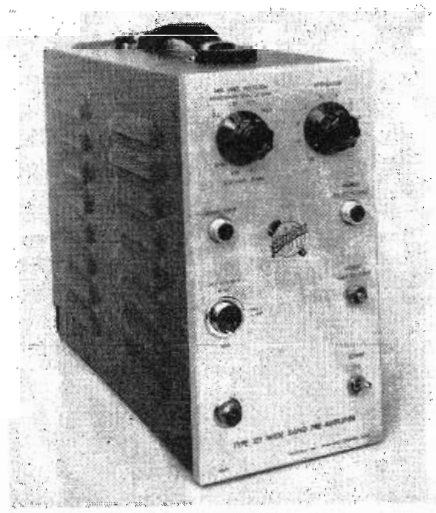
Wide Band Decade Amplifier

The type 500-A wide band decade amplifier has been developed to extend the minimum input signal level of the type 320-A phase meter down to 1 mv. The 320-A phase

meter requires signal input levels between 1 and 170 v. and in order to use it at lower signal levels, it was essential to develop an amplifier with zero degrees phase shift from 20 to 100,000 cps. Phase shift in an amplifier varies more rapidly than gain but shift is small in the type 500-A over a wide frequency range, so the gain of this amplifier is exceedingly flat over this frequency range. Input impedance is approximately 160 megohms shunted by 7 μμf. Output impedance is less than 300 ohms and gains of 10, 100, and 1,000 give a maximum output of 20 v. Frequency response is ±1 db from 10 cps to 100 KC and ±.5 db from 5 cps to 1 MC on all gain positions.—**Technology Instrument Corp., 1058 Main St., Waltham 54, Mass.**—TELE-TECH

Wide Band Pre-Amplifier

Sensitivity of Tektronix types 511, 511-A and 511-AB cathode ray oscilloscopes is increased by the use of the 121 wide band



pre-amplifier. The maximum gain of 100, plus the combined attenuator and gain controls, permit a sensitivity range from 2.5 mv/cm to 25 v./cm without the use of attenuators on the oscilloscope. A front panel power supply socket provides dc plate and heater voltages so that when both high input impedance and high gain are necessary, a cathode follower or a special pre-amplifier stage mounted directly on the signal source may conveniently be used. List $265. f.o.b. Portland.—**Tektronix, Inc., 712 S. E. Hawthorne Blvd., Portland, Ore.**—TELE-TECH

Armed Forces at the IRE Convention

Navy's 15 dynamic exhibits portray technical activities. Air Force schedules 10-megawatt tube. Equipment for Integrated Global Theater and Combat Signal systems major Army target

THE Navy electronics presentation at the IRE Convention this year will be entirely dynamic.* Although Navy technical officers and civilians will be on hand to explain exhibits to interested visitors, a battery of Navy teletype page printers will be spotted about the exhibits to describe them. As in all other Navy electronics exhibits, visitors will be invited to operate this equipment and obtain results which will aid them in visualizing the actual operation of the equipment.

The United States Navy and its sister service, the United States Coast Guard, are making available for inspection by IRE members, two vessels in the New York area. This innovation will enable members to see Naval electronics equipment, not only at the show, but also in its own element, the confines of a ship.

Teletypewriter "MUX"

Exhibit I—Among the dynamic electronic exhibits is the latest development in Navy teletypewriter equipment, the AN/FGC-5, electronic time division multiplex telegraph terminal. It consists of two sets, a telegraph transmitting group, and a telegraph receiving group. The first accepts on-off dc start-stop signals from local transmitting circuits, converts them to multiplex signals, and applies these in sequential order, channel by channel, to the telegraph circuit. The signals upon reaching the distant receiving group are converted to start-stop signals, and then redistributed in their original on-off dc form to the proper receiving stations.

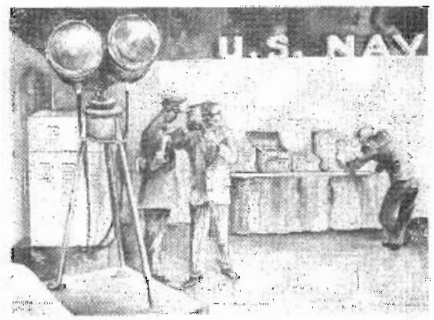
The set is capable of supplying a maximum of four channels from any one telegraph circuit at speeds of either 60 or 75 words/min. Synchronism between the transmitting and receiving groups is controlled by a highly accurate crystal controlled oscillator. A number of features, desirable for Navy use, have been incorporated. Once synchronized, they will remain so from one to one and one-half hours with the telegraph circuits disconnected. If either receiving or transmitting circuit is broken, there is a visual and an audible warning signal, and the fault may be readily traced by means of oscilloscopes mounted with both patched into any point of the circuits.

Telegraph Test

Exhibit II — The Navy model AN/PRM-3 recorder, for testing both telegraph equipment and circuits, represents an extremely valuable high speed and precise recorder and signal generator. Its precision is such that any differential in the received and transmitted signals provides an indication of the quality of the equipment on circuit under test. Exhibits I and II are displayed by the Electronics Divisions of the Bureau of Ships.

Infra-Red

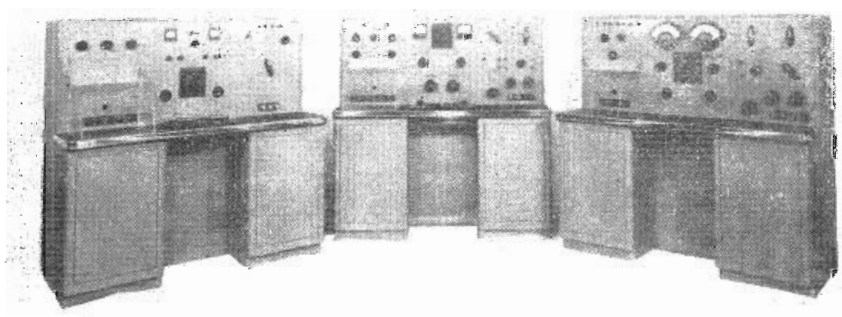
Exhibit III — The Infra-Red Communications exhibit. Research directed toward improving light beam voice and code communication systems as a supplementary means of communication to cover short distances which cannot be readily detected and interpreted by the enemy. Light-beam systems are particularly effective against enemy detection because (1) their range is definitely limited to line-of-sight; (2) they can easily be confined to narrow beams and directed where



desired; and (3) by means of optical filters the radiation may be rendered invisible beyond 300 yards or so.

The essential elements required for optical communications consist of: A transmitter, consisting of a source of modulated light, an optical reflector for beaming the radiation, an optical filter for removing visible light as required, a microphone for voice, a key for code, an amplifier when required for modulation of the source, and connection to power supplies for operation of the apparatus; and a receiving system consisting of a

Instrument calibration standards used by the United States Navy. Equipment for ac instruments is at left, dc at right, and dual ac-dc unit is shown in center. The dc unit, TS-689/U, which calibrates meters from 75 μa to 150 amps full scale in 20 steps and voltage ranges from 75 millivolts to 1500 volts full scale in 14 steps, will be shown at the convention



* Three technical Navy Bureaus are participating in the Institute of Radio Engineers show: the Bureau of Ships, the Bureau of Ordnance, and the Bureau of Aeronautics. Acting for the Bureau of Ships are the Bureau of Ships Electronics Divisions, Washington, D. C.; Naval Research Laboratory, Anacostia, D. C.; Naval Underwater Sound Laboratory, New London, Connecticut; New York Naval Shipyard, Brooklyn, New York. Acting for the Bureau of Ordnance are the Naval Ordnance Laboratory, White Oak, Maryland; and the Naval Gun Factory, Washington, D. C. Representing the Bureau of Aeronautics is the Bureau of Aeronautics Electronics Division; Naval Air Development, Center, Johnsville, Pennsylvania; and the Electronics Test Division of the Naval Air Test Center, Patuxent, Maryland.

light-sensitive detector, a reflector for increasing the detector sensitivity, an audio amplifier and demodulator as required, and headphones for reproducing the original speech or code. Exhibit III is being displayed by the United States Naval Underwater Sound Laboratory, New London, Conn.

Magnetic "Orthonal"

Exhibit IV — Presented by the Bureau of Ordnance is The Magnetic Amplifier Gun Detector, of the Naval Ordnance Laboratory, which replaces all vacuum tubes and other delicate parts, with devices using the new magnetic material, orthonol, (devised by the Naval Ordnance Laboratory) for the amplifying components. Such devices were used by the German Navy, for as long as ten years with no attention or servicing. Intensive research by the N.O.L. has produced a vastly improved magnetic material and these resulting amplifiers. A working scale model display of a gun turret firing at a surfacing submarine illustrates one of the many applications for a magnetic amplifier. This display should attract attention in the electronics industry for this device may well replace electron tubes in some forms of amplifiers since few if any electron tubes, ruggedized or not, will withstand the shock of gunfire for ten years.

Optimum Antenna Feed

Exhibit V (Presented by Naval Research Laboratory, Anacostia, D. C.) In this exhibit water ripples are used for the qualitative and semi-quantitative study of phase fronts near two-dimensional models of antenna structures. Electronically driven probe-vibrators are used to excite the water surface. Synchronously chopped light is then directed through the tank to a ground-glass screen where the phase front shadow patterns appear stationary. Using simple equipment, it is possible to visualize rapidly (or photograph) the changes in phase-front patterns brought about by changes in feed point position and in reflector configuration, as well as by changes of as much as several hundred percent in exciting frequency.

Radar Beacon

Exhibit VI—This Air Navigation Radar Beacon (the AN/CPN-6) demonstrates how the pilot of an aircraft equipped with microwave radar determines his position by using his radar to interrogate a radar beacon on ship or shore. It also shows how a series of such position determinations is used to navigate along any desired route.

When the airborne radar is switched to BEACON operation, the pulse width of its transmitted signals is expanded so that the discriminator of any radar beacon within line-of-sight range will accept the signal. At the same time, the discriminator rejects ordinary short search pulses from other radars in order to permit maximum numbers of simultaneous responses to deliberate interrogations. The beacon transmits a response, coded for identification, in synchronism with the received pulses. This signal appears on the oscilloscope of the airborne radar. The relative bearing of the beacon from the aircraft is determined from radar antenna position at the time the beacon response is received, and completes the information needed by the pilot for a "fix". This exhibit is displayed by the Electronics Divisions of the Bureau of Ships.

Instrument Calibration

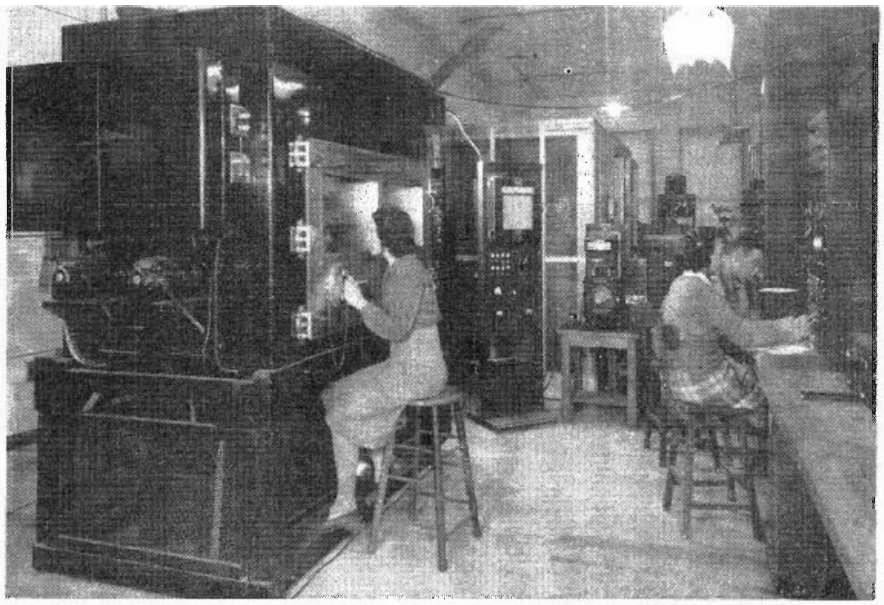
Exhibit VII—This exhibit, which is the dc Standard Instrument Calibration equipment, the TS-689/U, is an example of cooperation between the military and civilian agencies of the Government and commercial companies. This equipment can calbrate dc meters from 75 microamperes full scale to 150 amperes full scale in 20 steps and voltage ranges from 75 millivolts full scale to 1500 volts full scale in 14 steps. The rated accuracy is 0.5%. The equipment will perform

SIGNAL CORPS

INTERESTING items that have resulted from the research and development program of the Signal Corps today in the Signal Corps Engineering Lab will be shown in the Army section of the joint Military Services exhibit. This program falls into the broad phases of technical development applying the most recent advances to limited peacetime production, and capable of rapid mass production in an emergency; and long-range research, proceeding across nine major fields of electronics and its supporting sciences.

About twenty percent of the program is presently applied to overall research while direct development of military end-item equipments and components receives the other 80% of technical effort. A major target is equipment for integrated Global Theater and Combat signal systems providing high-capacity service, interconnecting echelons irrespective of geography or speed of movement.

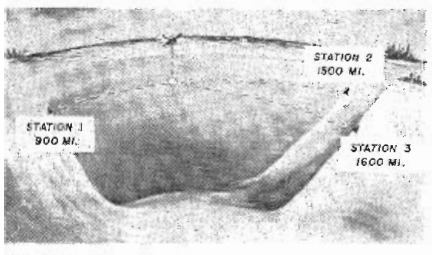
Ability of equipment to operate under extremes of temperature is a prime military consideration. Here piezoelectric crystals are given a complete check at "40 below"



within its rated accuracy under conditions of relative humidity from 0 to 75% and under temperatures from 10° to 45° C. from sea level to 10,000 feet above sea level.

Sofar

Exhibit VIII—Presented by the U. S. Navy Underwater Sound Laboratory, New London, Connecticut, is the Sofar exhibit, a system of air sea rescue. This diorama depicts one of the interesting electronics developments which have peacetime potentialities. We hear too frequently the report of the loss of aircraft at sea—without trace. Many aviators might have been saved, had they had positive means of signalling the position of dis-

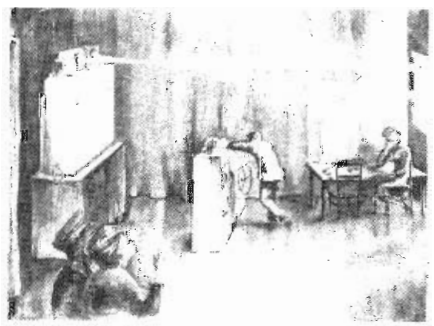


tress. In Sofar operation, a one-to-four pound hydrostatic fused bomb is dropped. At a certain depth, the bomb explodes, and the sounds of the explosion are monitored by three hydrophone listening posts. These posts may then determine an accurate fix immediately.

The special bomb creates a sound similar to kettle drums, and is easily identified. Exhibit IX—The "Fish Talk" exhibit has recordings of Sofar sounds and other interesting underwater sounds, such as a torpedo speeding to its target, striking it, and the counter-measures taken by the enemy destroyers.

Sonar

Exhibit X — Presented by the United States Naval Reserve is The QFA training equipment, functions for the sailor as does the Link trainer for the aviator. Sea conditions and actual submarine detection and destruction problems are



generated and fed to sonar equipments. The sonar operator must solve these problems to sink the submarine. The results of his solution are projected on a screen which is invisible to the operator.

AIR FORCES

THE U. S. Air Force display is divided into seven phases, of which a number will be either cutaway or operational. A backlighted translucent panel will depict the numerous programs and activities of an electronics nature being carried on by the Air Force. A unit of the Military Amateur Radio System will be displayed in operation as well as various units of radio equipment devised by USAF communications personnel such as grid meters, components testing devices, etc. Latest developments in component equipment will be a test panel and exhibit of such items as microspacers, miniature transistors, etc., illustrating work being done towards miniaturization of such components as tubes, transformers and condensers, printed circuits, and possibly a 10-megawatt tube (of which there are only three in existence).

Latest types of microphones, headsets and related communications equipment may be operated by the audience. An AN/ARC-33 and AN/URC-4 ultra-high frequency transmitters and receiving equipment may also be operated. The Omni-Bearing Distance Navigation System will be exhibited together with a demonstrator device to permit a simplified explanation of the system.

There will be a general exhibit on the principle of ground radar control. Included will be a visual presentation of the CPS-6 model ground radar station taking range, altitude and azimuth of aircraft. Various types of flush-mounted antennae which have been recently developed for aircraft will be shown. A 9½ foot model of the B-45 aircraft with cutaway nose and tail sections will permit exhibit of the electronic equipment installed in such aircraft and the actual installation of flush-mounted antennae. A cutaway of an actual "Gapa" guide missile measuring 12 feet in length will be utilized to show the component parts with arrangements to explain the functions and operation of each section.

UHF Doppler Effects

Exhibit XI—For the Bureau of Aeronautics, the Electronics Test Division of the Naval Air Test Center, Patuxent River, Maryland, presents a demonstration of UHF Air-to-Air Propagation Interference Modulation Effects.

When a transmitting antenna is a finite distance above the earth, it will create a lobe structure of signal strength in the following space. Due to the phase relationship of the direct and ground reflected rays, another aircraft, receiving the transmitting signals, will be flying through the lobe structure and therefore will detect a calibration signal of varying amplitude. The rate of this amplitude modulation at any point in space is dependent upon the carrier frequency, altitude, range, separation of the transmitting and receiving antenna, and the speed of one airplane relative to that of the other. At UHF frequencies, and at altitude and air speed presently obtainable, this lobe modulation rate is sufficiently high to limit the intelligibility under certain conditions.

This display demonstrates this interference phenomenon by showing two model aircrafts' flight toward and away from each other while comparing the direct and ground reflected transmission paths accompanied by a recorded voice description. The model aircraft makes three round trip flights to present the following three phases:

(1) A comparison of the phase relationship of the direct and ground reflected transmission; (2) A description of the "Lobe Structure" generated; and (3) An audio demonstration of the propagation interference modulation.

Radome Deflections

Exhibit XII—Presented by the Aeronautical Electronic and Electrical Laboratory, of the Naval Air Development Center, Johnsville, Pennsylvania, is a Bureau of Aeronautics Exhibit, depicting deflection of radar beams by radome materials. A radome is a weather cover for portions of a radar which would otherwise be exposed to the elements—such as the antenna. Visitors will be able to test and determine the relative values of deflection of the various radome

(*Continued on page 66*)

Color Investigation Reopened

Washington, D. C. becomes first city in world to have color as CBS, RCA and CTI demonstrate competitive methods. Final

By FRANKLIN LOOMIS

THE breathing spell between rounds one and two in the FCC hearing on color TV is at an end.* The next chapter which will lead to a decision on this subject has begun. It started with a demonstration by Color Television, Inc. (CTI) of San Francisco which was held on Feb. 20 at the Statler Hotel, Washington, D. C. Three days later, the second official comparative demonstration was staged for the FCC. CBS, RCA, and CTI systems were shown.

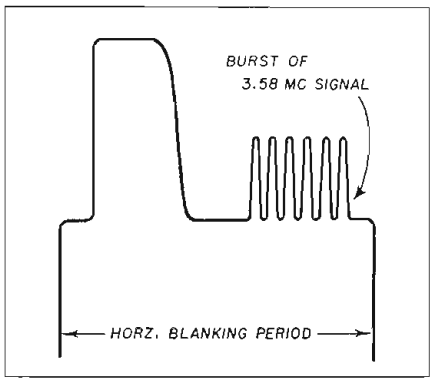


Fig. 1: Standard sync. pulse modified by the introduction of 3.58 MC sync. burst to provide complete control of horizontal sweep

The highly developed system of CBS apparently needed no technical modifications. It has been used in Washington demonstrating to thousands of observers just how much well-programmed color can add to the enjoyment of selected TV material. One purpose of these shows was to secure by means of questionnaires the public's reaction. It is reported that nine out of ten observers thought color "much more enjoyable" than black and white TV. This is as expected.

Automatic color synchronization and phasing have now been added to the RCA system. During recent demonstrations the greens, reds and blues of the received picture were not only in proper phase, that is, the grass was *always* green, but the sync. of the electronic "commutator" was such that large, solid areas of uniform color were properly reproduced, something we did not see in earlier demonstrations.

To show how fool-proof this auto. sync. was, the receiver controls were not touched by the operator during the 45 minute test period. When switched on and off several times, the receiver was always in correct color phase. Even electrical disturbances, specially generated and violent enough to affect picture content and horizontal sync. did not cause trouble.

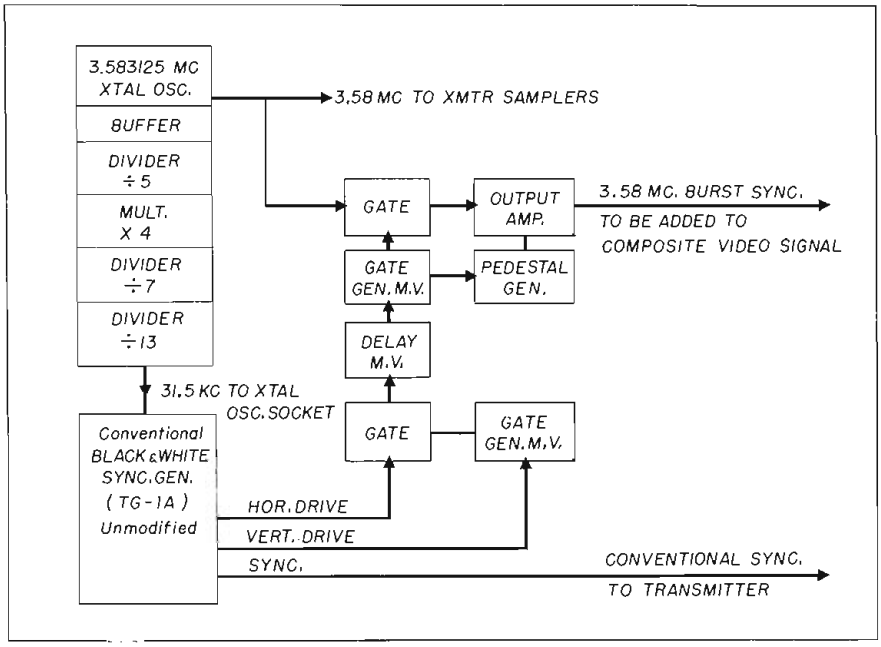
Critical inspection of the picture in this demonstration, transmitted a distance of about 5 miles over Channel 4, showed: (a) Resolution, read from the test chart, of 325 lines; (b) No flicker; (c) 100% automatic color phasing; (d) Compatibility with present monochrome (as shown by a high-definition black-white receiver) was 100%.

To continue with an evaluation of the RCA picture as demonstrated, it was found that browns, previously missing, were satisfactory and that the colors were realistic and pleasing. There were two defects noted. In close-ups when the person before the camera dropped his hands they appeared brownish red near the bottom of the picture. When lifted to the face they assumed the proper skin tone. One explanation was non-uniformity of the photo-emission over the entire sensitive surface of the image orthicon camera tube. (2) Many pictures had a purplish haze. This was seen in early RCA demonstrations. As a test, the writer viewed the picture with the blue channel only in operation. It seemed that the coordinate of this primary was chosen too far in the purple region. An RCA explanation was that "the engineer at the control room liked it that way"!

Transmitted Burst Method

To secure satisfactory color sync. and phasing the "Transmitted Burst Method" was used. This consists of adding to the transmitted signal, during each line retrace period, a short burst of the 3.58 MC sampling frequency. As seen from Fig. 1 this is 10 to 15 cycles of a sine wave placed on the "back porch" of the horz. sync. signal. At the receiver, the phase of the

Fig. 1: Block diagram of RCA transmitter showing additional circuits required to add 3.58 MC synchronizing burst to standard sync. pulse. Monochrome receivers are not affected



*TELE-TECH articles on color television will be found in the Oct. issue, p. 18; Nov. p. 24; Dec. p. 18 and Jan. p. 36.

by New Demonstrations

transmissions from three different TV stations using three color systems decision can now be made following determination of comparative tests

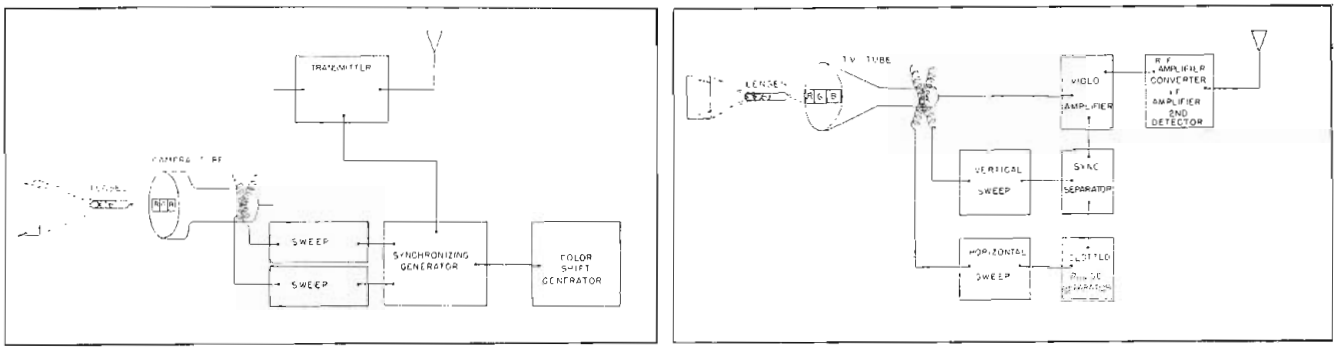


Fig. 3: Fundamentals of CTI system. Transmitter, left, has dichroic lens to split picture into three images, each passing through a separate filter. The three are scanned and transmitted. Receiver, right. Three images on kine are produced in red, green, and blue, projected as one

received burst is compared with the local sampling oscillator, and if a difference exists a correcting voltage is produced which brings into proper phase the sampling oscillator.

The ever-present problem in all such devices is securing freedom from noise disturbance — both external impulse and internal thermal noise. In this case, the excellent results noted in the demonstration were realized in the presence of noise because of the fly-wheel action of a tuned circuit and because of the integration of many bursts in a condenser before the voltage is applied to the controlled circuit. With a color phase circuit of such high stability, equal or better than standard horizontal sync. circuit performance can be obtained. Therefore the service area of a TV transmitter is not limited by the addition of color.

The addition of the burst following the horizontal sync. pulse has little effect on black-white receivers. If they use triggered vertical and AFC sync. of the syncroguide type there is no effect. In receivers using phase detectors for horizontal AFC the picture will be moved slightly to the left (⅛" for a 10" picture tube), an amount too small to be noticeable.

It is interesting to note that RCA has available for later field test other color sync. systems, such as Back-Edge Flywheel, Stop-Start Oscillator actuated from horizontal AFC, and the Pilot Signal Method.

For operation of the Burst Method RCA reports that the following additions to the present FCC TV standards are required:

Picture dot interlace—2 to 1.
Samp. rate—3.58 MC/sec./color.
Color picture rate — 15 per sec.
Samp. seq.—green, red, blue.
To standard sync. waveform, add to back porch of horz. sync. pulse 10 to 15 cycles of the sampling frequency.

A rather dim picture produced by CTI was obtained by the methods previously described.† Since the original demonstrations improvements and refinements have been made, resulting in the elimination of much tendency towards color crawl. The principle of operation is shown in Fig. 3 which illustrates both the transmitting and receiving equipment. At the transmitter the light from the scene to be televised is split into three images each of which is passed through a filter. The three images are placed side-by-side on the face mosaic of the image orthicon tube, and scanned. The side-by-side position of the three images results in each being scanned at normal TV horizontal speed, and there is a sync. pulse for each picture front edge. Thus, if the signal is received on a black and white receiver operating at normal speeds a single full size picture will be obtained.

At the receiver the cathode ray tube has three pictures side by side projected onto the screen.

†TELE-TECH December 1949, Color Television page 18.

COMPARISON OF COLOR SYSTEMS

	Horz. Dots Per Line	No. of Vert. Lines	Frame Flicker		Interline or Interdot Flicker		Picture Quality when C is recd. on M set	Compatible
			M	C	M	C		
PRESENT SYSTEM 6-mc Monochrome 30 frames, 60 fields	507	525	Equal	—	Equal	—	Equal	—
CBS SYSTEM 6-mc Sequenital Color	C 275 M 275	C 405 M 405	Inf.	Inf.	Equal	Equal	Inf.	No
COLOR TELEVISION, INC. 10 Color pictures. 50 fields Simple interlace plus color line commutation	C 507 M 507	C 525 M 525	Equal	Equal	Int.	Inf.	Inf.	Yes
RCA SYSTEM 6-mc Seq. dot, Color 15 color pictures, 60 fields Dot & Line interlace	C 507 M 507	C 525 M 525	Equal	Equal	Equal	Equal	Equal	Yes

KEY: C—Color M—Monochrome Inf.—Inferior

Test Methods for High

Comparison of transmitter waveforms against square wave Relationship of winding resistance, leakage inductance, and reflected

By E. B. HARRISON, Transformer Designer, Peerless Electrical Prod. Div., Altec Lansing Corp., 1161 N. Pine St., Hollywood, Calif.

THE use of square waves of suitable fundamental frequency is a convenient method for the rapid and accurate testing of electronic equipment. A square wave consists of a fundamental sine wave and its odd harmonics. The amplitudes of the harmonics are inversely proportional to the frequencies of the harmonics. That is, the amplitude of the third harmonic is one third that of the fundamental; the amplitude of the fifth harmonic is one fifth that of the fundamental; and so on. A square wave, then, is several test signals in one: it is a suddenly applied signal; it is a simultaneous series of sine wave signals of different frequencies and amplitudes, but having certain definite phase relations; and it is a signal which, for certain time intervals, has a level constant with respect to time.

If a square wave signal is fed to equipment under test, an examination of the wave form at the output of the equipment will disclose the important elements of the frequency, phase, and transient characteristics of the equipment. It can be shown that this reaction to the square wave (i.e. suddenly applied signal) will determine the reaction of the equipment to any type of signal. This method has been found to be particularly useful in the examination of audio transformers used with such equipment.

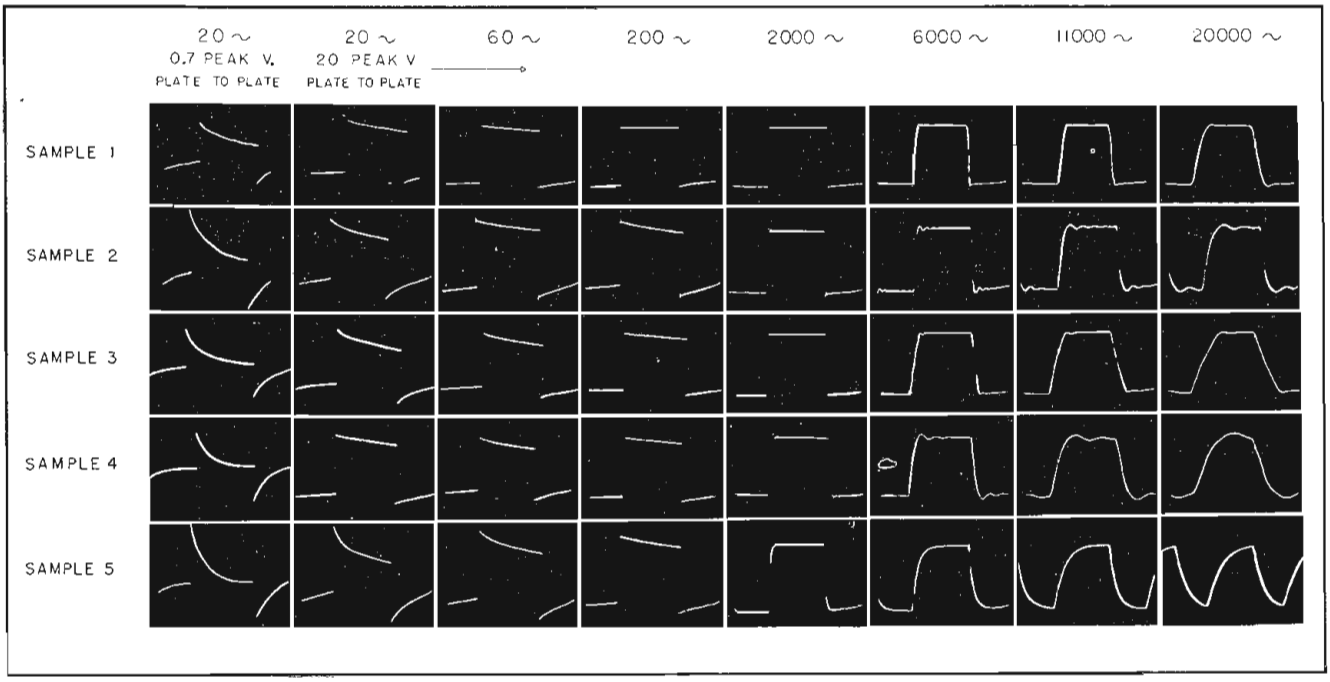
The test method consists of interpreting the deformed transmitted square wave in terms of the elements of the transformer equivalent circuit. For this work it is desirable to use several frequencies, although good results can be obtained with as few as two, when they are suitably chosen. Excellent results are obtained by using the low, high, and geometrical mean frequency of the normal transmission range. Normal transmission range can be defined, for the purposes of test, as the rated performance of the unit. For the usual high quality transformer this is the range from 20 to 20,000 cps., which places the geometric mean at about 630 cps.

These low and high frequencies are chosen because the transient characteristics are limited by the ability of the transformer to transmit its extremes of frequencies.

Low Frequency Square Wave

The low frequency square wave will show the effect of the self-inductance of the primary winding. Because the square wave is a suddenly applied signal, and there is no change in level after the initial rise, the only support for the wave top after the initial impulse is the energy from that initial impulse which is stored in the transformer by the primary self-inductance. Since the discharge time rate of the inductance is fixed by its associated circuit, it follows that the top of a square wave of low enough frequency (i.e. long enough duration) will no longer be flat or sloped, but instead will drop downward, exponentially, to zero signal level when the inductance is fully discharged.

Fig. 1: Waveforms obtained from five sample output transformers of competitive manufacture. Each transformer was led square wave input from a 5000 ohm balanced generator and was terminated in its rated load resistance. Seven testing frequencies used cover audio range.



Quality Audio Transformers

inputs at critical audio frequencies reveals design weaknesses. primary impedance to overall transformer performance described

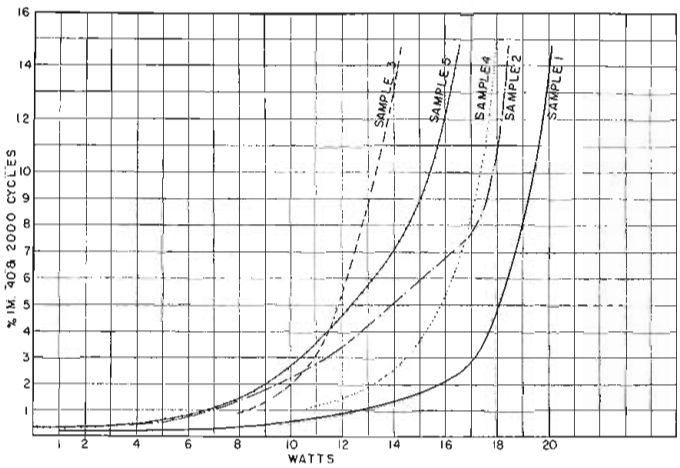


Fig. 2: Intermodulation distortion curves for samples tested

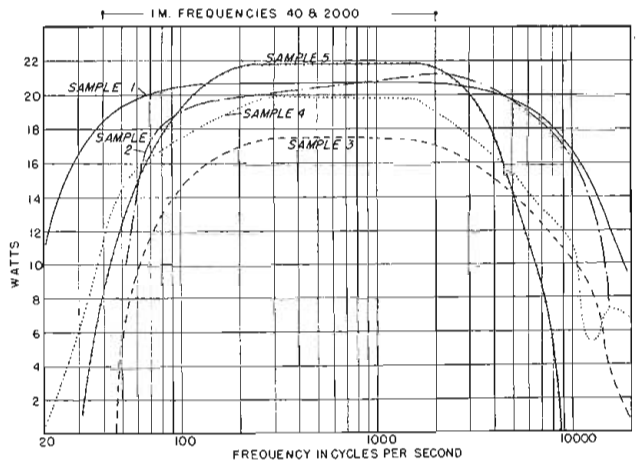


Fig. 3: Frequency-power characteristics of the five transformers

Toward the low frequency end of the transmission range this limiting effect of the primary self-inductance is first evidenced by a straight, sloping top on the wave, which represents a shift of phase between the fundamental sine wave and its harmonics; the fundamental shifting more because the reactance to it is less.

At the lower frequencies the amplitude of the test signal is quite important. This is so because the core permeability, and therefore the inductance, varies with signal flux density, increasing with signal strength up to the overload point, which is some value determined by series excitation tests.

The high frequency square wave will show the effect of the leakage inductance between windings, and the capacitances across windings. Moreover, this high frequency will clearly reveal the effect of an underdamped resonant circuit. The amplitude of the test signal at the higher frequencies is relatively unimportant because the transformer's capacitances and leakage inductance are constants which do not change with signal level.

The midrange frequency is important only in establishing the measured amplitude of the received square wave.

If the transmitted wave is square, the transformer can be considered to have a flat frequency response for at least 4 octaves above the fundamental; to have no phase shift, or to have phase shift proportional to frequency; and to be critically damped.

Competitive Transformers

To illustrate the value of square waves in transformer testing, measurements were made on several competitive output transformers, with similar ratings, which were selected from the catalogs of various manufacturers.

The output transformer was chosen because that is the most important transformer in an amplifier. It must handle power efficiently; it may be required to operate from an unmatched impedance; it generally works into a variable impedance of complex nature; and it must transmit program material, and at the same time backfeed transients from the load, where that load is a loudspeaker. The specification common to most manufacturers is:

Power: 20 watts approximately
Frequency: 20=20,000 cps.±1 db.
Primary Impedance: 5000 ohm with or without 3000 ohm.+ap.
Secondary Impedance: 15 to 16 ohms with assorted taps.
Weight: 5 to 7½ lbs.

Five transformers of different manufacture were procured and for the purpose of the tests they were identified as Samples 1, 2, 3, 4, and 5.

Square waves were examined at the following frequencies: 20 cps., 60 cps., 200 cps., 2000 cps., 6000 cps., 11,000 cps., and 20,000 cps.

(*Continued on page* 64)

TABLE I

	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
Winding Resistance, Primary	188 Ω	230 Ω	345 Ω	244 Ω	164 Ω
Winding Resistance, Secondary	0.44 Ω	0.34 Ω	2.15 Ω	0.5 Ω	0.6 Ω
Leakage Inductance[1]	13.6 mh	18 mh	45 mh	23.7 mh	98 mh
Relative Feedback Values[2]	20 db	19 db	13 db	19 db	10 db
Reflected Primary Impedance[3]	5000 Ω	5000 Ω	6000 Ω	5000 Ω	5300 Ω
Insertion Loss	0.5 db	0.6 db	1.6 db	0.7 db	0.6 db

1—Ref. to pri.
2—Stable operation
3—Secondary properly terminated

Directional Antenna

Operating notes and formulae for pattern and other important

By C. A. ROSENCRANS,
Engineering Products Dept.,
RCA Victor Div., Camden, N. J.

IN some instances, operators of television broadcast stations have relatively inaccessible locations such as the top of a high building or tower available for the installation of the RCA TRR1B relay receiver. The parabolic antenna system used with this receiver is very directive and must be aimed on the transmitter each time the transmitter is moved to a new location. Quite often the location of the receiving antenna is such that it becomes a serious problem to change the antenna from one direction to another.

Various positioning mechanisms may be designed for remote control of the antenna in both azimuth and elevation. All such mechanisms are complicated and expensive but can be simplified a great deal if one of the functions is omitted. We will, therefore, consider the possibilities of a system in which the receiving antenna is to be controlled in azimuth but fixed in elevation.

One possibility is illustrated by the following example. The elevation of the receiving antenna is 518 feet above the ground. The calculated distance to the horizon is therefore 28 miles—just about the maximum range for consistently good equipment performance. The question arises as to how the power at the receiver will vary as the transmitter is moved toward the receiver and the receiving antenna left aligned on the horizon. The diagram of Fig. 9 illustrates the general problem.

Tower height at receiver = 518 feet (above sea level)

Distance to transmitter = $d = 1.23\sqrt{H}$ = 28 miles (when transmitter is on the horizon) (12)

where d is in miles, H is in feet.

For any other distance d the increase in signal as the transmitter is moved toward the receiver is proportional to $(28)^2/d^2$. At the same time the receiving antenna is left aimed at the horizon. Therefore, due to the curvature of the earth, the transmitter moves below the original line of sight path by the angle θ and the distance h. Now

$D - d = 1.23\sqrt{h}$

or $h = (D-d)^2/(1.23)^2$ (13)

and

$\cot\theta = d \times 5280/h$ (14)

or

$$\cot\theta = \frac{(1.23)^2 d \times 5280}{(D-d)^2} = \frac{7989\,d}{(D-d)^2}$$

It is true that the actual distance between the receiving antenna and the transmitter is d′ and not d. However, for the small angles involved the error is small when d is used. For instance,

Let d = 1.4 miles = 7392 feet

then h = 470 ft.

and $\cot\theta = \frac{7989 \times d}{(28-1.4)^2} = \frac{7989 \times 1.4}{(26.6)^2} = 15.7$

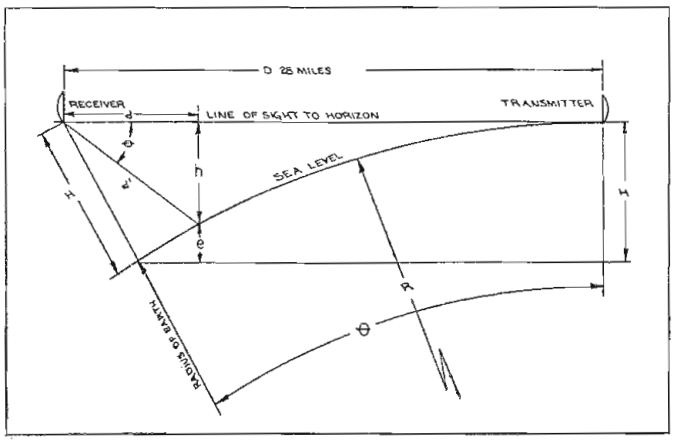


Fig. 9: Diagram of the circumstances in illustrative example used to study the possibilities of a system that is fixed in elevation but controllable in azimuth

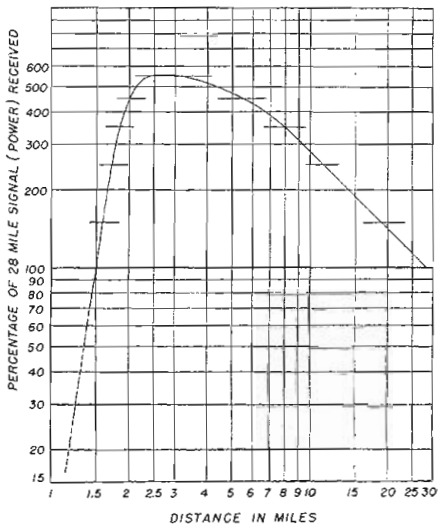


Fig. 10: Curve showing percentage of signal strength at receiver as transmitter is moved toward receiver from point of horizon

$\theta \cong 3.6°$

$d/d' = \cos\theta = .9980$

$d/\cos\theta = d'$ or 7407 ft. (16)

The error here is 15 ft. or .24% and decreases as d becomes larger.

In order to obtain the relative signal power at the receiver for each new position of the transmitter both (θ) and d must be known. The solution is then as follows:

The increase in power due to the transmitter being moved from D = 28 miles to d is

$P_d/P_D = D^2/d^2$ (17)

The decrease in power due to the receiving antenna no longer being aimed at the transmitter is taken from the curve of Fig. 4; a normalized antenna gain curve in terms of relative power and the angle off the main axis for an antenna having 1° beam width. If we assume that our receiving antenna has a 4° beam width, the angle coordinates on the curve must be multiplied by 4. If the power ratio obtained from this curve be $P_{(\theta)}$, then the net power ratio for any location d is:

$(P_d/P_D)P$ (18)

A plot of this is shown in Fig. 10. Note that as the transmitter is moved in toward the receiver, the power at the receiver first increases, but as d becomes small compared to D the power rapidly decreases.

Although the curve of Fig. 10

Systems for Microwave TV

PART TWO OF TWO PARTS

determining power gain, beam width, radiation characteristics of television microwave relays

illustrated the solution of the general problem, it will be recalled that the solution was based on a smooth earth's surface which is very seldom found in practice.

A more typical setup is like that shown in Fig. 11 in which the more usual contour of the earth shown in Fig. 4 is used.

The new location of the transmitter at distance D = 28 miles is now above the line of sight to the horizon by some elevation E and angle ϕ. It can be seen that the general solution is much the same as before. One new problem arises, however, and that is the positioning of the receiver's antenna. If it is aligned on the new transmitter location which is now at an elevation of H + E, the angle (θ) of the first case is increased by the angle ϕ. For E = 500 feet, ϕ would be approximately 11 minutes and not affect the results obtained appreciably. The effect of E as the transmitter is moved toward the receiver is generally to improve the signal level over that calculated for the smooth earth condition.

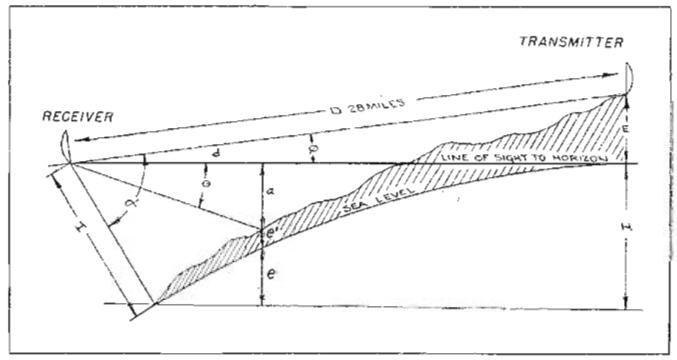


Fig. 11 Diagram of problem similar to that shown in Fig. 9 except that more usual contour of the earth is considered

Receiver Aligned in Azimuth

One may conclude that it is quite feasible to locate a receiving antenna so that it need be aligned in azimuth only and still supply sufficient power to the receiver for normal operation. However, each such installation should be considered a special case and calculations should be made to find out whether or not the results will be as desired.

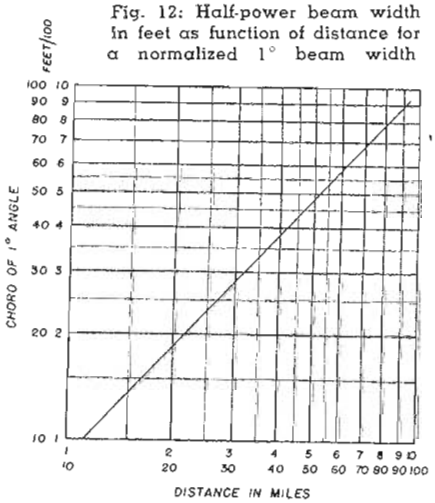


Fig. 12: Half-power beam width in feet as function of distance for a normalized 1° beam width

The methods used in the preceding example may be applied to a special case in which the azimuth angle is fixed and the elevation made the variable. This is essentially what is done in the solution of the interference problem. However, it is of interest at times to know the half-power beam width in feet as a function of distance. This function is plotted in Fig. 12 for the normalized 1° beam.

NOTE: It will be noticed that in all problems involving the antenna patterns the vertical pattern has been taken to be the same as the horizontal pattern. This is sufficiently accurate for most cases involving large parabolic reflectors although not entirely correct. Other antennas such as horn arrays, or modified parabolic systems may have entirely different horizontal and vertical patterns and this must be considered in special cases. The effect of ground reflections may also affect results in some instances where the line of sight path is near grazing. The general solution will nevertheless follow the same form.

Powerless Relay

It is possible that occasions may arise in practice when it is necessary to set up a system in which the transmitter and receiver are not in line of sight. The question of how to get the signal around the corner naturally arises. One method is that used in which two auxiliary antennas are used.

Calculations for the first method may be based on the discussion of multi-path effects described in "Special Considerations." It should be noted that the smaller the angle ϕ becomes, the larger the reflecting surface must be if the loss at the reflector is to be kept at a minimum. For very small values of ϕ the losses become excessive and the system becomes very difficult to align. Practical considerations indicate that values of ϕ less than 45° may prove to be very difficult to handle.

The second method is very inefficient since the energy propagated in the new direction is no longer a mirror reflection but instead is due to radiation from another antenna.

Suppose we consider a setup similar to that illustrated in Fig. 13. T is the transmitter having a power of W watts; R the receiver, and D the line-of-sight distance between T and R. R′ and T′ are the auxiliary receiving and transmitting antennas at the relay points, a distance d_1 from T and d_2 from R.

We may now calculate the ratio of the power received by the receiver R over the relay path to that over the direct path. (Under line-of-sight conditions.)

Power at R_1

$$\frac{P_{R'}}{P_T} = \frac{A_{R'}A_T}{d_2^2}C \qquad (19)$$

where

P_T = transmitter power
$P_{R'}$ = receiver power (auxiliary)
$C = 1/\lambda^2 = f^2/v^2$ = constant
$A_{R'}$ = area of receiving antenna
A_T = area of transmitting antenna

(*Continued on page 68*)

Measuring VHF Impedance of

New technic considers crystal temperature, aging, ZM-2 RF Ohmmeter, as end product of this technic,

By DOUGLAS A. VENN,
Naval Research Laboratory, Washington, D. C.

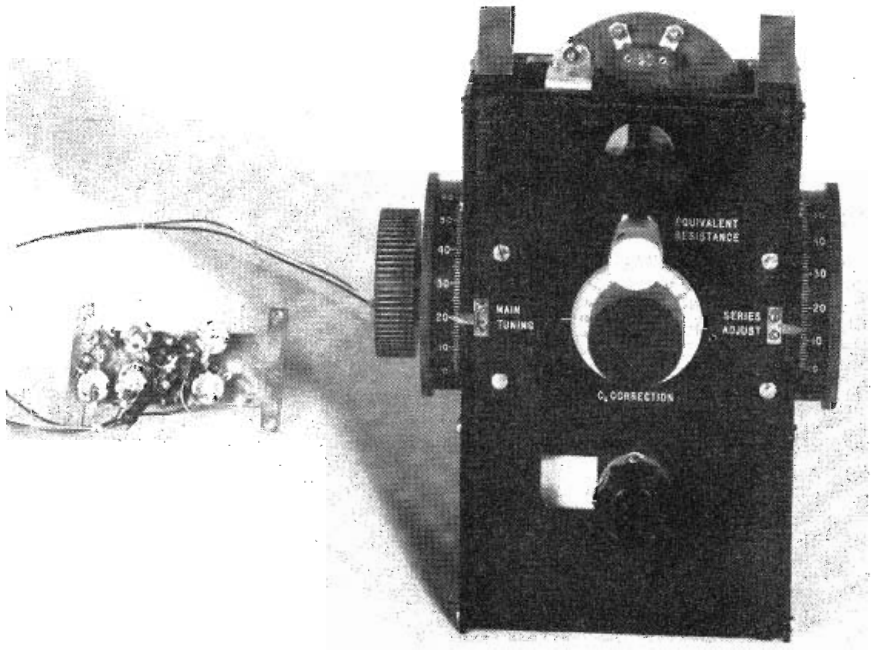


Fig. 2: Front view of oscillator assembly of r-f ohmmeter. 2C51 tube chassis at left

CONSIDERABLE attention has been given of late to the operation of quartz crystals at VHF at series resonance rather than at minimum impedance. An AT Cut Quartz unit will have a frequency tolerance of not more than ±.005% over the temperature range −55°C to +90°C. The temperature is only one item which governs the accuracy of operation of a crystal unit. Let us consider a few of the other more important items — aging, drive on the unit, operation off resonance.

The causes of aging are receiving attention at the present time. Both the series resonant frequency and the resistance (F_s and R_s) of a crystal depend upon the drive on the unit to a considerable degree as shown in Fig. 1 for a pressure mounted AT cut plate. The pressure mount accounts for the relatively high resistance at low drive. The plate is apparently restricted less by its mounting when being driven moderately. Quartz plates which are not clamped but plated and wire mounted exhibit the same characteristics but to a very much smaller degree. The resistance of all units increases under excessive drive.

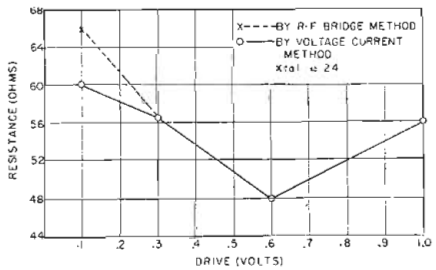


Fig. 1a: Series resistance change with drive

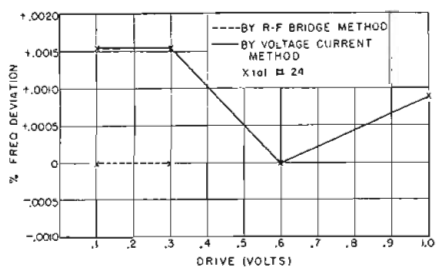


Fig. 1b: Crystal frequency change with drive

The frequency of all quartz units changes with drive, because of internal heating and to the change in the mechanical strain which the holder places on the quartz plate. However, in Fig. 1 variations in results were noted between two technics of measurement used.

Predicting Frequency

When a crystal is operated at anti-resonance the frequency cannot be predicted accurately unless the load capacitance into which the crystal looks is also known accurately. The same thing applies when operating at series resonance at very high frequencies. The reactance of the shunt capacity across the crystal unit approaches the same order of magnitude as the series resonant resistance of the crystal unit so the crystal will no longer operate at its series resonant frequency. Furthermore, the frequency of operation can be predicted if the total shunt capacity across the crystal is accurately known.

Three classical methods of making impedance and frequency measurements of quartz units are shown in Fig. 4. In the voltage current method, the technic is to measure the current through the crystal and the voltage across it. The frequency of the driving voltage is varied until the voltage across the crystal is a minimum to indicate the frequency and the magnitude of minimum impedance.

In the bridge method, it is possible to balance for any given condition such as unity power factor or minimum impedance by varying frequency, and thus measure resistance and reactance. A good bridge for use at 100 MC must be available.

The slotted line technic is most suitable for use at VHF and will provide measurements at anti-resonance, series resonance, unity power factor and minimum impedance. In any method the frequency generating equipment must be at least as stable as the crystals, and is not generally available at present.

For direct crystal control (series resonance) at frequencies above 75

Piezoelectric Crystals at Resonance

drive on the unit and off-resonance operation. measures frequency and impedance from 10 to 100 MC

MC, the equivalent circuit of the crystal cannot neglect C_a which becomes significant at such frequencies as is indicated in Fig. B.

From the laws of impedances in parallel (Fig. 5) if $C_a = 5$ $\mu\mu$f and $R = 50$ ohms at $F = 5$ MC/sec. (and we neglect 3rd order terms) it can be shown that the $R^2C_a^2w^2$ is much smaller than unity, and Z_{AB} is approx. equal to R.

This indicates that the crystal at 5 MC/sec. operates very close to the frequency where $w = \sqrt{1/LC}$ and at unity power factor.

If, however, $C_o = 17$ $\mu\mu$f and $R = 100$ ohms at $F = 100$ MC, the expression for impedance cannot be simplified and Eq. 1 holds. This is more formidable but would indicate that at 100 MC the crystal would operate at some impedance Z/ϕ which is smaller than R, and not at resonant and unity power factor as desired. Experiments show that the frequency of operation at minimum impedance is different from the resonant frequency depending upon the magnitude of C_o.

Fig. 6 shows the relationship between frequency and impedance under three conditions of operation. Under driven conditions a frequency corresponding to that of the zero reference line can be measured but under oscillating conditions, where there is stray capacity shunting the crystal, frequency deviations of the order .003% at 75 MC could be expected. This is not desirable when it is realized that a $\pm$.005% frequency change is permitted over the "A" range due to the temperature coefficient of the quartz and miscorrelation of oscillators. It is, therefore, necessary to operate the unit at resonance $\pm$.0005% in order to allow $\pm$.0045% change due to the temperature coefficient of the quartz.

There are only two ways of correcting this situation: eliminate C_a or control its magnitude closely. The first solution was chosen because the second one was not feasible.

Fig. 7 is the well known cathode coupled circuit as reported by Hill and Kenyon. Two conditions for oscillation at series resonance are (1) unity gain, and (2) no phase shift around the loop. The first is met when the crystal operates at minimum impedance. The condition of no phase shift will be met when

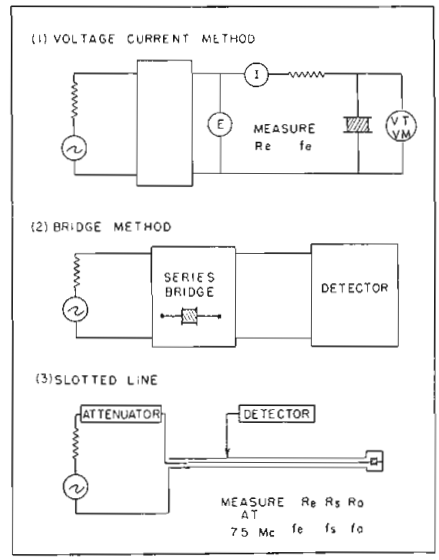
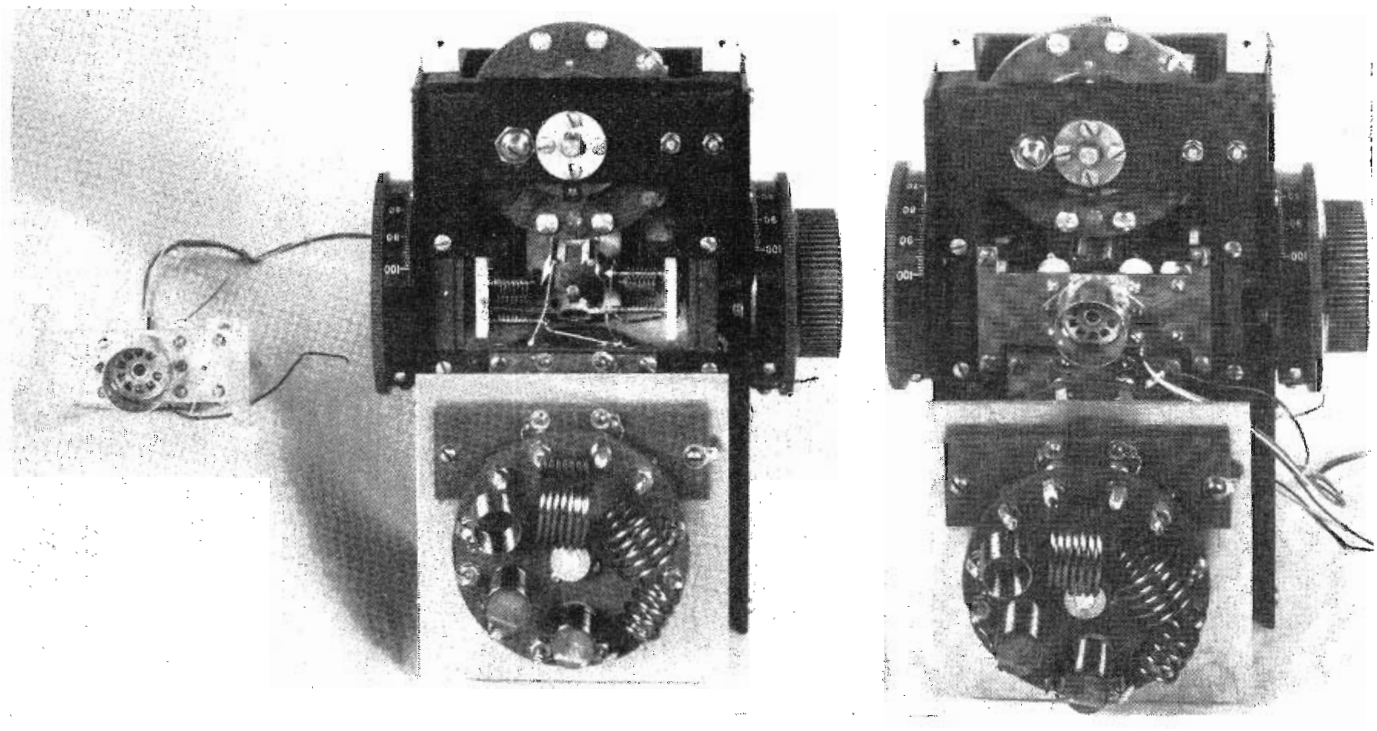


Fig. 4: Diagrams illustrating three classical methods employed for impedance and frequency measurements on quartz units

Fig. 3: Photos showing rear views of oscillator for r-f ohmmeter with (left) 2C51 tube chassis in unmounted and (right) mounted positions



VHF IMPEDANCE

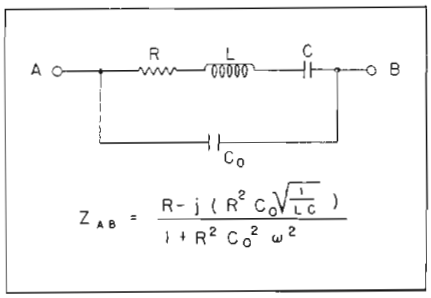


Fig. 5: Equivalent crystal circuit above 75MC

the element inserted between A and B has unity power factor.

As long as C_0 is large enough to be significant the above two conditions will not both be met at the same frequency, and it would appear that the circuit will oscillate at the frequency where the sum of the in phase voltages (superimposed on R_2) is greatest.

In the 75 MC case where C_t is the total capacity across the crystal, the reactance of C_t = approximately 100 ohms, and is of the same order of magnitude as R, the frequency of operation is about .003% lower than the frequency of series resonance. This is certainly objectionable when it is recalled that the tolerance of the unit over a wide temperature range is expected to be ±.005%.

It should also be pointed out that any reactance which appears in series with the crystal will force the crystal to operate off resonance with an effective R_s rather than with a series resonant resistance of R_s. Such reactance as is likely to be introduced at VHF using good VHF

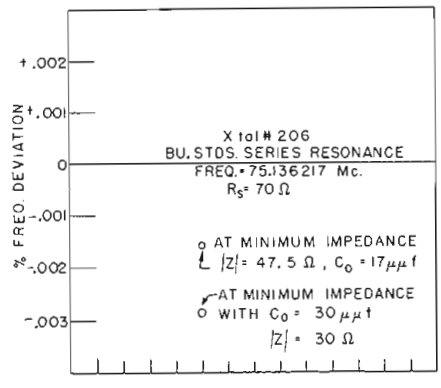


Fig. 6: Relationship between frequency and impedance under 3 conditions of operation

technics will cause R. to be up to 70% greater than R_s.

All of the factors we have mentioned to this point must be considered when attempting to correlate the measurements of series

(Continued)

resonant frequency and resistance between two different technics of measurement.

The two main corrections which must be applied to the general cathode coupled circuit are, correc-

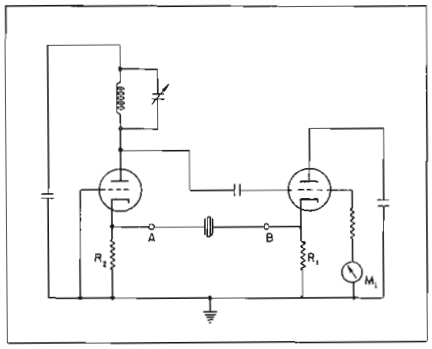


Fig. 7: Cathode coupled circuit developed as a means of eliminating the capacity C_0

tion for C_0 and correction for lead inductance. These two corrections when applied will make the circuit suitable at 100 MC/sec. both as a measuring device and an operational circuit.

These corrections are indicated in Fig. 6. C_1 is adjusted so that the reactance of L_1 is equal to the reactance of C_1 which assures that there will be no net reactance in series with the crystal. This adjustment is made with a conductor inserted between A and B which has approximately the same inductance as the leads in the crystal unit. In an oscillator circuit, C_1 is adjusted for maximum amplitude of oscillation which indicates minimum phase shift around the loop. The fact that L_1 and C_1 comprise a tuned circuit helps to restore the waveform after having been distorted by the cathode follower section which is not operating Class A, to one with sinusoidal characteristics. In any practical oscillating circuit there will be some capacity across R_1. The effect of this capacity

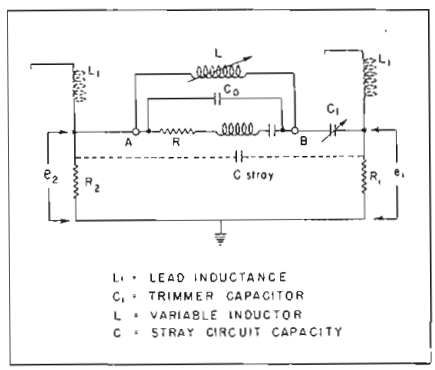


Fig. 8: Equivalent corrected circuit (Fig. 7)

can be kept to a minimum by making the time constant of the grid circuit in that tube equal the time constant of the cathode circuit. This will assure no phase shift in the cathode follower section.

There will also be some stray capacity across R_2. In practice its effect is minimized when C_1 is adjusted for maximum amplitude of oscillation for this will automatically correct for any phase shift caused by the stray capacity across R_2. L is adjusted so that the reactance of L is equal to the reactance of C_0 plus stray capacity.

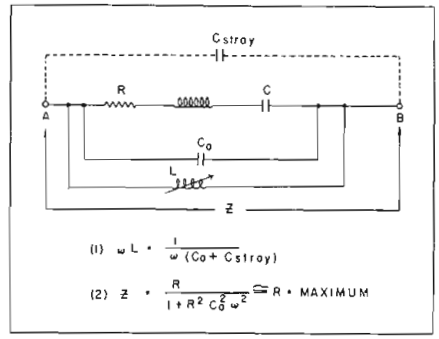


Fig. 9: Circuit conditions for resonance

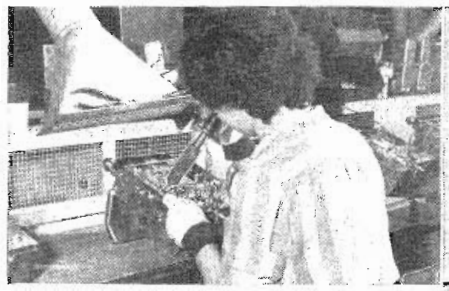
This adjustment is made after the adjustment of C_1 and with the crystal connected between A and B.

An indication of resonance can be observed when two equations are satisfied. When Eq. (1) Fig. 9 is satisfied, C_0 of Eq. (2) will go to zero and leave Z = R.

In practice Eq. (2) can be satisfied by adjusting L so that e_2, Fig. 8, is a minimum and adjusting the frequency of e_1 so that e_2 is a maximum. In an oscillating circuit this means changing the tuning of the tank circuit. When all corrections are made the circuit of Fig. 8 will look like Fig. 10 and $R. >> R_s$. When the circuit looks like (b) the phase relationship of e_1 and e_2 will be the same and the crystal unit must have unity power factor and hence operate at resonance.

When these conditions for no phase shift are met, a resistor (good at operating frequency) may be substituted for R. Since R_1 and R_2 remain the same the resistance R′ which is substituted for the crystal may be changed until the current is the same in both instances. When this condition is established, R = R′ and the frequency of oscillation with crystal and with the resistor will be one and the same. If the crystal unit can be replaced by a pure resistance in an oscillating circuit, it is certain that the crystal is operat-

(Continued on page 63)



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Commercial Television at UHF

Converter designed by RCA for television in the high band incorporates many novel features in double conversion circuit

By JOHN H. BATTISON
Associate Editor

STATION KC2XAK, the experimental NBC-RCA UHF station at Bridgeport, Conn., 55 miles from New York City, is now radiating 11.5 KW on frequencies of 530.25 MC for the video carrier and 534.75 MC for the audio carrier in the band 529 to 535 MC, or channel 24 under the proposed FCC allocation. With an antenna gain of 17 and a peak output of 1 KW (the maximum is 1.4 KW on peak sync. pulses) the signals radiate from an antenna with an average height above ground of 330 feet. Transmission characteristics are understood to be as good as those of conventional RCA transmitters and the output to the antenna from the notch type diplexer contains 350 lines. One of the main problems in the design of the equipment was to reduce circuit losses to a minimum; in the final production the overall efficiency of the PA and tripler is 82%.

For the video transmitter, grid bias modulation by means of eight 6L6's in parallel operating in a cathode follower circuit is used. RF power at 176.75 MC and 178.25 MC for the video and audio channel is obtained from a modified RCA TT-500-B 500 watt TV transmitter. These frequencies are applied to their respective tripler and power amplifier stages. Each stage uses eight RCA 4 X 150A's in parallel and mounted symmetrically in a cylindrical cavity. The screens and plates are connected to the top and bottom walls of the cylinder. A similar circuit is used for the audio RF channel. It is interesting to note that neutralizing is effected by a common inductance in the input and output circuits and is varied by adjusting the dimensions of the screen grid contacts. Load is varied by changing the impedance of a quarter-wave line section. An outer conductor is rotated, and this changes the proximity of ribs on the inside of the coaxial section. Power measurements are understood to have been made by means of a directional coupler, slotted line and a calorimeter load. At 530 MC, 90% of the power expected for lower frequency operation was developed, and the RF voltage required on the grid was somewhat higher than estimated.

The method of frequency stabilization is interesting. To maintain accurate spacing between the video and audio carriers the master oscillator of the audio transmitter is beaten against a signal from the crystal oscillator of the video carrier. The difference is compared with a standard reference signal and the resulting voltage variations

(*Continued on page* 51)

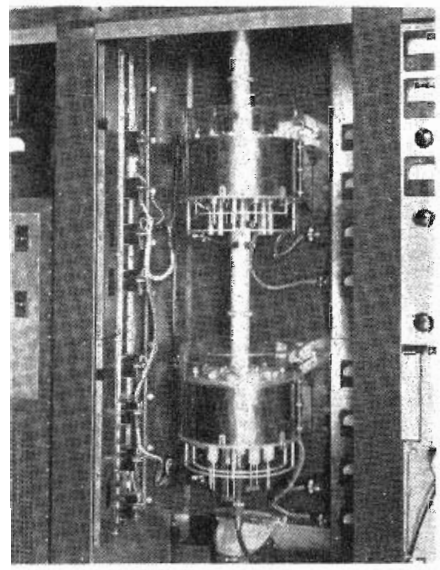
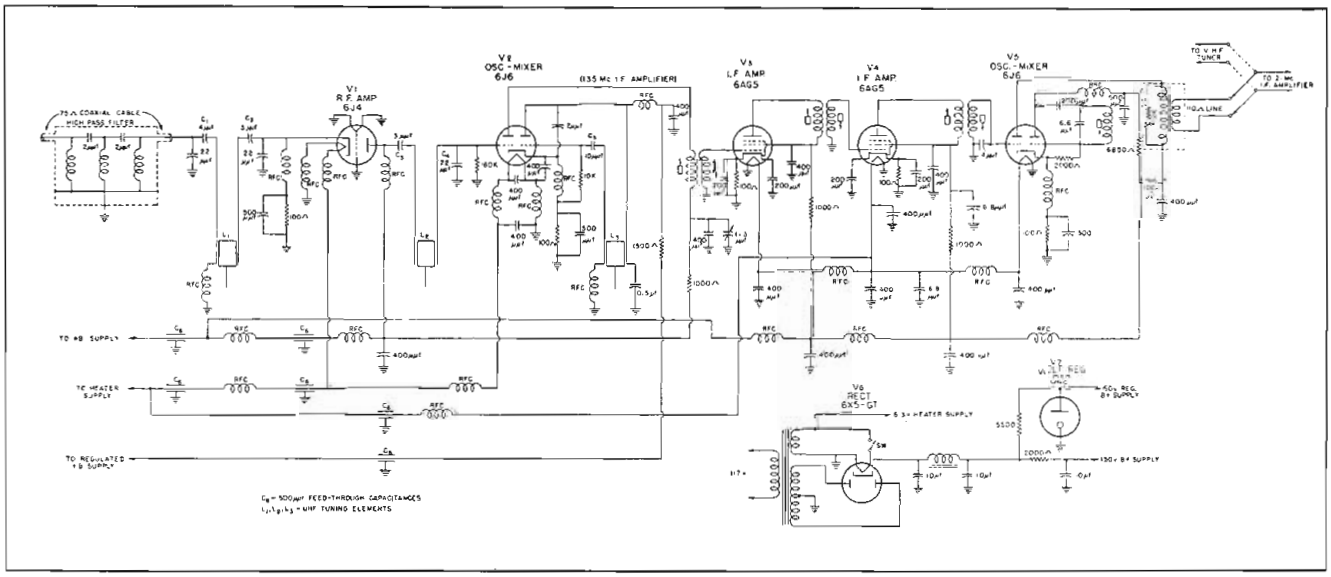


Fig. 1: Power amplifier and tripler stages of UHF video transmitter. Eight 6L6's are contained in each upper and lower cylinder

Fig. 2: Circuit diagram of the RCA five-tube UHF converter used in the Bridgeport tests. Mounted inside the cabinet of the receiver proper it operates in a double conversion circuit using 135 MC for the first I-F stages and feeding into the 21 MC I-F amplifier of the receiver



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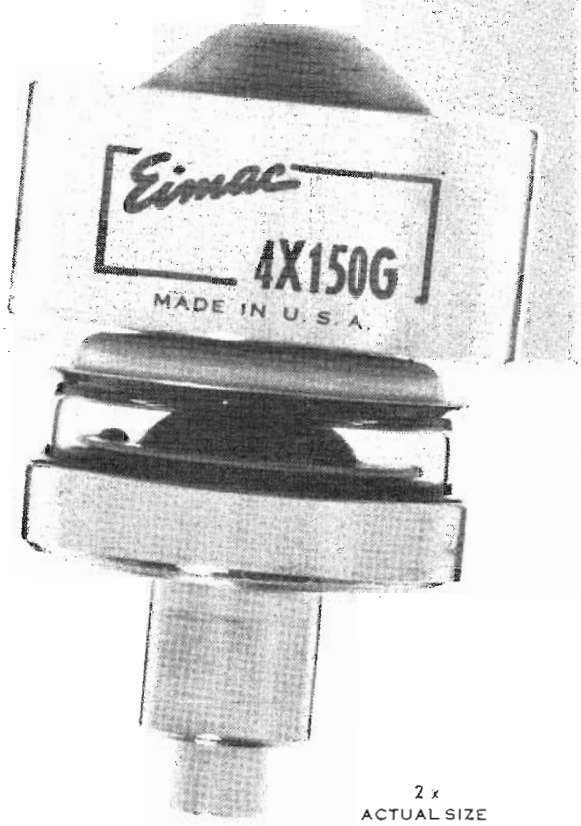

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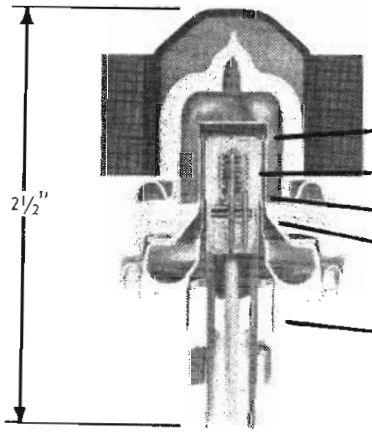
Maximum ratings and other operational characteristics for this new tetrode are available from the Eimac Field Engineering Department.



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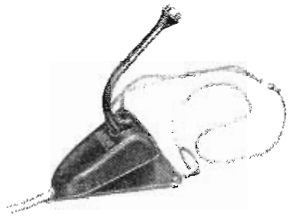

21B (chest)

21B (lapel)

632*

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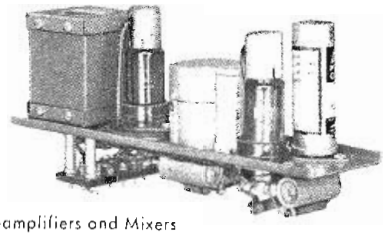
AMPLIFIERS



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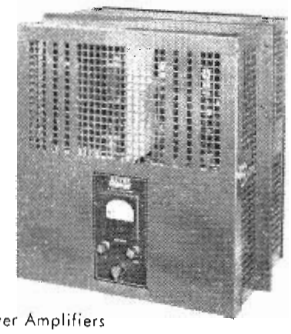

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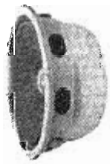
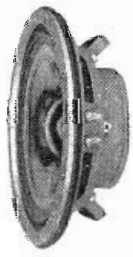
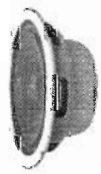




400B
755A*
600B
728B*
603B



754B*
604B
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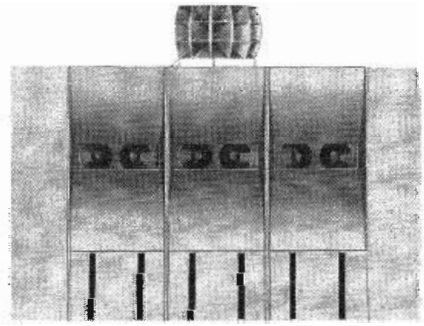
757A*



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(*Continued from page 48*)

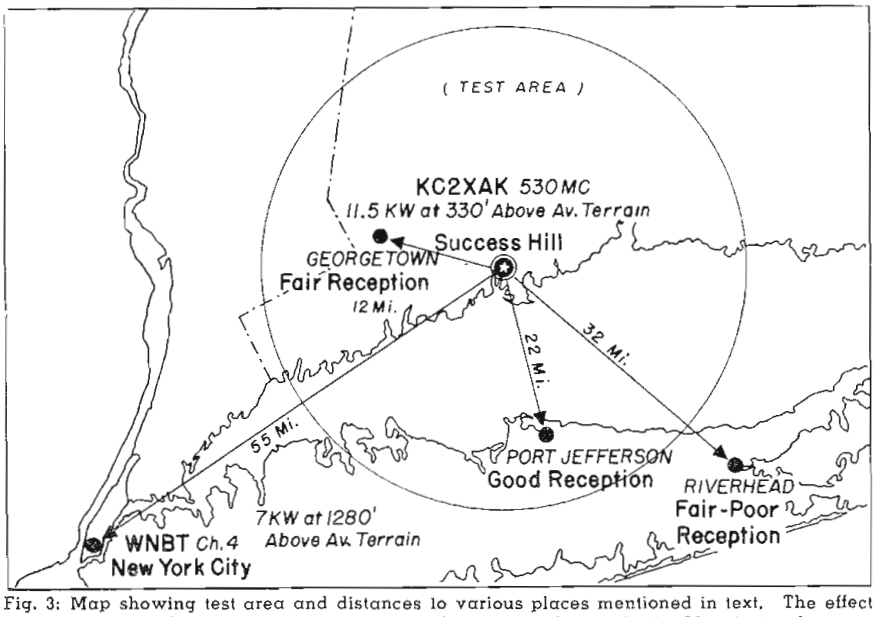


Fig. 3: Map showing test area and distances to various places mentioned in text. The effect of the water path and smooth terrain can be seen. The circle is 50 mi. in diameter

are applied to the audio master oscilator to maintain a difference of 4.5 MC. The overall frequency stability is .002%.

The antenna is a ten inch diameter copper tube forty feet long, with twenty-two groups of slots. Each slot is $\lambda/2$ long, with vertical separation also of $\lambda/2$. A coaxial feed balances the power in the upper and lower portions of the antenna and also the phase. By suitable phase adjustment it is possible to obtain substantially a circular pattern. In the vertical direction a beam width of about 2° is found at the half power point. Deicing equipment is fitted and the slots are protected against ice formation. Although special coaxial transmission line of 3⅛ inch diameter is used, the loss per hundred feet at this frequency is 0.222 db. Some experimentation, using a wave guide, is in progress to determine whether its use would result in an appreciable decrease in the power loss.

One hundred RCA type 9T246 receivers are being used for this experiment. Fifty of these have been modified by the addition of a five tube UHF converter built into the set. The other fifty are not modified, but utilize an external separate converter. It is expected that about 150 installations will be made by transferring receivers from house to house. At the time of writing all the sets had not been installed, in fact only 22 were in operation. Expressed percentagewise the first figures are encouraging: reporting reception as: very good, are 22.75%, good 22.75%, fair 27.5%, poor 13.5% and useless 13.5%.

The five tube converter uses two 6AG5's, two 6J6's and a 6J4, constituting a double conversion system. It is understood that in order to prevent tuning trouble due to drift the tube heaters in the converter are kept hot continuously. The current drain is, of course, quite low, but it is interesting to observe one of the ramifications of UHF operation in that for everyday use it is at present necessary to resort to such measures. (Consideration of this aspect alone points to the advantage of a continuous VHF frequency spectrum at this date rather than dual VHF and UHF operation as presently under discussion before the FCC). A block diagram of the tube line-up is shown in Fig. 4, and the schematic diagram appears in Fig. 2. The two frequencies used in the double conversion system are 132-138 MC for the first IF and 21 to 27 for the output IF (the signal to the stand-

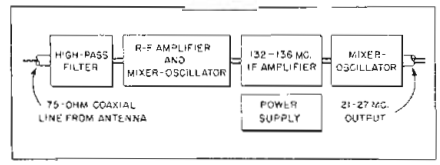


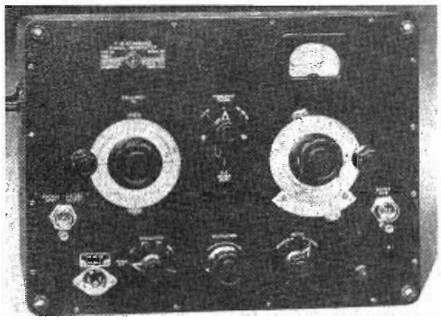
Fig. 4: Block diagram of receiver functions

(*Continued on page 69*)

NEW EQUIPMENT for Designers and Engineers

FM Signal Generator

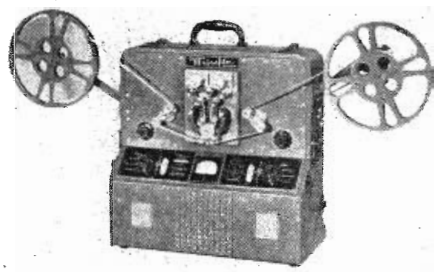
Model 1022-A FM standard signal generator has been designed specifically for testing FM broadcast receivers. Carrier frequency range



is 88 to 108 MC and i-f range 10 to 11.5 MC. The r-f oscillator is modulated directly by a reactance tube, thus eliminating the difficulties caused by spurious beats that occur in beat-type systems. Modulation system is flat from 20 cps to 15 KC, and internal modulating frequencies of 60 and 400 cps are provided. Deviation range is 0 to 200 KC, with less than 5% incidental amplitude modulation. **—General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.**—TELE-TECH

Synchronous Film Recorder

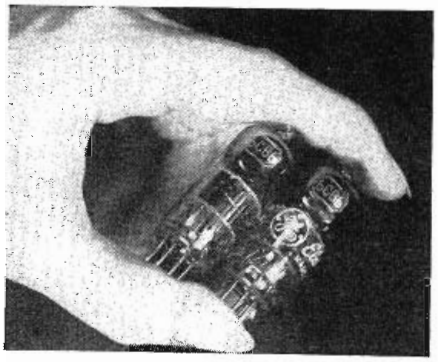
A new magnetic film recorder synchronously driven at a speed of 72 ft./min. by specially designed precision-cut sprocket drive is a re-



cent addition to the Movie-Mite line of sound photographic equipment. Frequency response is ±1 db. 50 cps to more than 10 KC. Automatic interlocking controls prevent erasure of "take" while reversing and friction device on take-up arm prevents overfeed of reversing film. Separate record-bias amplifier includes pre-amplifier. Inputs of either 50 ohm low level or 500,000 ohm high level, unbalanced, are provided. **—Movie-Mite Corp., 1105 Truman Road, Kansas City 6, Mo.**—TELE-TECH

Miniature Pentode

A miniature sharp cut-off pentode, the 6CB6, can be used as a wideband amplifier in the i-f or r-f stages of television and FM



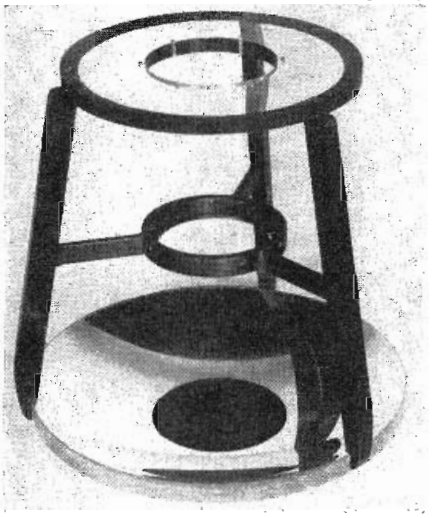
receivers. Suppressor and cathode are brought out on a separate base pin for greater flexibility in design. Characteristics of the tube include a transconductance of 6,200 micromhos and a plate current of 9.5 ma under typical operating conditions. **—General Electric, Syracuse, N. Y.**—TELE-TECH

Electrical Tape

Superthin in construction and high in dielectric resistance, Dutch Brand Plastix electrical tape has as high as a 200% stretch and resists water, oil, acids, alkalies and corrosive chemicals. Tape is supplied in a screw top container which holds five rolls, ¾ in. wide and 44 ft. long. **—Van Cleef Bros., Inc., Chicago 19, Ill.**—TELE-TECH

TV Projection Assemblies

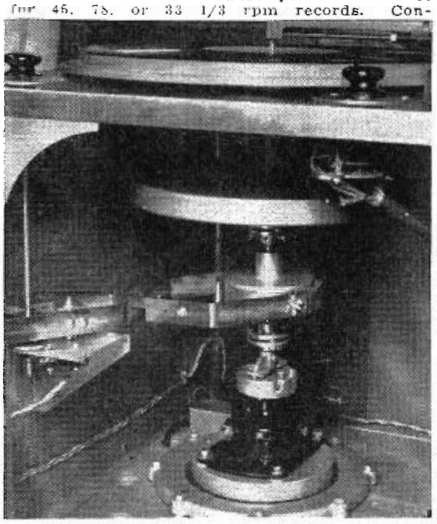
New stable and accurate plastic optical assemblies (Types 11/52, 11/40, and 8/37) are rigidly constructed self contained units which provide optimum performance and completely



eliminate the need for any optical alignment or mechanical adjustments in receiver assembly or installation. Projected picture sizes are: 20 x 15 in. for the 11/52; 16 x 12 in. (nominal) for the 11/40; 16 x 12 in. for the 8/37. There are 3 fixing holes in corrector plate at 120°. Overall length of the 11/52 (largest of three models) is 11.8 in. and weight is 3 lbs. 3 oz. **—Imperial Chemical Industries (New York) Ltd., 521 Fifth Ave., New York 17, N. Y.**—TELE-TECH

45 RPM Studio Turntable Conversion Equipment

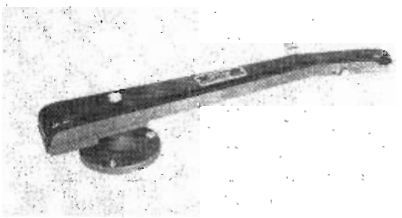
Simple, quickly installed equipment has been developed to convert the standard RCA 70-series broadcast transcription turntables for 45, 78, or 33 1/3 rpm records. Con-



sisting of a 45-rpm conversion kit (RCA type MI-11883), and a fine-groove pickup and tone arm assembly (MI-1154), the new equipment permits the operator to shift speeds quickly for 45, 78, or 33 1/3-rpm records. The conversion kit consists of a clutch assembly (speed changer), brake arm assembly, switch and cam shaft assembly, dial plate, shaft coupling, and adaptor hub. **—Radio Corporation of America, RCA Victor Div., Camden, N. J.**—TELE-TECH

Transcription Tone Arm

The viscous-damping principle of the new Gray transcription tone arm so effectively controls the motion of the arm that the pickup head can be dropped from any height



onto the record, without damage to the reproducing stylus. Because of virtually complete elimination of tone arm resonances, the manufacturer claims that perfect tracking of records is afforded at lower stylus pressures than with arms of conventional design. A plug-in feature permits instantaneous changing from 78 rpm to LP (micro-groove) or 45 rpm records, with correct stylus pressure automatically obtained. No counterweights need to be attached, nor any adjustments made. The offset head provides minimum tracking error. Arm length is such as to provide for records and transcriptions up to 16-in. in diameter. The patented viscous-damping principle has been tested daily for a year on the recording studios of a large record manufacturer. **—Gray Research & Development Co., Inc., Hartford 1, Conn.**—TELE-TECH

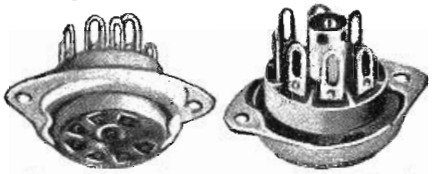
FM Signal Generator

A new FM signal generator, type 202-D, has been designed for use with telemetering receiver equipment covering the 175 to 350 MC frequency range. Continuously adjust-

able deviation ranges are provided from 0-24 KC, 0-80 KC, and 0-240 KC. In addition, amplitude modulation up to 50% may be obtained using the internal audio-oscillator and modulation to 100% using an external audio oscillator. The internal audio oscillator provides eight fixed frequencies 50 cps and 15 KC, any one of which may be conveniently selected by a rotary type switch for frequency or amplitude modulation. The deviation sensitivity of the FM system is within ±0.5 db from dc to 200 KC. The amplitude modulation system is substantially flat from 30 cps to well above 100 KC. **—Boonton Radio Corp., Boonton, N. J.**—TELE-TECH

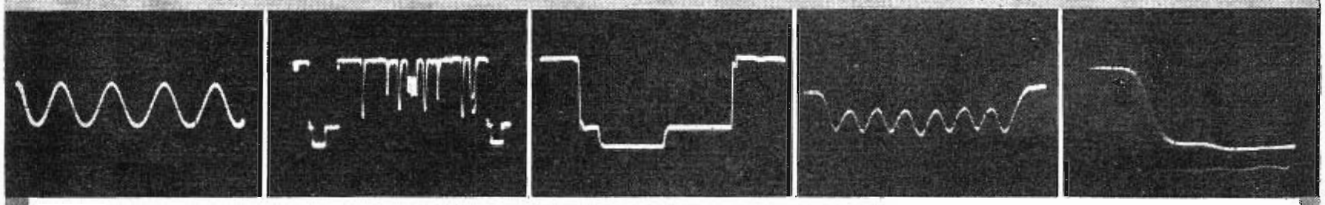
Miniature Tube Sockets

The manufacture of 7-pin miniature tube sockets has been initiated by a new company utilizing precision-molded Mycalex as an in-



sulator. The sockets are available in Mycalex 410 which was developed for applications requiring close dimensional tolerances not possible in ceramics and at much lower loss factor than mica-filled phenolic. Illustration shows two views (actual size) of the 7-prong socket. **—Mycalex Tube Socket Corp., 30 Rockefeller Plaza, New York 20, N. Y.**—TELE-TECH

THE T-V PICTURE-SIGNAL ANALYZED



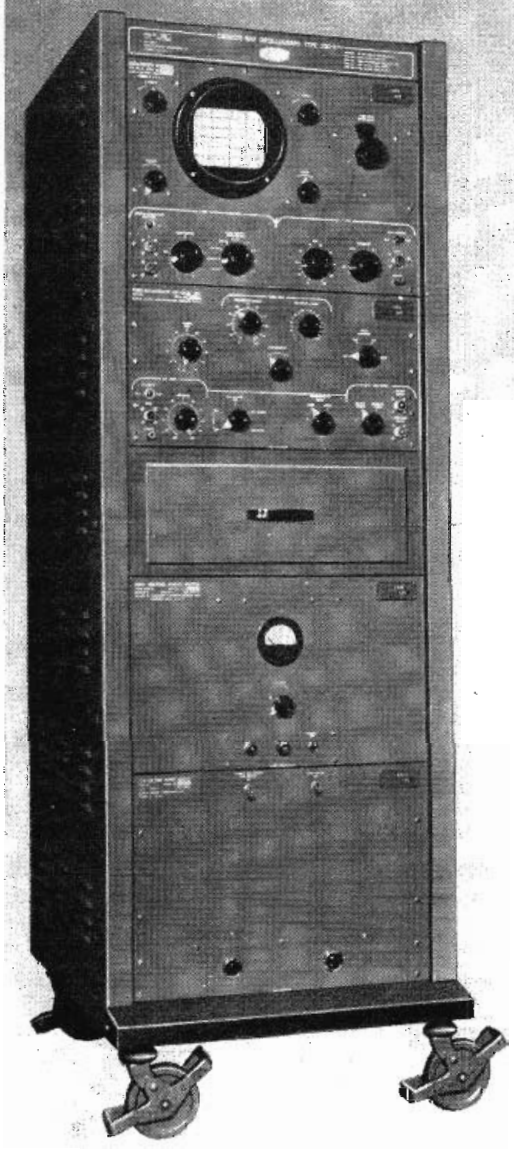
Output of one of the marker oscillators used in setting sweep speeds to known values. This case represents 0.2 microsecond/inch.

1.2 lines of television signal. Horizontal synchronizing and blanking pulses at each end. Video modulation in center.

Fractional part of a line. Horizontal synchronizing and blanking are shown.

Fractional part of line near center of line. Video modulation produced by wedge, is shown.

Leading edge of horizontal synchronizing pulse.



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DU MONT Type 280-A *Cathode-ray* OSCILLOGRAPH

The Du Mont Type 280-A is a precision instrument especially designed to make possible a complete, accurate analysis of the composite television signal, for installing and maintaining transmitter and studio equipment in accordance with existing standards.

For permanent record of this analysis, oscillograms may be photographed from the screen of the Type 280-A with either the Du Mont Type 314-A or Type 271 Oscillograph-record camera.

This instrument now utilizes the new Du Mont Type 5XP—Cathode-ray Tube, resulting in an overall deflection sensitivity of 0.1 volt peak-to-peak per inch.

Pertinent to the television analysis, this increased sensitivity provides sufficient deflection of the composite signal to obtain a detailed analysis of the synchronizing pulses, without causing amplifier overload.

Both the high- and low-operating potentials of the Type 280-A are supplied by a separate unit contained in the Type 280-A.

HIGH VOLTAGE OSCILLOGRAPH INDICATOR UNIT

- Du Mont Type 5XP- Cathode-ray Tube; operated at accelerating potentials variable from 7,000 to 12,000 volts.
- Wide-band vertical amplifier provides deflection over three times useful scan.
- Frequency response to 10 megacycles (down 3db).
- Compensated, linear-sawtooth generator. Sweeps variable from 1 to 15,000 microseconds.
- A strobe marker output may be fed to a standard television monitor to determine the portion of the picture being displayed on the Type 280-A.

VIDEO SYNCHRONIZER AND DELAY UNIT

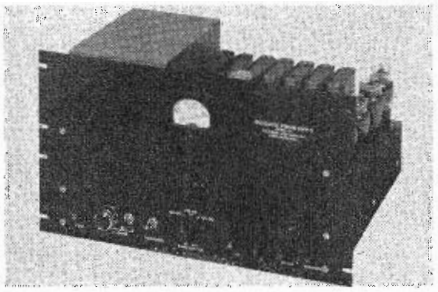
- Synchronizes the sweep-generator to either or both of the interlaced fields.
- A field and line selector and a vernier delay permit selection of any single line or portion of a single line on the T-V raster, for critical study.
- Will calibrate the sweep at intervals of 0.2, 1, or 10 microseconds per inch.
- Test-pulse output with fixed 25 microsecond delay.

DUMONT *for Oscillography*

ALLEN B. DU MONT LABORATORIES, INC., *INSTRUMENT DIVISION*, 1000 MAIN AVENUE, CLIFTON, NEW JERSEY

Regulated Power Supply

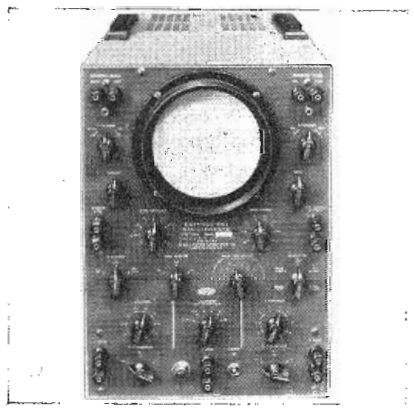
A continuously variable output from 100 to 400 v. by switch and variable control is provided by the model 107 regulated power



supply having less than 1% variation for voltages between 110 and 400 v., from no load to full load. Line voltage variations from 100 to 135 v. result in less than 0.5% output voltage variation. Power consumption is 320 watts at full load and 120 watts at no load. Primary taps are provided for line operation of 95 to 125, 100, 130, and 105 to 135 v. — **Electronic Associates, Inc., Long Branch, N. J.**—TELE-TECH

Oscillograph

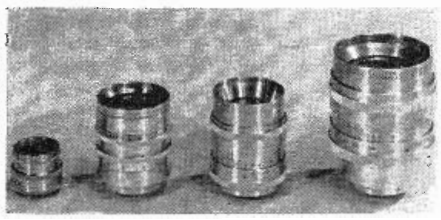
Improved sweep circuit, fast sweep starting time, and high light output characterize the new 250-AH cathode ray tube. Recur-



rent, single, or driven sweep durations are continuously variable from 5 sec. to 10 usec. The cathode ray beam rests at the left side of the screen, resulting in negligible sweep starting time on driven sweep. On the return cycle the trace is automatically blanked out. A Z-axis input is provided for intensity modulation. Overall accelerating potential, supplied by an external high voltage supply, is 13,500 v. This high potential facilitates the observation and photographing of high-speed signals recurring either at random or at slow, recurrent intervals.—**Allen B. DuMont Laboratories, Inc., 1000 Main Ave., Clifton, N. J.**

16mm Motion Picture Lenses

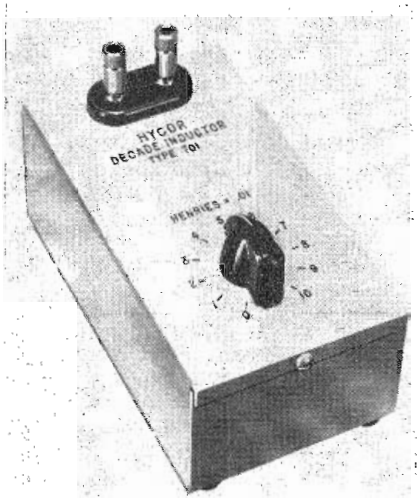
A new series of 7 lenses for 16mm motion picture cameras have been developed and 4 are now ready for delivery. The new optics



are said to be the most highly corrected lenses of comparable focal lengths and apertures ever developed for 16mm film. The manufacturer also claims that the new series is the first to offer a constant degree of magnification from one lens in the series to another. Lenses now available (shown left to right in illustration) are: .7 in. T 2.7 (f/2.5) B&H Super Comat; 2 in. T 1.6 (f/1.4) Taylor Hobson Cooke Ivotal; 2.8 in. T 2.5 (f/2.3) Taylor Hobson Cooke Panchrotal; 4 in. T 2.5 (f/2.3) Taylor Hobson Cooke Panchrotal.—**Bell & Howell Co., 7100 McCormick Road, Chicago 45, Ill.**—TELE-TECH

Decade Inductor Unit

High Q decade inductor units have been developed in 4 models to cover the .001, .01, 0.1 and 1 henry steps. The 4 models can be



connected in series to form a 4-dial unit covering 11.11 henries in .001 steps. Hycor toroid coils are used as elements to obtain high "Q", excellent stability and extremely low hum pickup. Type 700 (10 x .001 henry) has a Q factor of 40 at 1 KC, 75 at 4.5 KC; list $39.50. Type 701 (10 x .01 henry) has a Q factor of 60 at 1 KC, 125 at 4.5 KC; list $42.50. Type 702 (10 x .1 henry) has a Q factor of 60 at 1 KC, 125 at 4.5 KC; list $45. Type 703 (10 x 1.0 henry) has a Q factor of 60 at 1 KC, 125 at 4.5 KC, list $49.50.—**The Hycor Company, 7116 Laurel Canyon Blvd., North Hollywood, Calif.**—TELE-TECH

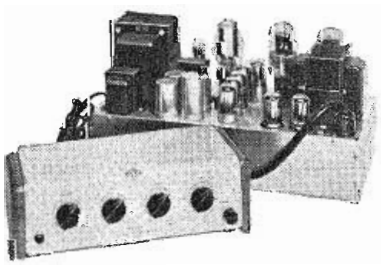
Antenna Switch

With the VEE-D-X 3-way antenna switch it is not necessary to attach a separate transmission line every time a different antenna is used. Featured in this unit is a specially-

designed low loss switch that prevents leakage. A terminal strip is located at the rear and will accommodate 3 separate lead-ins as well as the output line to the receiver. List, $4.95.—**LaPointe-Plascomold Corp., Unionville, Conn.**—TELE TECH

Audio Amplifiers

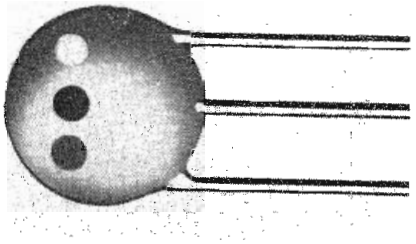
Built around triodes for considerably cleaner performance, the new Brook high quality audio amplifiers use transformers and



circuits which are exclusive with Brook; built, tested and developed in their own plant. The amplifiers are available in one or two units. The two-unit system contains a remote control pre-amplifier which can be extended 50 ft. from the basic amplifier. The small amplifier is contained in an attractively finished cabinet.—**Brook Electronics, Inc., Dept. X, 34 DeHart Place, Elizabeth, N. J.**—TELE-TECH

Ceramic Capacitors

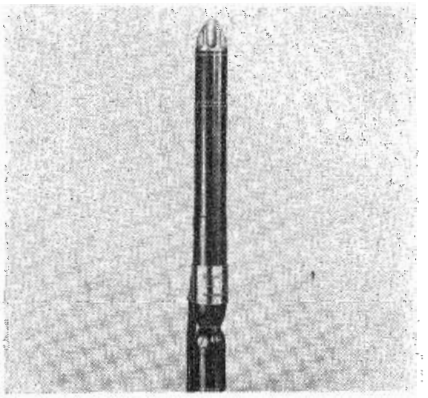
The addition of four dual value disc ceramic capacitors to the RMC line has been announced. Dual 1000, 1500, 4000 and 5000



mmf units are available in addition to the single 1000, 1500, 5000 and 10,000 mmf values. Dual capacitors have diameter of ½ in., single values have diameter from ¾ to 9/16 in.—**Radio Materials Corp., 1708 West Belmont Ave., Chicago 13, Ill.**

Dynamic Microphone

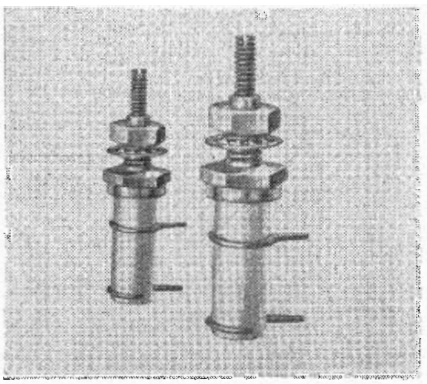
The TV 655 is a versatile microphone with ultra-wide-range, high fidelity dynamic performance and utility. It requires no closely-



associated auxiliary equipment and is omnidirectional, becoming slightly directional at extremely high frequencies. Smooth, peak-free performance is provided from 40 to 15,000 cps, plus or minus 2.5 db. A special hole in lower section of case permits easy control of bass response. It is supplied with 20 ft. of two-conductor shielded synthetic rubber-jacketed broad-case type cable. List, $200.—**Electro-Voice, Inc., Buchanan, Mich.**—TELE-TECH

Ceramic Coil Forms

LS-5 and LS-6 coil forms which have been designed to fit easily into small or hard-to-reach places are made of silicons impregnated



ceramic (grade 1-15, JAN-I-10) for high resistance to moisture and fungi. The LS-5 measures 1 1/16 in. in height (mounted), ⅜ in. in diameter. Ring terminals are adjustable. Both sizes are provided with a spring lock for the slug. The mounting stud is brass, cadmium plated to withstand severe service conditions. Both forms are available with high, medium or low frequency slugs.—**Cambridge Thermionic Corp., 439 Concord Ave., Cambridge 38, Mass.**—TELE-TECH

When is a dot not a dot?

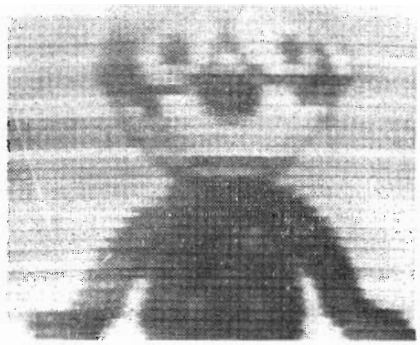
Look carefully at the pictures on this page, to see how television creates an image

•

No. 2 in a series outlining high points in television history

•

Photos from the historical collection of RCA



Felix the Cat was the "stand-in" when this 60-line image was made *mechanically* in tests at NBC's first experimental television station.

Improved definition is obvious to anyone in this *all-electronic* 120-line image of Felix—transmitted in the early days of NBC television.

By increasing the number of scanning lines to 441 lines in each picture frame, RCA scientists gave us a sharper, clearer television image.

And here you see the deep blacks, clear whites, and subtle halftones as transmitted by NBC with our present 525-line scanning system.

• As parlor magicians say: "The hand is quicker than the eye!" But modernize the statement so that it becomes: *Television magic is quicker than the eye*—and that's why you see a photographic image in motion . . . where actually there is only a series of moving dots!

To explain this to laymen, ask them to examine a newspaper picture through a magnifying glass.

Surprisingly, few people know that newspaper pictures are masses of tiny dots "mixed" by the eye to make an image. Even fewer know that the same principle creates a television picture . . . and, when picture after picture comes in rapid succession, the eye sees motion.

Devising a successful way to "scan" an image—to break it into dots which could be transmitted as electrical impulses—was one of television's first basic problems. Most of the methods dreamed up were *mechanical*, since electronics was then a baby science. You may remember some of the crude results transmitted mechanically.

Television as we now know it, brilliant images on home receivers, begins with the invention of the *iconoscope* tube by Dr. V. K. Zworykin of RCA Laboratories. First all-electronic "eye" of the television camera, this amazing tube scans an image—"sees" it even in very dim light—translates it into thousands of electrical impulses which are telecast, received, and re-created as sharp, clear pictures in black-and-white—on the phosphorescent screens of today's home television receivers.

And, just as the first flickering "30-line" pictures—produced mechanically—eventually became our present sharp 525-line images, so the iconoscope itself was improved until it became today's supersensitive RCA image orthicon television camera. All-electronic, the image orthicon peers deep into shadows, needs only the light of a candle to see and transmit dramatic action.

But every single television development made by scientists at RCA Laboratories depends, in the end, on a basic physiological fact: When the human eye sees a series of swift-moving dots on a television screen, it automatically "mixes" them into a moving photographic image!

Radio Corporation of America
WORLD LEADER IN RADIO—FIRST IN TELEVISION

WASHINGTON
News Letter

Latest Radio and Communications News Developments Summarized by Tele-Tech's Washington Bureau

LIFTING OF "FREEZE" UNIVERSALLY DEMANDED—With the virtually united front of the television broadcasting and manufacturing industries, which feel that further delay in the lifting of the television-station construction "freeze" will greatly handicap the progress of television, the FCC is definitely placed in the position of expediting the "thaw" of its present ban against considering and sanctioning new television-station construction permits. FCC Chairman Wayne Coy, probably because of the fact that it is rather lengthy governmental procedure to lift the freeze and to start approval of pending TV station CPs, recently told the House Appropriations Committee that the Commission would not lift the freeze until next fall.

TWO-YEAR BAN ON TV GROWTH—Such delay of course, would mean that the ban on new black-and-white television stations would be over two years old since it was first put into effect September 30, 1948, unless the FCC decides to relent from this timetable and to implement a more immediate decision of doing away with its ban. The feeling is definite among the leadership of the television industry and is growing in Congress and high Washington circles, it is felt, that the "thaw" of the "freeze" for VHF black-and-white television stations does not have to wait until the complicated problem of color television is decided.

COLOR TV HEARINGS LIKELY TO BE EXPEDITED—The color television hearings by the FCC were resumed Feb. 27, shortly before this issue of TELE-TECH was mailed, and at the time of the writing of this column there was every indication that at long last the FCC Commissioners, especially those who have been carrying the torch for immediate implementation of commercial color television, realize the hearings must be concluded in a much speedier fashion than they have been conducted since the proceedings first started on September 26, 1949. As projected by the FCC top legal staff at our press deadline, the direct testimony and cross examination on color television phases would take up all of March and might even go into April. But there is no question of the crescendo of industry and public opinion, together with the impetus of congressional reaction which was launched through the presentations of Dr. Allen B. DuMont before the New Jersey Congressional delegation in early February.

CHANGES IN TV RULES—After the color-television phase of the FCC hearings which also were highlighted by the comparative showings on Feb. 23 of the three competing systems—Color Television Inc., Columbia Broadcasting System and Radio Corporation of America —, the commission is to take up the important Part II of its television inquiry which includes changes in television rules and standards, the question of opening some 42 UHF channels, use of carrier offset, synchronization and directional antennas, stratovision, polycasting etc. There is even some speculation that this inquiry into the "general" subjects of television might be interposed between the conclusion of color TV proceedings so as to pave the way for expediting of the "freeze thaw".

COMMISSION TO TOP FCC & IRAC is proposed in Representative Sadowski's new bill introduced into Congress, as reported on a preceding page. The proposed board would be appointed by the President with confirmation by the Senate and would be composed of outstanding figures in the radio field, both government and private. Both Rep. Sadowski and Commissioner Webster, FCC, emphasized that it might be desirable for this board to closely examine the utilization of frequencies by government agencies as well as by non-government users.

DR. ENGSTROM IMPRESSES WASHINGTON NEWSPAPER CORPS—The achievement of complete color stability in the RCA all-electronic system of color television which was displayed in mid-February before the Washington newspaper corps was generally regarded as an important milestone in the controversy about color video's inauguration as a public service. Dr. E. W. Engstrom, vice president in charge of research of the RCA Laboratories, told the Washington newspaper corps that this had completed the basic foundations of the all-electronic system and that the next stages would be the refinements which would be necessary to simplify and make easily workable receivers for home installation and to establish color television standards that would be far sighted enough under which the structure of color television could operate for a relatively long time. The exposition and views of the RCA research chief were considered of tremendous weight by the newspaper correspondents and will probably have considerable influence in the determination of color video policies by the FCC.

COL. S. K. WOLF TO PENTAGON—The Munitions Board's Communications-Electronics Committee has a new executive director who has had a wealth of practical experience—Col. Sidney K. Wolf who served during the War as Assistant Director of the WPB Radio and Radar Division and later in three combat theaters with the Army Air Forces and since the war with the International Telephone and Telegraph Corp. and Federal Telephone & Radio Corp.

National Press Building
Washington, D. C.

ROLAND C. DAVIES
Washington Editor

TELE-TECH's NEWSCAST

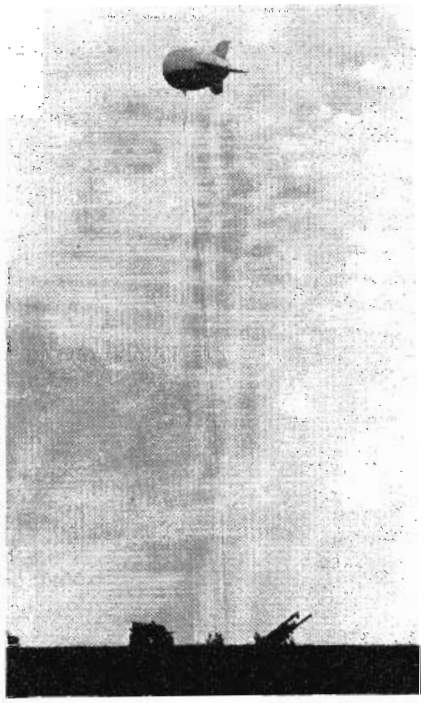
Officers For Audio Group

The San Francisco Section of the Audio Engineering Society, elected the following officers for 1950: chairman, Ross H. Snyder, KJBS-FM; vice chairman, Walter T. Selsted, Ampex Electric Corp.; secretary, Frank Haylock; treasurer, Harold W. Lindsay, Ampex. Members of the executive board are: Dr. Vincent Salmon, Stanford Research Institute; Bob Hugh Smith, electrical engineering department, University of California; and R. M. Beck, R. M. Beck Co.

Ionsphere Reflections Forecast Weather

It is reported in *Nature* that the ZiKa Wei Observatory, near Shanghai, under the direction of Father E. Gherzi is using radar to detect weather tendencies. His work goes back to 1939 when he discovered that pulses at the mean critical frequency for the E-layer provided information on approaching weather changes over an area of about 250 miles. Pacific maritime air masses produce an E echo if in the area or approaching while an F echo denoted the presence or approach of Siberian polar air and an F-2 echo heralded the proximity of tropical air. No reflections are caused by frontal weather conditions. From the air masses in the vicinity, and knowledge of their characteristic weather, it is possible to predict future conditions with considerable accuracy. This is somewhat similar to radar warning for storm detection except that all types of weather are forecast.

MOBILE FIELD SURVEY



This barrage balloon was used in recent field surveys by Motorola, Inc., Chicago, to determine primary coverage areas for 12 fixed stations being installed as part of a mobile radio system for the Illinois Power Co.

Signal Corps Offering Courses in Warehousing Operations

The U. S. Army Signal Corps is now accepting applications from representatives of industry for enrollment in training courses in military warehousing practices at Signal Corps depots in April. These courses are designed to familiarize key civilians with military supply procedures and operations. Reciprocally, selected military and civilian personnel receive on-the-job training in commercial warehousing practices in private concerns.

Training is offered to applicants from the communications industry and other industries concerned with the movement, handling and storage of supplies. Training courses are normally of five or 10 working days' duration and include all phases of depot operations, with emphasis on stock control, storage, maintenance and packaging of communications equipment.

The Signal Corps Depots at which training in military warehousing operations will be conducted are: Baltimore Signal Depot, Baltimore, Md.; Decatur Signal Depot, Decatur, Ill.; Lexington Signal Depot, Lexington, Ky.; Sacramento Signal Depot, Sacramento, Calif.

RMA Arranges International TV Exhibits

The RMA, in response to a request of the U. S. State Department, has designated industry representatives to assist the government in arranging for an international demonstration of American television in this country between March 27 and April 7.

The demonstration will be conducted for a group of European technicians comprising Study Group 11 of the International Radio Consultative Committee (C.C.I.R.) which met last July in Zurich, Switzerland, to consider international television standards. RMA and several U. S. manufacturers were represented at this meeting, and the State Department extended an invitation to the group to visit this country to see American television in operation.

The following nations are members of the Study Group: Austria, Belgium, Czechoslovakia, Denmark, France, Hungary, Italy, the Netherlands, Sweden, Switzerland, United Kingdom, Yugoslavia, and the United States. Following the television demonstrations in this country, the Study Group will visit Paris and Eindhoven for the French and Dutch demonstrations April 20-25 and London for a British demonstration April 27-May 4.

Radio Pioneers Name Officers

Frank E. Mullen, chairman of the board of Jerry Fairbanks, Inc., film producer, and former NBC executive vice president, has been nominated president of the Radio Pioneers, to succeed William S. Hedges, NBC, whose term expires April 4.

Dr. O. H. Caldwell, editor of TELE-TECH, who served during the past year as vice president and treasurer, has been nominated first vice president. Others nominated: Arthur Church, KMBC Kansas City, Mo., 2nd vice president; Paul W. Morency, WTIC Hartford, vice president and secretary; Carl Haverlin, president of BMI, vice president and treasurer; J. R. Poppele, WOR New York, vice president, and Martin Campbell, WFAA, Dallas, Tex., vice president.

Coming Events

March 6-9—IRE 1950 National Convention. Hotel Commodore and Grand Central Palace, New York City.

April 3 (week of)—URSI-IRE Joint Meeting on Antennas and Propagation, Navy Electronics Laboratory, San Diego, Calif.

April 4-8—National Production Exposition, Sponsored by Chicago Technical Societies Council, Hotel Stevens, Chicago.

April 5-7—Midwest Power Conference, Sponsored by Illinois Institute of Technology with cooperation of 18 universities and professional societies, Sherman Hotel, Chicago.

April 12-15—National Association of Broadcasters, Fourth Annual Engineering Conference, Stevens Hotel, Chicago.

April 15—New England Radio Engineering Meeting, Sponsored by North Atlantic Region of the IRE, Somerset Hotel, Boston, Mass.

April 19-22—Electrochemical Society, Fourth Annual Meeting, Hotel Statler, Cleveland, Ohio.

April 29 — IRE, Cincinnati Section, Fourth Annual Spring Technical Conference, Engineering Society Hdqts., Cincinnati, Ohio.

May 3-5—IRE Conference, Dayton Section, Dayton Biltmore Hotel, Dayton, Ohio.

May 12-13—Armed Forces Communications Association. Fourth Annual Meeting, Astoria, New York City, and Fort Monmouth, N. J.

May 22-25—Parts Distributors Show, Hotel Stevens, Chicago.

June 26-30 — American Society for Testing Materials, Chalfonte-Haddon Hall, Atlantic City, N. J.

August 23-26—AIEE Pacific General Meeting, Fairmont Hotel, San Francisco, Calif.

August 28-31—Associated Police Communication Officers, Inc., National Conference, Hotel Hollenden, Cleveland, Ohio.

Navy Honors Eitel-McCullough

At the Eitel-McCullough plant in San Bruno, Calif., Feb. 13, Jack McCullough and William Eitel were recipients of the Navy's Distinguished Public Service Award, the highest civilian honor granted by the Navy. Award was made for Eitel-McCullough's contributions to the Navy's research and development program, certificates being presented by Navy Captain F. R. Furth, director of the Naval Research Laboratory in Washington, D. C.

Col. S. K. Wolf to Electronic Div., Munitions Board

Col. Sidney K. Wolf, recently manager of special products division, Federal Telephone and Radio Corp., Clifton, N. J., associate of International Telephone and Telegraph Corp., has been appointed executive director of the Munitions Board Electronic Division, Washington, D. C. This division is preparing a mobilization plan to guide Army, Navy and Air Force in dealing with the electronics industry.

In his new post Col. Wolf will be concerned with the supervision of electronic equipment procurement, standardization of equipment specifications,

Col. Sidney K. Wolf

stock-piling of strategic materials and pinpointing areas in which shortages may develop.

From 1941 to October 1943, Col. Wolf was Deputy Director of the Radio and Radar Division of the War Production Board. He was commissioned a Colonel in the Army Air Force in 1943 and served in Alaska and in the European and Pacific theatres. Prior to World War II Col. Wolf spent 10 years with the Western Electric Co. as director of acoustic engineering for the Electrical Research Products Division.

In addition to his business experience Mr. Wolf spent five years on the faculty of the Sheffield Scientific School of the Yale University as an assistant professor where he received his MS in electrical engineering.

E. M. Martin Heads New Transmitter Co.

Formation of Standard Electronics Corp., Providence, R. I., for the designing and manufacturing of radio broadcasting and studio equipment, has been announced by George F. Hessler, vice-president of Graybar Electric Co., which will be national distributor for the company. Edwin M. Martin, formerly chairman of the Board of American Bosch Corp. and a former Farnsworth executive, has been named president and chairman, and Robert F. Moyer, vice president and treasurer.

Standard Electronics will succeed Western Electric Co. as Graybar's supplier of radio transmitting equipment. Western Electric is withdrawing from

Edwin M. Martin

the transmitting equipment field and has entered into an agreement with Standard under which the latter will provide maintenance parts and service to all users of Western Electric equipment.

The new company is privately financed and has its own plant at 4175 Elmwood Ave., Providence. It plans the manufacture and development of broadcast equipment, including television, microwave and radio communications equipment, and gradually to add other electronic equipment. Standard's engineering staff will be supplemented by the services of Hazeltine Electronics Corp., which holds many basic radio and television patents.

Components Conference

The Conference on Improved Quality Electronic Components, which will be sponsored jointly by RMA, IRE and AIEE with the cooperation of the National Bureau of Standards and other government groups, from May 9-11 will meet in the Department of Interior Auditorium, 18th and C Streets, N. W., according to an announcement by J. G. Reid, Jr., Chairman of the program committee.

He also advised that remittances for advanced registration, at $2 for members and non-members of sponsoring organizations, and reservations for copies of the Proceedings of the Conference, at $2.50 per copy, should be sent to A. E. Zdobysz, Treasurer of the Conference, 5510 Parkland Courts, S. E., Washington 19, D. C.

PERSONNEL

Donald McDonald has been appointed director of the signal laboratories section of Cook Research Laboratories, Chicago 14, Ill.

Dr. Allen B. Du Mont, president of Allen B. Du Mont Laboratories, Inc., has been elected a life trustee of Rensselaer Polytechnic Institute, Troy, N. Y., from which he was graduated in 1924.

Walter Weiss has been appointed vice president in charge of engineering of the Hickok Electrical Instrument, Cleveland, O.

Harold J. Adler, a veteran of over 25 years in radio and TV engineering, has been named chief TV engineer of Hallicrafters, Chicago

William H. Trevarthen has been appointed director of technical operations of the American Broadcasting Company to succeed the late George O. Milne. Previously, he had been New York engineering operations supervisor for ABC. **George F. Fisher, Jr.,** has been named to succeed Trevarthen.

Frank Goldstein has been appointed Chief Engineer of Radio Station WMOR, Chicago's largest independent FM, succeeding **David B. Pivan,** who resigned to take a position with James E. Everett Engineers, Evanston.

Edmund Charles Altenberger has joined Fugle-Miller Laboratories, Metuchen, N. J., in the capacity of Chief Engineer. He will be responsible for the design of new Television coil assemblies which will be offered to set manufacturers shortly.

LaVerne M. Poast has been named a partner of Craven, Lohnes & Culver, consulting radio engineers, Washington 4, D. C.

R. L. Grove has been appointed chief engineer of Cornell-Dubilier's Ceramic Division in New Bedford, Mass. Previously he was with Westinghouse Electric Corp. as ceramic engineer in the company's electrical porcelain plant at Derry, Penn., and more recently with the Centralab Division of Globe Union, Inc., Milwaukee, Wis.

Walter Hicks, vice-president of Reevesound Co., Inc., Long Island City, N. Y. is teaching a class in sound recording once a week at the New Institute in Brooklyn, motion picture training center. An executive of Fox Movietone for 16 years until the War, he has been prominent in magnetic recording development.

BOOKS

Electronic Engineering Master Index 1947-1948

By Electronics Research Publishing Co. Inc., 480 Canal St., New York 13, N. Y. 339 pages, price $19.50

As the third volume in the series covering communications engineering literature published throughout the world since 1925, the 1947-48 edition of the Electronic Engineering Master Index contains more than 18,000 new entries and indexes almost three times the number of publications listed in previous volumes. Among these publications are more than 230 major international scientific magazines and journals. Titles of all articles appearing in foreign language magazines have been translated into English.

Two entirely new sources for reference have been included in the present volume, the 5,500 electronic and allied patents issued by the U. S. Patent Office during 1947-48, and the declassified documents published by the U. S., British, and Canadian governments.

The listing of U. S., British, and Canadian declassified documents makes available much of the important war and postwar research in electronics, atomic physics, and allied fields. Included is the important work done at the M. I. T. Radiation Laboratory, Naval Research Laboratories, and universities and colleges throughout the country.

Electrical Engineers' Handbook Electric Power Section

Edited by Pender and DelMar, with staff of 69 specialists. 4th Edition. Published October 1949, by John Wiley & Sons, 440 Fourth Ave., New York 16, N. Y. Over 1600 pages. Price $8.50

This well-known handbook covers nearly all fields of Electrical Engineering outside the communication industry and certain specialized electronic devices. It is an authoritative, up-to-date reference source for all kinds of general and specialized information in any field of electrical application.

Electronics—Experimental Technics

By Elmore & Sands, Vol. I of Division V, National Nuclear Energy Series. Published 1949, McGraw-Hill Book Co., New York, N. Y. Cloth bound, 417 pages. (Lithographed) Price $3.75

(Note—This series, other volumes of which will appear at frequent intervals, is a record of research done under the Manhattan Project. It will ultimately contain some 60 volumes covering declassified work at all the operating plants of the project, which were grouped under eight Divisions)

The text of this volume contains information of a practical nature on electronic circuits and the special arrangements which are useful means-to-an-end in any kind of research. Each chapter contains a great deal of descriptive matter on various items of

electronic equipment, a minimum of theory and is not padded by a lot of data as to the specific uses for which any particular item was designed. The chapters include well written sections on circuit components, electronic equipment assembly, construction processes, circuit elements, voltage amplifiers, electronic counters, oscillographs, test and calibrating equipment and power supplies of all types. Over one hundred practical equipment circuits are given with details and values of components.

VHF Impedance

(*Continued from page 46*)

ing at resonance. This is a reliable substitution method, but it must be remembered that when the resistor is substituted for the crystal the C_o of the crystal unit has been removed from the circuit and said circuit must be again resonated by means of variable inductor L of Fig. 9.

No matter what is substituted into the circuit at the crystal terminals, the circuit must be corrected to look electrically equivalent to (b) of Fig. 10 before any comparisons of frequency are made or before R′ is substituted for R.

In practice rather than attempt to measure current and voltage in

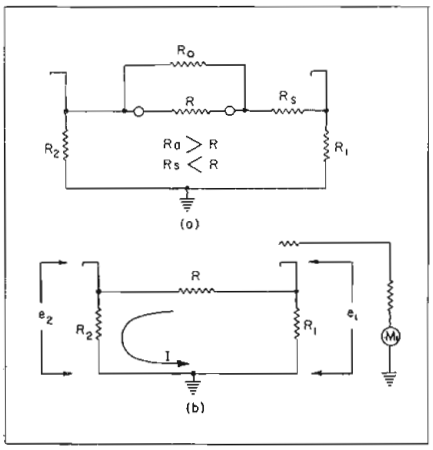


Fig. 10: Equivalent electrical circuit (Fig. 8)

the critical portions of the circuit, it will suffice to use the grid current as indicated by M_1 of Fig. 10 as a reference, (i.e.) observe the grid current when the crystal is properly at resonance and properly substitute resistance for the crystal until an equal grid current is obtained.

This technic will allow operation at resonance ±.0005% and will measure by substitution the series resonant resistance of a quartz unit ±15%. This is considered satisfactory when it is realized that the classical methods of measurement have errors of equal order of magnitude among themselves.

TRANSFORMER TEST

(*Continued from page 41*)

The peak voltage across each transformer primary was 20 volts at all frequencies. In addition, the 20 cps. wave was also examined at 0.7 peak volt. (Fig. 1). Each transformer was fed from a 5000 ohm balanced generator and terminated in its rated load resistance, 15 or 16 ohms as the case may be.

The seven frequencies were used to illustrate the importance attached to the extremes. While the 630 cps. reference was not used, a comparison of the 200 cps. and 2000 cps. waves will illustrate its suitability as a reference.

Because different transformers are not necessarily better, or worse, at both ends of the frequency range at the same time, but may be better in one part of the range at the expense of another, it has been necessary to list the five samples in the order of their overall goodness of waveform. Sample 1 is considered to be the best, while Sample 5 is believed to be the worst.

It is interesting to note (and a compliment to the various manufacturers) that for the samples tested the deformations of the waveform at both ends of the frequency range are of the same order of magnitude for each sample.

In addition to square waves, intermodulation distortion measurements were made at 40-2000 cps., (Fig. 2), frequency-power measurements were made, (Fig. 3), and the characteristics listed in Table I were measured.

An examination of the intermodulation distortion curves illustrated in Fig. 2 shows that the maximum powers delivered from an amplifier in which the transformers were tested, (8% and more I-M distortion) were in this order: Samples 1, 2, 4, 5, and 3. When the insertion losses of the various transformers are corrected to a common value, it will be found that the I-M distortion curve for Sample 3 will fall between Samples 2 and 4, which makes the sequence like the square wave sequence for 20 cps. and 60 cps. The unsatisfactory I-M distortion curve for Sample 2 below the 8% I-M level was predictable from the rapidly falling top of the *low voltage* 20 cps. wave. Similarly, the rounded generally unsatisfactory I-M distortion curve of Sample 5 was predictable from *both* the low voltage and the high voltage 20 cps. waves.

Fig. 3 illustrates the frequency-power curves of the samples. The low frequency responses are complicated by the modifying factors of insertion loss, relative core flux densities, core stacking arrangements, effective core air gaps, and their positions in the structure. However, it can be seen here also that (again correcting for insertion losses) the low frequency harmonic distortion tracks well with the square wave sequence of Samples 1 through 5.

The high frequency responses, because they are free from modifying core characteristics, follow the square wave form deformations more closely. Above 5000 cps. they track exactly. Furthermore, the cause of the large, relatively low frequency transient in the Sample 4 square waves probably is also contributing to the dip in the Sample 4 power curve.

Table 1 lists data pertinent to the samples, and to this discussion.

First in importance to square wave testing are the winding resistances, or insertion losses. These are important because they must be

known before a square wave measurement can be fully evaluated. Winding resistances are a hidden part of the load. They are linear; constant for all frequencies. A transformer can have the finest possible square wave transmission characteristics, but if it dissipates in itself most of the power delivered to it, it is practically worthless. It must also be efficient; and qualitative square wave measurements will not measure efficiency.

In the range between 200 cps. and 2000 cps. all five of the samples in Fig. 1 have acceptable and similar wave forms, yet in Fig. 3, in this same midrange, the power outputs are different and apparently unrelated. They are unrelated; not only to the midrange square waves, but also to the extremes.

The midrange levels of the power curves in Fig. 3 vary with the losses in the transformer windings, and most particularly with the losses in the primary windings, through which the output tubes receive their plate currents. The voltage drop (IR) across these windings reduces the applied B+ voltage, so that the actual plate voltage is something less than that at the center tap of the transformer primary. Since the measurements shown in Fig. 3 were made by inserting each transformer into the test circuit with no other changes, it can be seen that slightly different *plate* voltages existed for each transformer, favoring the one with the lowest primary resistance. A comparison of the primary winding resistances listed in Table I with the midrange powers shown in Fig. 3 will show that they both track in this order: Samples 5, 1, 2, 4 and 3.

Second in importance are the Leakage Inductances and Relative Feedback Values, which are found to track in order: Samples 1, 2, 4, 3 and 5.

This is also the order in which the leading parts of the 20,000 cps. square waves depart from the vertical. When the transformer is used with beam power tubes, which are becoming increasingly popular, and is included in a feedback loop, the slope of this wave front is of even greater importance.

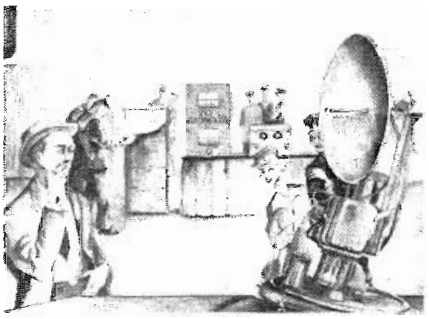
Last in importance, a comparison of the Reflected Primary Impedances shows that the resistance losses have been included in the impedance ratios of Samples 1, 2 and 4, and approximately in Sample 5. Sample 3 has a turns ratio correct for the theoretical impedance ratio. Its winding resistances add another thousand ohms.

Armed Forces

(*Continued from page 37*)

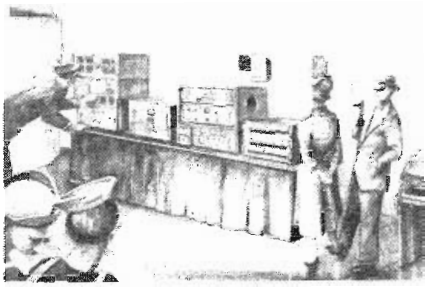
materials. Also presented is Exhibit XIII. which shows miniaturization progress made by the Electronics Divisions of the Bureau of Aeronautics and the Bureau of Ships.

Exhibit XIV—Another E ectronics Division. Bureau of Ships Exhibit is the Facsimile Recorder. It



is the Navy Model AN/UXH-1 which is the first continuous large page type recorder capable of unattended operation that has been developed in this country. The recording medium is a dry, direct-recording facsimile paper. The recorder is additionally capable of recording satisfactorily on a hectotype duplicating paper. Recording is accomplished on a continuous-page basis at 96 lines to the inch. The marking stroke is a minimum 18 inches long. The index of cooperation is 576 as calculated by the product of the drum diameter and the scanning lines per inch. The scanning speed corresponds to 60 lines per minute or to 30 lines per minute as selected. The marking element is easily replaced and does not require replacement or adjustment more often each 24 hours of continuous operation. Paper replacement is not required more often than once each 24 hours of operation.

Exhibit XV — UHF exhibit presented by the Electronics Division of Bureau of Ships and Bureau of Aeronautics shows the latest development in UHF transmitters and receivers. This exhibit portrays the new design trend toward lighter weight and smaller space requirements for Navy electronic equipment. Of interest in this exhibit are the AN/URR-9 and the AN/ARC-27. The AN/ARC-27 airborne communication equipment is a medium power, multi-channel transmitter-receiver operating in the UHF band. It is unusually small, light in weight, extremely rugged to shock and vibration, and is entirely pressurized to withstand high altitude, humidity or fungus conditions. While developed by the Navy



the equipment has been accepted by the United States Air Force and will be used extensively for aircraft in both services. The AN/VRR-9 is a rugged shipboard and shore station UHF receiver which may be automatically tuned to any of 10 preset channels, or manually tuned over its entire frequency range.

DuMont Licenses Sonotone

The Sonotone Corp., Elmsford, N. Y., leading manufacturers of hearing aids and other electronic devices, have been licensed by Allen B. DuMont Laboratories, Inc., Tube Division, to manufacture and sell the Du Mont bent-gun mount to all television tube manufacturers.

Allison Radar Distributor

Aline Rhonie, Suite 1146, 11 West 42nd St., New York City 18, has been appointed exclusive world-wide distributor of Allison Radar, Albuquerque, N. M.

BULLETINS

Transformers

A few of the many hundreds of transformers designed by the Audio Development Co., 2833 Thirteenth Ave. South, Minneapolis 7, Minn., are described in a catalog issued by the company—No. 19A. Units listed in this 16-page catalog have been selected as suitable for a stock program.

TV Tube Complement Manual

A new 56-page television receiver tube complement book listing by make and model the number and type of receiving and picture tubes used in more than 620 sets, has been announced by Sylvania Electric Products Inc., Radio Tube Division, Emporium, Pa.

The book also contains a chart showing the percentage of each of 136 receiving tube types used in TV sets distributed by 85 manufacturers.

Crossover Networks

A new 4-page booklet just released by Racon Electric Company, Inc., 52 East 19th St., New York City, supplies, for the first time in the industry, complete reliable, practical instructions and wiring diagram for the building of an economical, professional type 3 KC crossover network. A full range of specific inductance, capacitance and resistance values are given, plus complete coil winding information, to adapt the crossover network for use with cone speaker impedances of from 4 to 16 ohms.

TV, CR Tube Characteristics

A new 20-page booklet providing television picture tube and general purpose cathode ray tube characteristics; replacement tube data; base diagrams, suggestions for tube handling; and a concise description of cathode ray oscilloscope use in TV servicing has been published by the Radio Tube Division, Sylvania Electric Products Inc., Emporium, Pennsylvania.

A section of the booklet, in the form of a television viewing tube replacement chart, lists 120 tube types and documents directly interchangeable types; changes required for tubes of different face sizes and overall lengths; service data for TV sets designed for obsolete picture tube types.

Soft Solders

The Anchor Metal Co., 87 Walker St., New York 13, N. Y., has issued a new bulletin of its line of soft solders. A tin-lead melting point chart is included. Bulletin and samples free upon request.

TV, Radio Chassis Puncher

Bulletin 7 of the Wales-Strippit Corp., 345 Payne Ave., North Tonawanda, N. Y., illustrates and describes the Wales perforating method for mass production of television, radio, and radar chassis. Wales units permit the use and re-use of the same group of units on unlimited set-ups on the master template.

Signal Generators

A 44-page catalog on standard signal generators, television signal generators, pulse generators, square wave generators, megacycle meters, vacuum tube voltohmeters and other "Laboratory Standards", has been released by the Measurements Corp., Boonton, N. J. Catalog C is available upon request.

Aluminum Products

An informative booklet on aluminum, "Revere Aluminum Products", has just been released by the Magnesium-Aluminum Division of Revere Copper and Brass Inc., 230 Park Ave., New York 17, N. Y.

It contains complete descriptive information about the various forms in which Revere aluminum is fabricated. Included are a large number of illustrations of products using Revere aluminum alloys in the form of extruded shapes, tube, and coiled sheet.

Selenium Power Rectifiers

"Accurate Selenium Power Rectifiers" is the title of a new booklet just published by the Accurate Engineering Co., 2005 Blue Island Ave., Chicago 8, Ill. Known as bulletin 500, it describes and illustrates in detail the Accurate line of single and 3-phase selenium rectifiers with dc output capacities from 57 watts to 80 kw.

Microwave TV

(*Continued from page 43*)

d_1 = distance between transmitter T and receiving antenna R′

Next assume this amount of power be transmitted by transmitter T′. In this case the power at R will be

$$\frac{P_R}{P_{T'}} = \frac{A_R A_{T'}}{d_2^2} C \qquad (20)$$

where

$P_{T'}$ = transmitted power
A_R = area of receiving antenna
$A_{T'}$ = area of transmitting antenna
d_2 = distance from T′ to R
C = same constant as defined above

or

$$P_R = \frac{P_{T'} A_R A_{T'}}{d_2^2} C \qquad (21)$$

Since $P_{R'} = P_{T'}$, equation (19) may be written

$$P_{T'} = \frac{P_T A_{R'} A_{T'}}{d_1^2} C \qquad (22)$$

Substituting (22) in (21) and introducing frequency "f"

$$P_R = \frac{\frac{(P_T A_{R'} A_T)}{d_1^2 C_1} f^2 (A_R A_{T'}) f^2}{d_2^2 C_1} \qquad (23)$$

Where $C_1 = v^2$

$$= \frac{P_T A_{R'} A_R A_{T'} A_T f^4}{d_1^2 d_2^2 C_1^2} \qquad (24)$$

The power which would have been received over the direct path D is

$$P_R = \frac{P_T A_R A_T f^2}{D^2 C_1} \qquad (25)$$

The ratio of the two paths is therefore (24)/(25) or

$$\frac{A_{R'} A_{T'} D^2 f^2}{d_1^2 d_2^2 C_1} \qquad (26)$$

Often $d_1 + d_2 \cong D$ where the paths are long so that (26) may be written,

$$\frac{P_{relay}}{P} = \frac{A_{R'} A_{T'} (d_1 + d_2)^2 f^2}{(d_1 d_2)^2 C_1} \qquad (27)$$

Both equations (26) and (27) must be modified by a factor E to take into account the efficiency of the coupling between the two relay antennas.

It may be seen that the efficiency of the relay system as a whole is very poor, although it will increase when d_1 is made smaller than d_2 or vice-versa. Efficiency also increases as antenna size increases.

The chief advantage of this type of "relay" over a system utilizing a plane reflector is the relative ease with which it may be set up inasmuch as the two antennas may each be adjusted individually. However, the losses are so high as to make it impractical for any but very short distances.

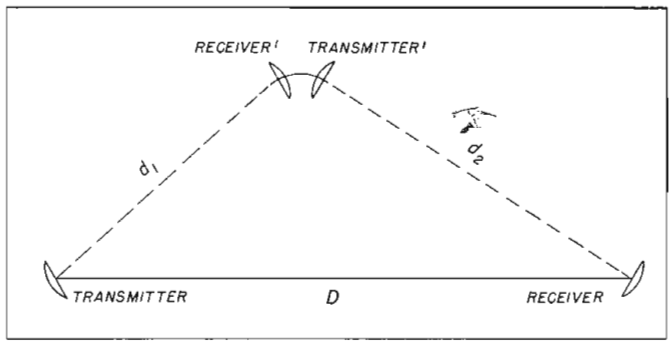


Fig. 13: Diagram showing antenna positions for relays that are not in the direct line of sight

UHF Bridgeport

(*Continued from page 51*)

ard receiver). This output signal is coupled into the first IF stage of the receiver proper. Since the first oscillator operates at a frequency below the desired carrier it is necessary to insert a high-pass filter in the antenna lead to prevent undesired responses to random signals. The filter has an input impedance of 75 ohms.

The main tuning elements are unusual in that they employ a form of "permeability" tuning obtained by sliding brass cores into the tubes on which the coils are wound. The coils use copper strips arranged in various shapes and windings according to the part of the circuit for which they are intended. The overall performance is good with a noise factor of about 14-15 db. While the gain is quite high — of the order of 50 db. — the response to unwanted signals is low with an image response in the region of 70-80 db. when using the high-pass filter.

The antenna in general use is the "Bow Tie" which is essentially a dipole formed of two triangular pieces of sheet metal somewhat shorter than $\lambda/4$. A matching transformer is used to couple into a transmission line of RG 59/U coaxial cable. One of the major problems involved in antenna installation at receiving points is transmission line loss. At the frequencies used RG 59/U has a loss of 8 db. per 100 feet. Raising the antenna, therefore, merely results in increasing the length of coaxial line with consequent higher loss offsetting the gain in signal pickup.

Other types used consist of stacked "Bow Ties", both single, one-above-the-other arrays, and side-by-side arrays, stacked "V" and stacked and single rhombic antennas. The small size of rhombic elements at this frequency makes them very suitable for stacking as well as for single use. Ten experimental parabola reflectors and dipoles have been constructed but it is understood that they are not superior to the rhombics. Up to the present no field strength measurements have been made but the service area is about the same as was expected and agrees with the results obtained during the Washington, D. C. UHF tests. Fair to poor results have been reported from Riverhead, Long Island, 32 miles away, and good results from Port Jefferson, 22 miles away, also on Long Island.

UHF Television in Mo.

Station KA2XAQ owned by KMBC, Kansas City, Mo. put the first UHF TV signal on the air in that area on Feb. 15. Radiated from an Andrews antenna mounted 420 ft. above ground on the top of the Power and Light Building a power of 400 watts, video, was obtained. During the tests video information was transmitted on a frequency of 507.25 MC. Audio will be on 511.75 MC when that part of the transmitter is completed. Reception tests were made on a Zenith receiver with UHF strip inserted in the tuner, and a Sentinal receiver using an RCA converter. In each case results were obtained equal to VHF quality.

Conventions Held by TV

The DuMont Television Network has announced details of a method of using television to cut convention costs by means of a closed circuit hook-up. According to the plan, instead of assembling all the members and executives in a given city, the executives gather in a studio in one city which is connected via the coaxial cable to television studios in other cities where convention delegates are assembled. In this way personal, visual contact is obtained without the cost of travelling for scores of company representatives.

WTTG Survey

(*Continued from page 29*)

Since all of the measurements made during this survey were made before 9:00 P.M. (July-August '49), no diurnal effects were noticed. Because of this effect, greater signal strengths would have been experienced, especially at the outer extremities of the radials, if the measurements had been taken during the hours of darkness when most television viewing occurs.

IRE Program

(*Continued from page 31*)

"Space Charge Effects in Reflex Klystrons"—V. Westberg and M. Chodorow, Stanford University, Stanford, Calif.

"Recent Development in High-Power Klystron Amplifiers"—C. Veronda and V. Learned, Sperry Gyroscope Co., Great Neck, L. I., N. Y.

"A new Super-Power Beam Triode"—W. N. Parker, W. E. Harbaugh, M. V. Hoover, and L. P. Garner, Radio Corporation of America, Lancaster, Pa.

"External Cathode Inverted Magnetron"—Joseph F. Hull, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Navigation Aids

"Analysis of Course Errors in the VFH Omni-Directional Radio Range"—J. Wesley Leas, Air Navigation Development Board, Civil Aeronautics Administration, Washington, D. C.

"Dynamic Aspect of Errors in Radio Navigation Systems Particularly in Case of Fast-Moving Receivers and Transmitters"—H. Busignies, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"A New Basis for Analyzing Radio Navigation and Detection Systems"—N. L. Harvey, Sylvania Electric Products Inc., Bayside, N. Y.

"Stochastic Processes as Applied to Aerial Navigation and Direction Finders"—L. A. de Rosa, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

"1000 MC Crystal Controlled Airborne Transmitter for Distance Measuring Equipment"—B. Warriner, Federal Telecommunication Laboratories, Inc., Nutley, N. J.

Symposium: Sound Recording

"Noise Consideration in Audio Systems"—F. L. Hopper, Western Electric Company, Hollywood, Calif.

"Considerations of Noise in Sound Recording and Reproducing Systems"—Albert W. Friend, Radio Corporation of America, Princeton, N. J.

"Magnetic Recording Frequency Response—Measurement Procedures and Pitfalls"—R. E. Zenner, Armour Research Foundation, Chicago, Ill.

"Distortions in Recording Systems"—H. E. Roys, Radio Corporation of America, Camden, N. J.

"Perceptibility of Flutter in Recorded Speech and Music"—Harry Schecter, Air Force Research Laboratories and Massachusetts Institute of Technology, Cambridge, Mass.

Propagation II—Impact of Propagation on Operation of Systems

"A Microwave Propagation Test"—J. Z. Millar and L. A. Byam, Jr., Western Union Telegraph Co., New York, N. Y.

"Diversity Reception Techniques"—S. H. Van Wambeck, Washington University, St. Louis, Mo.; A. H. Ross, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Experimental Evaluation of Diversity Receiving Systems"—John L. Glaser and S. H. Van Wambeck, Washington University, St. Louis, Mo.

"Comparison of Modulation Methods for Voice Communication over Ionospheric Radio Circuits"—M. Acker and B. Goldberg, Laboratories, Mineola, L. I., N. Y.; H. F. Meyer and A. H. Ross, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Comparison of Modulation Methods for Facsimile Communication over Ionospheric Radio Circuits"—M. Acker and B. Goldberg, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

Electron Tubes IV—Materials & Technics

"A Vacuum Seal Between Metals and Ceramics for High Temperature Applications"—H. W. Soderstrom and K. H. McPhee, Collins Radio Co., Cedar Rapids, Iowa.

"Effect of Coating Composition of Oxide-Coated Cathodes on Electron Emission"—E. G. Widell and R. A. Heliar, Radio Corporation of America, Harrison, N. J.

"Effects of Controlled Impurities in Nickel Core Metal on Thermionic Emission from Oxide-Coated Cathodes"—George Hees, Sylvania Electric Products Inc., New Gardens, L. I., N. Y.

"Investigation of Contaminants in Vacuum Tubes"—Paul D. Williams, Eitel-McCullough, Inc., San Bruno, Calif.

Components

"Miniaturization Approaches: A Discussion and Proposal"—M. Abramson and S. Danko, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"The Exponential-Line Pulse Transformer"—E. R. Shatz and E. M. Williams, Carnegie Institute of Technology, Pittsburgh, Pa.

"Universal Precision Resolvers"—Donald L. Herr, Reeves Instrument Corp., New York, N. Y.

"A Compact Magnetic Memory"—Paul L. Morton, University of California, Berkeley, Calif.

"Synchrocyclotron Field Regulator"—C. S. McKown, Sperry Gyroscope Co., Great Neck, L. I., N. Y.; Wm. P. Caywood, Jr., Carnegie Institute of Technology, Pittsburgh, Pa.

Oscillators

"The Transient Behavior of a Class-C Oscillator"—Chester H. Page, National Bureau of Standards, Washington, D. C.

"Mode Suppression in Broadband Reflex Klystron Oscillators"—A. H. Sonnenschein, Polytechnic Research and Development Company, Inc., Brooklyn, N. Y.

"Telemetering Blocking Oscillator"—W. Todd, Signal Corps Engineering Laboratories, Fort Monmouth, N. J.

"Some Aspects of RF Phase Control in Microwave Oscillators"—E. E. David, Jr., Massachusetts Institute of Technology, Cambridge, Mass.

"Seven League Oscillator"—F. B. Anderson, Bell Telephone Laboratories, Inc., New York, N. Y.

DeWald Color TV System

The DeWald Radio Manufacturing Corp. of 35-15 37th Ave., Long Island City, New York, has announced that Mark Glaser, vice president in charge of engineering, has developed a color TV system which requires no filters to re-introduce natural colors into the received picture. Full details are not yet available since patent application is being made. However, it is understood that the system is fully electronic, fully compatible, can be produced at low cost, operates on very high frequency or ultra high frequency, is adaptable for present receivers at a cost of less than $100, requires no accurate color registration, and can be operated with present picture tubes. A simplified transmission change converts present systems and it is of the repetitive cyclic interval type.

George O. Milne

George O. Milne, 47, of Wood Ridge, N. J., director of technical operations for the American Broadcasting Co. and one of radio's pioneers, died Jan. 28, in a Miami Beach, Fla., hospital of a heart attack.

RMA TV Color Report

Copies of the report of the Color Television Committee of the RMA Engineering Dept. are now available for sale at $6.00. Orders may be placed with L. G. Cumming, Technical Secretary of the IRE, 1 East 79th St., New York City.

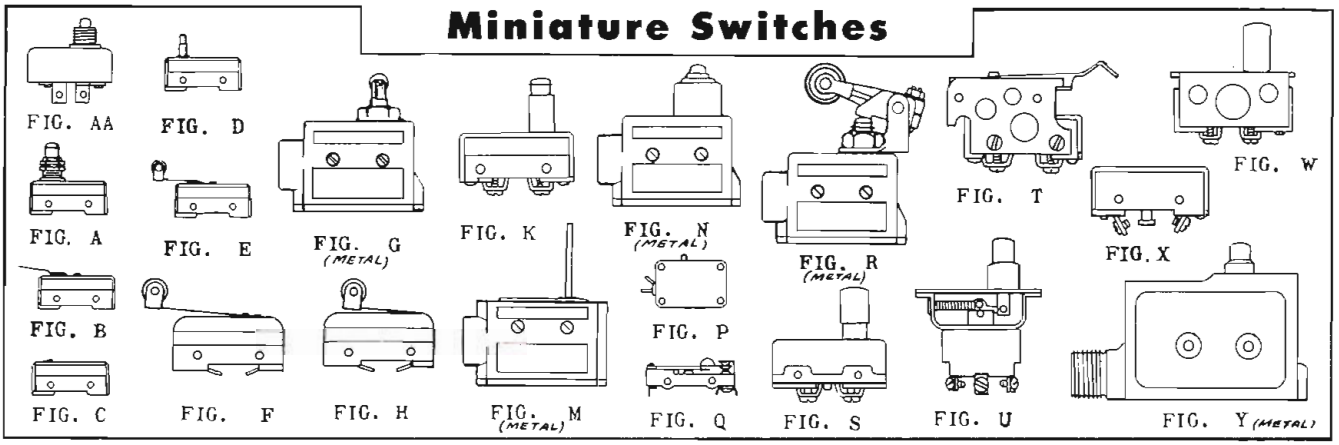
TELE-TECH

Advertisers March 1950

While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.

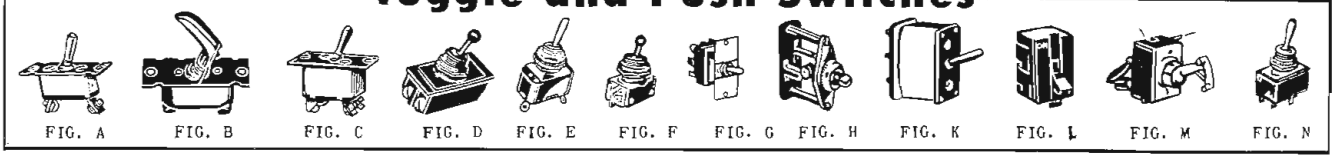
SAVE on Miniature and Toggle Switches at WELLS

Miniature Switches



STOCK NUMBER	MANUFACTURER	MFR. TYPE NO.	CONTACTS	ILLUSTRATION	PRICE EACH
305-10	Microswitch	WP3M5	N.C.	FIG. AA	$0.40
305-160	Microswitch	WP-5M3	N.C.	FIG. AA	.40
307-210	Microswitch	YP3A	N.O.	FIG. AA	.50
L309-75	Microswitch	YZ-RQ1	N.O.	FIG. A	.92
303-67	Microswitch	YZ7RA6	N.O.	FIG. A	.71
PH-100	Acro	RO1P2T	N.O.	FIG. A	.71
301-46	MU-Switch	MLB-321	SPDT	FIG. B	.85
301-93	Microswitch	YZ-2YLTC1	SPDT	FIG. B	1.01
301-30	MU-Switch	RO2M	SPDT	FIG. B	.95
301-78	MU-Switch	Green Dot	SPDT	FIG. B	.75
303-79	Microswitch	BZ-RL32	SPDT	FIG. B	.75
303-85	MU-Switch	MLB329	SPDT	FIG. B	.67
305-154	Acro	XO4-5L	SPDT	FIG. B	.78
311-130	Acro	— —	SPDT	FIG. B	.70
PH-101	Microswitch	BRL13	SPDT	FIG. B	.78
PH-102	Microswitch	YZRL8I2	N.O.	FIG. B	.65
PH-103	MU-Switch	Blue Dot	SPDT	FIG. B	.68
PH-104	Microswitch	YZ3RLTC2	N.O.	FIG. B	.64
PH-105	Microswitch	YZR31	N.O.	FIG. C	.53
PH-106	Microswitch	R-R36	N.C.	FIG. G	.50
PH-107	Microswitch	G-R36	N.C.	FIG. C	.53
PH-108	Microswitch	WZ-2RT	N.C.	FIG. C	.50
305-161	Microswitch	YZ3R3	N.O.	FIG. C	.71
311-115	Microswitch	WZR31	N.C.	FIG. C	.71
311-123	Microswitch	WZ-7R	N.C.	FIG. C	.60
311-126	Acro	HR8C7.1A	N.C.	FIG. C	.50
311-125	Acro	HR807.1A	N.O.	FIG. C	.53
311-121	Microswitch	WZ7RTC	N.C.	FIG. C	.50
311-128B	Microswitch	YZ	N.O.	FIG. C	.53
370-6	Microswitch	X757	N.C.	FIG. C	.45
PH-109	Microswitch	RRS13	N.C.	FIG. D	.45
PH-110	Microswitch	BRS36	SPDT	FIG. D	.53
PH-111	Microswitch	QRS	N.O.	FIG. D	.49
311-116	Microswitch	SW0186	N.C.	FIG. D	.63
303-49	Microswitch	YZ2YST	SPDT	FIG. D	.68
309-93	Microswitch	BRS36	SPDT	FIG. D	.68
370-17	MU-Switch	QRS	SPDT	FIG. D	.75
PH-112	MU-Switch	MBW	SPDT	FIG. E	.72
305-64	Microswitch	WZR12	N.C.	FIG. E	.65
311-25	MU-Switch	CUN24155	N.C.	FIG. E	.85
370-10	Acro	RO2M12T	N.O.	FIG. E	.70
303-32	Microswitch	YZ-3RW2T	N.O.	FIG. F	.65
306-10	Microswitch	BZE-2RQ5TM1	SPDT	FIG. G	2.48
309-101	Microswitch	BZ-2FW221	SPDT	FIG. H	.95
PH-113	Microswitch	RZBQT	SPDT	FIG. K	.58
L306-1010	Acro	RO7-8586	N.O.	FIG. K	.55
370-18	Acro	HR071P2TSF1	N.O.	FIG. K	.60
370-19	Microswitch	YZRQ41	N.O.	FIG. K	.65
370-40	Cutler Hammer	— —	N.O.	FIG. K	.75
370-8	Microswitch	RN-11-HO3	SPDT	FIG. M	1.50
309-157	MU-Switch	— —	N.C.	FIG. N	1.15
370-15	MU-Switch	AHB203	SPDT	FIG. N	1.25
370-7	Microswitch	WZE-7RQTN	N.C.	FIG. N	1.35
305-11	Acro	2M031A	N.O.	FIG. P	.37
305-71	Acro	2M041A	SPDT	FIG. P	.37
305-50	Microswitch	Open Type	SPDT	FIG. Q	.35
370-28	Microswitch	YZE-RQ22	N.O.	FIG. R	2.75
303-84	Acro	HR07-4PST	N.O.	FIG. S	.50
303-83	Microswitch	YZ-RQ4	N.O.	FIG. S	.50
PH-114	Microswitch	WZR-31	N.C.	FIG. T	.65
PH-115	Cutler Hammer	8905K564	DPDT	FIG. U	.65
PH-116	Microswitch	WZRQ41	N.O.	FIG. W	.60
PH-118	Microswitch	BZRQ41	SPDT	FIG. W	.60
311-128A	Microswitch	YZ-RTX1	N.O.	FIG. X	.90
PH-117	MU-Switch	Z	N.C.	FIG. Y	1.35

Toggle and Push Switches



STOCK NUMBER	FIG.	CONTACT ARRANGEMENT	MANUFACTURER & NUMBER	PRICE EACH
PH-500	A	SPDT	B1B	.35
PH-501	A	SPDT	AN3022-3B	35
PH-502	A	SPST MOMENTARY	B10	.30
PH-503	A	SPDT CENTER OFF MOM EACH SIDE	B11	.32
PH-504	A	SPDT CENTER OFF	B14	.35
PH-505	A	SPDT MOMENTARY	B21	.30
PH-505	A	SPST	AN-3022-2B	30
PH-506	A	SPDT CENTER OFF	AN-3022-1	.35
PH-507	A	SPDT CENTER OFF MOM EACH SIDE	AN-3022-7B	32
PH-508	A	SPST MOMENTARY	AN-3022-8	.28
PH-513	A	SPDT CENTER OFF	CH AN-3022-1B	.38
PH-514	A	SPST	CH B-5 A	.35
LT-104	A	SPDT 1 SIDE MOMENTARY	CH 8905K568	.35
309-168	A	SPST	168553	.30
309-171	A	SPDT CENTER OFF MOM 1 SIDE	CH 8209K5	.35
370-1	A	SPST MOMENTARY	CH AN-3022-8B	.25
370-4	A	SPDT CENTER OFF	CH B-9A	.35
370-14	A	SPDT CENTER OFF 1 SIDE MOM.	CH B-7A	.30
370-25	A	SPST MOMENTARY	CH B-6B	.25
305-171	A	SPDT CENTER OFF MOM 1 SIDE	8209K5	.32
309-169	B	SPST MOMENTARY	CH B-19	.35
PH-509	C	DPST	AN-3023-2B	.45
PH-510	C	DPDT MOMENTARY	CH 8715K2	.50
PH-511	C	DPDT MOMENTARY	CH 8715K3	.50
PH-512	C	DPST CENTER OFF	CH 8720K1	.55
303-65	C	DPST	CH AN-3023-2	45
305-174	C	DPDT CENTER OFF MOM 1 SIDE	AN-3023-5	.50
305-177	C	DPDT CENTER OFF MOM EACH SIDE	C-3	.50
305-176	C	DPDT CENTER OFF MDM EACH SIDE	AN-3023-7	.50
305-173	C	DPDT	8710K3	.55
305-175	C	DPDT CENTER OFF MOM EACH SIDE	3712K3	.50
305-179	C	DPDT CENTER OFF MOM EACH SIDE	8732-K2	.50
309-163	C	DPDT CENTER OFF MOMENTARY	CH C-11	.55
309-162	C	DPST	CH C-1	.45
309-164	C	DPST MOMENTARY	CH 8711K3	.40
370-31	C	DPDT	CH C-1B	.55
305-87	D	1 SIDE DPST MOM 1 SIDE SPST	AH & H	.95
305-111	E	SPST MOMENTARY	CH 8817K2	.28
305-153	E	SPDT CENTER OFF	CH AN-3021-1B	.35
LT-100	F	SPST	CH	.22
LT-101	F	SPST MOMENTARY	AH & H w/LEADS	.20
301-51	G	4PDT MOMENTARY	CH 8905K12	.75
305-140	H	DT NO MAKE EACH SIDE	OPEN FRAME	.25
309-161	K	SPST	CH 8781K3	1.95
305-76	L	DPST	AH & H OPEN FRAME	.75
311-77	L	DPST	AH & H	1.25
301-12	M	DPST	AH & H SPECIAL FOR HANDY	.40
LT-107	N	DPST	AH & H TALKIE	.25

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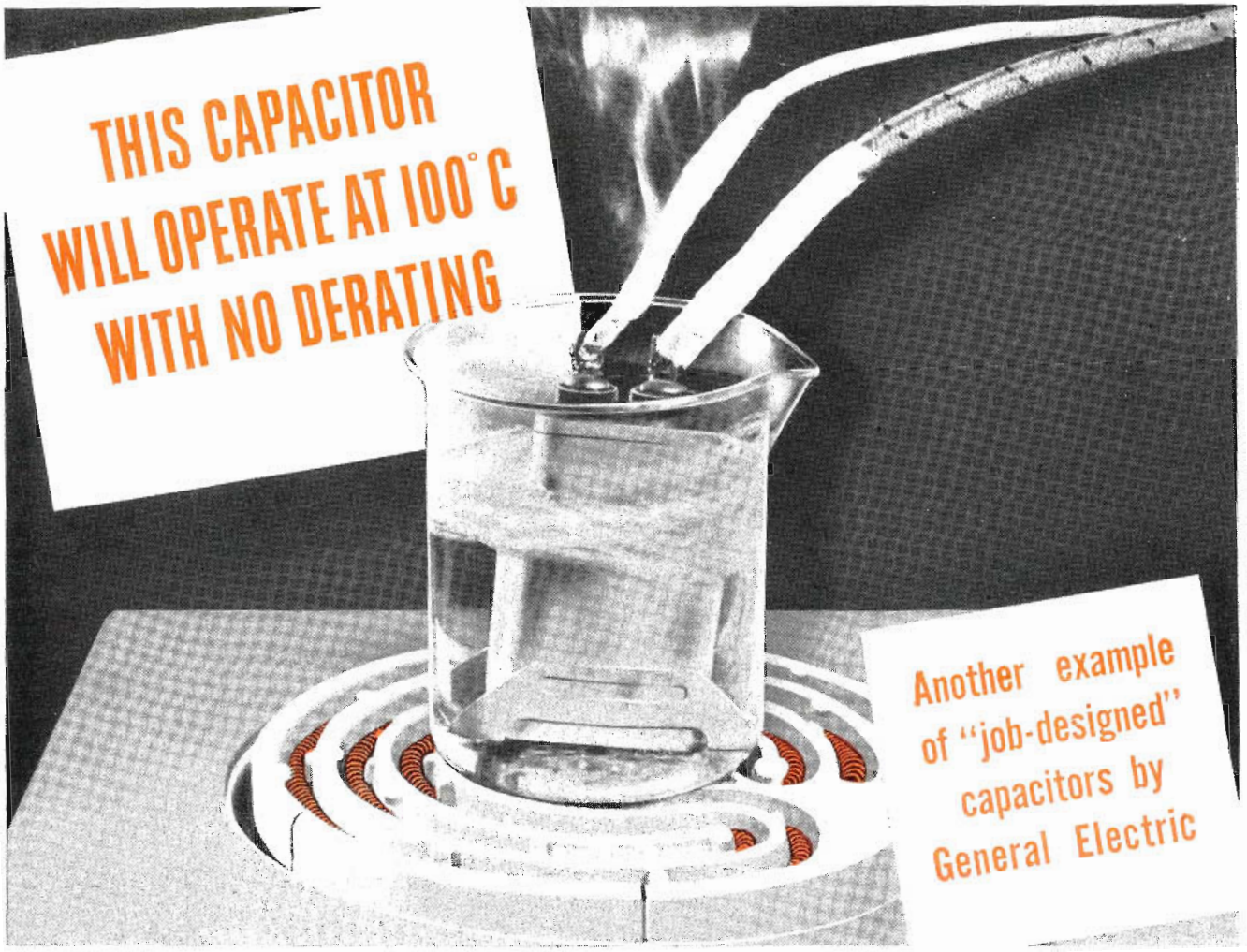

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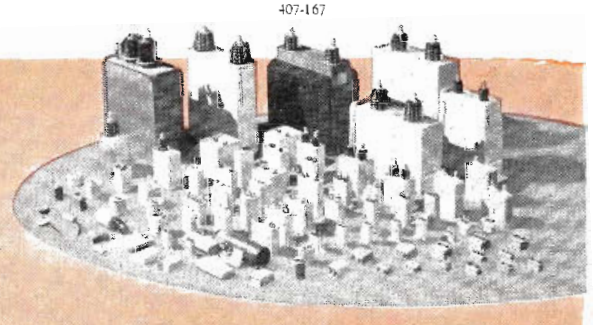

The Fountainhead of Modern Tube Development is RCA

The new RCA-5831 has a conservative 500-kw output* with less than 2-kw grid drive!

IMAGINE A TUBE just a shade over 38 inches long and 9 inches in diameter that handles with high efficiency an input of 650 kilowattts* in continuous commercial service . . . that, then, is the new and revolutionary RCA-5831 super-power *beam triode* —tipping the scales at a mere 135 pounds!

This new tube can be operated with maximum rated plate voltage and plate input at frequencies up through the AM broadcast band and much higher. The limitations for operation at the higher frequencies have not yet been determined, but we will welcome requests for information on specific applications.

The RCA-5831 is unique in that it features a symmetrical array of unit electron-optical systems embodying a mechanical structure which permits close spacing and accurate alignment of the electrodes to a degree unusual in high power tubes. Ducts for water-cooling the plate and beam-forming cylinder are built-in and have simplified hose connections. The grid-terminal flange employs a water-cooled connector. Because of the electron-optical principles incorporated in its design, the 5831 has low grid current and hence requires unusually low driving power.

Other features of the RCA-5831 include a multi-strand, thoriated-tungsten filament for economical operation as well as high emission capability, and low-inductance rf leads and flange terminals.

A technical bulletin covering the RCA-5831 in more detail, is available from RCA Commercial Engineering, Section C57R, Harrison, N. J. *Unmodulated class C service

ANOTHER new RCA tube . . .

. . . the RCA-5675 "Pencil-Type" Triode for UHF applications: RCA-5675 is a new medium-mu triode employing a double-ended coaxial-electrode structure, for use in grounded-grid circuits. As a local oscillator, it will deliver a power output of 475 milliwatts at 1700 Mc. and about 50 milliwatts at 3000 Mc.

See the new RCA-5831 at the RCA Exhibit, I.R.E. National Convention, Grand Central Palace, N.Y.C., March 6-9.

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