THE SCANNER

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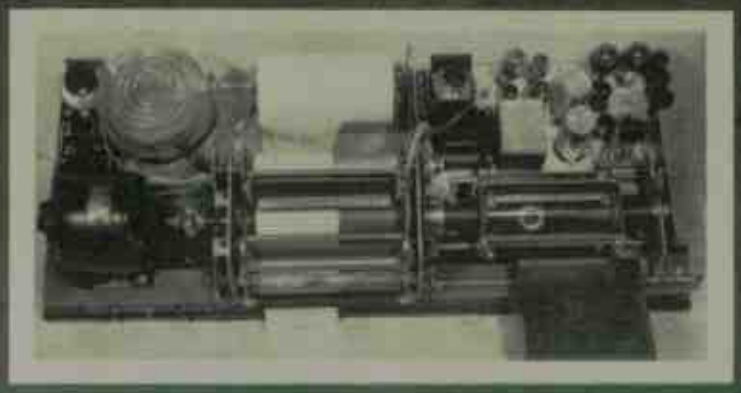
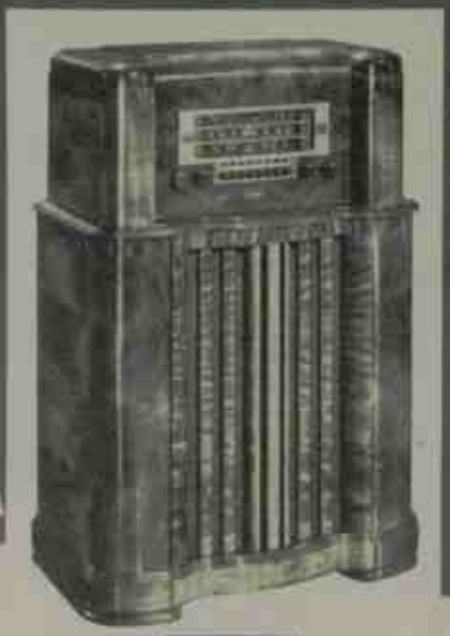
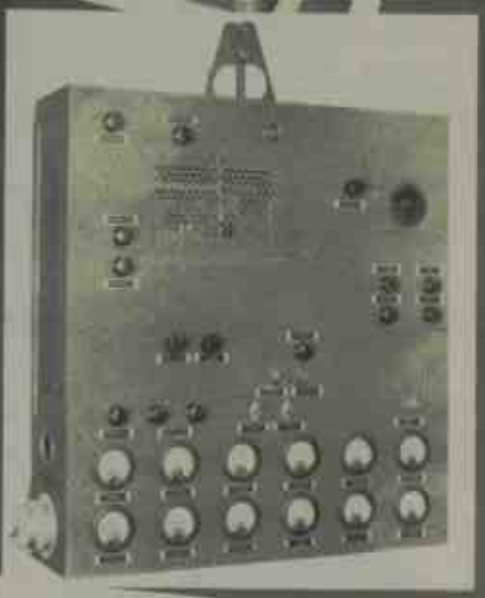
RCA MANUFACTURING CO., INC.







OUTSTANDING CONTRIBUTIONS TO THE ART

Vol. 5 Jan.-Feb.-Mar.-1940 No. 1

THE SCANNER

EDITORS

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PRINTED PRIMARILY FOR THE INFORMATION OF THE MEMBERS OF THE ENGINEERING DEPARTMENTS OF THE RCA MANUFACTURING COMPANY, INC.

This first quarterly issue of our fifth volume again gives us an opportunity to summarize our engineering accomplishments for the past year. Our front cover shows views of some of the equipment developed or designed during 1939 while other items are pictured throughout the text which describes them.

In this issue will also be found our annual list of technical papers published during 1939 by our engineers and those of the other members of the RCA Family.

Among the loose-leaf sheets included with this issue are two which we feel will be widely useful. The first is the "Preference List" of Receiving Tube Types which is discussed elsewhere in the issue. The second is the list of "Abbreviations and Letter Symbols" which should be of value to our secretaries and stenographers as well as to the engineers. This list includes all the essential material for the abbreviations which we use most frequently. If all will follow this list, misunderstandings will be avoided and a contribution will be made to the uniformity of appearance of our technical articles and reports.

Included also are more charts from the Broadcast Equipment Catalog and a sheet of frequently used Purchase Specification and Finish Numbers supplied by our Standardizing Department which will be useful to all having frequent occasion to refer to them.

In This Issue

The Management is fully cognizant of the part which the engineers in the laboratories have contributed to these accomplishments. The department managers and directors could do little without the aid, inventive contributions, and painstaking efforts of their engineers.

The Management takes this opportunity to compliment the engineers who worked on these developments and on any others of value which may have been omitted here due to lack of space. These men are commended for the excellent work done and they can be assured that the Management appreciates and has noted their contributions to the achievements of the Company.

GENERAL RESEARCH

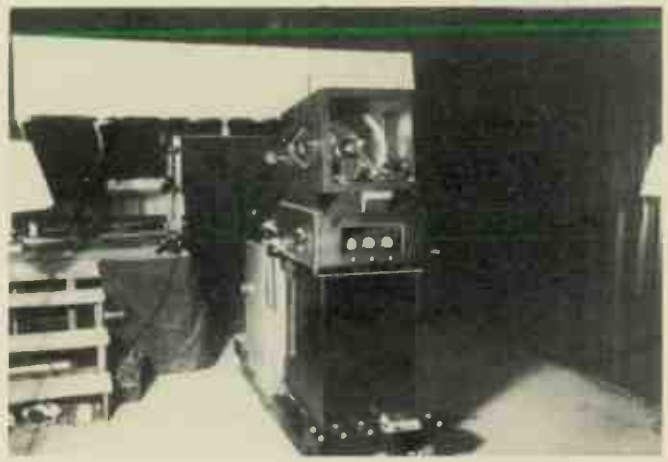
Television

Much special apparatus was developed and produced for the purpose of publicizing television at the New York and San Francisco Fairs. Simplified demonstration equipment was developed and subsequently exhibited by broadcasting stations, department stores, museums, and others throughout the country.

A television picture 4-1/2 by 6 feet in size was successfully demonstrated in the laboratory, using a 50,000 volt projection Kinescope and a special optical system. Work was begun on similar apparatus to provide a 9 by 12 foot picture.

Television Demonstration Unit or "Jeep"

The Orthicon, or low velocity scanning beam Iconoscope, was applied to advantage to all types of television pickup with improved picture quality through freedom from extraneous signals such as "black spot" and "flare".



Projection Kinescope Equipment in Demonstration Studio

During the year in television we developed, designed, and produced two complete new pickup equipments from Iconoscope to transmitting antenna for the 300 Mc band in a period of about 5 months time. We have reports of satisfactory operation over distances of nine miles on the West Coast and six miles in New York. One of these equipments was set up in Washington for a demonstration to the F.C.C. on December 1. Notwithstanding unfavorable weather conditions, resulting in a dark cloudy day, a very favorable impression was created on both the members of the F.C.C. and hundreds of the F.C.C. staff.

Reception of television signals transmitted 200 miles by "line-of-sight" from the Empire State Building to an airplane 4 miles above Washington, D. C. was demonstrated. Apparatus was constructed and tests were made to investigate the possibilities for television transmission at 325 Mc for remote pickup.

Television antennas practicable for home use were developed and the suitability of the "turnstile" type of antenna for television transmission was demonstrated. Cooperation in industry activities was continued, particularly

Television Camera from
Portable Pickup Equipment

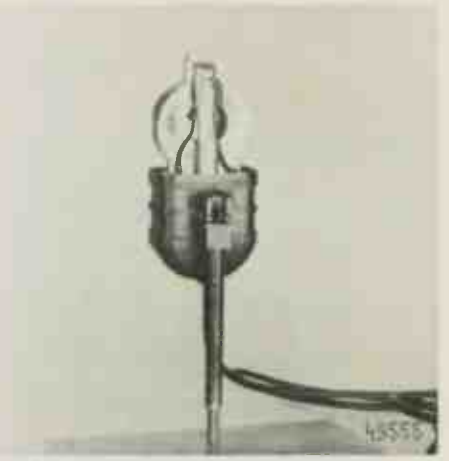
Camera Control Unit from
Portable Pickup Equipment

in the field of interference measurement and suppression. Limiting circuits in the receivers were found decidedly effective in reducing the disturbing effect of ignition noise on picture synchronization.

Acoustics

Very small speakers of the single-ended balanced armature type were developed to give surprising fidelity considering their size and simplicity. For the larger speakers a folded suspension was devised which gives an additional octave of low frequency response. Compound horn speakers having efficiencies many times those of the usual cone speaker were developed for broadcast receiver use.

A unidirectional type of microphone was developed using a new and very simple method of cancelling the effect of sound approaching from the back in order to obtain the desired directivity. With this construction the weight can



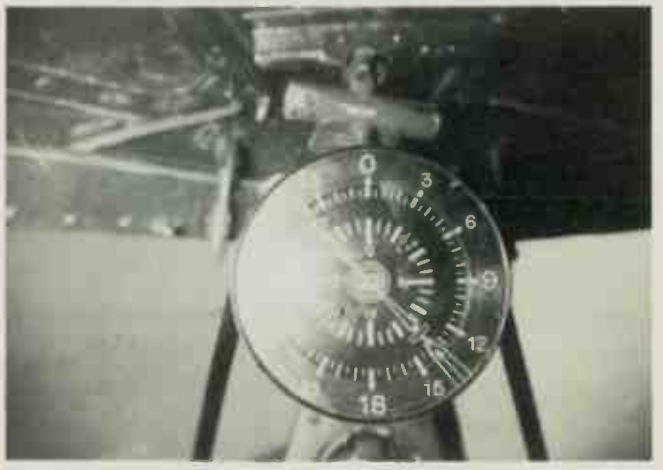
New Unidirectional Microphone Mechanism

be reduced to half that of previous designs, and four different directional characteristics, circular, figure 8, cardioid, and limacon, can be obtained at will by shifting a simple mechanical lever.

Facsimile

Field tests of facsimile broadcasting by sub-carrier frequency modulation combined with a new self-synchronizing method using a 60 cycle keyed 480 cycle tone were made under limiting conditions of noise and selective fading, and these indicated a very significant improvement in quality of copy over that obtained with previous methods. Many improvements were made in an experimental facsimile duplicating machine as a result of experience with it in productive work. Several specific duplicator applications were investigated in detail, and for one of these - the copying of telegraph messages - a convenient roller-shade type of mechanism was developed for applying the originals to the scanner. A duplicator embodying this mechanism and capable of copying a complete telegraph message in a quarter of a minute was completed during the year and shipped to R.C.A. Communications shortly after the first of the year for trial operation in their traffic department.

Treatment methods for increasing the wet strength of paper were investigated in an effort to find practical ways of using cheaper paper for electrolytic recording.



Omnidirectional Radio Range
Indicator Face with Overlay

INFORMATION FOR AUTHORS
Compiled by the Editors of
The Scanner

This short discussion is intended to provide helpful information to authors of technical papers. It is recommended that those who write or may write such papers keep these sheets for reference. If these rules and suggestions are followed, the work of editing the papers, both before they leave us and after they arrive at the publishers, will be facilitated and the probability of early publication will be greatly increased. In addition, uniformity of the editorial style of RCA papers is an asset to our company.

Publishers differ somewhat as to the form which they prefer for location of footnotes and certain other mechanical details of the article's arrangement. Such matters can be most easily complied with by observing the style used in the periodical or journal to which the article is to be submitted and instructing the typist accordingly.

Below are given some general rules which apply to a majority of publishers. Where there are important exceptions, these are noted.

Number of Copies to be sent publisher or society: 1 for all organizations except A.I.E.E. (3 if for presentation before a meeting and 2 if for publication); and S.M.P.E. (2 for convention presentation, 1 for publication).

Form — Typewritten, one side, double-spaced (except for presentation before A.I.E.E. conventions when the 3 copies required should be typed single-spaced).

Outline of Contents

- Title
- Name of author or authors
- Company affiliation (generally below author's name)
- Summary of paper (not to exceed 500 words and preferably between 100 and 300) should give concisely the scope of the paper, method of approach, and important results and conclusions.
- The paper proper. The value and clarity of a paper are increased by dividing it into sections with appropriate sub-headings. Utmost brevity consistent with telling the story is desirable. Anything which is generally known should not be repeated at length; it should be covered by bibliographical reference only.
- Acknowledgments
- A complete list of references or citations
- A complete set of illustrations
- List of captions for illustrations on a separate sheet.

General Requirements

Line drawings should be in India ink on tracing cloth or heavy tracing paper. The number of illustrations used in an article should be proportional to the text space. In general, a maximum of one illustration (photograph, line drawing, curve sheet, etc.) for each 500 words of text should not be exceeded.

Curves on cross-section paper should be traced in black ink, preferably on tracing cloth with all but the major cross-section lines omitted.

Lettering on drawings and curves should be neatly done and of such a size that when reproduced in reduced size in the publication, the smallest lettering will not be less than 0.06 inch high. Printing on figures should not extend much beyond the drawing itself. Simple Gothic letters reproduce most legibly; capitals rather than lower case letters are preferred. Large drawings, requiring great reduction in size, should be simplified as much as possible.

The minimum amount of reading matter should be included on the illustrations themselves. Necessary information can be better set in type in the illustration caption.

Style

Manuscripts should be written, in general, from an impersonal viewpoint, or in the third person, so as to focus the reader's attention on the author's statements rather than on the author.

Where more than a few references to publications are used in the text, they should be numbered consecutively and each explanatory reference should be typed at the bottom of the page on which it occurs. Exception: S.M.P.E. require all references to be grouped in a list at the end of the article. References to periodical literature should contain the following items in the order given.

Reference number corresponding to number in text (This is a superior number in the text and is without parentheses)

Name of author or authors (last name first in S.M.P.E.)

Title of article in quotation marks.

Name of periodical.

Volume number.

Date (month and year).

Serial number preceded by the abbreviation "No."

Page number preceded by the letter "p." (or "pp." if followed by first and last page numbers).

References to books should be made as follows:

Reference number

Author's name

Name of book in quotation marks

Edition

Publisher

Place of Publication

Date of publication (year)

Page preceded by the letter "p."

Footnotes in tables should appear below the table. To avoid confusion with text numerical references, footnotes for tables should not be numbered but should be referred to by signs such as *, **, #, etc.

In general, abbreviations should be avoided in the text. In tabular material and on figures they are sometimes permissible to save space.

Symbols or letters used in mathematical expressions or equations should be listed and explained. Legibility of mathematical expressions is important to avoid errors and expensive resetting of type. Special care should be taken regarding inferior and superior characters, Greek letters, and all unusual symbols.

Tabulations, except when very short, should be typed, each on separate sheet, and numbered consecutively using Roman numerals. A brief descriptive heading should appear at the top.

When, as is usual publisher practice, galley proofs are returned with the original manuscript for proof reading by the author, both should be returned to the publisher.

How to Plan a Paper*

"Remember the reader!" The function of a paper or article is to convey to the reader ideas or information in the possession of the author. This is accomplished through the medium of words, and is most effective when done simply and concisely. Readers' understanding may be aided materially by the correct use of carefully chosen words. The author should have clearly in mind what he wishes to say before attempting the first draft of a manuscript. Then he should begin where his story begins; tell his story in simple, straightforward style and in logical sequence; stop when it has been told.

A well-considered advance plan will lighten the task of actual preparation of a manuscript. A simple and effective procedure is to make an outline or skeleton of the paper, similar to a table of contents, using a separate heading for each main division of the subject and appropriate subheadings to cover subdivisions. This affords a ready means of arranging the contents of a paper in logical order. Then the actual writing of a paper consists simply of preparing suitable material under each heading.

Another method preferred by some authors is to write upon cards various hints and suggestions in regard to the paper and, when ready to prepare the manuscript, to sort the cards into their proper sequence. Then the suggestion on each card may be expanded into one or more paragraphs expressing fully the author's ideas.

A third method is to write or dictate all that comes to mind on the subject under consideration, regardless of proper order or sequence; then to clip and paste this rough draft until a logical development of the subject is obtained.

Length

Papers should be as short as the nature of the subject matter will permit without detracting from their interest or omitting vital information. Authors are reminded that many papers suffer in clarity of presentation from a superabundance of words and the inclusion of information not pertinent to the main purpose of the article.

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*This is quoted from a booklet "Information to Authors" published by the A.I.E.E.

Advice to Authors

If you've got a thought that's happy--
Boil it down.
Make it short and crisp and snappy--
Boil it down.
When your brain its coin has minted,
Down the page your pen has sprinted,
If you want your effort printed,
Boil it down.

Take out every surplus letter--
Boil it down.
Fewer syllables the better--
Boil it down.
Make your meaning plain--express it,
So we'll know--not merely guess it,
Then, my friend, ere you address it,
Boil it down.

Skim it well--then skim the skimmings--
Boil it down.
When you're sure 'twould be a sin to
Cut another sentence in two,
Send it in, and we'll begin to
Boil it down.
(Quoted from Canadian Public Health Journal, 1936)

--ooOoo--

INDUCTANCE OF SINGLE LAYER SOLENOIDS

By N. I. Korman
Special Apparatus Division

The Bureau of Standards Circular C74 (page 252) gives the inductance of a single layer solenoid as:

$$L = 0.03948 \frac{a^2 \quad n^2}{b} \quad K$$

where L is the inductance in microhenries

a is the coil radius in centimeters

b is the coil length in centimeters

n is the number of turns in the coil

K is a function of $\frac{2a}{b}$ which is tabulated

It is usually more convenient to use the formula in one of the following forms:

$$L = 0.0251\ dn^2 \frac{d}{\ell} K \quad = 0.025\ dn^2 K_3 \quad \ldots\ldots\ldots (1)$$

$$L = 0.0251\ \ell n^2 \frac{d^2}{\ell^2} K \quad = 0.025\ \ell n^2 K_4 \quad \ldots\ldots\ldots (2)$$

$$L = 0.0251\ d^3\left(\frac{n}{\ell}\right)^2 \ell K \quad = 0.025\ d^3 N^2 K_1 \quad \ldots\ldots\ldots (3)$$

$$L = 0.0251\ \ell^3\left(\frac{n}{\ell}\right)^2 \frac{d^2}{\ell^2} K \quad = 0.025\ \ell^3 N^2 K_4 \quad \ldots\ldots\ldots (4)$$

$$L = 0.00254\ \frac{1}{\ell}\left(\pi n d\right)^2 K \quad = 0.00254 \frac{1}{\ell} \omega^2 K_2 \quad \ldots\ldots\ldots (5)$$

$$L = 0.00254\ \frac{1}{d}\left(\pi n d\right)^2 \frac{d}{\ell} K \quad = 0.00254\ \frac{1}{d}\ \omega^2 K_3 \quad \ldots\ldots\ldots (6)$$

where L is the inductance in microhenries

d is the coil diameter in inches

ℓ is the coil length in inches

n is the number of turns on the coil

N is the number of turns per inch

ω is approximately the length of wire in the coil

K_1, K_2, K_3, K_4 are functions of $\frac{\ell}{d}$ which are plotted on the back of this sheet.

Formula (1) is useful when the coil diameter and total number of turns are fixed.

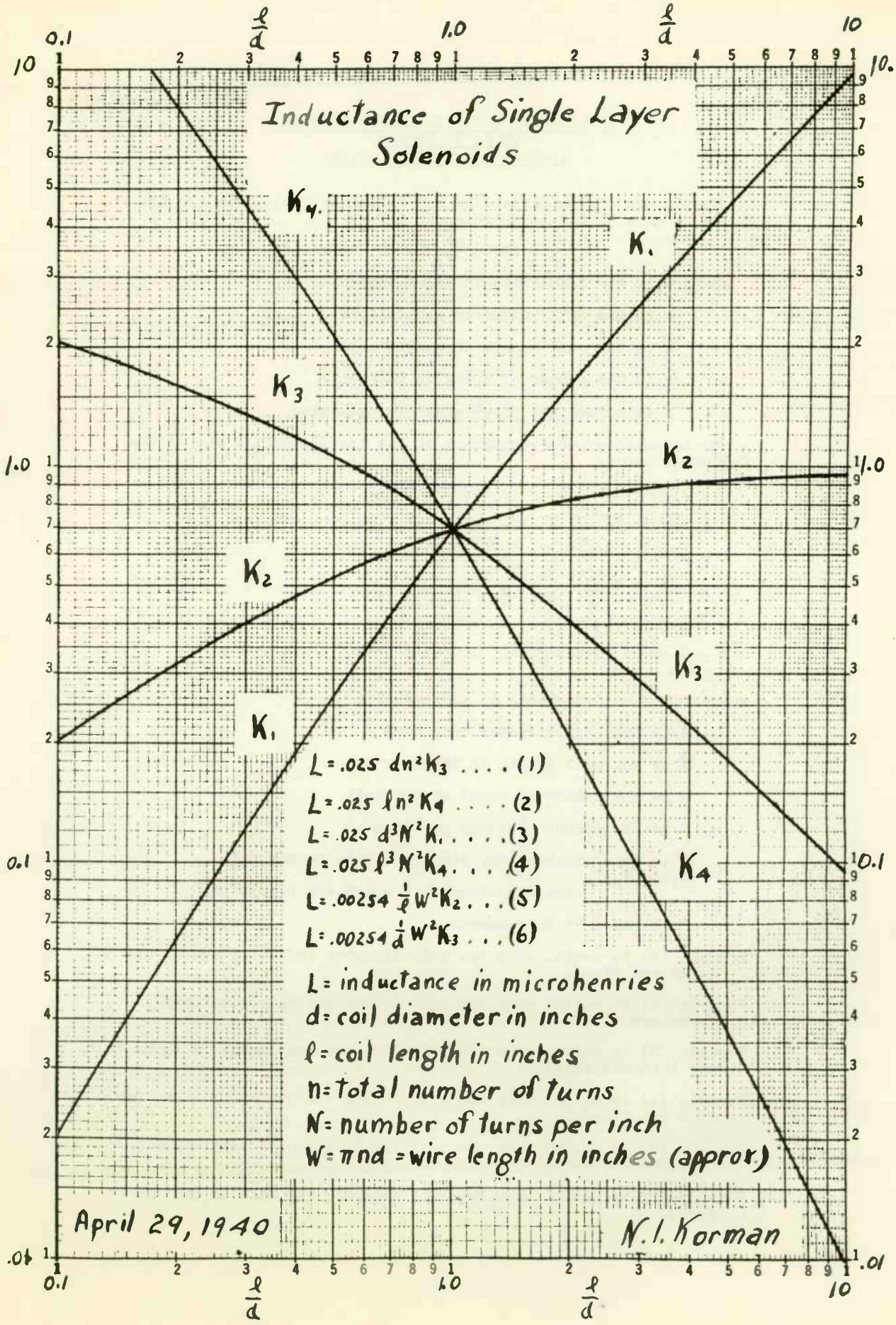
Formula (2) is useful when the coil length and total number of turns are fixed.

Formula (3) is useful when the coil diameter and number of turns per inch are fixed.

Formula (4) is useful when the coil length and number of turns per inch are fixed.

Formula (5) is useful when the coil length and wire length are fixed.

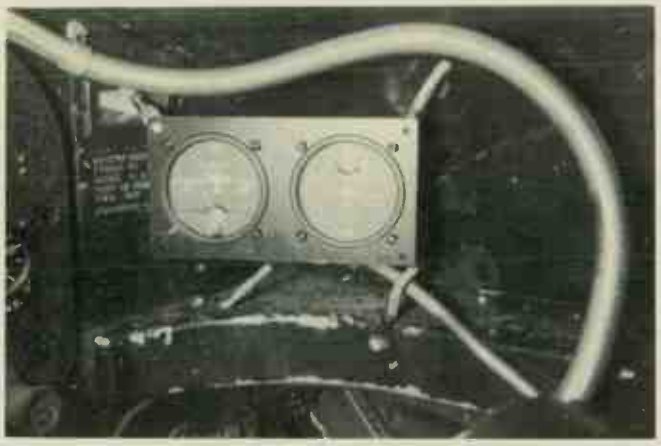
Formula (6) is useful when the coil diameter and wire length are fixed.



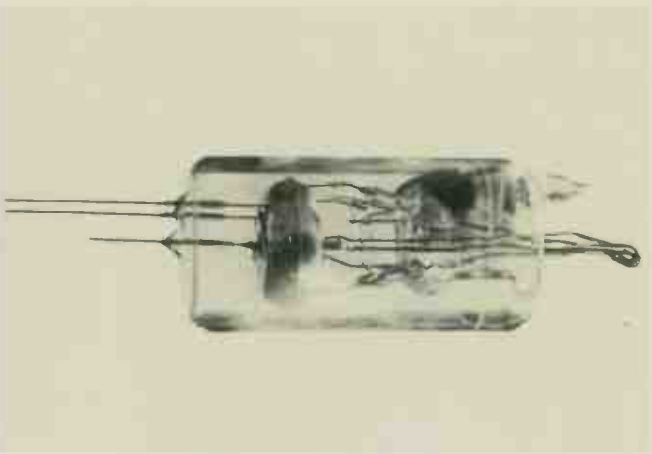
PROPERTIES	PHENOL-FORMALDEHYDE COMPOUNDS					METHYL METHACRYLATE RESIN		STYRE RESI
	Molding			Laminated				
	Woodflour Filler	Mineral Filler	Macerated Fabric Filler	Paper Base	Fabric Base	Cast	Molding	
Molding Qualities	Excellent	Excellent	Good to fair	—	—	Good	Excellent	Good
Compression Molding Temp., ° F.	280–360	270–350	270–330	275–350	275–350	—	300–370	220–27
Compression Molding Pressure, lbs. per sq. inch	2000–4500	2000–6000	3000–8000	1000–3000	1000–3000	—	1000–3000	1000–50
Injection Molding Temp., ° F.	275–375	275–350	—	—	—	—	390–500	300–45
Injection Molding Pressure, lbs. per sq. inch	2000–10000	2000–15000	—	—	—	—	10000–30000	3000–30
Compression Ratio	2.2–3.0	2.0–7.1	2.5–11.0	1.5–3.0	1.5–3.0	—	1.6–2.0	2.0
Mold Shrinkage, inches per inch	0.006–0.010	0.002–0.006	0.003–0.007	—	—	—	Compression 0.001–0.005 Injection 0.004–0.006	Compress 0.002–0.0 Injectio 0.008–0.0
Specific Gravity	1.25–1.52	1.59–2.09	1.37–1.40	1.30–1.40	1.30–1.40	1.185	1.18–1.19	1.05–1.0
Specific Volume, cubic inch per lb.	22.2–18.2	16.4–13.3	20.2–19.8	21.3–19.1	21.3–19.1	23.4	23.4–23.2	26.3–25.
Refractive Index, N_D	—	—	—	—	—	1.49	1.49	1.59–1.6
Tensile Strength, lbs. per sq. inch	4000–11000	4000–10000	6500–8000	7000–18000	8000–15000	7000–9000	4000–6000	5500–85
Elongation, %	—	—	—	—	—	5–15	1–5	1.0
Modulus of Elasticity lbs. per sq. inch × 10^4	10–15	10–45	7–12	4–20	3.5–15	4–6	—	4.6–5.1
Compressive Strength, lbs. per sq. inch	16000–36000	18000–36000	20000–32000	20000–40000	20000–44000	11000–13000	10000–15000	13000–13
Flexural Strength, lbs. per sq. inch	8000–15000	8000–20000	10000–13000	13000–30000	13000–30000	14000	10000–15000	6500–80
Impact Strength, ft. lbs. energy to break $\frac{1}{2} \times \frac{1}{2}$ in. bar C = Charpy, I = Izod,	0.10–0.28 I	0.11–0.36 I	0.4–2.4 I	0.3–3.8 I	0.8–7.5 I	0.25–0.5 C	0.2–0.4 C	Compressi 0.20–0.35 Injection 0.20–0.5 I
Hardness (2.5 mm. ball, 25 kg. load), Brinell No.	30–45	—	—	24–40	30–45	18–20	18–20	20–30
Thermal Conductivity, 10^{-4} cal. per sec. per sq. cm./1° C. per cm.	4–12	8–20	3–5	5–8	5–8	1–10	—	1.9
Specific Heat, cal. per ° C. per gram	0.35–0.36	0.25–0.35	0.30–0.35	0.3–0.4	0.3–0.4	0.4	0.4–0.5	0.32
Thermal expansion, 10^{-6} per ° C.	3.7–7.5	2.5–4	2–6	1.7–2.5	1.7–3	8	8–9	7–8
Resistance to Heat, ° F. (continuous)	350	450	250–350	212–300	212–350	140–160	120–140	—
Softening Point, ° F.	None	None	None	None	None	150–230	150–230	190–250
Distortion under Heat, ° F.	240–285	—	—	>320	>320	155	125–160	150–190
Tendency to Cold Flow	None	None	None	None	None	Very slight	Slight	Slight
Volume Resistivity, ohm.-cms. (50% relative humidity and 25° C)	10^{10}–10^{13}	10^{8}–10^{11}	10^{8}–10^{11}	10^{10}–10^{12}	10^{10}–10^{13}	10^{15}	10^{16}	10^{17}–10^{1}
Breakdown Voltage, 60 cycles, volts per mil (instantaneous)	300–500	250–400	300–450	400–1300	150–600	500	500	500–700
Dielectric Constant, 60 cycles	5–12	5–20	5–10	—	—	3.5	3.0–3.1	2.6
Dielectric Constant, 10^3 cycles	4–8	4.5–20	4.5–6	—	—	3.2	3.3–3.5	2.6
Dielectric Constant, 10^6 cycles	4.5–8	4.5–20	4.5–6	3.6–5.5	4.5–7	3.2	3.1–3.3	2.6
Power Factor, 60 cycles	0.04–0.30	0.10–0.30	0.08–0.30	—	—	0.06	0.05–0.06	0.0003
Power Factor, 10^3 cycles	0.04–0.15	0.10–0.15	0.08–0.20	—	—	0.06	0.06–0.07	<0.0001
Power Factor, 10^6 cycles	0.035–0.1	0.005–0.10	0.04–0.10	0.02–0.05	0.02–0.08	0.025	0.02–0.03	<0.0001
Water Absorption, immersion—24 hrs.	0.2–0.6	0.01–0.3	1.0–1.3	0.3–9.0	0.3–9.0	0.4	0.4–0.5	0.00
Burning Rate	Very low	Nil	Approx. nil	Very low	Very low	Slow	Slow	Slow
Effect of Age	None	None	None	Improves mechanical and el properties		Practically Nil	Practically Nil	Very slig
Effect of Sunlight	Light shades discolor			Lowers surface resista		Very slight	Very slight	Yellows slightly
Effect of Weak Acids	None to slight depending on acid					Practically Nil	Practically Nil	None
Effect of Strong Acids	Decomposed by oxidizing acids; reducing and organic acids n					Affected only by oxidizing acids		None
Effect of Weak Alkalies	Slight to marked depending on alk					Practically Nil	Practically Nil	None
Effect of Strong Alkalies	Decomposes	Decomposes	Decomposes	Decomposes	Decomposes	Practically Nil	Practically Nil	None
Effect of Organic Solvents	None on bleed-proof materials					Soluble in ketones, esters and aromatic hydrocarbons		Soluble in aromatic an chlorinated hydrocarbon
Effect on Metal Inserts	Inert	Inert	Inert	Inert	Inert	Inert	Inert	Inert
Machining Qualities	Fair to good				Fair to exc	Excellent	Excellent	Poor to good
Clarity	Opaque	Opaque	Opaque	Opaque	Opaque	Transparent (90–92 % light transmission)		Transparen (90–92 % li transmissi
Color Possibilities	Limited	Limited	Limited	Limited	Limited	Unlimited	Unlimited	Unlimited

CHART

HELLAC COM-POUND	CELLULOSE COMPOUNDS					PROPERTIES
	Ethyl-cellulose	Cellulose Acetate		Cellulose Acetate Butyrate	Cellulose Nitrate (Pyroxylin)	
		Sheet	Molding			
Good	Excellent	Excellent	Excellent	Excellent	Good	Molding Qualities
240	320–360	210–320	250–350	270–330	185–250	Compression Molding Temp., ° F.
000–2500	1500–2500	500–5000	1500–5000	1500–5000	2000–5000	Compression Molding Pressure, lbs. per sq. inch
180–260	380–425	—	300–440	310–390	—	Injection Molding Temp., ° F.
1000–1200	3000–30000	—	8000–30000	8000–30000	—	Injection Molding Pressure, lbs. per sq. inch
2–3	2.2–2.5	—	2–2.8	2.0–2.3	—	Compression Ratio
0.002	0.004–0.007	Positive and injection 0.002-0.003; Semipositive 0.005-0.007 Flash; 0.008-0.009			—	Mold Shrinkage, inches per inch
1.1–2.7	1.14	1.27–1.37	1.27–1.37	1.20–1.22	1.35–1.60	Specific Gravity
25.2–10.3	24.3	21.8–20.2	21.8–20.2	22.8–23.1	20.5–17.3	Specific Volume, cubic inch per lb.
—	1.470	1.49–1.50	1.47–1.50	1.47–1.48	1.50	Refractive Index, N_D
900–2000	6000-9000	6000–11000	3500–10000	3700–6800	5000–10000	Tensile Strength, lbs. per sq. inch
—	10–40	20–55	8–30	15–36	10–40	Elongation, %
5–6	2–4	1–3	1–4	—	2–4	Modulus of Elasticity, lbs. per sq. inch × 10^5
8000–17000	10000–12000	4000–16000	11000–27000	11300–20300	—	Compressive Strength, lbs. per sq. inch
—	9000–10000	—	5000–16000	5600–11900	—	Flexural Strength, lbs. per sq. inch
2.6–2.9 I	0.6–1.8 I	0.15–0.60 C	0.9–1.6 C	1.3–3.3 C	0.25–1.0 C	Impact Strength, ft. lbs. energy to break ½ × ½ in. bar C = Charpy, I = Izod
—	—	6–11 (10 kg.)	8–15 (10 kg.)	9–14	8–11 (10 kg.)	Hardness (2.5 mm. ball, 2.5 kg. load), Brinell No.
—	5.6	5.4–8.7	5.4–8.7	7.7	3.1–5.1	Thermal Conductivity, 10^{-4} cal. per sec. per sq. cm./1° C. per cm.
—	0.25–0.40	0.3–0.4	0.3–0.45	0.35	0.34–0.38	Specific Heat, cal. per ° C. per gram
—	10–14	14–16	14–16	13–15	12–16	Thermal Expansion, 10^{-5} per ° C.
150–190	140–180	140–180	140–180	140–200	ca. 140	Resistance to Heat, ° F. (continuous)
150	240–265	140–230	145–260	140–250	160–195	Softening Point, ° F.
—	130–150	122–212	122–212	130–200	—	Distortion under Heat, ° F.
Slight	Slight	Slight	Slight	Slight	—	Tendency to Cold Flow
1.8×10^9	10^{13}	$(5–30) \times 10^{13}$	$(1–6) \times 10^{13}$	—	$(2–30) \times 10^{10}$	Volume Resistivity, ohm.-cms. (50% relative humidity and 25° C.)
200–600	1500	800–2500	350–900	—	600–1200	Breakdown Voltage, 60 cycles, volts per mil (instantaneous)
3–4	—	3.5–7.5	4.5–6.2	3.6	6.7–7.3	Dielectric Constant, 60 cycles
4–5	2.5–3.5	3.5–7.0	4.5–6.0	—	—	Dielectric Constant, 10^3 cycles
—	2.0–3.0	3.0–5.0	4.0–5.0	3.6	6.15	Dielectric Constant, 10^6 cycles
0.001–0.01	—	0.02–0.07	0.01–0.04	0.014	0.06–0.15	Power Factor, 60 cycles
0.05	0.005–0.025	—	0.02–0.06	—	—	Power Factor, 10^3 cycles
—	0.007–0.03	0.04–0.09	0.04–0.06	0.018	0.07–0.10	Power Factor, 10^6 cycles
—	1.25 (48 hrs.)	1.5–3.0	1.4–2.8	0.8–1.1	1.0–3.0	Water Absorption, immersion—24 hrs.
High ood filler)	Slow	Slow	Slow	Slow	Very high	Burning Rate
None	Slight	Slight	Slight	Slight	Slight hardening	Effect of Age
None	Slight	Slight	Slight	Slight	Discolors and becomes brittle	Effect of Sunlight
eteriorates	Slight	Slight	Slight	Slight	Slight	Effect of Weak Acids
eteriorates	Decomposes	Decomposes	Decomposes	Decomposes	Decomposes	Effect of Strong Acids
teriorates	None	Slight	Slight	Slight	Slight	Effect of Weak Alkalies
teriorates	None	Decomposes	Decomposes	Decomposes	Decomposes	Effect of Strong Alkalies
Attacked by some	Widely soluble	Soluble in ketones and esters; softened or slightly soluble in alcohol; little affected by hydrocarbons				Effect of Organic Solvents
Inert	Inert	Inert	Inert	Inert	—	Effect on Metal Inserts
Poor to Good	Good	Good	Good	Good	Good	Machining Qualities
Opaque	Transparent translucent opaque	Transparent translucent opaque	Transparent translucent opaque	Transparent translucent opaque	Transparent translucent opaque	Clarity
imited; pastels excluded	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Color Possibilities



In- and Out-Bound Meters of Omnidirectional Radio Range



Centimeter Wave Detector Tube

Other Research

Methods of measuring radio noise were investigated as our contribution, through RMA, to cooperative activities of the radio, electrical manufacturing, and electrical power industries for the mitigation of radio interference. This has led to preparation for joint publication of specifications for a radio noise meter of a new type. Design and development work for an instrument of this kind to be manufactured by our company has been completed.

Centimeter Wave Signal Generator

Continued work on quartz crystal resonators led to the design and construction of a crystal filter providing the same selectivity at 5 Mc as the conventional 455 kc broadcast receiver intermediate frequency amplifier. Crystal filters were also built for band widths of 20 and 100 cycles at a mean frequency of 50 kc for use in a wave analyzer.

A general purpose ultra-short wave antenna with improved mechanical and electrical characteristics and which does not require adjustment on erection was developed and placed on sale.

A thermal radio-frequency wattmeter was developed for measuring the power output of broadcast transmitters in actual operation.

Research with centimeter waves was concentrated on the problem of more sensitive receiving apparatus. A new and much more efficient type of detector tube was developed in which the detection is accomplished through velocity modulation of an electron beam by means of a cavity resonator. Measurements were facilitated by the construction of a new signal generator involving a thermo-couple for determining signal generator output in a special manner as an intrinsic part of the output attenuator.

Another omnidirectional radio range system for use in air navigation was constructed to operate at 125 megacycles instead of the 6 megacycles frequency used in the first construction. This equipment was tested to investigate the basic limitations due to the operating frequency and demonstrations of this equipment to the Air Transport Companies are planned for the near future.

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ELECTRONIC RESEARCH

The Iconoscope

Iconoscope development work has centered primarily around the type of tube employing the low velocity scanning beam which has proved so advantageous in the Orthicon.

In order to improve the sensitivity, a secondary emission multiplier has been added to this form of pickup device to intensify the signal prior to amplification with the conventional thermionic amplifier. Low velocity multiplier Iconoscopes have been built with one-stage multipliers. These tubes give an excellent picture and have about three and one-half times the sensitivity of similar tubes not incorporating the multiplier. Tubes are now being developed with a view towards further increasing the sensitivity through the use of a multi-stage multiplier.

Dr. Marton and Mr. Banca with First Model of Biological Electron Microscope

A second form of low velocity Iconoscope has been investigated which requires no magnetic field and which employs the same type of deflection used in the normal Iconoscope.

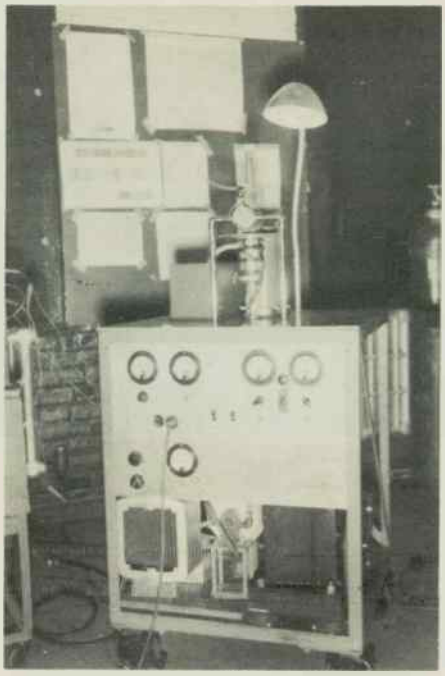
Electron Microscopes

Two preliminary electron microscopes were put into operation for purely experimental purposes, in order to obtain information regarding improvements and design changes to be made in a more permanent instrument.

On the basis of the results thus obtained, a new biological microscope was designed and constructed, incorporating many new features which greatly improve and facilitate its operation. To mention only one, it is possible to view the specimen under examination with a light microscope at the same time that it is being electronically magnified. Very excellent results have been obtained with this instrument, and micrographs have been made which show a resolution of 120 to 150 Å, ten to twenty times better than is possible with a light microscope. Even higher resolving power is expected when the final adjustments are completed.

This type of microscope requires very constant power supplies for both its lens coils and the overall voltage. Suitable units have been designed and built for this purpose. It was found possible to employ an r-f oscillator, resonant transformer, and rectifier to obtain the 100 kilovolts needed for the microscope. A power source with these elements can be made compact, inexpensive, and easily regulated.

Another, and quite different, type of microscope has also been actively investigated. This is the scanning microscope which is similar in principle to the familiar monoscope, but employs an enormously finer spot and smaller scanning pattern. Two instruments of this type

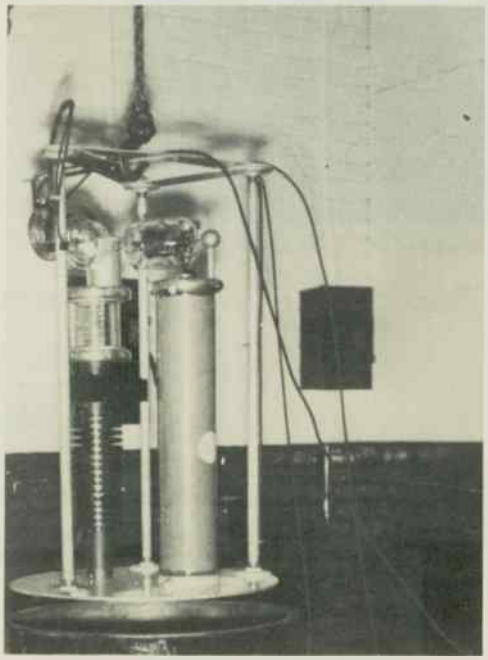


Scanning Microscope Equipped for Easy Change of Specimen

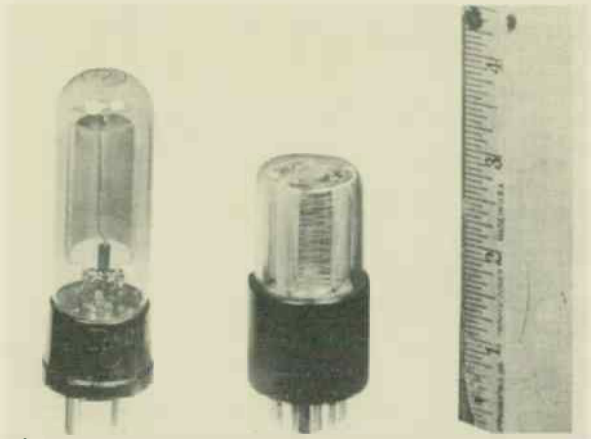
have been built, one using "sealed off" microscope tubes and giving a high magnification; the other being a low power demountable outfit.

The former has been used primarily in the study of the electron optics of the problem, particularly those related to the obtaining of sufficient current in the very small scanning spot. It might be mentioned that point type, cold cathode emitters have been found the most satisfactory electron source for these tubes. Magnifications up to 10,000 diameters have been obtained with the microscope.

The demountable instrument has a magnification limited to about 1,000 diameters. It is so arranged that the object to be examined can be inserted easily and rapidly without break-



100 KV Rectifier Mechanism



Standard Photocell and Electron Multiplier Photocell

ing the vacuum in the microscope. This makes it a very handy research tool which can be used in the study of secondary emitting surfaces and similar investigations.

Secondary Emission Multipliers

A small circular nine-stage multiplier has been designed and developed to the point where it is ready for manufacture. The tube itself is about the size of a commercial phototube, and therefore can be used to replace the latter in a number of different types of equipment without any major changes.

A possible application for this tube is the reproduction of sound from moving picture film. A moving picture projector was altered to accommodate one of these multipliers, and satisfactory performance was obtained with the equipment. Measurements show that at full light the noise level is the same as for the ordinary photophone equipment, and considerably lower at low light, corresponding to small sound intensity. In this equipment the exciter lamp is operated from a radio-frequency power supply, while the multiplier uses a d-c voltage of 700 volts.

The problem of designing a high sensitivity, low dark current multiplier has also received considerable attention. The electron optics of the multiplying targets and an extended photocathode have been worked out for this type of tube. Various types of photoemitting and secondary emitting surfaces have been examined to determine their usefulness in this class of multiplier.

Study of Electron Emitters

The investigation of photoelectric and secondary emitting surfaces has been continued throughout the year.

Electron Diffraction Camera

A study was made of a number of photoemissive surfaces which had properties desirable either for secondary emission multipliers, or for Iconoscopes. The two most important were a surface employing an evaporated caesium chloride and one employing caesium and antimony. The former, while less sensitive than the conventional caesiated silver surface, requires no free alkali metal and has a very low thermionic emission, making it suitable for the low dark current multiplier. The second has a higher photoemission than caesiated silver and a maximum response in the blue region of the spectrum.

To facilitate the study of the structure of surfaces, an electron diffraction camera was constructed. This equipment has given very satisfactory service.

An alloy of silver and magnesium which has been found to have very desirable secondary emission characteristics was examined in considerable detail. Determinations were made of methods of activating these surfaces, of their life under various conditions of operation, of the effects of various contaminants, and of similar important properties. The scanning microscope and the electron diffraction camera were used to obtain information about the nature of these surfaces.

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RADIOTRON DIVISION

NEW TUBES

75 new tube types were added and 19 obsolete tubes were dropped during 1939 to bring the total number of tubes regularly listed and sold by RCA to 364. Of the new types added, receiving tubes account for 52, transmitting tubes for 4, television tubes for 10, phototubes for 4, and other types for 5. The 19 tubes dropped included 12 obsolete receiving tubes, 2 obsolete cathode-ray tubes, and 5 obsolete transmitting tubes.

Receiving Tubes

The 52 receiving tubes announced in 1939 in-

Miniature Glass Tubes

cluded 7 metal octal types, 1 metal Octalox type, 30 GT types, 3 G types, 4 miniature glass types, 2 glass Octalox types, and 5 glass locking-base types.

The metal type additions were 12-volt, 0.15-ma designs similar to existing 6-volt designs. Six of these types were of the single-ended construction in which the grid lead is brought out to a base pin instead of to a top cap.

In general, the trend toward small-sized a-c/d-c sets without resistor cord and the trend toward portable, battery-operated sets accounted for a very large proportion of the new types announced during the year.

A number of types, including the Octalox and locking-base types were added primarily to take care of renewal demands.

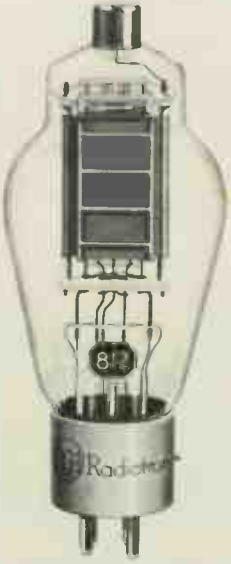
The four miniature battery tubes announced the latter part of the year feature small size (only about 2" long), and efficient performance on a 45-volt B supply. The small size of these tubes is made possible by a compact structure in which the mount is carried directly on lead wires which project through the seal to form base pins.

Type 811 High Mu Transmitting Tube

An important move by the Receiving Tube Sales Department was the announcement of the RCA Tube Preference List to set manufacturers. This list of 36 tubes, which eliminates closely overlapping types, provides a suitable choice of tubes for almost any receiver design job. Concentration of demand on these types will result to the Radiotron Division in ability to make better deliveries, to provide better quality, and to attain lower costs. In turn, the set manufacturer benefits from lower prices and additional economies in stocking a smaller number of tubes and accessory parts. Far-sighted set manufacturers have enthusiastically welcomed this program.

Transmitting Tubes

In this group, a new transmitting beam-power amplifier, the RCA-1624, having a filament cathode, was introduced for portable transmitter applications requiring quick on-off operation, such as police and aviation equipment. The plate input capability of this tube is 54 watts. It may be operated at full input for frequencies up to 60 Mc.



Type 812 Low Mu Transmitting Tube

The 828 is a beam power tube intermediate in size to the 813 and 814. This tube was designed particularly for audio purposes but performs excellently in r-f circuits. A pair of these tubes in class AB_1 service is capable of putting out 385 watts.

The 811 and 812, two low-cost transmitting tubes, were announced during the fall particularly for amateur applications. These two tubes - the first having high mu and the second having low mu - have a plate-input capability of 55 watts. They list at $3.50 each. The new Micanol base, a special low-loss phenolic plastic compounded with powdered lacquer, was used on these tubes. This new base compares very favorably in performance at high frequencies with ceramic bases. The plates of the 811 and 812 are new in that they employ a zirconium coating. This material has excellent radiating qualities and also acts as a very effective clean-up agent for gases.

At the same time the 811 and 812 were made available a new dual system of ratings was announced. This new system rates tubes for con-

Short Kinescope

tinuous commercial service (CCS) and for intermittent commercial and amateur service (ICAS). Both sets of ratings were given for the 811 and 812. A number of older types, including the 802, 804, 806, 807, 809, 810, and 814, were also covered. This new system of ratings makes it practical for the designer to adjust operating conditions to obtain a proper balance between initial costs and operating costs.

During the year Radiotron Division started the manufacture of a number of the large transmitting tubes previously purchased. These include the 204-A, 207, 849, 851, 891, 891-R, 892, and 892-R.

Television Tubes

During the year four new Kinescopes were announced. Two of these featured short bulb design; the 5AP4/1805-P4 which has a 5" diameter screen and employs electrostatic deflection, and the 7AP4 which has a 7" diameter screen and employs magnetic deflection. The two other types employ magnetic deflection. These are the 1804-P4 which has a 9" screen and the 1803-P4 which has a 12" screen. All four of these tubes have a white phosphor.

Two Iconoscopes, the 1849 and 1850, were announced early in the year. The first of these is for pickup from motion-picture film and the second, for direct pickup from the scene being televised.

A new high-voltage rectifier tube for Kinescope B supply, the 2V3-G, was made available. This type has a peak-inverse voltage rating of 16,500 volts. Also during the year the rating of the 879 was increased to 12,500 volts and the tube was renumbered 2X2/879.

A small-sized Monoscope, RCA-1898, having a 3" screen with girl's head on the electrode to be scanned, was made available. This tube can be used to produce a signal for television testing and for demonstrating the principles of television.

The 6AG7 is a video power amplifier pentode intended primarily for use in the output stage of the video amplifier of television receivers. Because of its exceedingly high value of transconductance, this tube can also be used advantageously as a coupling device between the video stages and transmission lines.

Special Tubes

Four new phototubes, the 924, 925, 926, and 927, were announced. All of these tubes feature small size. The 926 is of special interest in that it employs a rubidium surface. This surface gives higher blue response than the caesium surface used on most RCA phototube types.

Three 1600-series tubes, the 1620, 1621, and 1622, were made available for Photophone applications.

Two gas tetrodes for relay applications, the 2050 and 2051, were announced about the middle of the year. These two tubes have very high sensitivity. The 2050 is structurally similar to the 2051 but uses a Xenon gas filling which permits of substantially higher voltage and current ratings.

COST REDUCTION ACTIVITIES

The Research and Engineering Department at Harrison have continued cooperative efforts with the Manufacturing Department to reduce manufacturing costs and to maintain or improve quality. Such activities include new, simpler structures for receiving tubes, the use of "Batalum" getter for glass tubes, investigation of improved filament materials, investigation of the use of steel to replace nickel, investigation of Kinescope exhaust problems, and many other investigations of similar nature.

RESEARCH ACTIVITIES

Research activities during the past year have been concentrated on the fields of ultra-high frequencies and television. A series of papers was given last September on the new u-h-f water-cooled screen-grid power amplifier mentioned in last year's report. Investigation has also continued on the inductive output tube mentioned in last year's report, and small-scale production of one of these designs has been undertaken. Work is being continued on transmitting tubes and receiving tubes for

Type 2050 Gas Tetrode

higher frequencies. A new development is a filament-type triode for signal relay systems capable of handling 50 watts at frequencies up to 600 Mc. A feature of this tube is multiple leads for filament, plate, and grid in order to reduce lead inductance effects to a minimum. A filament-type beam pentode having an air-blast cooled external anode and capable of 1 kilowatt output at 108 Mc is being investigated for use in medium-sized television transmitters. In the receiving-tube field, advance work has been carried on with amplifiers depending on beam deflection effects and on orbital beam effects.

For television camera tubes, work has been conducted toward the design of a small-sized Iconoscope suitable for portable camera equipment. A new development, the Orthicon, was reported at a June I.R.E. meeting covering a new form of camera tube making use of low-velocity beam scanning. A feature of this tube is elimination of dark spot. Another activity of great importance is the investigation of projection Kinescopes both for use in the home and for use in larger installations in theaters.

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RECEIVER ADVANCED DEVELOPMENT

To cover in a short article the development subjects handled by this department during 1939 necessarily requires extreme brevity in describing the work accomplished.

Antennas

In 1939 antenna problems attained more than their usual importance. Television receiving antennas had to be developed and study and development of loop and similar self-contained antennas for broadcast reception was necessary. Several television receiving antennas were developed ranging from simple wire arrangements to self-supporting rod type arrays embodying interference reducing reflector elements. Also for use in apartment and office buildings a television signal distribution system has been developed.

The commercial exploitation of loop antennas for broadcast reception focused engineering attention on ways and means of utilizing loops to best advantage. In the course of studying shielded versus unshielded loops a neutralized loop arrangement was evolved which possesses spectacular noise reduction qualities and yet is simple and inexpensive. In this connection, Mr. Harbaugh has called to our attention the Patent U.S. 1,396,571 by Goldsmith and Weinberger which covers the basic idea of this loop. Figures 1 and 3 of this patent are reproduced here.

Fig. 1.

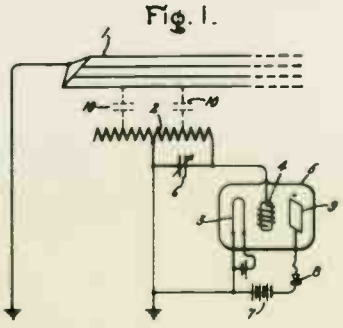
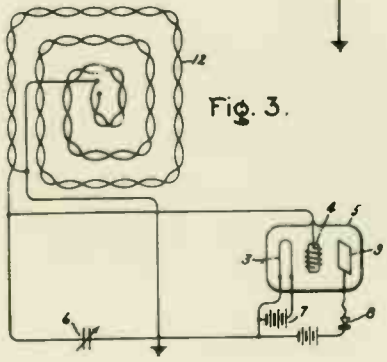


Fig. 3.



Work on very small loops brought out the Q improvement resulting from winding the loop in a single layer flat form. Where the ultimate reduction of receiver size is necessary, means for obtaining good results from a "wrap-around" loop have been worked out.

Small Receivers

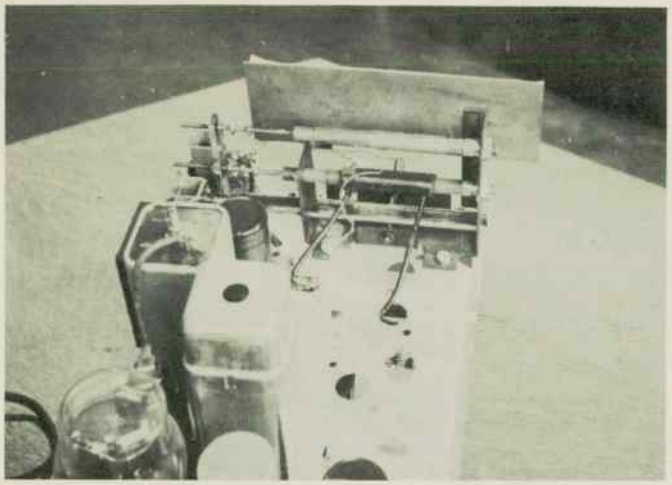
Much time and effort was put into the development of ultra-small battery receivers. Four distinct models were developed. This class of receiver has been brought up to the point where it is battery and speaker rather than receiver chassis size which limits further size reduction. In addition to these ultra-small receivers, two meritorious receivers in the compact class have been developed. One of these is a small version of the standard Pick-

Miniature Personal Receiver

Me-Up but having in addition to its size to recommend it, the fact that it delivers upwards of 1/2 watt output - economically - from its batteries. The second receiver is one which may be described as a high-power personal receiver. Some 10 watts of audio is obtainable from this self-contained receiver which is not greatly larger than a little Nipper.

Phonograph Tone Quality

Extensive listening tests were carried on by this department in order to determine public tone taste in connection with record reproduction. Bracketing tests conducted with some two



Chassis Equipped with
Permeability Tuning

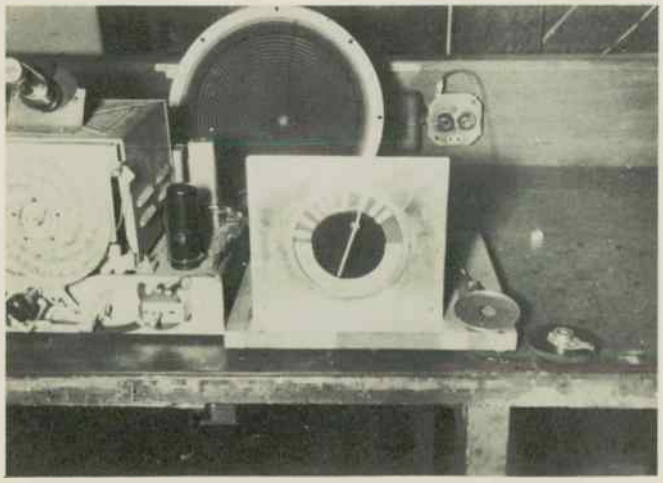
hundred and fifty subjects established certain guides which can do much to help the company incorporate in our phonographs the tone quality most pleasing to the average listener. Ways of confining the phonograph pickup noise have been investigated and one way - the sealed lid method - was developed and used in the current Model U-44. Reduction of pickup noise through the use of a low impedance pickup also received attention.

Loud Speakers and Acoustics

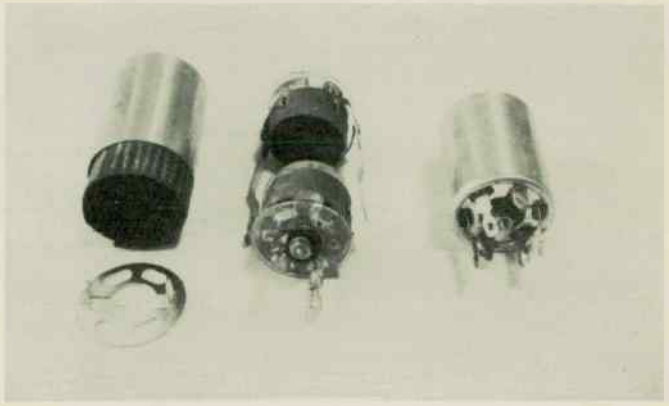
Innumerable speaker and acoustic problems of a consultation and measurement nature were handled by this section during the year. In addition, such special problems as the study of flexible rim, closed back speakers were carried on. An inexpensive two-inch magnetic speaker was designed for production. Cost reduction and application of folded horn speakers received considerable attention.

Tuning Systems

Permeability tuning in its several phases was studied with consequent development in application technique. Under tuning system development should be included also a new station selecting dial which is unique, convenient and inexpensive.



Inexpensive Station Selecting Dial



Miniature I-F Transformer and Parts

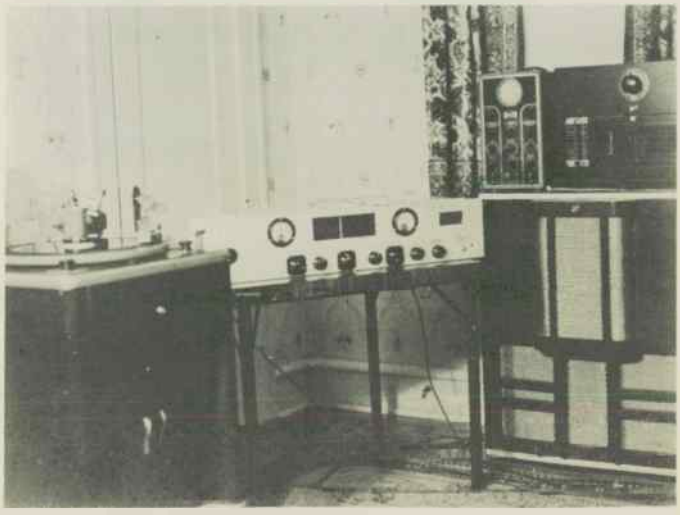
Components

Development and application in connection with powdered iron cores continued, particularly with reference to wide range coverage. A permeability tuning system has been developed and is being used in our auto receivers. New uses and applications for styrol were worked out. One notable development was a miniature i-f transformer using powdered iron and moulded styrol in its makeup thus permitting a unit of extremely small size having good performance.

Frequency Modulation Investigations

Studies of the merits and demerits of frequency modulation reception were pursued. A special receiver was designed and built to permit side by side comparisons of wide-band vs. narrow band F.M. reception as well as frequency modulation vs. amplitude modulation reception.

The accompanying photograph shows in the center, one of these frequency modulation receivers set up for test at the home of W. L. Carlson. At the extreme left is one of the RCA high fidelity instantaneous recorders on which records were made of the frequency modulation broadcast programs from the RCA transmitter in New York.



Instantaneous Recorder and Special
Frequency Modulation Receiver

By recording the broadcasts it was possible to check the relative merits of varying transmitting conditions. Special test programs were put on the air and observations were made of wide vs. narrow band transmission, man-made electrical noises, etc. By listening to repeated playings of the records, conclusions were drawn which possibly could not have been reached by a single hearing.

Tube Application

Countless tube application and coordination problems were handled, this section acting as the major technical contact agency for receiver tubes between Harrison and Camden.

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HOME RECEIVERS

Nipper Receivers

This year is the first in which RCA Victor has really been in the small set business. A beginning was made last year when we first introduced a set to retail for $9.95. The whole Nipper line was then built around two basic chassis, both of which were designed for sets in the $9.95 price bracket, and around one plastic cabinet, also designed for the $9.95 class of merchandise. It was soon realized that the sale of Nippers was limited by the size of the available chassis, by the performance which it was possible to build into a chassis of this size, and by the lack of variety in plastic cabinets. It was found that it is impossible to cover the price brackets from $9.95 to $29.95 unless a rather wide variety of chassis and cabinets is made available as the basis for the line. The variety in chassis and cabinet size should also permit improved performance with respect to sensitivity and tone quality.

Model 46X3 Nipper

Performance is more important in this low-priced merchandise than in any other type of receiver, due mainly to the fact that competition is very keen. Consequently, the first consideration in the design of the present line was to produce the best possible performance which the cost allowance would permit. Performance in this type of merchandise boils down to three major items; namely, sensitivity, selectivity, and tone quality - this last including fidelity and acoustic output. The present line of Nipper receivers was designed to out-perform competitive merchandise in all of these respects.

The appearance of the receiver is the next most important feature of the design. In this respect, the present line of Nippers is excellent. Two new plastic cabinets were designed and tooled to cover the higher price brackets. The small plastic cabinet used last year was re-styled to give a better appearance. A complete line of wooden cabinets was designed to cover the highest price bracket for each type of receiver. Large, legible dials were provided for each model.

Eleven models were selected as the basis for the Nipper line. Several models have been derived from these basic designs to fill special requirements or to fill out weak spots in the line. The eleven basic models are listed in the table on the next page with their major features.

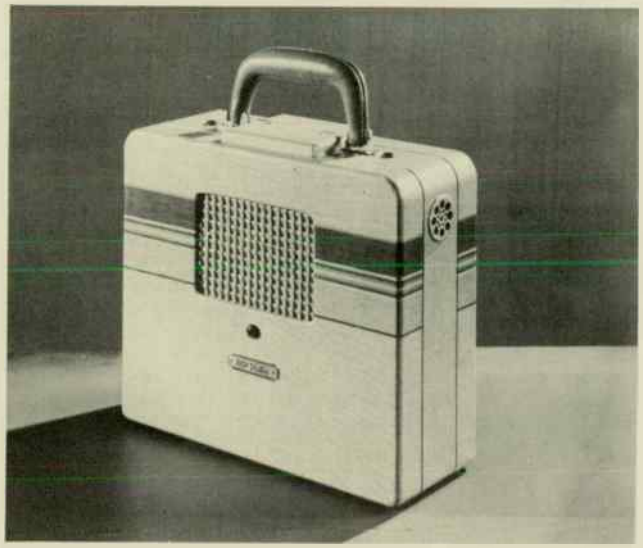
The two small receivers, 45X1 and 45X2, are the only ones which do not have a built-in loop antenna. These use the hank type of antenna. They do not have Underwriters' listing.

The 45X11 and 45X12 are built in the smaller of the two new plastic cabinets. Loop antennas are provided in both of these. The 45X13 is the same chassis as the 45X11 in a wood cabinet. This series of receivers do not have Underwriters' listing.

The 46X1 and 46X2 are the same as the 45X11 and 45X12 with Underwriters' listing and a ballast tube added. Minor styling changes have been made in the dial assembly to improve the appearance. The 46X3 uses the 46X1 chassis in a wood cabinet.

Table Model T-65

Model	List Price	Cabinet	Antenna	Tubes	Bands	Speaker
45X1	$9.95	Walnut Plastic	Hank	5	A	4" EM
45X2	12.95	Ivory Plastic	"	"	"	4" EM
45X11	12.95	Walnut Plastic	Loop	5	A	5" EM
45X12	14.95	Ivory Plastic	"	"	"	5" EM
45X13	17.95	Wood	"	"	"	5" EM
46X1	14.95	Walnut Plastic	"	5 tubes + ballast	"	5" EM
46X2	16.95	Ivory Plastic	"	"	"	5" EM
46X3	19.95	Wood	"	"	"	5" EM
46X11	19.95	Walnut Plastic	"	"	A-B	5" EM
46X12	22.95	Ivory Plastic	"	"	"	5" EM
46X13	24.95	Wood	"	"	"	5" EM



Pick-Me-Up Model BP-55

Models 46X11, 46X12, and 46X13 are two-band sets using five tubes and a ballast resistor. The first two are in the larger of the new plastic cabinets and the third is in a wood cabinet. The second band has a frequency coverage of 2300 to 6300 kc.

All receivers have essentially the same electrical output and acoustic output. The fidelity is improved in the 46X11, 46X12, and 46X13 by the use of low frequency compensation and a low frequency tone control. In all models except the 45X1 and 45X2, iron core i-f transformers are used. Loops are wound with litz wire to insure maximum sensitivity and selectivity. Provision is made on all receivers for the addition of an outside antenna.

Larger Home Receivers

The major change in the design of broadcast receivers during the year was the introduction of loop reception. The loops were constructed in three different designs; a small fixed loop for table models, a larger movable loop for lower priced consoles and phonographs and a shielded movable loop for our high-priced consoles and phonographs. All loops were designed to attach an outside antenna for improved reception in areas of low field strength. The use of a loop antenna improved the reception of broadcast stations in areas of high signal strength by reducing the amount of cross modulation and beats ordinarily prevalent with antenna reception.

Practically all home receivers were equipped with a new type of push-button tuning, operating mechanically on the variable condenser. There were two mechanical designs used; a tape tuner manufactured by the American Steel Package Company and the 80° condenser and cam type by Radio Condenser Corporation. In the tape type design, the push-button is directly connected to a 180° variable condenser through a length of tape which rotates the variable condenser to the proper angle when the push-button is pressed. Stations are set up on the push-buttons by loosening a set screw on the tape mechanism, rotating the variable condenser to the selected station and tightening the screw. In the cam type of mechanical tuner, the push-button rotates the variable condenser through a cam and rocker arm. The stations are set up in the manner similar to the tape tuner.

The "Pick-Me-Up" portable receiver was introduced during the year and later in the year the alternative of a-c/d-c operation of these battery receivers was added. The circuit was designed in such a manner that by suitable switching a rectifier tube was added to the circuit for operation from the power line.

Console Model K-80

Phonograph Combination Model U-46

A new type of lid sealing for phonographs was designed for our combinations. This sealing consisted of a rubber bead around the door openings of the cabinet similar in some respects to a refrigerator type of sealing. The sealing was also used between the motor board and the surface of the cabinet to prevent the pickup noise leaking out the rear of the phonograph cabinet. In the case of the U-46, the phonograph compartment was completely sealed with a wooden back which required special rubber mounting and strengthening to prevent vibration and re-radiation of motor noise.

A new type of automatic record changer was designed (RP-145) which incorporates a new type of drive mechanism. This design is cheaper and equal in performance to the mechanism formerly used.

Television Attachment TT-5

Television Receiver Design

Four new television receivers were designed and manufactured for sale to the public. These models included a 5" Attachment, a 5" Television Receiver Console with All-Wave Radio, a 9" and a 12" Television Receiver Console with All-Wave Radio. The five inch receiver tubes are electrostatically deflected and focused and operate at approximately 2000 volts. The 9" and 12" tubes are electrostatically focused and electromagnetically deflected and operate at approximately 7000 volts. The equipment for the 9" and 12" consoles was practically identical. The larger television designs used a 12 tube high fidelity all-wave receiver.

Television Receiver Model TRK-12

A special deflection chassis was also designed for sale to our licensees. This chassis contained the deflecting circuits and high voltage power supply.

Export Receivers

Export operations during the past year included receivers ranging from a four-tube, three-band battery operated model housed in a plastic cabinet, to a nine-tube, seven-band receiver with a modified type of band spreading.

The battery receiver, primarily for operation from 1.5 v and 90 v supplies, carried as an accessory a socket power unit which could be housed in the same cabinet enclosure, and which was equipped with a semi-universal type of power transformer.

Closely related in external appearance were a five-tube, three-band semi-universal a-c operated model, and two a-c/d-c sets. All were housed in a streamlined plastic cabinet of unusual styling and met with wide acceptance in the market.

The next step-up in the line included receivers with tuned r-f stages, and these were housed in a similar type of plastic cabinet. These included a six-tube a-c, and a six-tube a-c/d-c model. Beginning with this a-c/d-c set, a trend may be noted toward multi-voltage adaptability in the a-c/d-c branch of the line without additional or substitute parts. This is accomplished by use of a special ballast tube which is rotated to the proper socket position for the available voltage. Dual ratio drives were developed for these receivers which permitted the use of an additional concentric control. In this range also, four bands began to appear, in combination with a high-performance type of i-f transformer which reduced the number of stages required to meet given specifications.

Export Model 5Q5

Export Model 6Q1

A six-volt battery-operated receiver formed the basis for seven-tube models, together with a-c and a-c/d-c sets having pronounced Continental styling and wooden cabinets.

The eight and nine-tube receivers were the result of considerable effort to reach optimum tone quality in table models. Low frequency hang-over and hollow response were avoided by employing an eight-inch speaker of fairly low resonance, combined with as complete cabinet closure as could be arrived at with due provision for heat dissipation. Cone resonance of the order of 55 cycles was reached by changing the rim and center suspension designs, and resulted in better performance.

"Spinner" drives were employed in the seven and nine tube receivers where controls were not of the concentric type. While not sufficiently free from friction to permit complete band scanning with a single twist of the knob, they did result in a smooth and easy action representing an improvement over the dual ratio types.

Band spreading appeared only in one nine-tube model. It was approached from a somewhat altered point of view; namely, in an effort to provide ease of tuning comparable with that which would be desired on the American broadcast band. It was felt unnecessary to exceed this amount of spread, and, in fact, even undesirable. In addition, more spreading was done over the short-wave broadcasting bands than in the immediately adjoining frequency spectrum, and the amount of spreading was also partially dependent upon the relative importance of a given band from a usage standpoint.

Export Victrolas were made available in some cases with either crystal or magnetic pickups at the customer's discretion. Somewhat of a challenge may be noted in the reluctance of certain markets to accept instruments using crystal pickups.

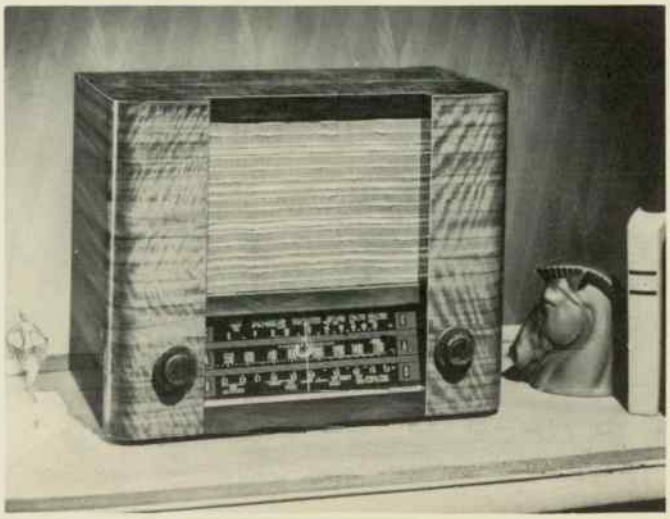
It is, perhaps, of general interest to note that various types of controls, including in some cases the tuning control, appeared on the side rather than the front of the receiver. So far as is known, no adverse reaction to this procedure has been found. In addition, it may be noted that no loops or push-buttons were included in the designs, the only demand for such features apparently being limited to nearby markets such as Mexico and Cuba.

With reference to the affect of war conditions on the export market, the main influence to date has been a reduction in the utility of our "X" band due to cessation of activity on the part of some of the popular long-wave European broadcasting stations. Brand line activity has been somewhat in evidence in the export field during the past year and shows indications of increasing in the near future.

AUTOMOBILE RECEIVERS

A major accomplishment of the year in automobile radio has been the improvement, refinement and cost reduction of push-button tuning systems. This has resulted in the production of three principal types of units in 1939 RCA-built automobile receivers. The first of these consisted of a simple mechanical push-button system driving the gang condenser. The tuning knob turns with the condenser. With careful design, a very satisfactory overall performance was obtained at low cost. Systems of this type were employed in the M-70, M-50 and M-60 RCA models as well as in two models built for Sears-Roebuck.

A fundamental problem in this type of unit is the proper balance of the tuning load of the system. If this is too large, a hard push and inaccurate performance will result, while if



Export Model 8Q2

Export Model 9Q4

it is too light, the unit may detune on rough roads. A powerful solution for this problem consists in the employment of an electric clutch to declutch the manual drive while a button is pushed. The clutch then locks the tuner in place against detuning. A unit of this type is employed in the 1940 Buick receiver.

Some customers prefer an automatically actuated touch-type tuner. The Pontiac Super-DeLuxe receiver of 1940 employs a tuner of this type. It consists of multiple solenoids, each controlling a cam and stations can be set up remotely. Obviously a unit of this type is much more expensive and hence is suitable only for the highest priced models.

Practically all 1939 custom automobile receivers are mounted behind the instrument panel, culminating the trend begun by the RCA built 1937 Buick set. Most of the receivers are single-unit designs with built-in speaker, although a few mount the speaker in the panel separately. In both cases the panel acts as a baffle and with proper design, good acoustic performance is obtained. In both the 1939 Buick and Pontiac radios, the speakers are designed into the receiver housing.

The absence of running boards in many 1939 models has practically eliminated all but whip and rod type antennas. Buick in 1939 turned to the use of the overhead type controlled from inside the header of the car, similar to that demonstrated to the industry by RCA in 1937. Most companies use the more conventional side-cowl antenna of either the manual or vacuum-lift type. Both types offer excellent performance with modern tight-coupled antenna coil designs.

Circuit changes in 1939 models in most cases consisted of refinements and cost-reduction items. Developments during the latter part of 1939 in permeability tuning and short-wave adaptations promise to make 1940 a year of greater changes in automobile radio design.

DEVELOPMENT IN COMPONENT PARTS

The main developments of the Component Parts Group in 1939 consisted of improvements of previous developments as well as the introduction of entirely new features.

In the January 1939 issue we gave a resume of the work done in 1938 in developing a new high dielectric constant impregnant for paper roll condensers. It was pointed out that due to its decreased size and cost, we expected to make a large quantity of rolls of this type. It is interesting to note that a majority of the rolls made in 1939 were of this type. Our efforts to standardize this type have also been successful and it is expected that in 1940 receiver production, 75 percent of our paper tubulars will be supplied by eight rolls.

Considerable effort had been expended in the last two years to reduce the cost of our ordinary mica or "tooth-pick" capacitor. This finally was accomplished in two ways; first, by using the clamp as part of the active area thereby eliminating one foil and two pieces of mica; and second, by using a piece of heavy mica plate in low capacity units instead of several pieces of thin mica. Also in low capacity units, heavier foil strips were used instead of multiple foils as previously. These design features reduced the price of "tooth-picks" approximately 50 percent, and the performance, except in some isolated cases, was as good as on previous designs.

During 1939 we designed and produced some high voltage wax-impregnated units for use in television circuits up to 3000 volts d-c operating voltage. These units were smaller in size and lower in price than our previous oil condensers for these applications and have proved satisfactory in service.

To meet the continuous demand of transmitter designers for capacitors to operate at high temperatures, our Faradon group has developed a new type of transmitting capacitor impregnated in polystyrene. These new capacitors will carry greater kva loads than the present type, and will operate safely at 60°C without any dripping of impregnating wax as is sometimes experienced with the older capacitors.

The polystyrene capacitors are enclosed in cases similar to, and entirely interchangeable with, the present standard cases. Production is limited on the new units so, for the present, they will be made only on special order.

A new type of molded Faradon, the Model NF, was put in production during the year. This capacitor offers much more universal manufacturing facilities than the older Model F and allows for soldered connections as well as the screw connections provided on the "F". The Model NF is rapidly replacing the Model F and when present stocks are exhausted, the Model F will be built to order only.

A polystyrene impregnation has been developed for the Model NF capacitors which makes them very resistant to moisture and at the same time greatly reduces the temperature coefficient and drift of these units making them suitable for high stability applications. This impregnation is also used on special small "tooth-pick" condensers for Special Apparatus' applications.

Development work on transformers in 1939 included several projects started but with most of the work not yet finished. One project started was the development of small audio transformers for Special Apparatus. One input transformer has been designed and built in small quantities having a total weight of less than one-half the unit it replaced. The frequency characteristic and shielding is essentially the same as the previous design. Development of even smaller units has been started but is still incomplete.

In developing a simultaneous radio range filter for commercial sale, we were able to better the Bureau of Aeronautics' specifica-

tions as to size and weight and still maintain the specified characteristics of the filter.

The main development on coils was the celanese type self-supporting loop antenna. This loop is wound in pancake form using celanese covered litz wire which is passed through a bath of solvent during the winding process which causes adjacent turns to adhere to each other, thus providing the self-supporting feature. This new type has resulted in substantial reduction in cost and increased performance.

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SOUND EQUIPMENT

COMMERCIAL SOUND ACTIVITIES

Public Address Field

Public Address business for the year 1939 far exceeded that of any previous years. This increased activity may be accounted for in many ways. More concentrated effort has been exerted by the Sales Department on this line of equipment than previously which resulted in the landing of two of the largest sound installations of 1939, the New York and San Francisco World's Fairs. Also many aggressive campaigns were projected into the school equipment field with very telling results. All of these Sales activities were well fortified by a well rounded outline of sound equipment which permitted ready adaptation to almost any type of installation. Comparatively few additions were made to our line of equipment but great strides were made in perfecting and lowering the manufacturing costs of our equipment in general.

Amplifiers

Five new amplifiers were added to our line, two of which replaced existing amplifier types, while the other three served to round out our line and make it more versatile.

MI-12204 replaces MI-4264 and is a six watt portable amplifier utilizing a single 6L6 output stage with sufficient inverse feedback to produce a low impedance power source for the loud speaker and relatively low wave form distortion. The gain is sufficient to operate from any low level high impedance microphone and provision is made to permit a convenient installation of an input transformer to provide a balanced line input of 250 ohms, if desired.

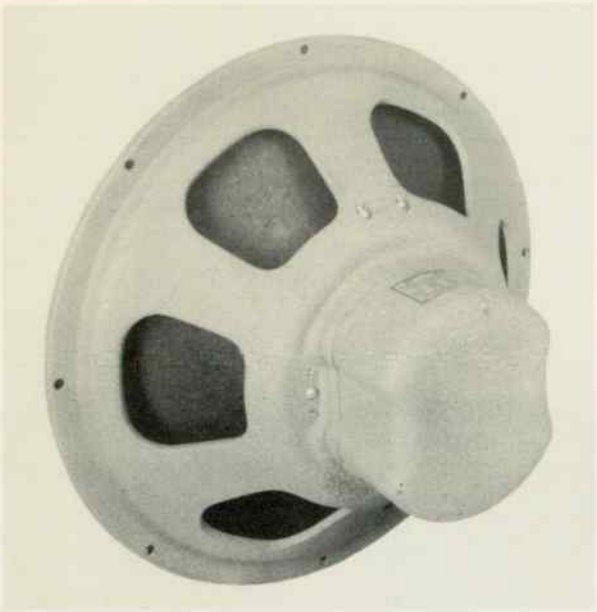
MI-12204 6-Watt Amplifier

MI-12214 50-Watt Amplifier

MI-12205 is a 25 watt portable amplifier which replaces MI-4284. It features high power output with sufficient inverse feedback to produce low wave form distortion and excellent output regulation so that wide variations in output impedances occasioned by switching on and off varying numbers of loudspeakers will produce practically no change in signal voltage across the output terminals. This amplifier also provides great flexibility of control of the frequency characteristic. Two low impedance balanced line inputs and two universal inputs are provided so that either high or low impedance microphones may be accommodated. Remote control of the volume for either or both of the inputs is easily accomplished by plugging in a remote control unit. Also two additional inputs may be plugged into this amplifier in the form of MI-12208 to provide a total of four balanced line inputs. MI-12208 obtains its power from MI-12205.

MI-12211 is an entirely new amplifier and is essentially the same as MI-12205 but without the two inputs. One high impedance input is provided and convenient terminals permit the connection of an MI-12208 two-position preamplifier. The MI-12211 is intended principally as a bridging amplifier so that almost any number of them may be connected to a common low impedance signal bus or line. It has sufficient gain to operate from a low impedance magnetic phonograph pickup and its input impedance is high enough to produce negligible loading to high impedance signal sources. These features permit innumerable applications.

MI-12214 is also an entirely new addition to our Commercial Sound line. It is a 50 watt amplifier using four 6L6's in the output with inverse feedback with its well known advantages and two 250 ohm balanced line inputs. The gain is ample to drive the amplifier to full output from any of our lowest output microphones with no additional pre-amplification.



MI-6237 15" Permanent Magnet
Dynamic Loud Speaker

Microphones

Our Junior Velocity Microphone, MI-4036, continued to be the best microphone value on the market and was continued throughout 1939 with no fundamental changes.

The Aerodynamic, MI-6226 and -6228, gained considerably in popularity through 1939 as the public became more appreciative of its excellent close talking quality, and its dependable and rugged construction.

The high quality dynamic microphone, MI-4048-A, proved to be a very popular microphone in its class and although its cost is high for this field, a considerable number were sold for high quality installations.

Our most sensational microphone, the unidirectional, MI-4042-A, outperformed everything in its field and, in spite of its high price compared to competition, was difficult to keep in stock.

Loudspeakers

Two new permanent magnet dynamic loudspeaker units were designed for indoor applications to fill a much felt need.

MI-6234, six-inch folded-edge loudspeaker which utilizes a new principle of diaphragm suspension permitting large voice coil excursions with low distortion was designed and will be marketed early in 1940. This loudspeaker is sensational in performance compared to similar sized units now on the market. It permits excellent low frequency response even below 100 cycles when mounted in a small inconspicuous cabinet. When used in clusters with diverging beams of sound, excellent coverage may be obtained over wide angles. Convenient cabinets are being provided to permit mounting singly or in clusters.

MI-6237, 15-inch permanent magnet dynamic loudspeaker was designed to provide a high power handling, good quality loudspeaker at a popular price. It will be made available early in 1940. A choice of two cabinets for mounting this loudspeaker will be available; one a wall mounting type and the other a floor mounting type. The basic cabinets will also house clusters of MI-6234 by supplying suitable baffle boards.

Control Cabinets

Our control cabinets designed in 1938 were not changed radically in 1939 and they continued to dominate the school field not only in low cost but also in styling and performance.

Instantaneous Recorders

Our MI-12700 and MI-12701 Instantaneous Recorders designed in 1938 continued to be quite popular throughout 1939.

Electronic Musical Instruments

The Storytone piano announced early last spring has enjoyed unusual popularity even among renowned musicians who desire concert grand tone in an instrument of small size. A re-order of amplifiers, speakers and parts has been placed on the factory in testimony of its wide and immediate acceptance by the trade.

Electric carillons have gotten off to a slow start because of numerous manufacturing and technical difficulties but there is very great interest in the instrument and a number have been sold. The commercialization of this product should open up a lucrative field for high power sound equipment in churches, universities, memorial parks, etc.

Coca Cola Inspection Machine

The Coca Cola inspection machine was advanced to a high state of perfection during 1939 and numerous field tests in actual bottling plants were carried on during the year. The results have been very gratifying to the customer and an early order is expected so that we may proceed with the manufacture of this equipment. This equipment tests bottled Coca Cola for the presence of foreign matter after the bottle is crowned. This machine after it is installed in a bottling plant will not permit even a single bottle to get into the

Kiel Reporter

hands of a customer without a thorough test for foreign particles. Bottles containing foreign particles are accurately separated from the good bottles. A system of self-checking completely checks the machine between each bottle. Speeds up to 120 bottles per minute with 100% accuracy are now commercial practice.

Kiel Reporter

Two models of this unusual equipment have been completed during 1939 and are now being field tested. This machine records on ribbon safety film over continuous periods up to 24 hours with practically no attention. Convenient indexing of the film permits immediate playback of any part of the film desired. The quality is good enough only for commercial uses where intelligibility is the prime requisite.

SOUND MOTION PICTURE RECORDING EQUIPMENT

The MI-10803 Modulated Carrier Oscillator provides a frequency source which is used in measuring the cross modulation products generated in various audio transmission equipment and in film recordings. Its greatest use is found in establishing and maintaining photographic control of variable area sound tracks and it has become an essential tool in all progressive film laboratories handling variable area film.

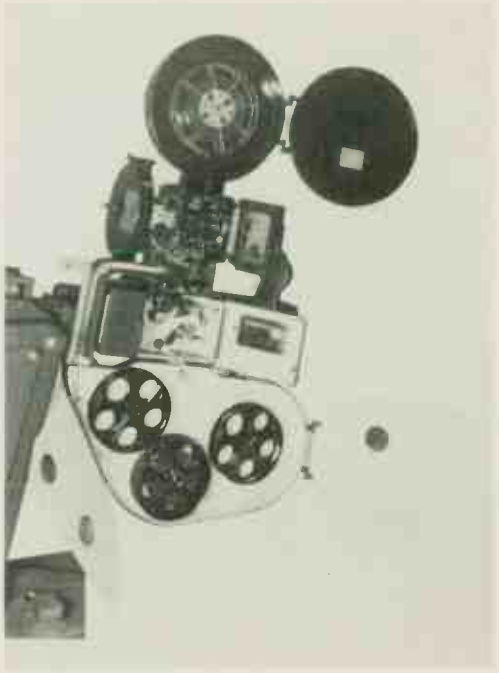
MI-10803 Modulated Carrier Oscillator

The MI-10706 Preview Attachment consists of a single lower magazine for a 35 MM theater type projector that permits the reproduction of a sound picture with the sound and picture on separate films. This gives motion picture producers a means of seeing a completed picture without printing the sound and picture on a single film, a procedure which results in a considerable saving in time and expense.

The MI-3043 Uni-directional Microphone is a high quality, high sensitivity microphone having cardioid directional characteristics. It was developed especially for sound film recording and is designed for suspension mounting from a microphone boom. Reports from Hollywood indicate that this microphone is finding wide acceptance among our licensees.

16 MM EQUIPMENT

Early in 1939, the design of a new 16 mm Sound Motion Picture Reproducing System was started. This apparatus is now being completed in production, and was recently adver-

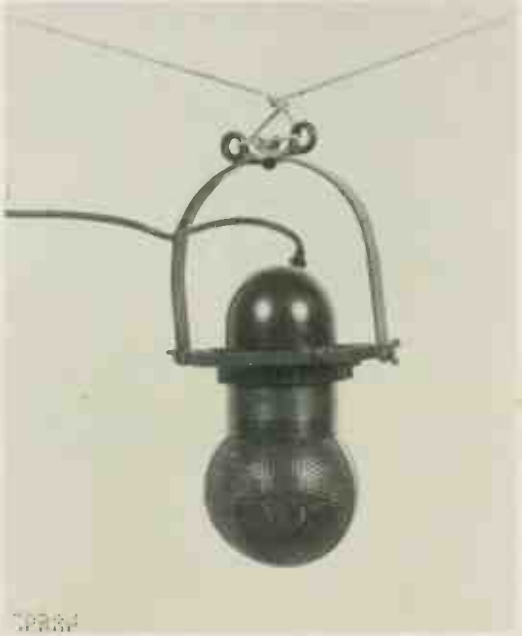


MI-10706 Preview Attachment

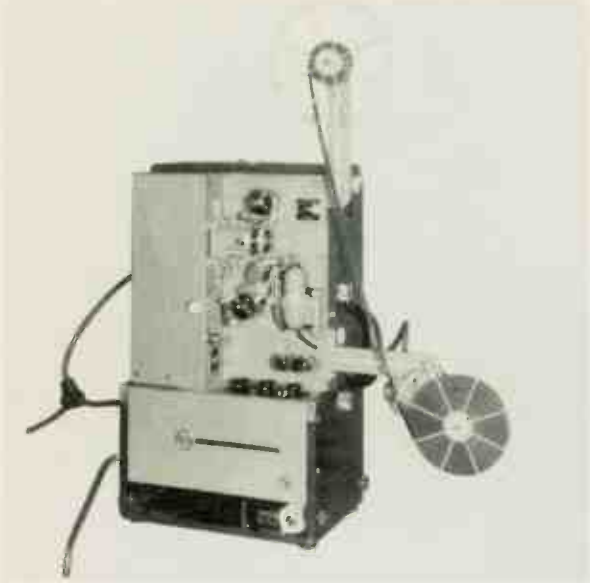
tised to the trade as our Model PG-170 16 mm Sound Motion Picture Projector.

It was mainly designed for use by schools, clubs, industrial organizations, and other non-theatrical users of 16 mm Sound Motion Pictures, taking into consideration the requirements of these particular fields. It has many desirable features, the more important of which are described below.

All controls are conveniently located and operation at either 24 frames for sound films or 16 frames for silent films can be obtained by merely throwing a toggle switch to the position corresponding to the film speed desired. In addition to the controls required for normal operation, a separate tone control to accommodate various types of input and a volume con-



MI-3043 Unidirectional Microphone



16 MM Sound Motion Picture Projector

trol for a high impedance microphone or phonograph have been provided.

The use of large sprockets coupled with a good film path layout produced a simple mechanism to thread. This is particularly desirable for infrequent users. The large sprockets also reduce wear on films by avoiding abrupt turns and engaging a greater number of sprocket holes.

The Film Take-Up Equalizer consists of two rollers mounted on a bracket with the complete assembly located between the take-up reel and the lower sprocket. The assembly is spring tensioned against the pull of the take-up reel which reduces the magnitude of jerks, uneven pulls, etc. A separate motor take-up further helps to insure a uniform tension on the film for either 400, 800, or 1600 ft. reels. This separate motor for take-up, which also acts as a rewind, affords the very distinctive feature of "no belts".

The Projector Optical System employs a special condenser lens, which when working with the standard f 1.65 objective lens gives 10% to 20% greater screen illumination with a 750 watt lamp.

A specially designed blower cools the projection lamp, amplifier and aperture plate. The lamp house is barely warm while in operation, and a burnt-out lamp can be replaced in less than a minute if first cooled by the blower for that length of time.

Theatrical Type Framing is provided so that the up and down movement of the picture area on the screen, as is common with many equipments, is eliminated when framing. Furthermore, the film is kept in the center of the most efficient light.

The sound optical system, projector objective lens assembly, and the projection lamp support are all of hinged construction, permitting quick access for cleaning and replacement of parts.

The amplifier employs a 6V6 push-pull output stage and has an output of 10 watts at 5% distortion, at 1000 cycles. The loudspeaker is of the dynamic type, with an electromagnetic field.

Type OP-7 Portable Mixer and OP6 Portable Mixer

The complete equipment is housed in two carrying cases which are easily portable. Their respective weights are 39 and 28 lbs.

BROADCAST SPEECH INPUT EQUIPMENT

A new portable amplifier, Type OP-6, has been designed. It is an unusually light weight (20 lbs. approximately) and compact design (12" x 7" x 9"). Its performance is in keeping with the high quality required for broadcasting stations and its component parts are accessible for easy servicing. The selling price is $95.00 (less VU meter) a very competitive figure for portable equipment.

A new portable mixer, Type OP-7, has been designed as a companion unit for the OP-6. It consists of a four-position high-level mixing system with self-contained power supply.

A new combination pickup head, which plays either lateral or vertical cut records, has

Type 73-A Deluxe Recorder

Stock No. 41904 Photoelectric Relay

been developed for our popular 70-C turntables. The head has a diamond stylus and exerts only 3/4-ounce pressure on the record, thus increasing the useful life of the record many times.

An improved recording attachment, Type 72-C, has been developed for our 70-C turntables. Among its many features are the spiraling handwheel, the improved dropping action on operating lever, and the stylus cutting angle adjustment that can be made while the machine is operating.

A deluxe recorder, Type 73-A, has been developed for cutting on lacquer type discs. Among its many features are its double motor drive for obtaining less slippage and "wows", recording inside-out or outside-in at any one of several pitches by rotating a knob, a microscope, a suction nozzle, plus all operating features of the 72-C.

ELECTRONIC DEVICES

Toys

During the year several types of toy equipment have been produced. These include three different types of Electronic Kits which permit youngsters and experimenters to construct various educational electronic devices. A Sound Control Studio consisting of several wood and metal sound producing devices mounted on an attractive child's size desk, can be made to simulate many of the sound effects regularly produced on broadcast programs. A Radio Coupling Unit consisting of an oscillator and toy microphone permits entertainment broadcasting through the medium of the home radio receiver. This device can also be used to connect a record player to practically any type of broadcast receiver. RCA Victrola Jr. provides an excellent toy record player for children. This compact motor driven unit has its needle pick-up and speaker mechanism neatly housed in the tone arm.

Electrostatic Relay, Stock #41903

Stock #41903, Electrostatic Relay, is a capacity operated device which responds to rapid changes in its antenna to ground capacity, but does not function on slow capacity variations, such as would be caused by atmospheric conditions. The device carries Underwriters' approval and operates economically from standard 110 volt a-c power. Its industrial applications for measurement, process control, and protection are practically unlimited.

Photoelectric Relay, Stock #41904

This device is a novel departure from the standard version of this type of equipment in that no definite light source is required, although a definite light source may be used if desired. The device is of the self-balancing type, and functions only on a rapid decrease in the given source of illumination but will not function on an increase. This device will readily fulfill many industrial applications for which photoelectric relays are especially adapted.

Electronic Temperature Control, MI-12914

This is a novel electronic type of heat control which is applicable to industrial as well as large residential structures. The device regulates the heating plant so that the correct amount of heat is supplied to properly compensate for the heat losses of the structure. Outdoor temperatures are compared in a bridge circuit with heating medium temperatures and the result is used to "start-stop" or "modulate" the means which raises the temperature of the heating medium. This device provides uniform, economical heat control.

MI-12914 Electronic Temperature Control

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TRANSMITTER ADVANCED DEVELOPMENT

The Transmitter Advanced Development Department was formed as a separate group the early part of 1939. Since that time its activities have been concerned mainly with Frequency Modulation as applying not only to transmitter problems but to reception and propagation problems as well.

A number of different experimental forms of low power frequency modulated transmitters have

Messrs. Winlund and Duncan with 25-Watt Frequency Modulated Transmitter at Haddonfield Police Station

been developed and their characteristics, advantages and disadvantages determined with a view to both broadcasting and point-to-point communication, such as police and aviation services. The transmitters have been employed for field tests and for providing information to the engineering sections having to do with product design. One transmitter was employed in tests at Haddonfield, N. J. for the purpose of investigating the possibilities of frequency modulation operation for police service. A view of this installation is shown in the accompanying figure.

Work on both transmitter and receiver problems for frequency modulation has been carried on. Different forms of frequency modulation receiver circuits have been investigated and their characteristics determined. This information has been made available to the receiver engineering sections.

A series of transmission and reception tests were planned and are under way at the present time in New York City and the surrounding territory. Transmission is from the Empire State Building antenna with receivers at different locations and at different distances from the transmitter. Amplitude and frequency modulation are being compared for broadcast operation with different degrees of frequency swing on frequency modulation. The RCA Manufacturing Company supplied the transmitting and receiving equipment for these tests and jointly with the National Broadcasting Company and R.C.A. Communications is taking part in them.

Development work has been done on transmitter systems suitable for various types of service and having a wide range of power and frequency ratings.

This department has also carried on a theoretical study of single sideband transmission as applied particularly to broadcasting, and a combined theoretical and experimental investigation of crystal-controlled oscillator circuits for transmitters leading to the determination of the circuit conditions which gave the greatest regularity in starting of oscillation.

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SPECIAL APPARATUS

TELEVISION TRANSMITTERS

Type M-25 Relay Television Transmitter

The type M-25 portable television transmitter was developed in order to fill a definite need in the commercial television field for equipment which could be used for remote television pickup, and which would not depend upon wire lines for transmission to the main transmitter. This type of service requires a transmitter which is small in size, easily portable, has good fidelity and sufficient power output to cover reasonable distances.

The M-25 transmitter operates in the frequency band from 288 to 342 megacycles and is crystal controlled with a peak power output of 25 watts. There are four radio frequency stages, in the first three of which the frequency is multiplied eighteen times. Two new types of tubes are used: the RCA-829, which is a double beam pentode, as a frequency tripler; and the RCA-1628, a high frequency triode, as both frequency tripler and neutralized power amplifier.

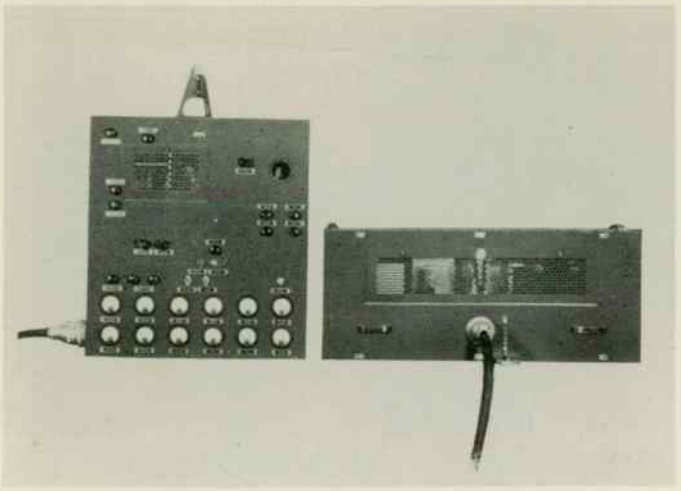
At these frequencies it is possible to utilize relatively small antenna arrays both for transmission and reception which give power gains of approximately twelve. This assists materially in extending the usefulness of the equipment.

The transmitter is capable of handling the standard RMA video signal and transmits d-c component. Its video system is flat from 30 cycles to 7 megacycles and the transmitter unit contains its own oscilloscope for monitoring purposes.

Preliminary reports from the field indicate that the transmitter is capable of furnishing a commercially usable signal over a propagation path of approximately ten miles.

Type T-1 1 KW Television Transmitter

During 1939 the RCA Model T-1, 1 kw television transmitter was modified to conform to the changed RMA television standards. The modulation band was increased from three to over four and one-half megacycles which necessitated redesign of the modulation circuits and development of a new power amplifier section using larger tubes. Improved methods of neutralizing were developed resulting in more satisfactory neutralization at ultra-high frequencies. The transmitter was converted from "line" frequency control to crystal control



Type M-25 Portable Television Transmitter

as it was felt this would be more favorably accepted.

The filament operation was changed from d.c. to a.c. with no unfavorable results thus making possible the elimination of a costly filament generator. Accessory and auxiliary equipment was relocated making possible the elimination of three of the original six component units, considerably reducing floor space requirements and increasing operating convenience. Several production model equipments have been constructed and tested and are now in stock and ready for shipment.

General Television Transmitter Development

During the past year close cooperation with Harrison on the development of a high power television tube was continued. This tube (A-2027) is a tetrode, the construction of which can be seen in the photographs with the circuit in which it is employed. The screen connectors are brought out as two rings on either side of the anode. These rings form the top and bottom of a box which shields the entire plate tank circuit.

With optimum coupling an output of 56 kw was obtained from two tubes at 57 megacycles at 58% efficiency. With the tubes loaded to provide a calculated band width of nine megacycles an output of 36 kw at 35% efficiency was obtained at a plate voltage of 7000 volts and a total plate current of 16.4 amperes. At present, these tubes are being run as a Class B linear amplifier being driven by the 1 kw television transmitter.

BROADCAST TRANSMITTERS

MI-7165 1 Kw UHF Transmitter, 30-44 Mc

This equipment consists of a type 100-F exciter and 1 kw power amplifier-modulator for broadcast applications. It features high efficiency, Class B modulation and good fidelity.

250-K 250 Watt Standard Band Broadcast Transmitter

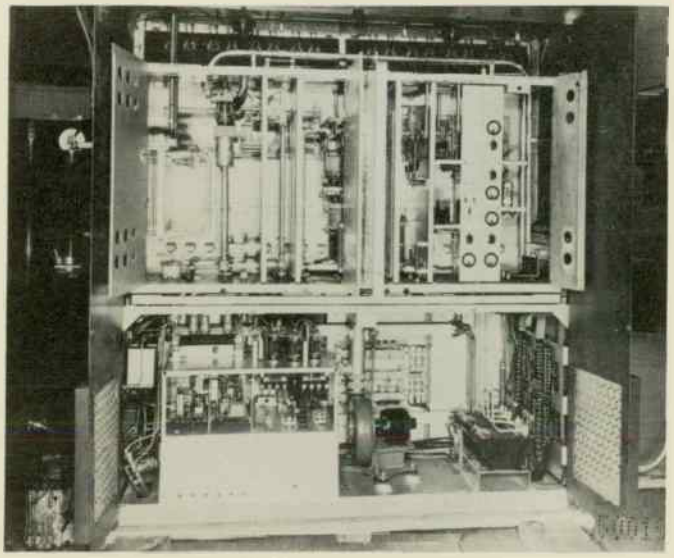
This equipment represents a new departure in styling, accessibility and performance in low power broadcast equipment. The frequency range is 550-2500 kc.

Type RB-2 Relay Broadcast Transmitter

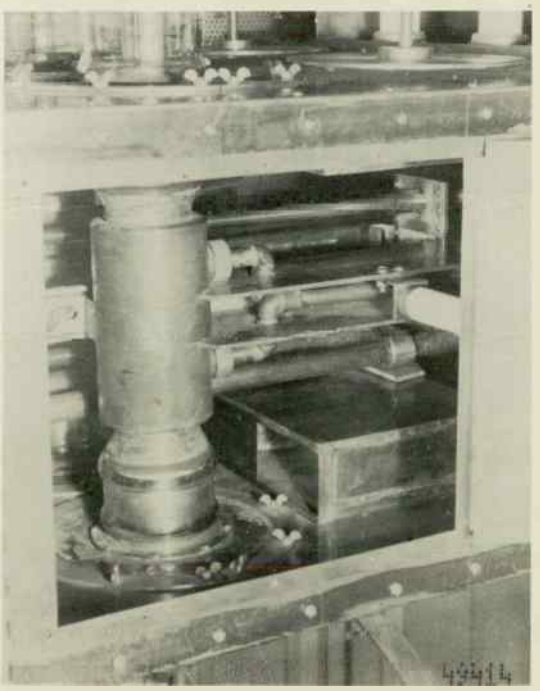
The RB-2 transmitter is a high quality pack transmitter for broadcast pickup applications. It is crystal-controlled and operates on frequencies between 30-40 Mc. The audio system incorporates automatic gain control and broadcast fidelity. The weight of the complete equipment with batteries is 30 lbs.

Phasing Equipments

Phasing equipments were designed and constructed for five broadcast stations during the past year, ranging in power from 250 watts to 50,000 watts. These equipments are custom made to the individual specifications of each station.



Interior of Type T-1 Television Transmitter



Type A-2027 Tetrode Showing Mounting in Television Transmitter

General View of Television Transmitter Using A-2027 Tetrode

POLICE TRANSMITTERS

MI-7745 250 Watt UHF Police Station-House Telephone Transmitter

This equipment is designed to be used for one or two-way police communication circuits over medium ranges. The equipment is compact, being mounted in a standard cabinet rack, is inexpensive and easily maintained. The frequency is 30-44 Mc.

10-M Multi-Channel Police Transmitter

This equipment, designed for recently inaugurated inter-city police communications, contains three 500 watt cw units, each of which may be operated on three adjacent frequencies in the range between 2000-8000 kc and a 1 kw telephone channel for talk-back or broadcast service.

20 Watt Police Transmitter

A new 20 watt police transmitter was designed for mobile service. The principal features of the design are increased efficiency, lighter weight, and lower cost.

AVIATION TRANSMITTERS

AVT-19A Transmitter

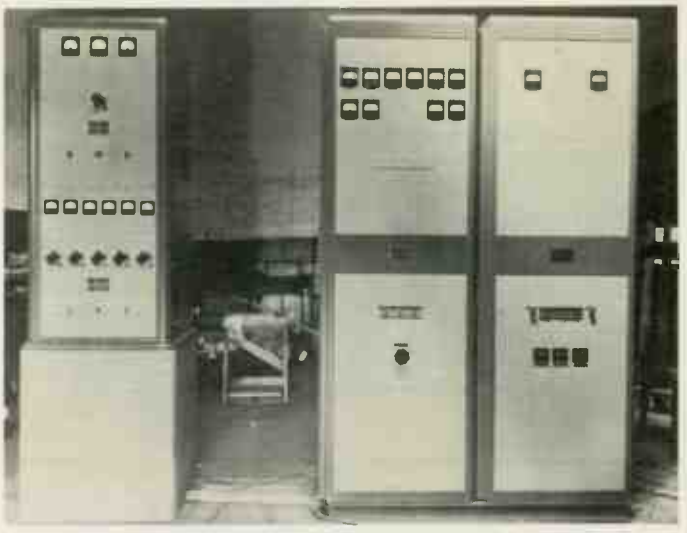
This is a commercial, 10 watt, 130-140 Mc aircraft transmitter for use in communicating with the ground station. Equipment is complete with dynamotor power supply but is mounted in a single standard ATR rack.

AVT-15 Aircraft Transmitter

The AVT-15 is an 8 watt aircraft transmitter for private flyers for operation on 3105 and 6210 kc. The equipment has C.A.A. approval which greatly increases its field of application. One of the features of the design is a sealed vibrator power supply for operation on either 6 or 12 volts.

Crystal Holders

During the past year the type AVA-53 crystal holder has been developed to supplant the type AVA-10, primarily for aviation purposes. It weighs less than half and occupies less than two-thirds the space of the AVA-10. A low cost, moulded Styrol holder, MI-8088, has been developed for use in receiver oscillator circuits. It is small, light and weatherproof.

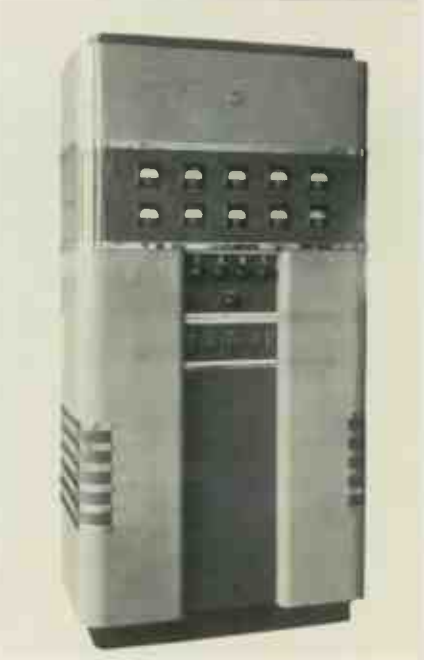


MI-7165 1 Kw U-H-F Transmitter

SPECIAL TRANSMITTERS

AVT-22/22A 2.5/5 Kw Cw/Telephone Transmitter

This is an unusually compact dual-purpose equipment featuring the use of air-cooled glass tubes throughout. Two basic units are available: The first consisting of a modulator-rectifier assembly; the second consisting of two radio frequency channels mounted in a single cabinet. Either telephone or cw operation may be selected on any of three frequencies for each radio frequency channel. The control circuit is arranged to permit installation of a number of channels to provide operation on numerous frequencies. Frequency range is 2.5 to 19 Mc.



Type 250-K Broadcast Transmitter

Type RB-2 Relay Broadcast Transmitter

ET-4332 General Purpose Communication Transmitter

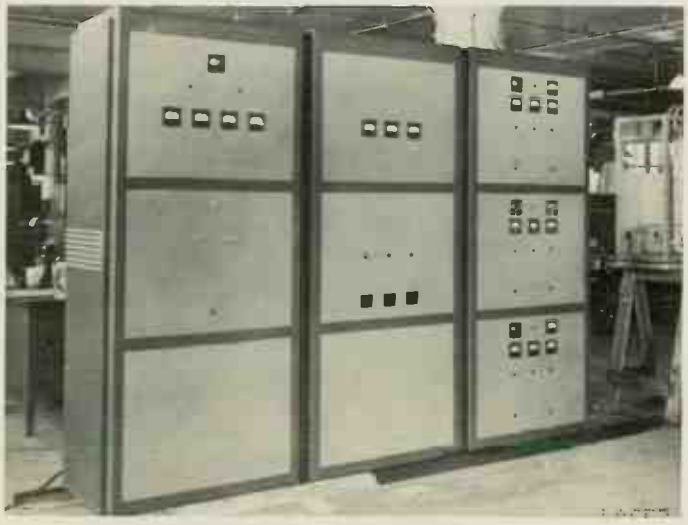
The type ET-4332 transmitter was developed for general communication use, mainly for export. It delivers 250 watts output and covers a frequency range of 2.2 Mc to 20 Mc and the transmitter may be set in a short time to any frequency in this range for which a frequency is available.

Forestry Tower Unit

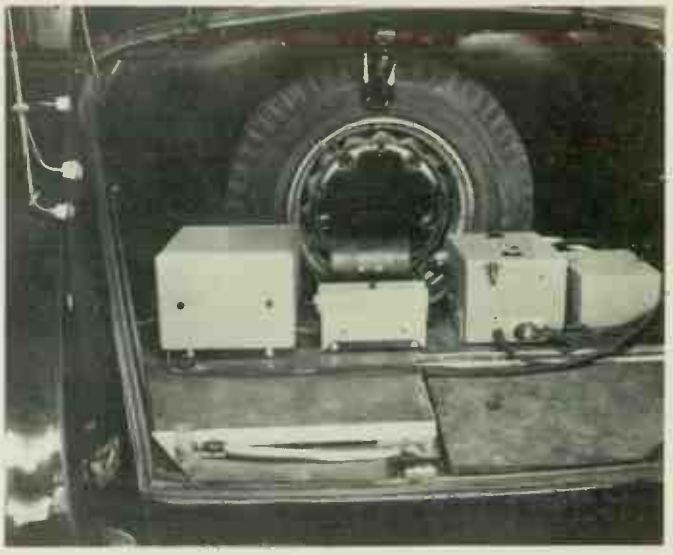
This equipment is designed for the Forestry Service for control station operation. A battery power supply is used to operate the transmitter, receiver and modulator. A single antenna is used with a receive-transmit switch. A non-crystal controlled oscillator, doubler, and power amplifier provide for a carrier output of approximately 2 watts which can be modulated approximately 85% over the voice range. The front panel controls permit of tuning from 30-40 Mc. The complete equipment weighs approximately 125 lbs., including the batteries. (The batteries are not supplied.)

MI-7181 Speech Inversion Equipment

This simplified inversion or privacy equipment has been designed to permit two-way radio voice communication to be carried on from two pairs of lines at each end of the communication system. The equipment is simple and efficient in operation and provides for inverting the speech as it is delivered from the microphone and also re-inverting and making intelligible the incoming speech being received from the opposite end of the circuit similarly equipped.



Type 10-M Multi-Channel Police Transmitter



20-Watt Police Mobile Transmitter in Car

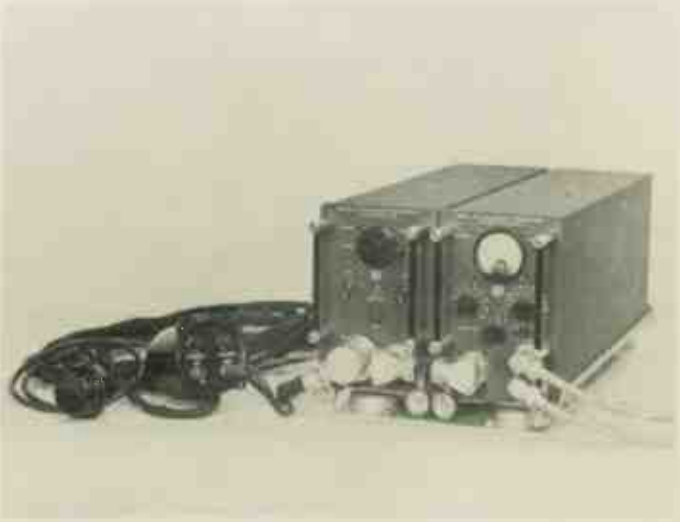
SPECIAL RECEIVERS

Crystal Controlled UHF Police Receiver

To meet the demand of the police services for receivers with crystal controlled oscillators, a modification kit was designed to permit changing present receivers. Plated crystals mounted in molded styrol holders are used.

AVR-20 Aircraft Communication Receiver

The design and development of a compact, light-weight, four tube aircraft communication receiver was completed. The receiver, designated as the AVR-20, covers a frequency range of 2300 to 6700 kc. Features of the design in-



Type AVT-19A Aircraft Transmitter

Type ET-4332 Communication Transmitter

clude a cw oscillator, provision for two crystal lock-in frequencies and voltage regulator of the plate supply for the heterodyne oscillator. The receiver is intended for local control and weighs but 6 lbs. 4 ozs. The rigid requirements for Civil Aeronautics Authority type certification were considered in the design and the equipment bears the C.A.A. type certificate No. 235.

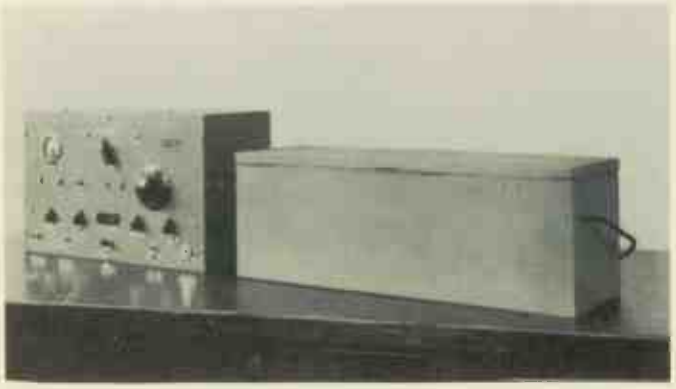
AVA-51B and AVA-51C Vibrator Power Units

The AVA-51B and AVA-51C vibrator power units were designed for aircraft application. A maximum power output of 210 volts at 100 milliamperes is available for one or two AVR-20 or AVR-15 receivers. The AVA-51B is designed for operation from a 12 volt supply while the AVA-51C is employed with a 6 volt supply. Both units have C.A.A. approval and bear type certificates Nos. 441 and 442 respectively. Each unit weighs 6 lbs. 7 ozs.

AVR-7H Aircraft Receiver

The AVR-7H is a three-band remote control aircraft receiver covering the following frequency ranges:

195 to 415 kilocycles
500 to 1400 "
2300 to 6800 "



Forestry Tower Unit

MI-7181 Speech Inversion Equipment

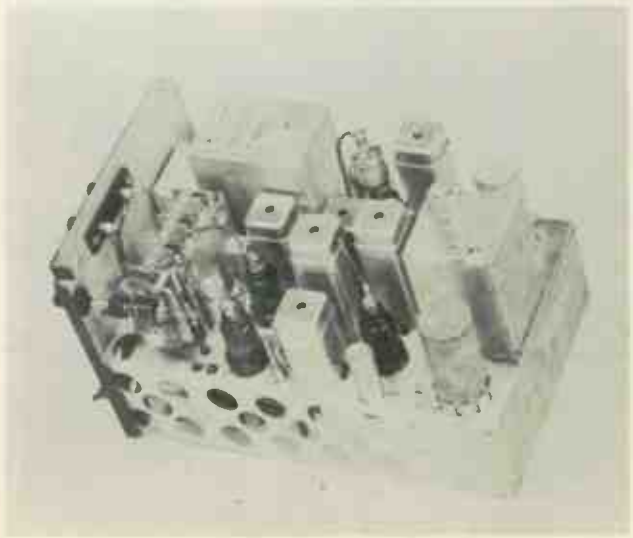
Among the design features are provisions for cw reception, selection of manual or automatic volume control, two frequency crystal lock-in on the highest frequency range and C.A.A. approval under C.A.A. type certificate No. 440.

Selective Calling Equipment

Early in 1939 several power companies indicated a need for a device suitable for selectively signaling by radio any one of a fleet of service trucks. This signaling device to be designed to operate a signal that could be seen or heard at a considerable distance from the truck in order that the repair man might work outside of the audible range of the speaker.

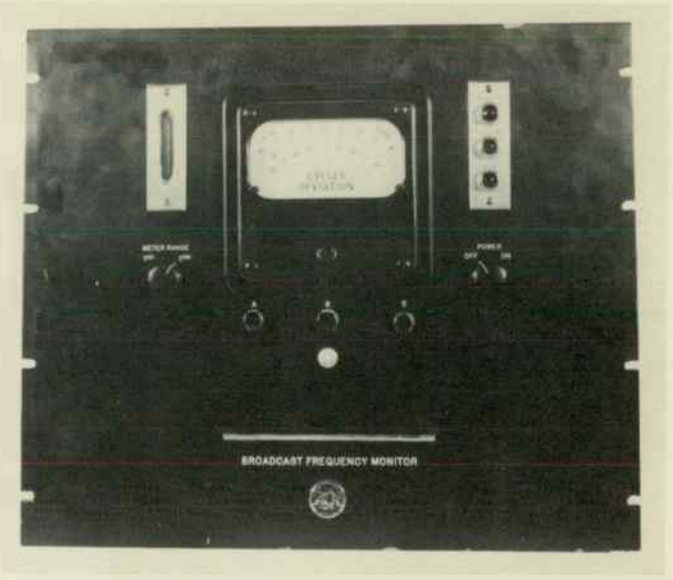
A model was built during February, 1939 and later tested on a radio network. Production design was started in December, 1939. The device is designed to operate on a 1000 cycle keyed tone coded by means of push buttons. These coded tone signals are transmitted by a start-stop time division distributor and received by a similar device.

At the receiver this coded signal is electrically checked against a code set up for that particular receiver and rejects it if it does



Type AVR-7H Aircraft Receiver

Type 305-A 9" Oscillograph



Model 311-A Broadcast
Frequency Monitor

not match in every respect. If the signal does match, a relay is operated which sets off the alarm or other signaling device. This signaling device is arranged to remain locked in until manually released.

AR-77 Communication Receiver

The AR-77 communication receiver is a general-purpose receiver to the extent that it was designed to fulfill the most exacting requirements of two specific services, namely, amateur and communication. Styling is modern and controls are located for maximum convenience. A description of this receiver, outlining its outstanding features, will be found on another page of this issue.

LABORATORY AND TEST EQUIPMENT

Sixteen items of test equipment were designed during 1939. Outstanding among these new instruments developed were three new cathode ray oscillographs. The type 305-A 9" oscillograph is designed for television research and development and has amplifiers essentially flat from 5 cycles to 10 megacycles. The Model 158 5" oscillograph was designed for television servicing and has amplifiers essentially flat from 10 cycles to 500,000 cycles. The Model 160 5" oscillograph is a general purpose oscillograph with amplifiers essentially flat from 3 cycles to 70,000 cycles.

During the year we added to our line of service test equipment two instruments developed and previously produced by John L. Rider - the chanalyst and the voltOhmyst - both of which are extremely popular in the service field.

A new instrument of extreme accuracy is the Model 311-A broadcast frequency monitor. This instrument reads the deviation in cycles of a broadcast transmitter from its assigned channel with an accuracy of better than 5 parts per million.

--ooOoo--

STANDARDIZATION

During the year the Standardizing Department continued its work in cooperation with other departments. 217 Standardizing Notices (exclusive of Finishes and Purchase Specifications) were issued, of which 93 were new subjects and 124 were revisions of existing subjects. Any change in commercial or Industry Practices is reflected in our Notices on the subject as soon as consistently practicable.

Initial steps were taken to Standardize on fundamental cabinet size dimensions with resultant benefits in the form of fewer "set-ups". It appears that progress can be made in this field without sacrificing Styling appeal or restricting new designs. Further work will be done on this subject during 1940.

Infra Red Ray baking for metal finishes was completed from a development and investigation standpoint and is now in active consideration by Camden and Indianapolis for actual installation. The installation in Canada is reported to be very successful and of decided benefit.

Wood drills were Standardized in increments of 1/32" and the 1/64" steps abandoned. This results in a lower cost for drills without impairing process or product.

The establishment of processes for metal finishing and identification of the desired finish by a number is an accepted procedure. The number of different finishes has been reduced to the minimum required for our products. A uniform method of testing finish materials has been in use and is accepted by our vendors. Stocks of metal finishing materials are low without impairment of service to production, and the matter of excessive or obsolete stocks of metal finishing materials is no longer a problem.

Data has been issued on Aluminum and its

Standardizing Department Office

Standard Parts Display Boards

alloys. The sizes and physical properties Standardized are in accord with commercial practices and the selections have been established on the basis of what is regularly available in vendor's warehouse stocks. Work of this kind will be carried on in 1940 to cover other metals.

Standards were established for Faradon condensers and the indications are that the number of types and values will be reduced without detriment to our sales position. A moulded mica type Faradon, known as NF, was designed and Standardized in cooperation with the Manufacturing Department. The result has been encouraging and the feature permitting "insulated mounting" without the use of ceramic insulators is a definite improvement.

Initial Standards have been issued on Quartz Crystal Units. This effort is pointed toward a simplification of variables, particularly in the matter of containers and methods of mounting.

Standards accepted by the manufacturers have been set up for Name Plates. This standardization established selected basic materials, depth and styles of etching and embossing, and the approved methods of finishing. Indications are that this work has been of benefit to us in uniformity and to our suppliers by removal of uncertainties.

The Standard Drafting Practice Manual and Standard Shop Practice Manual are serving a need. The Shop Practice Manual is in process of being expanded to cover additional methods in general use by industry and which are not subject to early change. These data include information on types of bends for metals, probable accuracy of a Drop Sheared edge, clearances necessary for power tools such as screw drivers and rivetters, minimum metal allowances for staking and spinning operations, and data of like nature.

At the request of the Safety Department, the regulations on Safety were issued as Standardizing Notices. These data were prepared by the Safety Department who felt that "Standard Safety Code" was a desirable means for covering those phases of Safety regulations which can be issued in this form.

During 1940, the Standardizing activity is being expanded in organization and scope. This should result in greater coverage and control of various materials and processes with consequent benefits to our company.

--ooOoo--

AMATEUR AND COMMERCIAL COMMUNICATION RECEIVER
MODEL AR-77

By L. E. Thompson
Special Apparatus Division

Like other radio services, Amateur Radio has advanced considerably in the last few years. New requirements and ideas have made their appearance which make specialization of design necessary. To meet these requirements to the highest degree with the inevitable cost figure in mind, the AR-77 has been designed.

This receiver has a frequency range of 540 kc to 31.0 Mc in six bands. The main tuning scale is calibrated in frequency. The band spread tuning system consists of a small capacitor gang connected in parallel to the main capacitor gang. When the main tuning dial is set at the highest frequency of an amateur band, the band spread tuning just covers this band, having an approximately linear scale calibrated in frequency. To accomplish this result, a 3 "gang" capacitor was used, having 3 sections in each "gang". The band switch connects the proper section for each frequency range.

The electrical circuits, in general, consist of one stage r-f amplification, 6K8 detector oscillator, 2 stages of i-f amplification with a crystal filter, diode detector and noise limiter, 1 stage of audio, beat frequency oscillator, and output stage. A simple diode a.v.c. circuit is used, with a signal strength meter connected in the plate circuit of one of the controlled tubes.

One of the important features of this receiver is the frequency stability. This is accomplished by the use of good insulation material, a temperature compensating capacitor, and the use of an oscillator circuit having the tube elements tapped down on the tuned circuit. On a sample receiver, the "warm-up" drift measured 3 kc at 30 Mc during two hours of operation from a cold start at room temperature. At the same frequency (30 Mc) a line voltage change of 105 to 125 volts altered the high frequency oscillator 1300 cycles.

A selectivity control on the front panel varies the band width (6 db down from resonance) from 6 kc to 80 cycles in six steps. The approximate values for each step are 6 kc, 3 kc, 2 kc, 500 cycles, 175 cycles, 80 cycles. The change of selectivity is accomplished in the crystal filter circuit alone.

The sensitivity of the receiver is approximately 2 microvolts for 0.5 watt output. From 1.5 to 2.5 microvolts, 30% modulated at 400 cycles gives a 2 to 1 signal to noise voltage ratio. These values were obtained with the selectivity control in the broadcast position and using a 300 ohm dummy antenna.

The image ratio at 30 Mc is approximately 20 to 1 using a 300 ohm antenna and about 40 to 1 using a 50 ohm antenna.

In order to increase the overall fidelity when used for broadcast reception, a compensated negative feedback circuit is used in the audio amplifier. This circuit may be connected by means of a switch on the front panel. The overall electrical fidelity (measured across the speaker voice coil) is down 6 db from the 400 cycle response at 40 and 4500 cycles.

The receiver is housed in a steel cabinet of modern design. The finish is a dark grey wrinkle with stainless steel trim. The overall dimensions are 20-1/8 x 10-1/2 x 11-5/8 inches. The speaker is of the permanent magnet dynamic type, housed in a separate cabinet of matched design.

The tuning dials (both main tuning and band spread) are mounted back of rectangular windows. Between the windows and the dial scale are slide shutters with an aperture just large enough to view one frequency range at a time. These shutters move up or down with the setting of the range switch. This is accomplished with a drive cord connected from a pulley on the range switch shaft, over an adjustable idler pulley and then to an adjustable bushing on the shutter. The shutter slides on a pair of rods with a compression spring to carry it in the correct position. The shutter assembly is one complete unit assembled to the front of the chassis apron. A third rectangular window permits a view of an arbitrary scale on both the main tuning and band-spread dials. These scales have vernier indexes to permit accurate resetting to previously logged stations.

Polystyrene coil forms are used on the two highest frequency range r-f coils and in all of the i-f coils. Ceramic insulation is used for the r-f tube sockets, range switch, tuning condensers, and trimmers. All trimmer capacitors are of the air dielectric type.

NATIONAL ASSOCIATION OF MANUFACTURERS HONORS RCA ENGINEERS

Five hundred industrial engineers and scientists were chosen recently by the National Association of Manufacturers to receive awards as "Modern Pioners on American Frontiers of Industry". Forty-seven of these were members of the RCA organization. The awards were given for original research and inventions which have "contributed most to the creation of new jobs, new industries, new goods and services, and a higher standard of living".

Special national awards were given by the N.A.M. to nineteen of the five hundred persons receiving honors. Dr. Vladimir K. Zworykin of our Company was chosen to receive one of these national awards.

The forty-seven RCA "Modern Pioneers" received their awards at dinners sponsored by the N.A.M. in observance of the 150th anniversary of the founding of the American patent system - in Philadelphia on February 16, and in New York on February 27. Thirty of the forty-seven RCA men were from the RCA Manufacturing Company and their names are listed below:

R. C. Ballard
M. C. Batsel
A. V. Bedford
G. L. Beers
R. A. Braden
G. H. Brown
W. L. Carlson
L. M. Clement
G. L. Dimmick
R. S. Holmes
H. A. Iams
R. D. Kell
E. W. Kellogg
W. R. Koch
E. A. Lederer
H. W. Leverenz
L. E. Mitchell
H. F. Olson
R. T. Orth
G. M. Rose, Jr.
B. Salzberg
O. H. Schade
T. M. Shrader
B. J. Thompson
H. C. Thompson
W. A. Tolson
A. W. Vance
I. Wolff
C. J. Young
V. K. Zworykin

We are very proud to have had so large a group of our engineers picked to receive this honor. Our hearty congratulations to them all.

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RCA ACQUIRES PLANT AT BLOOMINGTON, IND.

The RCA Manufacturing Company has acquired a plant at Bloomington, Indiana, preparatory to the establishment of another modern factory for the production of "Nipper" table model radios.

Acquisition of the new building at Bloomington was made necessary because of the Company's continued expansion in all of the fields in which it operates, and in anticipation of future growth.

The Company produced and sold more small radios of the Nipper type during the past year than ever before in its history. Market requirements for a considerably greater number of units during the latter part of the year could not be filled, because of limited space and facilities at Camden. The Company is projecting plans for expansion of all of its products to meet increasing public acceptance.

The installation of manufacturing facilities at the Bloomington plant will be started immediately with the hope of having production well under way by the middle of the year. Besides providing employment for hundreds of men and women, the new Bloomington plant is expected to stimulate the home building, social, business and civic growth of the surrounding area. All employees, with the exception of a skeleton supervisory staff, will be recruited in the Bloomington area.

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RCA ANNOUNCES TRANSFER OF TELEVISION ENGINEER

Henry Rhea, who has been active in the development of television apparatus in the RCA engineering laboratories at Camden, has been named assistant to T. A. Smith, Manager of Television Transmitter Sales, it was announced by J. L. Schwank, Manager of the Engineering Products Division.

Mr. Rhea played an active part in the development of the new RCA field pickup television equipment, and has had a hand in working out new television circuits. He has recently returned from Los Angeles, where he assisted in advising the Don Lee personnel in the operation of equipment purchased from RCA. He was graduated from the University of Illinois in 1935, and joined the RCA engineering staff the same year.

...'''...

MANUFACTURERS ENDORSE TUBE "PREFERENCE LIST"

The enthusiastic reception with which radio manufacturers, distributors and dealers have hailed the RCA "Preference List" program to limit insofar as possible the number of receiving tube types, has surpassed all expectations.

The RCA "preference list" of standard receiving tube types was advanced to radio and phonograph manufacturers as a result of an exhaustive study into the sales of the 470 different types of receiving tubes on the market. It was revealed that 90% of all sales are centered in only 90 tube types which perform only 20 basic functions.

The "preference list" was selected from the 90 most popular tube types to fill the needs of design engineers for practically every type of radio receiver, including a-c and d-c receivers, auto radios, and battery instruments.

In December, 82% of the receiving tubes RCA shipped to radio manufacturers were of the 36 basic types in the "preference list". This compares with only 30% in January, 1939, ten months before the plan was announced.

One of the benefits claimed for the tube standardization plan at the time of its announcement last November was the possibility of reduced manufacturing costs, with additional savings in handling, stocking and merchandising receiving tubes for all concerned.

First evidence of the soundness of this prediction is found in the fact that twelve of the types on the "preference list" have been reduced in price to equipment manufacturers. This has been possible because of lowered tube manufacturing costs resulting from concentrated volume on fewer tube types.

The "Preference List", for the benefit of those who don't already have it, has been prepared as a loose-leaf sheet accompanying this issue.

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RCA ANNOUNCES NEW 16 MM SOUND PROJECTOR

The RCA Manufacturing Company, largest producers of radio and sound equipment for school use, has announced a new 16 mm sound motion picture projector. Known as Model PG-170, the projector was designed specifically for use among schools and by industrial users of 16 mm films. Price is $300.

Its features include: Unusually brilliant projection with a standard 750-watt lamp; RCA Photophone sound with push-pull amplification - 10-watt output; simplified threading with threading line on projector casting; theatrical framing - no change of projector position; efficient cooling of projection lamp. The lamp itself is quickly changed and the lamphouse remains cool after long operation.

One of the most interesting features of the new RCA projector is the separate motor for film take-up and rewind. This eliminates entirely the use of exterior belts and is instantly adjustable to provide proper tension for 400, 800, 1200 or 1600-foot reels.

Other features include one-point lubrication of high speed parts, - all journals are permanently lubricated; sound and silent film projection speeds with governor-controlled motor; easy cleaning of aperture gates; provision for using microphone for public address or to explain either silent or sound films during projection; connection for record players using either crystal or magnetic pickup; variable tone control; and extreme portability of projector (39 lbs.) and speaker (20 lbs.), both cased in attractive and durable black fabrikoid.

...'''...

"PINOCCHIO" FILM SCORE RELEASED IN VICTOR ALBUM

Six Scenes From Disney Cartoon Classic Recorded From Film Sound Track

In the case of "Pinocchio", the puppet come to life, immortalized by Walt Disney in a new full-length technical production, all five of the hit songs of the picture, as well as the highlights of the action, have been recorded directly from the film sound track for a special Victor album of three records.

The six scenes that have been recorded are heard exactly as in the picture. Pinocchio, Jiminy Cricket, the Blue Fairy, Geppetto, Monstro (the whale), the Fox, the Cat, and a number of other characters speak and sing to give the most important points of the fairy tale. Permission to make the records from the film is exclusive with RCA Victor.

...'''...

NEW TYPE OF DRIVE-IN THEATER INSTALLATION

A new Drive-In Theater at Tucson, Ariz., will open shortly with new individual under-ground loudspeakers for each car. The new speaker system was perfected jointly by RCA Photophone and the Drive-In Theaters, and is being used for the first time.

...'''...

HOME PHONOGRAPH RECORDS USED TO TREAT DEAFNESS

Invention of Famed Physicist Aids Hearing by Stimulation of Inner Ear

A remarkable invention for the deafened, utilizing for the first time scientifically prepared home phonograph recordings which provide acoustic stimulation of inactive portions of the ear mechanism to rehabilitate the hearing, has been perfected by Dr. Christian A. Volf, nationally known physicist.

The recordings are available to any deafened person on prescription from a physician or otologist, and are fitted to individual needs at Dr. Volf's laboratory at Jersey City, N. J. A different recording is supplied for each ear, to conform exactly to the need of both.

The recordings are played on a standard home phonograph (equipped with an earphone which may be unplugged when the instrument is to be used for ordinary entertainment purposes) for ten minutes each day at a volume level which produces a tingling sensation in the middle ear.

"By 'pumping' especially created synthetic sounds into the ear, we find that in a relatively short time we are able to help many types of deafness," Dr. Volf explained. "The treatment is taken by the patient himself in his own home and is entirely painless. If the acoustic treatment is to help at all, its helpful effects are noted within ten days."

The recordings were made at our studios in New York and are being manufactured for Dr. Volf at our Camden plant. The sounds vary in pitch and intensity according to the type of hearing defect they are designed to help.

The physicist explained that vibrations produced by the resonator sounds serve to "exercise" the tiny muscles and other parts of the inner ear. Since many types of deafness are due entirely to inactivity of the inner parts of the hearing mechanism, the exercise serves to rehabilitate them and improve or restore hearing - provided, of course, that the affliction is not caused by organic failure. This method does not rely on bone conduction. During treatment the earphone is held against the outer ear, exactly as is a telephone receiver.

...'''...

CLEVELAND CRIME DROPS ---- THANKS TO RADIO

Cleveland police report that major crimes in Cleveland dropped 17.23 percent in 1939, the first year in which the two-way radio and a zone patrol system were in full use.

According to Capt. Chester I. Burnett, head of the police record bureau, there were 1,177 fewer felonies during the past year than in 1938. Both Capt. Burnett and Assistant Safety Director Robert W. Chamberlin were inclined to give the new radio system major credit for the reduction.

Cleveland now has the largest and most complete two-way police radio system in the world. The equipment was designed and installed by RCA. There are three transmitting stations located in different sections of the city to give com-

plete radio coverage of Cleveland and 56 surrounding suburbs. Transmitting and receiving apparatus is installed in approximately 100 patrol cars, as well as in detective cruisers, patrol wagons, emergency cars, and a number of cars used by the fire department.

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RCA ANNOUNCES NEW RADIO TUBE MANUAL

A new edition of the RCA Radio Tube Technical Manual, standard reference book of the tube industry, was released late in January.

The new edition, known as the RC-14, covers a total of 237 different types of tubes, revising and bringing up-to-date information on practically every tube announced by RCA. The book contains 224 pages, handsomely bound in an attractive two-color cover.

Data is arranged in numerical-alphabetical reference by tube-type numbers and supplemented by curves and special sections devoted to the theory and application of tubes, circuits and resistance-coupled amplifier operating conditions. Single copy price is 25 cents.

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NEW VICTOR RECORD CATALOG ANNOUNCED

Largest Printing in Recent Years Reflects Widening Interest in Records

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A strip of paper ten feet wide and 630 miles long, when cut up into a handy size and imprinted, comes out as the new edition of the Victor Record Catalog. The first printing, the largest in recent years, is nearly a quarter of a million copies, reflecting the ever-widening popular interest in recorded music.

In addition to the tremendous store of information on recordings, artists and composers which has long characterized the Victor Catalog, this edition boasts a new feature, a complete pronouncing glossary of musical terms, composers' names and music titles. In addition, the former chronological list of leading composers has been expanded and enlarged.

Approximately 7,500 Red Seal and Black Label Victor records are listed, cross-indexed by artist, composer and title. All records and albums listed in 1939 monthly supplements have been included. The volume is bound in a striking three-color cover featuring many of the composers whose works are available in Victor records.

It took six box carloads of paper, a ton of ink, a couple of barrels of glue, and an almost inestimable amount of labor to turn out the new edition.

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RCA VICTOR PREPARES AFRICAN RHYTHM ALBUM

An authentic album of "music in the raw", a collection of African drum symphonies and tribal rhythms, is being distributed by RCA Victor.

Representing the fruits of four scientific expeditions to Africa by Mrs. Laura C. Boulton, the collection runs the scale of the African emotions from the gay quick tempos of the wedding dance to the savage and sinister call to war.

Great interest in the collection has already been shown as the result of Mrs. Boulton's lecture tours. Enquiries have come from educational institutions interested in rounding out their music history courses, from swing band leaders who frankly confess that the intricate drum patterns and syncopations are beyond them, and from "jitterbugs" captivated by the jungle rhythms and cross rhythms.

The album, with a photographic cover, comprises six ten-inch green labeled records including songs of praise, ceremonial songs, war horns, drums and flutes from the French Sudan, Timbuctu, Nigeria, and the British Cameroons. The set comes complete with a picture booklet and full description of the music by Mrs. Boulton, an accomplished musician in her own right.

"The natives have worked out rhythms beyond anything we've ever conceived," she declares. "Their sense of rhythm is beyond our scope."

Walter Damrosch pronounced the collection "a valuable contribution". Stravinsky wanted to sit up all night to hear it, while Stokowski, after several long sessions with the album, was apparently ready to take the next boat to Africa, according to Mrs. Boulton.

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AUDIO-VISUAL SCHOOL AIDS SHOWN IN RCA VICTOR BOOK

The 1940 edition of "Audio-Visual Service for Schools", a widely-read presentation of sound products and services developed especially for educational use, has been announced.

Presenting radio and related equipment of a wide variety, the booklet is being distributed to thousands of educators throughout the country, and may be obtained without cost from Mr. Dent's office at Camden, New Jersey.

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NATIVE MUSIC AND SPEECH BEING RECORDED IN AFRICA

American Travel Expedition Uses RCA Victor Instantaneous Recorders

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The music, folk lore and customs of African natives in their jungle surroundings are being filmed and recorded for American school children and adult lecture audiences by a two-year expedition sponsored by the World Travel Club, of Rochester, Minn. The expedition will also record messages from American and English missionaries to their home churches.

David Griffin, President of the Club, is en route to Africa with a specially equipped truck on which three RCA instantaneous disc recording units have been installed. By synchronizing sound recordings of the scenes he plans to photograph with motion picture cameras, Mr. Griffin expects to return with a complete record of his adventures. The pictures and recordings will be used in schools and on lecture platforms.

The expedition's equipment includes a two-year supply of film and recording blanks. The truck carries a portable recorder for use where quick setups are required, and two deluxe re-

corders which, when used alternately, permit a continuous recording of unlimited length to be made.

Installation of the recording equipment was made at our Camden and Indianapolis plants. C. A. LaHar, of our San Francisco office, gave the equipment its final inspection before the expedition sailed. Mr. Griffin's party left from the West Coast for Africa via China and India because of the war danger in the Atlantic. The journey is 10,000 miles longer as a result.

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PASSING ESKIMO FOLK MUSIC RECORDED BY FAMED PRIEST

The vanishing native music and chants of the primitive Eskimo race, as well as numerous folk lore tales in the Eskimo tongue, have been preserved on phonograph records by Father Bernard F. Hubbard, famous "Glacier Priest" whose parish is Alaska.

Taking a modern RCA Victor Portable recorder into the vastness of the Arctic wilderness to reach the isolated settlements of the native tribes, he brought back one hundred 12-inch recordings after months of traveling and work. He plans to use the recordings in his lectures.

Father Hubhard declared that the records have already disproved one popularly-held conception - that the American Indians and the Eskimos are related races. He explained that careful comparison between his recordings and others previously made of Indian speech disproves the theory by failing to show any similarity in word forms and speech characteristics.

...'''...

CHESS CLUB RESUMES ACTIVITIES

RCA Victor A.A. Chess Club invites all chess players - from beginners to capablancas - to come to its meetings which are held every other Thursday at the Lunch Club, Bldg. 3. The next meeting will be held on March 21. No membership formalities are necessary, just drop in any time after 7:00 P.M. to find a worthy opponent. Free instructions are given to beginners. Miss Rita Griffin of Victor A.A. sees to it that adequate refreshments are always made available at the meetings.

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TECHNICAL TERMS DEFINED

Mr. M. S. Gokhale of our Standardizing Department offers the following for those who are doubtful of the meaning of certain terms we use.

Draftsman - A man who puts his own ideas on paper for others to change.

Checker - A man with a blue pencil, but without a conscience.

Tracer - A slave, who knowing nothing himself, never understands what the Draftsman thinks he knows.

Engineer - A mechanical or electrical genius, who spends his time thinking up ideas which he refuses to recognize later, when he meets them on a drawing.

Tool Designer - A collection of erroneous ideas surrounded by a boss.

Drafting Room - A place where the time between arguments is spent in making drawings to be changed.

Standard - Trade name for motor fuel; sometimes also means recommended procedure.

Tracing - A piece of linen used for taking high spots off erasers.

Data Book - A collection of information, which everybody scorns until needed.

(With apologies to R. W. Emery of Cleveland)

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TRANSFERS AND ADDITIONS TO THE ENGINEERING DIVISIONS

Radiotron Division

New Employee

Mr. J. Hirmann	Cathode-Ray Development Section of the Factory Cathode-Ray Development Shop.

Transfers

Mr. L. G. Lessig	Commercial Engineering Section to Sales Promotion Department at Camden.
Mr. T.C. Morrison	Design Development Shop to Factory #1.
Mr. G. M. Rose	Advanced Development Section to Equipment Section.

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Victor Division

New Employees

R. Snepvengers	Receiver Development
G. A. Ferguson	Drafting
C. F. Millard	Drafting
R. McBride	Drafting
M. Freas	Model Shop
J. W. Dougherty	Drafting
J. H. Hillier	Electronic Research
J. Hexem	Sound Engineering

Transfers

D. W. Peterson	Service Dept. to General Research
M. S. Klinedinst	Sound Eng. to Record Div.
D. B. Nason	Receiver Dev. to Special Apparatus
L. E. Barton	Receiver Dev. to Special Apparatus
F. J. Weyher	Sound Engineering to Sales
H. Kihn	Service Dept. to Receiver Dev.
R. C. Willman	Foreign Sales to Sound Engr.
G. E. Brunner	Mfg. Dept. to Office Service
E. S. Watson	Mfg. Dept. to Blueprints
J. Feizet	Mfg. Dept. to Blueprints
H. E. Rhea	General Research to Sales
B. D. Toschniwal	Receiver Dev. to Home & Auto Receivers
Miss Haneman	Mfg. Dept. to Standardization
C. M. Purdy	Order & Stores to Standardization
H. D. Sarkis	Home & Auto Receivers to Standardization

H. R. Terhune	Special Apparatus to Standardization
J. P. O'Hanlon	Office Service to Blueprints
M. Passwater	Office Service to Blueprints
L. J. Hayney	Blueprints to Drafting
K. H. Kaufmann	Blueprints to Drafting
H. F. Witt	Blueprints to Drafting

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On March 16, Miss Nellie Sahns, 56 Potter Street, Haddonfield, N. J. (Standardizing Department) will be married to Mr. George J. Wadsworth, of Schenectady, in the First Baptist Chruch of Haddonfield. Mr. and Mrs. Wadsworth will reside at 48 Cleveland Avenue, Norwood, Penna.

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Mr. and Mrs. L. J. Anderson announce the birth of a daughter, Cynthia Ruth Anderson, at the Cooper Hospital on January 25, 1940. Cynthia Ruth weighed 6 lbs. - 11 ounces on arrival.

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A new addition in the home of Mr. and Mrs. H. L. Donley (General Research Department) is daughter, Kathleen Ann, born on January 11. Kathleen Ann weighed 7 lbs. - 12 ounces on arrival.

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Mr. and Mrs. L. J. Flodman (Sound Engineering Department) have announced the birth of a daughter, Dorris Elaine, on September 30, 1939, at the Cooper Hospital. Dorris Elaine weighed 9 lbs.

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A new arrival in the home of Mr. and Mrs. Max A. Kerr is Martha St. John Kerr, born on December 6 at the Cooper Hospital. Martha weighed 6 lbs. - 9 ounces.

...'''...

New Equipment Recently Marketed

Model	List Price	Description
		Table Model
T-56	$27.95	5 tube table model, range 540-1720 kc, 6 push buttons, loop antenna, walnut finish cabinet.
46X21	$22.95	5 tubes plus ballast a-c/d-c walnut plastic cabinet - ranges 540-1550 and 6000-18,000 kc, loop antenna.
46X23	$29.95	Same as 46X21 in wood cabinet.
46X24	$32.95	Same as 46X21 in larger wood cabinet and with 6 push buttons added.
T-63	$34.95	6 tube and Magic Eye, a-c, walnut wood cabinet - ranges 540-1560 and 5800-18,000 kc - loop antenna - 6 push buttons.
T-65	$39.95	6 tube and Magic Eye, a-c, walnut and mahogany cabinet, same ranges as T-63 - 6 push buttons.
4QB	$29.95	4 tube battery table model with plastic cabinet - ranges 540-1720, 2300-7100, 7100-22,000 kc. Uses 1.5 v. "A" and 90 v. "B" - Easily convertible for a-c operation.
		Communication Receiver
AR-77	$139.50*	10 tubes - range 540-31,000 kc. Bandspread - r-f stage - carrier level meter - in crackled lacquer metal case. Also obtainable for rack mounting. (See article in this issue for further information)
MI-8303	$ 8.00	Loud speaker with case for AR-77
		Tubes
7B5(LT)	$ 1.25	Interchangeable with types without the "LT" and "LM" designations
7B6(LM)	1.25	
7B8(LM)	1.25	
7C5(LT)	1.25	
		Test Equipment
161	$107.50	RCA "Signalyst", a low-priced signal generator. Range 100 kc to 120 Mc on 10 bands. A-c operated - max. output .05 v. (low range) and 1.3 v. (high range).
		Monitor Loud Speaker
64-B	$140.00	10 w. monitor loud speaker - permanent magnet - 60-10000 cycles double voice coil cone and folded horn cabinet
		16 MM Projector
PG-170	$300.00	Projector for school and commercial use. 750 w. lamp. Up to 1600 ft. reels. Sound or silent film.

Model	List Price	Description
		Electronic Control
41903	$22.00	Electronic Switch - operates by changes in electric field near its antenna wire. A-c operated.

*Amateurs' net price.

		Consoles
K-61	$49.95	6 tube a-c console - Ranges 540-1560 and 5800-18,000 kc - 6 push buttons - loop antenna.
K-62	$59.95	6 tube a-c console - ranges 540-1720, 2300-7000 and 7000-22,000 kc - 8 push buttons - rotatable loop antenna.
K-82	$79.95	7 tube a-c console - ranges same as K-62 - 8 push buttons - rotatable loop antenna.
		Victrolas
U-43	$125.00	7 tubes plus Magic Eye, a-c Victrola with automatic record changer for 10" and 12" records - Ranges 540-1560 and 5800-18,000 kc - rotatable loop antenna - 6 push buttons - top opens.
U-45	$225.00	9 tubes plus Magic Eye, a-c Victrola with automatic record changer for 10" and 12" records - Ranges 540-1560, 1550-4000 and 5800-18,000 kc - rotatable loop antenna - 6 push buttons - front doors open. Has record storage space.

Engineering Library News

Radiotron Division

LR-120 - Progress Report on the Annealing and Aging of Nipron Wire, S. Umbreit - 9/25/39.

LM-48 - A Tantalum Cathode for Projection Tubes, L. B. Headrick - 10/9/39.

LM-50 - 6SQ7 Construction Change, H. F. Hafker and J. T. Cimorelli - 10/9/39.

LM-53 - Color Analysis of Kinescope Screens, T. B. Perkins - 10/17/39.

LM-55 - Untuned R-F Amplifiers, W. A. Harris - 10/23/39.

LM-56 - Gas Shrinkage Analysis, D. H. Wamsley - 10/25/39.

LM-57 - Investigation of Flame Temperature Changes of Factory 1 Equipment, C. A. Jacoby - 10/25/39.

LM-58 - 1853: Factory Noise Test Set Calibration for 1853 in R-F Amplifier Position, J. T. Cimorelli - 10/23/39.

LM-59 - 6Y6-G's as Damper Tube in Wide Angle Deflection Circuits, T. B. Perkins - 11/10/39.

ST-92 - A Theoretical Analysis of Single Side Band Operation of Television Transmitters, L. S. Nergaard - Oct. 1939.

ST-150 - An Automatic Spectral Sensitivity Curve Tracer, T. B. Perkins - June 1939.

ST-186 - The Orthicon, a Television Pick-up Tube, A. Rose and H. Iams - October 1939.

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Victor Division

DISTRIBUTION OF BIBLIOGRAPHIES ON AVIATION EQUIPMENT AND REMOTE CONTROL

It will be of interest to some of our readers to know that copies of TR-418 - Aviation radio equipment bibliography and TR-447 - Remote control bibliography, have been sent to the following libraries for their files:

1 - Inst. Aeronautical Sciences
1 - Franklin Institute Library
1 - University of Chicago
1 - Western Society of Engineers, Chicago
1 - Engineering Library Univ. of Minnesota
1 - College of Engr. & Commerce Univ. of Cinn.
1 - Engr. Societies of Northwestern Pa.
1 - Univ. of Colorado, Engr. Library
2 - Engineering Societies Library, N.Y.C.

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Technical Reports

TR-458 - Comparison of Selective Side Band and Double Side Band Transmission of Television Detail Over Channels of Equal Width, R. D. Kell and G. L. Fredendall - 9/7/39.

TR-459 - Variable Width Recording with Polarized Light, J. R. Alburger - 9/15/39.

TR-460 - RCA Picture Negative Developer, J. R. Alburger - 9/15/39.

TR-461 - Small Receiver Sets and Separate Speakers, W. M. Perkins - 9/19/39.

TR-462 - Minimizing Frequency Changes Due to Capacity Variations in an Oscillator Tube, V. D. Landon - 9/22/39.

TR-463 - Application of the Aluminate Principle to Picture Negative Developer Design, J. R. Alburger - 10/18/39.

TR-464 - Television Power Amplifier Design, T. L. Gottier - 10/23/39.

TR-465 - A Single (ribbon) Element Unidirectional Microphone, H. F. Olson and J. Preston - 10/30/39.

TR-466 - Comparison Between Plate Circuit and Cathode Circuit Amplifiers, T. L. Gottier - 11/15/39.

TR-467 - Low Frequency Characteristics of the Interstage Coupling Circuit of Video

Amplifiers, H. L. Donley and D. W. Epstein - 12/13/39.

TR-468 - Power Transmission Loss Due to Wall Absorption in Exponential Horn, W. D. Phelps - 12/15/39.

TR-469 - Investigation of Loop Antenna with Lumped Series Inductance, P. F. G. Holst - 12/20/39.

TR-470 - Comparative Study of Various Self-Contained Antenna Devices for "A" Band Operation, W. F. Sands - 12/20/39.

TR-471 - Permeability Tuning Systems for Multi-band Superheterodyne Receivers, W. F. Sands - 12/19/39.

TR-472 - A Neutralized Loop Antenna, P. F. G. Holst - 12/21/39.

TR-473 - Phonograph Listening Tests, W. M. Perkins - 12/22/39.

TR-474 - Continued Tests on Rotating Adcock Direction Finder at 130 Mc for Aviation Ground Station, V. D. Landon - 12/22/39.

TR-475 - Optical System for Variable Width Recording by Polarized Light, J. R. Alburger - 12/26/39.

TR-476 - 56,000 Volt Television Projection System for 4½ x 6 Feet Images, I. G. Maloff - 1/12/39.

Engineering Memorandums

EM-2174 - RCA Picture Negative Developer, J. R. Alburger - 10/18/39.

EM-2175 - The Conditions for Starting and Maintenance of Oscillators in Certain Types of Crystal Oscillator Circuits (a preliminary report), R. D. Duncan, Jr. - 10/23/39.

EM-2176 - Rejuvenation of Developing Solutions, J. R. Alburger - 11/1/39.

EM-2177 - Development of Directly Heated Tantalum Cathode for Kinescope, F. H. Nicoll - 11/10/39.

EM-2178 - Discriminators for Frequency Modulation Receivers, N. I. Korman - 11/29/39.

EM-2179 - Alteration of General Radio Type 736-A Wave Analyzer, W. R. Koch - 12/29/39.

R.C.A. Communications' Publications

F-32-28 - Temperature Compensation of R-F Heterodyne Oscillators, H. A. Moore - 12/12/39.

F-43-76 - Propagation UHF Automobile Ignition Field Strength vs. Frequency 40 Mc - 450 Mc, R. W. George - 12/19/39.

F-52-P-17 - The Service Range of Frequency Modulation, M. G. Crosby - 12/28/39.

F-65-6 - Monitor Kinescope, J. E. Smith - 10/23/39.

F-65-7 - Video Line Amplifier, J. E. Smith - 11/28/39.

F-65-8 - Television Oscilloscope, J. E. Smith - 11/29/39.

F-65-9 - Video Frequency Signal Generator, J. E. Smith - 11/30/39.

RCA Radiotron Publications

ST-181 - Herold, E. W., Superheterodyne Converter System Considerations in Television Receivers - Jan. 1940.

ST-187 - Rose, Albert, Electron Optics of Cylindrical Electric and Magnetic Fields - Jan. 1940.

LM-63 - Memorandum on the Power Requirements of Candoluminescent Screens, J. M. Stinchfield - 12/20/39.

LM-65 - The Properties of Tantalum-Tungsten Alloy, D. B. Langmuir and L. Malter - 1/4/40.

LR-123 - Review of Work Done on the Spectrograph, H. T. Swanson.

LR-126 - Some Factors Affecting the Choice of Lenses for Television Cameras, H. B. De Vore and H. Iams.

LR-127 - Application of Transparent Evaporated Films, R. B. Janes - 1/16/40.

Application Note #105 - Application note on a change in maximum ratings of receiver tubes, November 15, 1939.

Receiving Tube Manual RC-14

Translations

G-82 - Disturbance Free Broadcast Reception. Translated from Der Rundfunk-handler, p. 971, 972, November 1938 by J. L. Barnes.

G-83 - Linder & Schneidermann. Influence of Self-inductance Roll Condensers on their Apparent Impedance. Translated from ETZ, Heft 27, July 6, 1939 by E. G. McAllister.

R-13 - Rakoff & Antonoff. Secondary Emission of Tungsten, Copper and Iron at High Potentials. J. of Tech. Phys., v. 9, #10, 1939 by I. G. Maloff.

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Klemin, A. - Bibliography of Vibration and Flutter of Aircraft Wings and Control Surfaces, 1937.

Knight, H. deB. - Hot Cathode Rectifiers and Thyratrons. (British Thomson-Houston Co.)

Kohman, G. T. - Cellulose as an Insulating Material. (Bell Telephone Monograph B-1165)

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Morgan, Howard K. - "Aircraft Radio and Electrical Equipment", N. Y. Pitman, 1939.

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Wooster, W. A. - "Textbook on Crystal Physics", Cambridge, University Press, 1938.

Zworykin, V. K. & G. A. Morton - "Television - The Electronics of Image Transmission", N. Y. Wiley, 1940.

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PHILIPS TRANSMITTING NEWS
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W

WIRELESS ENGINEER & EXPERIMENTAL WIRELESS
WIRELESS WORLD

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Papers Approved for Presentation or Publication

Victor Division

Title	Author	
Deluxe 35 MM Film Soundhead	R. H. Heacock	RCA Review
Progress in the Development of Instruments for Measuring Radio Noise	C. M. Burrill	RMA-I.R.E. Rochester Convention
Acoustic Line Loudspeaker	W. D. Phelps	Electronics
Frequency Measurements	A. C. Stocker	Radio Club of Drexel Institute
Acoustics in Studios	M. Rettinger	Institute of Radio
Television Reception in an Airplane	R. S. Holmes	RCA Review
Evaluation of Sound Insulation in Buildings	K. C. Morrical	Architectural Record
A Precision Television Synchronizing-Signal Generator	A. V. Bedford & J. P. Smith	RCA Review
Radio	L. M. Clement	American Year Book
Simple Antennas and Receiver Input Circuits for Ultra-High Frequencies	R. S. Holmes & A. H. Turner	Radio at UHF - Bonus Book
Two New 50 Kw Stations of the Canadian Broadcasting Corporation	E. A. Laport	Broadcast News
Electron Optics and Its Applications	E. G. Ramberg	Seminar Brooklyn Polytechnic
Standardization at RCAM	M. S. Gokhale	RCA Service News
The Modern Sound System	F. H. Schneider	RCA Review
RCA Experimental Uhf Omnidirectional Range	D. G. Luck	Pamphlets for Airline Pilots
Electron Optics for Radio Engineers	V. K. Zworykin	Montreal I.R.E.
The Point by Point Method of Transient Analysis	Robert Serrell	RCA Review
Broadcast Transmitter Test Equipment	H. J. Schrader	Ohio State Conference
Television Measurements Compared with Broadcast Station Measurements	T. L. Gottier	Ohio State Conference

A New Radio Noise Meter	C. M. Burrill	Broadcast News
The RCA Type 311-A Broadcast Frequency Monitor	J. M. Brumbaugh	Broadcast News
Radiotron Division		
Cathode-Ray Television	H. W. Leverenz	Electrical Dev. League of San Francisco and Santa Clara Co. Section of Pacific Gas & Electric Co., San Jose
Television Today	Harley Iams	Stanford Illustrated Review
Some Notes on Coupled Circuits	W. R. Ferris	RCA Review
A Wide-Band Inductive-Output Amplifier	A. V. Haeff & L. S. Nergaard	Proc. of the I.R.E.

New Tube Data

Technical information has been issued on the following tubes and is available in the Library.

Type	Description
6X5-GT	Full-wave high-vacuum Rectifier.
RCA-12K8	Triode-hexode Converter (metal type).
3A8-GT	Diode-Triode-R-F Amplifier Pentode
117Z6-GT	High Vacuum Rectifier-Doubler
RCA-12SR7	Duplex-diode Triode (single ended metal type).
RCA-928	Gas Phototube (non-directional type).
RCA-1628	Ultra-high frequency transmitting Triode
RCA-1840	Orthicon
RCA-1848	Iconoscope

Recently Issued Patents Assigned to RCA

Issued November 14, 1939

2,179,974 - Signal Receiving System - G. L. Beers.

2,179,607 - Cathode Ray Deflecting Circuits - A. V. Bedford.

2,179,929 - Mercury Arc Rectifier - C. W. Hansell.

2,180,107 - Short Wave Transmitter - J. L. Hathaway.

2,179,954 - Photocell Amplifier - R. H. Ranger.

2,179,956 - Automatic Selectivity Control Circuits - W. Van B. Roberts.

2,179,966 - Noise Suppression Circuits - K. R. Sturley.

2,179,838 - Temperature Control Device - L. L. Young.

Issued November 21, 1939

2,181,080 - Double Diode - G. F. Elston.

2,180,734 - Screen Material - R. H. George.

2,180,706 - Temperature Control Device - H. E. Goldstine.

2,180,736 - Phase Modulation Receiver - C. W. Hansell.

2,180,413 - Magnetically Tuned High Frequency Circuits - R. L. Harvey.

2,180,944 - Television and Like Receiver - A. A. Linsell.

2,180,815 - Gas Discharge Tube and Circuit - W. L. Meier.

2,180,946 - Television Transmitting Tube - G. A. Morton and A. W. Vance.

2,180,722 - Lead-in Arrangement - N. M. Rust.

Issued November 28, 1939

2,181,170 - Electronic Device - C. H. Brown.

Issued December 5, 1939

2,181,861 - Photographic Developer - J. R. Alburger.

2,181,870 - Wide Band, Short Wave Antenna and Transmission Line System - P. S. Carter.

2,181,871 - Concentric Line Tuned Circuits - J. W. Conklin.

2,182,336 - Automatic Lighter and Display Device - H. E. Goldstine.

2,182,087 - Luminescent Material - H. W. Leverenz.

2,181,901 - Resonant Line - N. E. Lindenblad.

2,181,946 - High Voltage Generator - N. E. Lindenblad.

2,182,322 - Wave Limiter Circuit - W. v. B. Roberts.

2,181,982 - Variable High Frequency Transformer - S. Tarzian.

2,181,953 - Cooling System - G. L. Usselman.

2,182,328 - Band Width and Tone Control Circuit - J. Weinberger.

Issued December 12, 1939

2,182,860 - Cathode Ray Tube Fluorescent Screen - N. W. H. Addink and J. H. de Boer.

2,183,209 - Electroacoustical Apparatus - L. J. Anderson.

2,183,211 - Sound Motion Picture Apparatus - G. B. Banks.

2,183,215 - Line Resonator and Electron Discharge Device Circuit Therefor.

2,182,870 - Oscillation Generator - K. W. Jarvis and R. M. Blair.

2,182,871 - Material Cutter and Stacker - N. R. Jones and B. R. Carson.

2,183,147 - Printing Telegraph System - J. B. Moore and R. E. Mathes.

2,183,203 - High Frequency Amplifier - W. J. Poch.

2,183,206 - Resonance Tuning Indicator System - F. B. Stone.

2,183,340 - Deflecting Circuits - W. A. Tolson.

Issued December 19, 1939

2,183,784 - Directional Antenna - P. S. Carter.

2,183,609 - Automatic Volume Control Circuit - D. E. Foster.

2,183,865 - Modulated Carrier Wave Transmitter - E. Green and N. H. Clough.

2,183,741 - Radio Receiving System - G. L. Grundmann.

2,183,612 - Shielded Relay Attenuator - S. Gubin.

2,183,562 - Radio Relaying System - C. W. Hansell.

2,183,717 - Modulation Control System - O. E. Keall.

2,183,718 - Modulated Carrier Wave Receiving Installation - A. A. Linsell.

2,183,795 - Modulator System - H. O. Peterson.

2,183,725 - Remote Control System - S. W. Seeley.

2,183,947 - Sound Film Splice - R. S. Sumner.

2,183,731 - Electron Discharge Device Amplifier - G. M. Wright.

2,183,634 - Radio Course Indicator - V. K. Zworykin.

Issued December 26, 1939

2,184,542 - Acoustical Measuring Device - H. Belar.

2,184,546 - Film Identifying Apparatus - M. E. Collins.

2,184,547 - Sound Recording and Reproducing - G. L. Dimmick.

2,184,548 - Recording of Electrical Impulses - G. L. Dimmick.

2,184,382 - Radio and Other High Frequency Telegraph Transmitters - D. F. George.

2,184,958 - Electromechanical Drive - D. W. R. Goddard.

2,184,939 - Weld Splash Shield - N. H. Green.

2,184,386 - Electric Arc Discharge Lamp - C. W. Hansell.

2,184,740 - Mercury Arc Oscillator - C. W. Hansell.

2,184,556 - Microwave Electronic Amplifier - E. G. Linder.

2,184,565 - Sound Picture Apparatus - J. S. Pesce.

2,184,754 - Measuring Short Wave Noise Levels - H. O. Peterson.

2,184,945 - Frequency Multiplier - J. L. Reinartz.

2,184,400 - Wave Transmission Circuits - W. v. B. Roberts.

2,184,571 - Modulation System - A. W. Vance.

Issued January 2, 1940

2,185,879 - High Frequency Amplifier - H. C. Allen.

2,185,882 - Phonograph - A. V. Bedford.

2,185,590 - Cathode Ray Tube - D. W. Epstein.

2,185,373 - Oscillograph Apparatus - R. H. George.

2,185,192 - Keying System - C. W. Hansell.

2,185,199 - Keying System - A. Kahn.

2,185,302 - Picture Transmission System - A. Karolus.

2,185,252 - Device for Viewing Photographic Film - E. W. Kellogg.

2,185,410 - Metal Compositions - E. A. Lederer.

2,185,378 - Electron Gun for Cathode Ray Tubes - I. G. Maloff.

2,185,379 - Electrically Controlled Light Valve Apparatus - L. M. Myers and E. F. Goodenough.

2,185,562 - Mounting for Electrical Apparatus - J. F. Nielsen.

2,185,870 - Volume Control Device - J. P. Smith.

2,185,612 - Automatic Gain Control - B. Trevor.

2,185,239 - Cathode Ray Tube - M. Von Ardenne.

Issued January 9, 1940

2,186,239 - Receiver System - J. L. Finch.

2,186,544 - Frequency Changer - W. R. Koch.

2,186,422 - Diversity Antenna - W. I. Matthews.

2,186,182 - Frequency Measuring Device - A. C. Stocker, H. J. Schrader and B. W. Robins.

2,186,208 - Radio Receiving System - J. D. Reid.

Issued January 16, 1940

2,187,171 - Vacuum Tube for Microwaves or Ultra-Short Waves - K. Okabe.

2,187,172 - Vacuum Tube - K. Okabe.

2,187,107 - Mount for Electron Discharge Devices - C. P. Vogel.

Issued January 23, 1940

2,188,145 - Remote Indicating System - Samuel G. Frantz.

2,187,805 - High Impedance Band Pass Filter - Vernon D. Landon.

2,188,165 - Radio System - Adolph A. Thomas.

2,188,068 - Modulated Carrier Wave Television and Like Transmitter - Wm. S. L. Tringham.

Issued January 30, 1940

2,188,647 - Cathode Ray Apparatus - Ernst Busse.

2,188,649 - Antenna - Philip S. Carter.

2,188,650 - Magnetic Recording - Gilbert R. Clark.

2,188,410 - Electron Multiplier - Alfred A. Linsell.

2,188,611 - Impulse Generator - Lowell E. Norton.

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Research and Engineering Departments

RCA RADIOTRON DIVISION, HARRISON, N. J.

"Miniature Tube Types" by K. G. Bucklin, Electronics (November, 1939).

"Effect of Electron Transit Time on Efficiency of a Power Amplifier" by A. V. Haeff, RCA Review (July, 1939).

"Space-Charge Effects on Electron Beams" by A. V. Haeff, Proc. of I.R.E. (September, 1939).

"An Ultra-High-Frequency Power Amplifier of Novel Design" by A. V. Haeff, Electronics (February, 1939).

"Circuit Design and Its Relation to Tube Performance" by L. C. Hollands, Electronics (March, 1939).

"A Fixed-Focus Electron Gun for Cathode-Ray Tubes" by H. A. Iams, Proc. of I.R.E. (February, 1939).

"The Image Iconoscope" by H. A. Iams, G. A. Morton* and V. K. Zworykin*, Proc. of I.R.E. (September, 1939).

"Recent Improvements in the Design and Characteristics of the Iconoscope" by R. B. Janes and W. H. Hickok, Proc. of I.R.E. (September, 1939).

"New Television Amplifier Receiving Tubes" by A. P. Kauzmann, RCA Review (January, 1939).

"Contrast in Kinescopes" by R. R. Law, Proc. of I.R.E. (August, 1939).

"Luminescent Materials" by H. W. Leverenz and F. Seitz**, Jour. of Applied Physics (July, 1939).

"The Rate of Evaporation of Tantalum" by L. Malter and D. B. Langmuir, Physical Review (April 15, 1939).

"Resistance, Emissivities, and Melting Point of Tantalum" by L. Malter and D. B. Langmuir, Physical Review (April 15, 1939).

"Light Output and Secondary Emission Characteristics of Luminescent Materials" by S. T. Martin and L. B. Headrick, Jour. of Applied Physics (February, 1939).

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"Phenomenon of Secondary-Electron Emission" by Herbert Nelson, Physical Review (May 15, 1939).

"A Theoretical Analysis of Single-Side-Band Operation of Television Transmitters" by L. S. Nergaard, Proc. of I.R.E. (October, 1939).

"An Automatic Spectral Sensitivity Curve Tracer" by T. B. Perkins, Jour. of Optical Society of America (June, 1939).

"The Orthicon, a Television Pick-Up Tube" by Albert Rose and Harley Iams, RCA Review (October, 1939).

"Television Pick-Up Tubes Using Low-Velocity Beam Scanning" by Albert Rose and Harley Iams, Proc. of I.R.E. (September, 1939).

"Electrostatic Deflection Kinescope Unit for Television Receiver" by J. B. Sherman, QST, (March, 1939).

"Using Electromagnetic Deflection Cathode-Ray Tubes in the Television Receiver" by J. B. Sherman, QST (February, 1939).

"Construction and Alignment of Television Receiver" by C. C. Shumard, QST (January, 1939).

"On the Resonant Impedance of Transmission Lines" by B. Salzberg and L. S. Nergaard, Proc. of I.R.E. (September, 1939).

"Kinescopes for Television Receivers" by L. C. Waller, Communications (April, 1939).

"A Push-Pull Ultra-High-Frequency Beam Tetrode" by A. K. Wing, RCA Review (July, 1939).

Book Review of "Moderne Mehrgitter - Electronenrohren" Vol. II, by M. J. O. Strutt; reviewed by B. Salzberg, Electronics, (May, 1939).

* Camden
** Non RCA

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"A Simplified Derivation of the General Properties of an Electron-Optical Image" by E. G. Ramberg, Journal of the Optical Society of America, p. 79-83 (February, 1939).

"Absorption and Emission Spectra of Luminescent Materials Used in Kinescopes" by E. J. Wood and H. W. Leverenz, Journal of the Optical Society of America (abstract), p. 142 (March, 1939).

"Multiple Coil, Multiple Cone Loudspeaker" by H. F. Olson, Acoustical Society Journal, p. 305-312 (April, 1939).

"Coil Design for Amateur Band Receivers" by D. Pollack, QST, p. 54-57, 88 (February, 1939).

"Improving the Fidelity of Disc Records for Direct Playback" by H. J. Hasbrouck, p. 246-252 (March, 1939).

"Reversed Speech" by E. W. Kellogg, Journal of the Acoustical Society, p. 324-326 (April, 1939).

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"Some Television Problems from Motion Picture Standpoint" by G. L. Beers, E. W. Engstrom and I. Maloff, S.M.P.E. Journal, p. 121 (February, 1939).

"Gamma and Range in Television" by I. G. Maloff, RCA Review, p. 409 (April, 1939).

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"Graphical Network Synthesis" by E. A. Laport, Broadcast News, p. 24-27 (January, 1939).

"Uni-Directional Microphone" by H. F. Olson, Broadcast News, p. 3 (May, 1939).

"Applied Acoustics" by H. F. Olson and F. Massa, complete book, revised edition, 1939.

"A Reverberation Time Scale for High Speed Level Recorders" by K. C. Morrical, Acoustical Society Journal, p. 300-301 (April, 1939).

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"Acoustic Condition Factors" by Michael Rettinger, S.M.P.E. Journal, p. 410 (October, 1939).

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"Television Receiving and Reproducing Systems" by E. W. Engstrom, Journal of Applied Physics, p. 455 (July, 1939).

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"Class A-B Push Pull Recording System" by C. N. Cartwright and W. S. Thompson, S.M.P.E. Journal, p. 289 (September, 1939).

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"Newly Designed Sound Motion Picture Reproducing Equipment" by J. S. Pesce, S.M.P.E. Journal, p. 551-571 (November, 1939).

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"A Direct Reading Vacuum Tube Milli-Voltmeter for Bio-electric Studies" by R. E. Heller, M.D. (non-RCA) and W. Lyons, Electronics, p. 25 (November, 1939).

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"Microphone Efficiency: A Discussion and Proposed Definition" by Frank Massa, Acoustical Society Journal, p. 222 (October, 1939).

"On the Sensitivity of Photographic Emulsions for Electrons Between 50 and 100 ekV" by L. Marton, Physical Review "Letters to the Editor" section, p. 290 (August, 1939).

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(December, 1939).

"Starting Characteristics of Speech Sounds" by R. O. Drew and E. W. Kellogg, S.M.P.E. Journal, p. 597 (November, 1939) for abstract, p. 43 (January, 1940) for article.

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"Great Lakes Radiotelephone Service", H. B. Martin - RCA Review, p. 32 (July, 1939).

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"New Coaxial Transmission Line at WTAM" by W. S. Duttera, Electronics (March, 1939).

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EVERYBODY'S GOING
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