

JUN 1 1930

Tenth Year of Service

RADIO ENGINEERING

COMMUNITY RADIO SERVICE
1947 E. TIOGATA ST.
PHILA., PA.
PHONE: JEFF 6362

Vol. X

JUNE, 1930

No. 6

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\$2.00 per year*



The Journal of the Radio Industry

RIVALS Keep on Thinking

EVEN if within the next few weeks we begin to speak of the "recent" depression, some of the results, started by the last jolt, will still be getting under way. The actual dangers to some concerns will be just starting.

Every time there is a bad jolt, everybody instantly starts looking ahead and thinking "fast"—even the people who hate it most.

The instant the curve seems to hesitate or flatten out, some people just naturally say to themselves—

"That is good; the bad part is all over. Changes won't be necessary; old designs, equipment, costs, values, are not obsolete after all; and people are again going to be willing to pay for them.

"Now we can breathe easily. We were doing some fast and painful thinking. But, thank goodness, now we can stop."

Just when they are in the greatest danger, and ought to be doing their fastest and most thorough planning and action!

Because competitors do *not* stop. Not all of them. Some of them go right ahead with the new thinking that the jolt started with the planning, and the changes, the advancements and re-equipping, which they believe will give them an earlier, stronger upturn, and a better lead in the New Prosperity.

* * *

Industry has now awakened to the fact that too often the **REAL** drag on profits, and on success in competition is the using of **WRONG MATERIAL**.

The New Thoroughness recognizes the supreme importance of one indispensable factor—the question—

Are You THINKING IN THE RIGHT MATERIAL?

NVF

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DONALD McNICOL

Associate Editor
AUSTIN C. LESCARBOURA

Vol. X

June, 1930

Number 6

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Radio Exports

EIGHTY-ONE foreign countries now are buying American radio products in varying quantities, according to a report submitted to the RMA board of directors at their French Lick Springs meeting in May by Chairman H. H. Pollock of the foreign trade committee. Canada still is the principal foreign purchaser of American radio products.

An export questionnaire sent recently to the RMA membership developed that twenty-four companies maintain export departments, while ninety-seven use combination export managers, sales factors, and similar export sales agencies. Many requests regarding American radio products are received by the foreign trade committee which recently has been reorganized to become more efficient in developing export trade for RMA members. A governing committee has been appointed by Chairman Pollock. Its members are—Arthur Moss of Electrad, Inc.; A. S. Hughes of the Colin B. Kennedy Corp.; C. J. Hopkins of the Crosley Radio Corporation, and W. J. Avery and L. DeBlock. Various committees to intensively handle export matters also have been appointed, as follows: Advertising, merchandising and patents, Chairman Pollock; Tariff, C. J. Hopkins of the Crosley Radio Corporation; Traffic and packing, W. E. Batchellor of the Atwater Kent Manufacturing Co.; Statistics, Alvar Chaves of the Diamond Electric Corporation; Engineering, A. Hautzch of the Best Manufacturing Company; Trade shows and expositions, A. S. Hughes of the Colin B. Kennedy Corp., and Credit, N. Simons of M. Simons & Sons Co.

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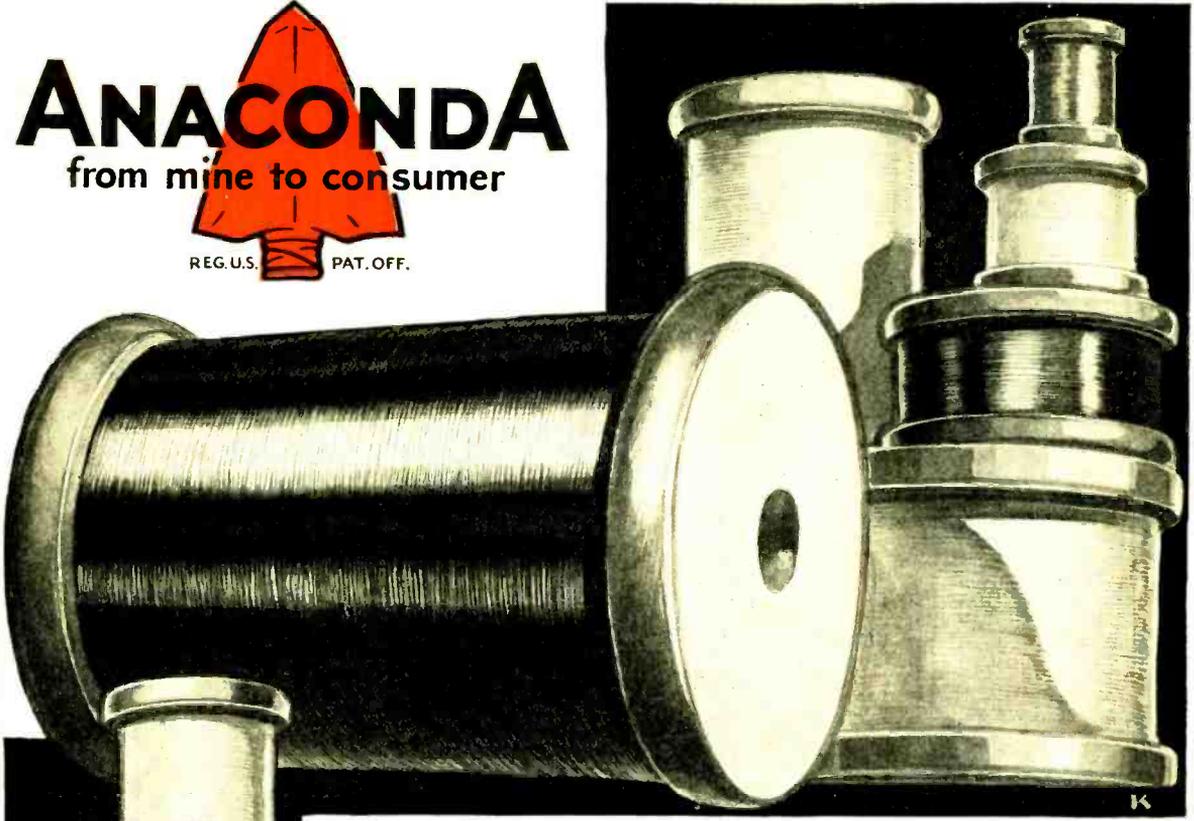
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from mine to consumer



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Anaconda offers Magnet Wire in every size and insulation used in the radio industry. Super-quality results from a careful selection of raw materials, perfected manufacturing processes, and exacting tests from bare wire to finished spool May we discuss your requirements with you?



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EDITORIAL

June, 1930

PROFITS FROM RADIO MANUFACTURE

RECENTLY one of the long established manufacturers of a non-radio product told the writer that his line had for a year or longer been in the doldrums. His explanation was to the effect that a few years of unusual demand had sucked into the business manufacturers of other products who thought they heard opportunity knocking. The net result of the invasion was that the newcomers lost a lot of money while at the same time they "crabbed" the business of the regulars who from long experience knew the line thoroughly.

The radio industry has experienced no little amount of this disturbance, and there are those who will say that there is small hope of the legitimate, responsible manufacturers of radio equipment being freed from the menace of the fly-by-night "factories."

However, any executive or engineer who takes the time to make an analysis of just what is being done by the leading radio manufacturers to circumvent the get-in-and-get-out interlopers will make an encouraging discovery.

On the assumption that the fundamentals of sales are product and price, the thinking manufacturers are arming to insure the highest grade of receivers, at reasonable list prices—and with reasonable margins of profit.

In the April issue of RADIO ENGINEERING we gave a convincing account of how some of the tube manufacturers are producing good tubes, at reasonable prices, and at a profit. The seemingly impossible is rendered quite practicable by installing modern manufacturing machinery.

Taking a leaf from the book of the tube makers, thinking manufacturers of other radio accessories are investing in machinery for their factories which will make it easy for them to compete in price and turn out products that meet all requirements.

Taking advantage of important researches in the steel industry radio manufacturers are now enabled to avail of the high silicon content steels. Also, losses from rejects are reduced because of uniformity of raw materials purchased. Steel for power pack and distribution transformers may have core losses not exceeding 0.80 watt per pound.

In another direction, resistors of accuracies to one-half of one per cent. are possible because of the availability of such materials as crolite, and ohmite ideal heat-conducting bobbin materials; also the new nickel alloy resistance wires.

There are available for the manufacturer coreless high-frequency induction furnaces which are the last word in melting equipment.

For the modern manufacturing plant there are new model toolroom precision lathes for making precision master taps, screw gages, spiral screws, dies, fixtures and tools to meet the most exacting needs of efficient manufacture.

Those manufacturers of radio receivers or accessories who expect to make profits from sales of products turned out by methods that are not now up-to-date are likely to find the going harder in the days ahead.

There are in the situation opportunities for profits for radio manufacturers who modernize their manufacturing facilities and who have the vision to see that what radio brings to millions of homes is of a nature that cannot escape being permanent, even on a broader and extended scale in the years ahead.

WILL THERE BE A SHORTAGE OF NICKEL?

RADIO and communication engineering advancements in recent years have brought into being no end of new and useful circuit arrangements built around resistances, leaks, shunts and filters. The newer resistance wire alloys make extensive use of nickel. Last year the demand was so great and the sources of supply so limited, or controlled, that there was an embarrassing shortage.

In these circumstances it behooves manufacturers to get their orders in early so that when the radio receiver rush begins in the factories there will not be failures to deliver in time to meet the market demands.

There is always the possibility of developing satisfactory substitutes. Along this line resistance wire manufacturers have opportunity for economies and for betterments.

WATCH OUT FOR THESE MEN

AT the RMA Show at Atlantic City RADIO ENGINEERING will be represented by observers from the editorial and business offices of this journal. These men shall be expected to miss nothing that is of importance to the welfare of the industry. What they observe shall be written down plainly in coming issues of RADIO ENGINEERING.

DONALD McNICOL, *Editor*

THESE SCREWS ARE FAMOUS

as Time-savers in the radio industry...

Speed and more speed is called for when big production is crowded into a short season. In meeting this demand, radio production engineers have found Hardened Self-tapping Sheet Metal Screws to be valuable assistants. No other means of fastening parts securely to a chassis is so speedy or simple.

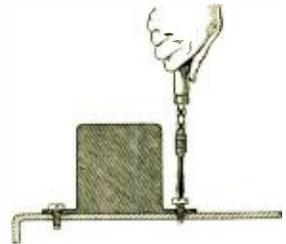
No tapping or tapping plates necessary. No nuts or washers to fumble. No trouble with stripped and crossed threads. *Just one operation required* . . . Turn the Self-tapping Screw into a drilled or pierced hole. A fastening made this easy way is as secure as one made with machine screws. And any unskilled workman can do the job.

You will find these Screws saving time, labor and money all along the assembly lines of such famous sets as Philco, Stromberg-Carlson, Edison, Colonial, Kolster and General Motors Radio. They save 44 tapping operations on each Philco receiver. What will they save on your assemblies? Find out . . . a test will tell. Mail the coupon now for free trial samples.



These Screws Tap their own thread

Simply turn a Self-tapping Screw into a drilled or punched hole. It taps its own thread in the material as you turn it in—binding the sections securely together.



Test them for —

Among the many applications for which radio manufacturers use Self-tapping Screws are: Fastening padding, power, by-pass and neutralizer condensers; condenser braces; power chokes; power and push-pull transformers; volume control shields; shield plates; wire clamps. Try them for similar assemblies.

FREE SAMPLES

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Send me samples of Hardened Self-tapping Screws. I want to try them for:

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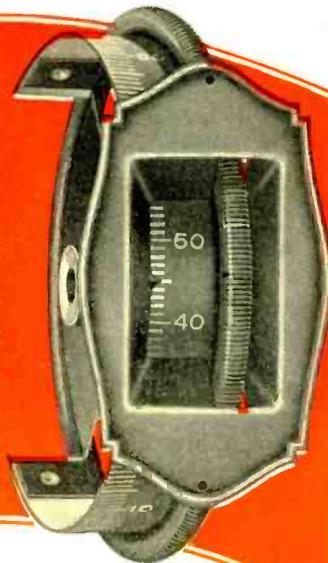
The escutcheons shown in this column are coin embossed



We carry many dies for stock shapes which may be utilized with little or no cost. Blue prints will be sent you on request.



Where small runs are required—or when changes in name are necessary for dealers' or jammers' use, escutcheons that are etched rather than embossed are recommended.



No. 29 DIAL

A practical low-priced tuning unit, positive in motion and trouble free, with a minimum assembling cost.



No. 30 DIAL

Smooth in action and well adapted to certain requirements, this dial is moderate in cost and easily and accurately mounted.

WRITE FOR BULLETINS No. 30 and 32

For the above drums and dials we have an assortment of escutcheons to meet all requirements. Escutcheons quoted separately. Send for descriptive literature and samples.

DIALS • DRUMS *and* ESCUTCHEONS

to none—guarantees accuracy and originality.

... send us your blue prints and we will be glad to submit designs ... without obligation to you, of course!

..... a legion of ideas are contained in our bulletins No. 30 and No. 32 ... they have been designed for and are available to radio manufacturers and their personnel ... write for them now!

VISIT
.. US AT ..
Booth 24C
RMA
TRADE SHOW
ATLANTIC CITY

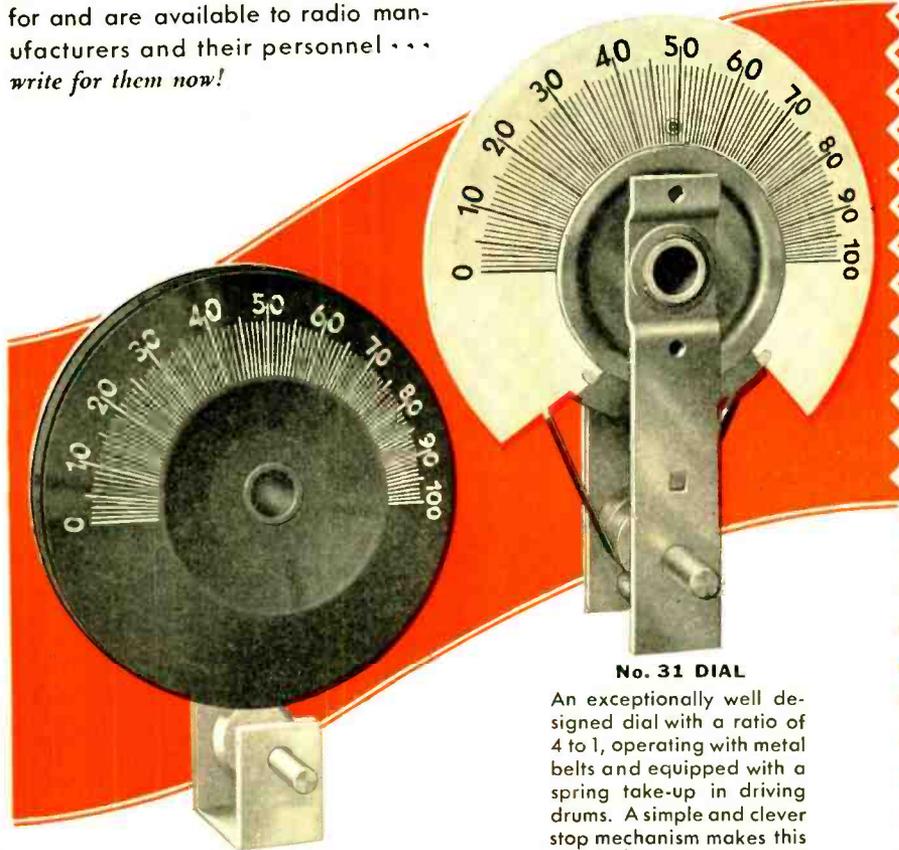
All three of the escutcheons shown in this column are etched



Our Art Department will be pleased to prepare sketches based on your ideas. This in no way obligates you.



Usually the etched escutcheon is made to your own specifications. We have, however, a selection of stock dies which may appeal to you. Ask us!



No. 32 DIAL

This dial with a 6 to 1 ratio friction drive, is equipped with an etched scale made in varied colors. Special scale may read through 360° if desired. The cost is low.

No. 31 DIAL

An exceptionally well designed dial with a ratio of 4 to 1, operating with metal belts and equipped with a spring take-up in driving drums. A simple and clever stop mechanism makes this dial fool-proof. It is engineered for high-grade sets.

CROWE NAME PLATE AND MANUFACTURING CO.
1757 Grace Street Chicago, Illinois

The "Little GIANT"

Capacity
8 MFD
Peak Voltage
430 DC
Can Negative



HERE'S the real "surprise package" of the radio industry. The new, perfected Sprague electrolytic condenser—with the exclusive one-piece, rolled-edge anode—concentrating 8 MFD capacity into a space of only 1 3/8" diameter and 5" long.

Individual socket mounting makes it instantly adaptable to any circuit. Protected vent integral with top prevents all liquid leakage. And because there isn't a soldered or welded joint anywhere—the Sprague gives you in *practical* performance the maximum of efficiency.

Sprague electrolytic and paper condensers will be exhibited at the RMA Show, Auditorium Booth D-50, Atlantic City, June 2nd to 6th.

Radio set designers, builders and service men are invited to write for illustrated literature, on Sprague Electrolytic Condensers.

SPRAGUE SPECIALTIES CO.

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Factories: North Adams, Mass.

SPRAGUE

Electrolytic CONDENSER

Radio manufacturing has become highly specialized.

Materials are being selected with increasing care.

Aluminum sheet and castings are meeting increased demands.

Great strides have been made in the development of the radio industry during the past decade.

Radio now ranks sixth among all American industries.

Each successive year brings new uses for radio apparatus.

Each year sees further advances in manufacturing methods.

To the Radio Industry now assembled, FAIRMONT brings a service unexcelled.

In the continued progress of the industry FAIRMONT proposes to contribute substantially.

Never have greater opportunities been presented to any industry.

Greetings, then, to the Radio Manufacturers Association

— and —

Sincere good wishes for 1930-31.

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Condensers and Shield-
ing*

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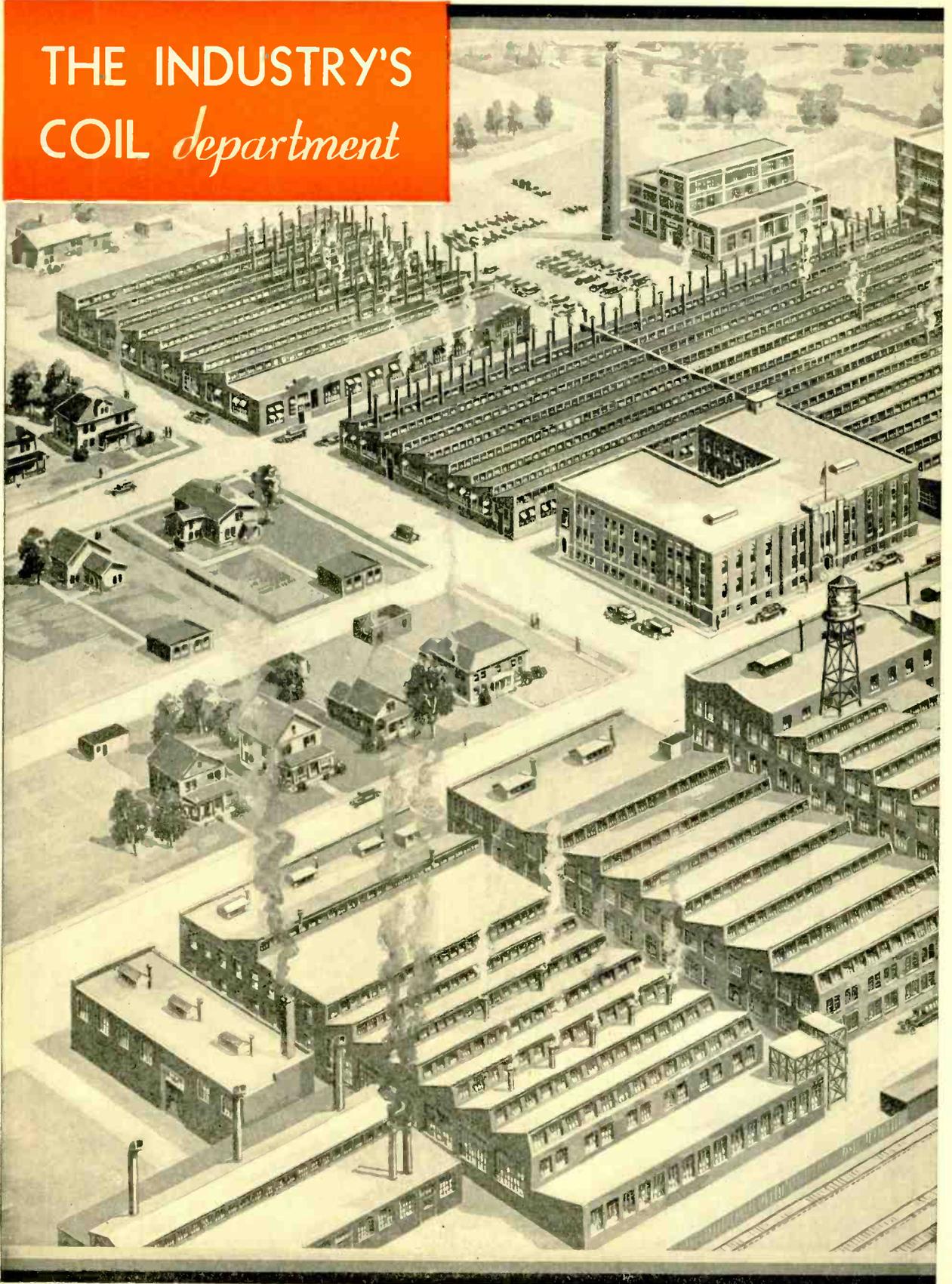
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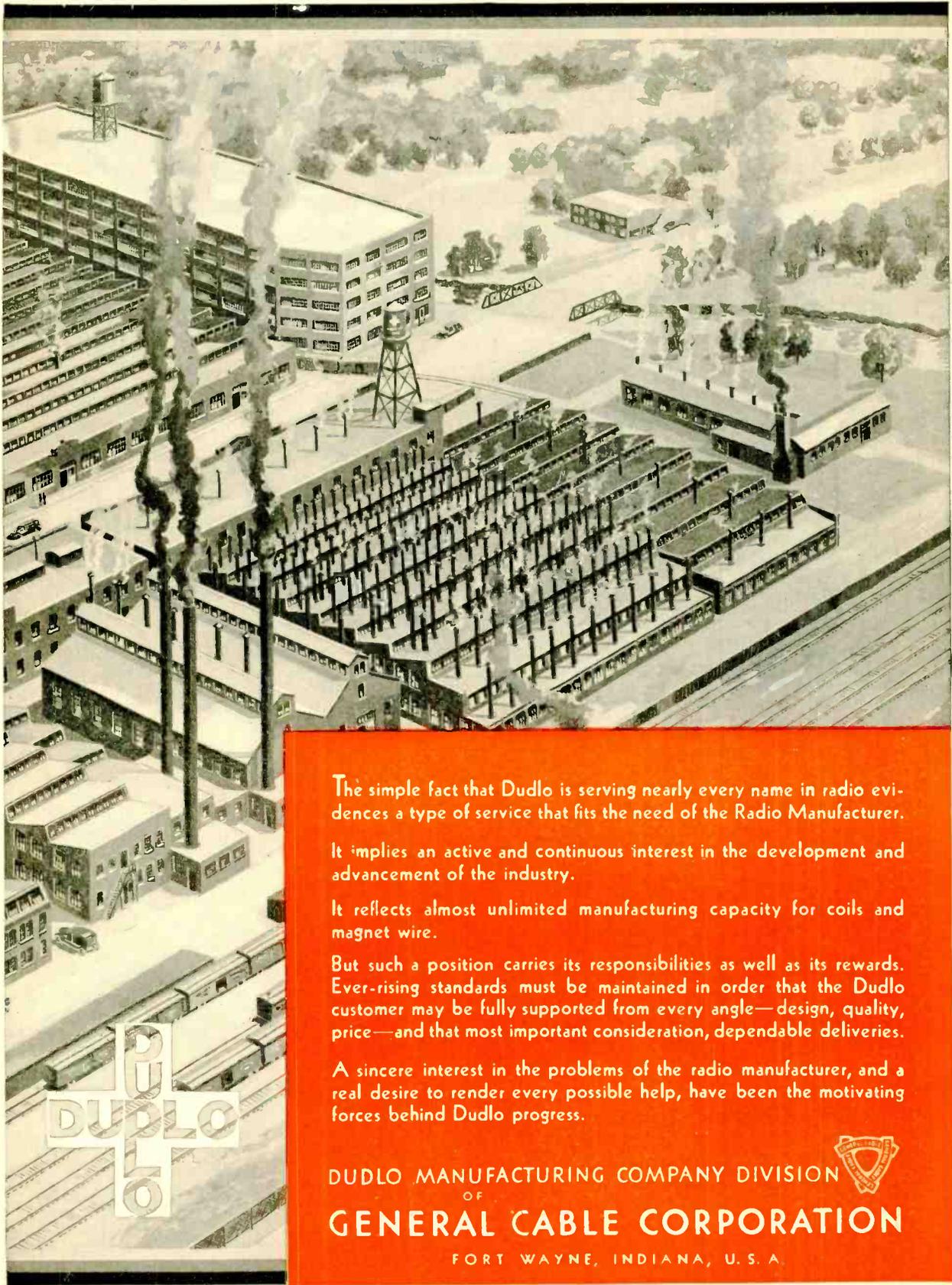
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RMA Exhibit, Booths 53 and 54, Section D.



The simple fact that Dudlo is serving nearly every name in radio evidences a type of service that fits the need of the Radio Manufacturer.

It implies an active and continuous interest in the development and advancement of the industry.

It reflects almost unlimited manufacturing capacity for coils and magnet wire.

But such a position carries its responsibilities as well as its rewards. Ever-rising standards must be maintained in order that the Dudlo customer may be fully supported from every angle—design, quality, price—and that most important consideration, dependable deliveries.

A sincere interest in the problems of the radio manufacturer, and a real desire to render every possible help, have been the motivating forces behind Dudlo progress.

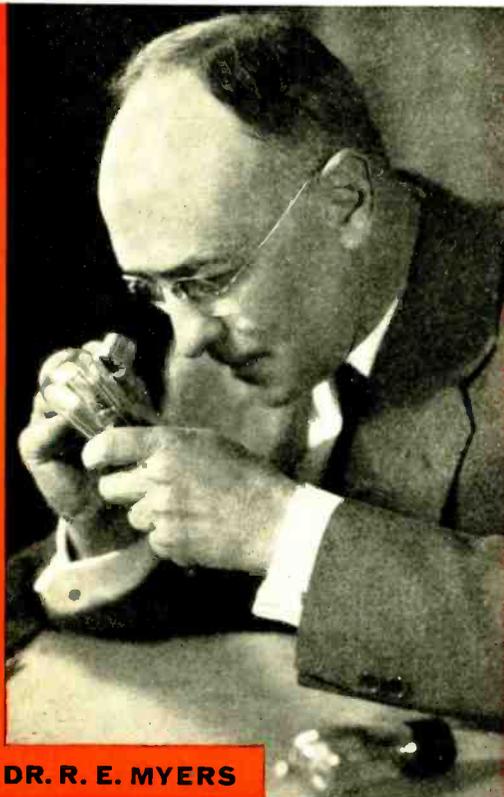
DUDLO MANUFACTURING COMPANY DIVISION
OF
GENERAL CABLE CORPORATION



FORT WAYNE, INDIANA, U. S. A.

RMA Exhibit, Booths 53 and 54, Section D.

... Three months ago us permission



DR. R. E. MYERS

This vacuum tube authority, formerly the Chief Engineer of the Tube Division, Westinghouse Company, has joined National Union Radio. With him he brought a picked staff of 15 Westinghouse engineers and manufacturing experts. Now he gives his emphatic endorsement to this statement at the right.

Why we engaged Dr. Myers

To produce a tube at least as good as any now on the market, we sought the finest engineering talent that the radio business could offer. We went to Westinghouse and to General Electric, who at that time were producing all the tubes for R. C. A.

After several weeks of negotiation, Dr. Ralph E. Myers, Chief Engineer of the Westinghouse Lamp Company, agreed to join us. He brought with him what he considered the pick of the Westinghouse organization — 15 able experts who, for the past six years, have

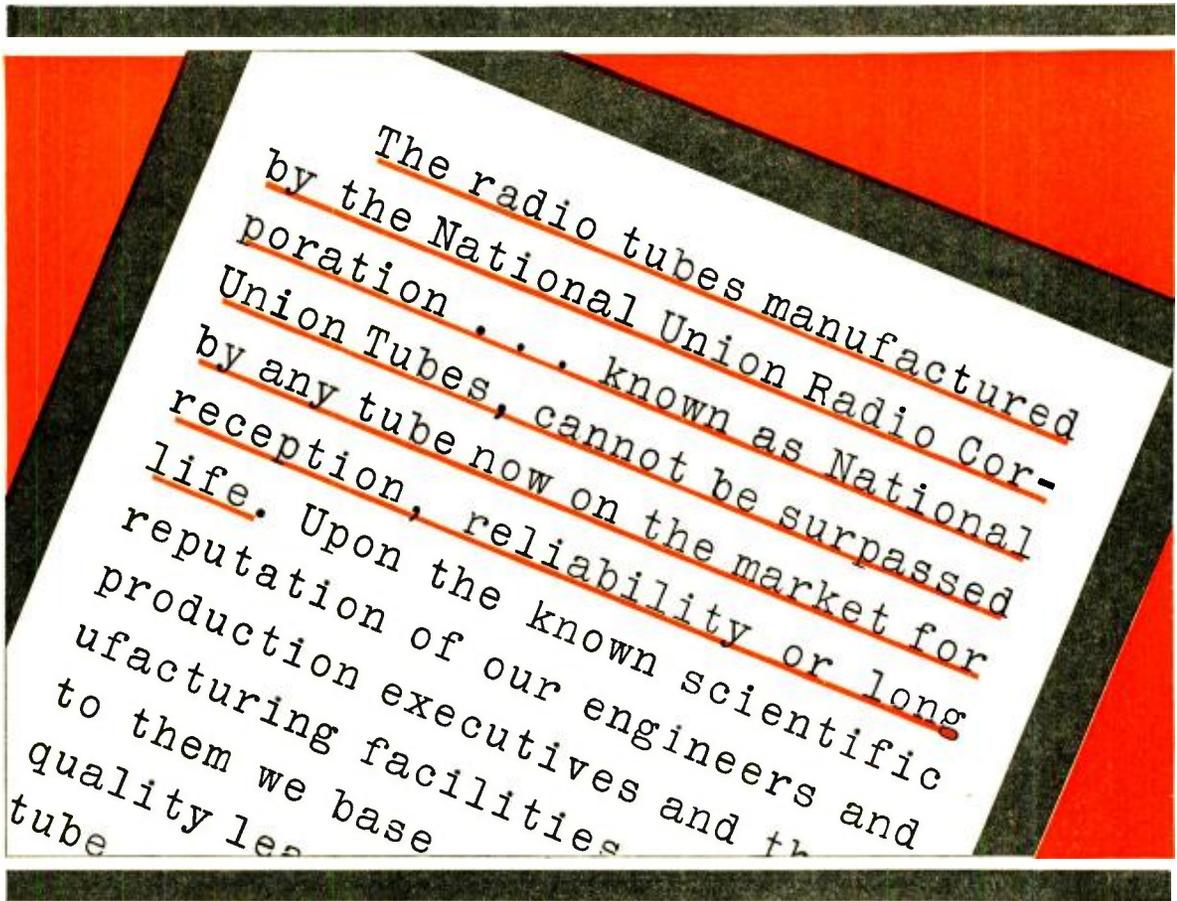
been responsible for the quality of the R. C. A. and Cunningham tubes manufactured by Westinghouse.

Naturally, we wished to make public the fact that Dr. Myers and his staff had joined us, but he flatly refused at that time to allow this.

Then he and his organization went to work. We placed unlimited funds at their disposal. They secured the equipment and concentrated on the production of the finest radio tube that science could devise.

The result is the new National Union Tube. Tests prove it lasts as long or longer than any tube on the

Dr. R.E. MYERS *refused* to print this ad !!



market. Musical experts and eight leading set engineers say its tone is second to none.

And most important of all, perhaps, you can count on perfect uniformity. Dr. Myers installed the "double test" system whereby *each* tube, in addition to passing the production inspection, must also pass a second inspection supervised by a representative of the Sales Department. This guarantees you against receiving any tubes of even slightly doubtful quality.

Dealers who have installed National Union Radio Tubes in the sets they have sold, are already beginning to report fewer service calls—and growing sales.

REMARKABLE PROFIT PLAN

The New National Union tube offers you profit possibilities that cannot be duplicated in any other tube of proved quality.

It also offers you constructive merchandising help. A card brings full details in prices, also a description of the sensational National Union display idea—the idea that puts Rudy Vallee to work on your sales staff, free!

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LARGEST EXCLUSIVE MANUFACTURERS OF COILS IN THE U. S.

5 GOOD REASONS WHY EASTON QUALITY COILS ARE *Right* AND *Not Expensive*

- 1. *Materials and Structure*** — All materials used in the manufacture of Easton Quality Coils must meet with the most rigid tests. Easton Coils are either of the multiple paper interlayer type or the random or solid wound type. Easton recommends vacuum treatment, varnish or compound, to render all paper interlayer wound coils moisture proof.
- 2. *Performance, Uniformity and Endurance*** — Easton Coils have a long and impressive record for superlative performance, endurance and uniformity which is proved by continued patronage from outstanding manufacturers who have specified Easton Coils exclusively for years.
- 3. *Manufactured to Exacting Specifications*** — Easton Coils are made to your specifications or to specifications supplied you by our long experienced engineering department to meet your individual requirements.
- 4. *Economy*** — The Easton multiple paper interlayer coil assures uniform layer winding at a minimum cost. All types of Easton quality coils are manufactured in a modern plant where reduced costs are passed on to you.
- 5. *Easton Free Engineering Service*** — The Easton Coil Company has gained an outstanding reputation by assisting the engineering and manufacturing divisions of important firms to design coils that qualify to exacting specifications. Send your specifications to Easton. All information and data furnished to our engineering and data department will be held in strict confidence. Samples and quotations promptly furnished.

EASTON COIL COMPANY
EASTON, PA.

P. O. Box 237

LARGEST EXCLUSIVE MANUFACTURERS OF COILS IN THE U. S.

MERSHON ELECTROLYTIC CONDENSER



Single anode inverted type



The Pioneer

First patented in 1911. First publicly displayed for use in radio receivers in 1921—and in continuous development and production since then—the Mershon Condenser is unquestionably the pioneer, practical, successful electrolytic condenser. And by virtue of the vast experience and research behind it, it is today years ahead of any other condenser in the field. It was first to provide high capacity in small space, to afford absolute freedom from puncture and to embody a service life measured in *years*, rather than weeks or months.

Multiple anode, upright type



31 Manufacturers Use It as Standard Equipment

The fact that 31 of the leading set manufacturers of America use Mershon Filter Condensers as standard equipment in their products, is proof of the premier position they hold in the radio field.

Engineers and manufacturers, as well as experimenters—thinking solely in terms of maximum efficiency and reliability—have found in the Mershon vastly improved performance and substantial savings in space, cost and service.

The new booklet "Puncture-Proof Filter Condensers" describes the Mershon Condenser, and shows how it can be effectively used in power converter equipment.

**THE
AMRAD CORPORATION**
240 College Avenue
MEDFORD HILLSIDE MASS.

"We'll See You At
Atlantic City"
Auditorium Booth C-1
June 2nd to 6th

AUTO RADIO

How would YOU do it?

Wanted:
standard output
two microvolt sensitivity
equal amplification
excellent selectivity

Using:
a three-gang condenser
five tubes
outside dimensions 5 1/2 x 6 x 8 1/2

It CAN be done.



.... requires the extremes in selectivity and gain—which are readily attained by the use of Bank Wound **LITZ WIRE** coils.

.... to enumerate a few of the other advantages possessed by these remarkable coils—lower losses—compactness—precision matching—reduced production difficulties and—quite important in today's "buyer's market"—low cost.

.... only **KING LEAR COILS** embody all of these features.

.... some of the largest manufacturers in the industry are using our coils in Screen Grid Sets.

.... **THEY** consulted our Engineers—why don't **YOU?** samples and information mailed promptly.

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REPRODUCING a nation's entertainment

The greatest tribute ever paid to any product of the radio industry. . . . Reproducing a nation's entertainment. . . . Approval voiced so effectively by leading engineers and critics that Jensen Electro-Dynamic Speakers are now more widely used than ever before. At the Atlantic City R. M. A. Trade Show more radio receivers will be equipped with Jensen Speakers than with any other make. These receivers are destined to be the season's best sellers for they will offer the finest possible tone quality. To the manufacturers of these receivers the cost of the speaker has been secondary. . . . Designers and engineers of talking moving picture, public address and allied apparatus have also voiced their approval, particularly of the new Jensen Auditorium, with 12-inch cone, and Auditorium, Jr., with 10-inch cone, Speakers. . . . The new model D-8 Jensen Concert Speaker, with 10-inch cone, has been designed particularly for use in radio receivers. . . . All of these new reproducers represent the culmination of Peter L. Jensen's genius and twenty years of experience. All are available for either AC or DC operation from any convenient source of power supply.

JENSEN RADIO MANUFACTURING CO., 6601 S. LARAMIE AVE., CHICAGO, ILL.

Write immediately for new Jensen Folder No. 28 which gives complete information, response curves and other technical data on all three of these new Jensen Electro-Dynamic Speakers.



New Model DA-7
JENSEN AUDITORIUM SPEAKER
List Prices, \$15.00 up



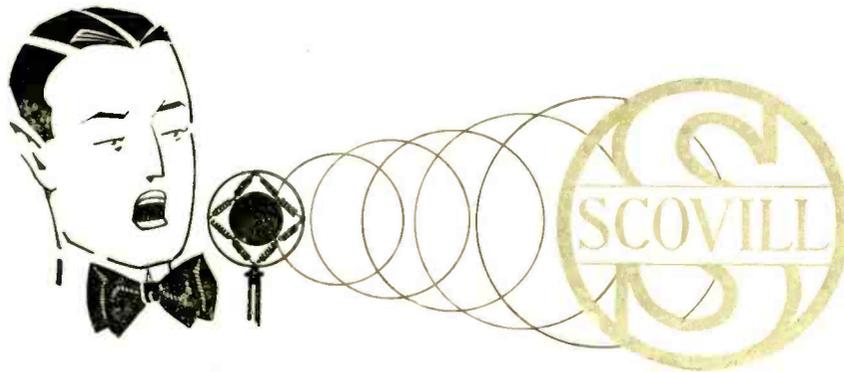
New Model DA-9
JENSEN AUDITORIUM, JR., SPEAKER
List Prices, \$30.00 up



New Model D-8
JENSEN CONCERT SPEAKER
List Prices, \$27.50 up

Jensen Patents Allowed and Pending. Licensed under Lektrophone Patents.

three new **Jensen**
ELECTRO-DYNAMIC SPEAKERS



Talking *and* **SPEAKING!**

TO a radio listener a condenser means nothing. But when you have given years to its development it is an important article. Frankly, we admit that the condenser is only a "part" in the "set." But without it you could hear nothing. The "speaker" couldn't talk.

It's important, then, to have a quality condenser accurate to the full extent of engineering knowledge, adequate for every job it is called upon to do. Scovill has been making such condensers since radio was in its infancy.

Today Scovill radio condensers are known to engineers and manufacturers as the finest products of their kind. Scovill service and Scovill condensers have kept abreast—even perhaps a little ahead—of progress. And you may rest assured that this Scovill reputation will be maintained for the benefit of those leading manufacturers who insist on using Scovill condensers in the radio sets they build.

SCOVILL

Established 1802

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San Francisco
Philadelphia

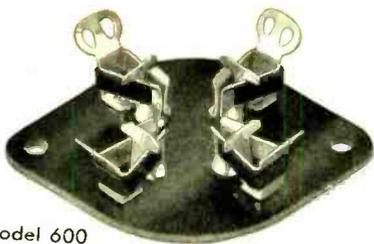
Cincinnati
In Europe—
The Hague, Holland

Announcing the **NEW**

SOCKETS

Contact...

The new 800 model provides, in a more compact form and at substantially lower cost, all of the features found in CRC sockets of the past. The most important feature — the Steel Re-inforcing Spring — assures the best possible contact and is being widely used by makers of the better known sets. . . . *Send for samples and prices.*



Model 600



The NEW
Model 800



Model 600

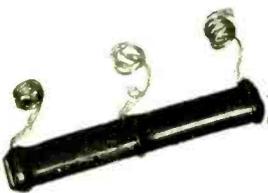
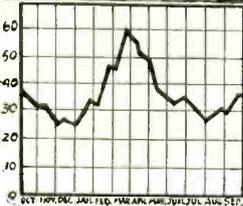
CENTRAL RADIO CORPORATION

BELOIT .. WISCONSIN

RADIO SOCKETS EXCLUSIVELY

W

to meet your PEAK needs



Vitrohm Resistors may be had with various types of terminals. The braid wire type illustrated finds many applications. Vitrohm Resistors may be had with any desired number of terminals.

WARD LEONARD ELECTRIC CO.

31 South Street
Mount Vernon, N. Y.

Resistors Specialists for More Than
Thirty-Nine Years

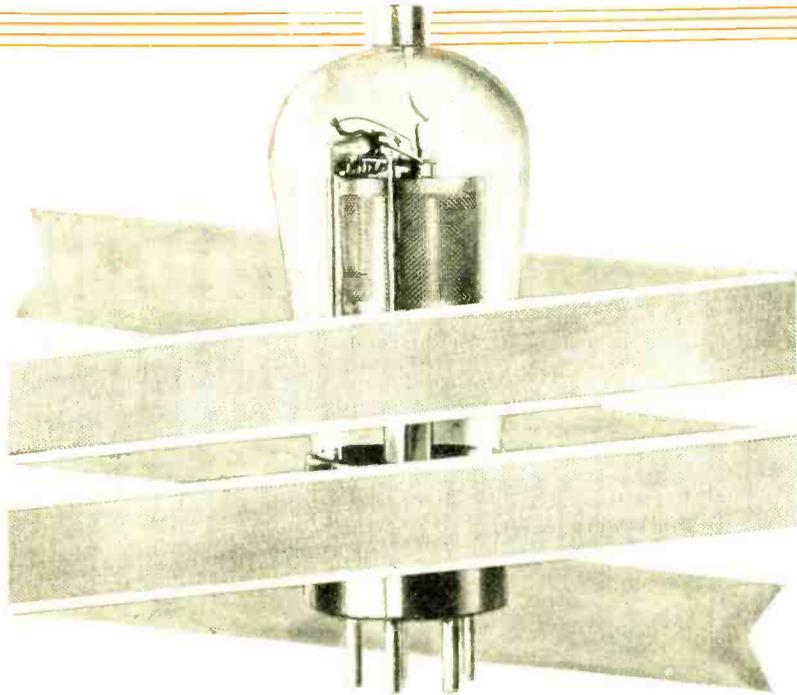
THE time is here for planning this year's set production schedules. Purchasing Departments and Engineers have had their semi-annual get-together party. Now it's up to the P. A. to satisfy Production.

When it comes to wire-wound, vitreous-enamelled resistors, Purchasing Agents should remember that Ward Leonard is a source of supply that has met the demands of industry for two generations.

We're not only specialists in the design of resistors*, but we get them out on time - - in any quantity - - at a price you can't beat.

Now is the time to write your own ticket on special designs and on delivery schedules. Get in touch with a Ward Leonard Sales Engineer - - he'll be on the job fast.

*Among the Products of Ward Leonard are Vitrohm (vitreous-enamelled) Resistors and Rheostats . . . A. C. Voltage Regulators . . . Theatre Dimmers . . . A. C. and D. C. Motor Starters and Controllers . . . Slide Wire Rheostats . . . Arc and Spotlight Rheostats and Ballasts . . . Mobile Color Lighting Equipment . . . Adaptors . . . D. C. Battery Charging Equipment . . . Circuit Breakers.



Gilby Filament Wire is synonymous with accuracy, uniformity and long life. Its use assures a better tube! Look for the large diameter, aluminum spool, it's a Gilby feature. Watch Gilby for developments on Filament.

Gilby Selvage Mesh, the superior Screen Material, has been Gilby's latest contribution to the Radio Industry. Solid, even edges simplify welding,—the mesh is interlocked effecting unusual rigidity. Gilby Selvage Mesh may be accurately supplied within .005 plus or minus as specified. Patent applications fully cover this material and the tube of which it is a part.

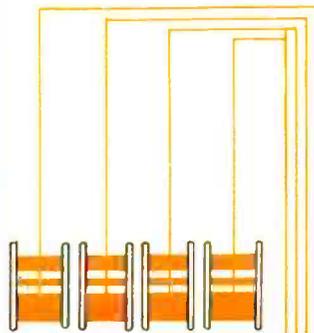
Samples of either of these products on request. Resistance and Ballast Wires, too! We would appreciate an opportunity to cooperate with your engineering department.

[See our Exhibit at the RMA Trade Show at Atlantic City, June 2nd to 6th, Booth C-40]

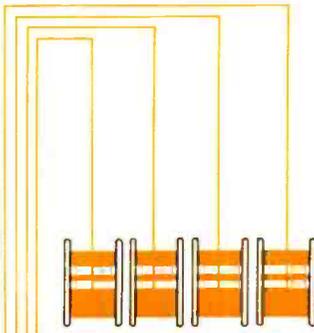
GILBY WIRE COMPANY

Wilbur B. Driver, President

NEWARK, NEW JERSEY



GILBY G O O D WIRE





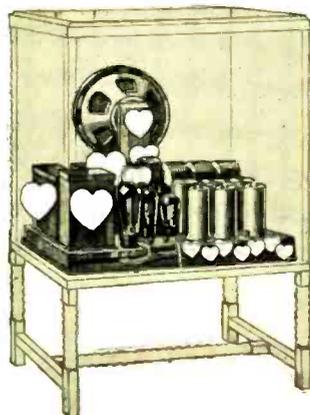
POLYMET PRODUCTS

The HEART of Things Electrical

determine heart-strength in advance! They can incorporate units, at the birth of equipment, which insure long life, stamina, leadership!

Polymet produces tested essential parts for many successful radio receivers, motors, ignition devices, clocks, telegraph and signal systems —where electricity actuates or controls. Such wide acceptance proves these carefully made Polymet Products are Strong Hearts, too!

PAPER, MICA, AND ELECTROLYTIC
 CONDENSERS,
 ELECTRICAL COIL WINDINGS, RESISTORS, TRANSFORMERS
 ENAMELED COPPER WIRE, RADIO
 ESSENTIALS

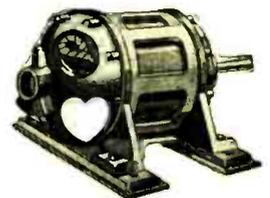


Strong Hearts win the industrial race, too! As compared with the ways of nature, electrical manufacturers have a tremendous advantage: they can



Manufacturers' parts specifications are solicited for prompt quotation.

The new "Polymet Engineering Manual" will be sent to executives on letterhead request.

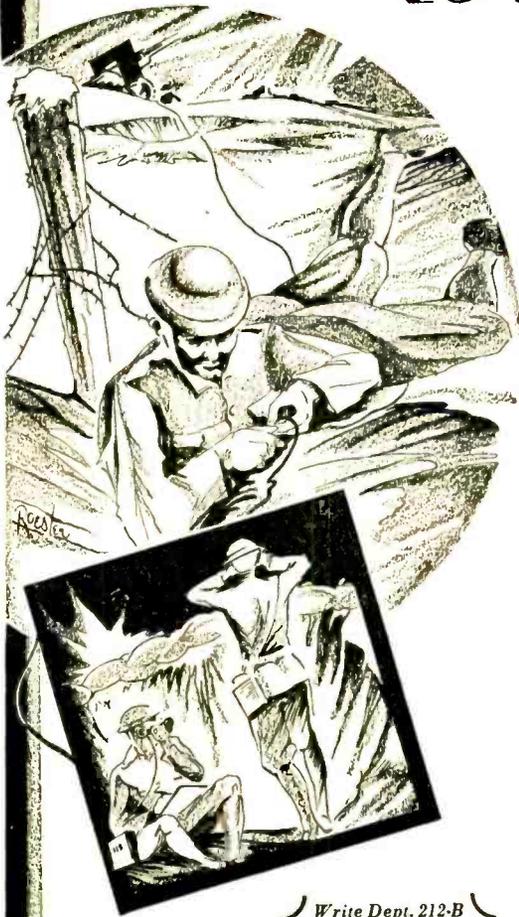


Polymet Manufacturing Corporation
439-C E. 134th St. New York City

it would be

FATAL

to lose CONTROL



BARBED WIRE—trenches—dug-outs—
—a field set and a thin strand of wire.

The difference between control and lack of control may spell life or death to an entire brigade.

It's a far cry from No Man's Land to the comforts of your own home.

But even in your radio set . . . control plays a vital part . . . and it has been the privilege of CENTRALAB to furnish the volume controls of millions of radio receivers.

Is your radio—CENTRALAB equipped?

Write Dept. 212-B
for Free Booklet
"Volume Control,
Voltage Control
and Their Uses"



This shows the exclusive rocking disc construction of Centralab volume control. "R" is the resistance. Contact disc "D" has only a rocking action on the resistance. Pressure arm "P" together with shaft and bushing is fully insulated.

Centralab

CENTRAL RADIO LABORATORIES
Dept. 212 B., 28 Keefe Ave. Milwaukee, Wis.



The
SOURCE
of 
SUPPLY
for

high quality metals and alloys, refined especially for vacuum tube parts

*Molybdenum
(99.95% pure)*

An exceptionally high grade product, refined by exclusive Fansteel process which assures unusual purity and uniformity.

*Moly "B"
Moly "X"*

Two carefully compounded hardened Molybdenum Alloys, excellent for heaters, springs, hooks and support members, each possessed of special characteristics that make it best for certain purposes.

Tantalum (99.9% pure)
A superior metal of extremely low vapor pressure, great gas absorbing properties and ability to withstand high temperatures. Ideal for plates and grids.

"TAW" Metal

A new Tantalum Alloy of exceptional characteristics.

*Caesium
Rubidium*

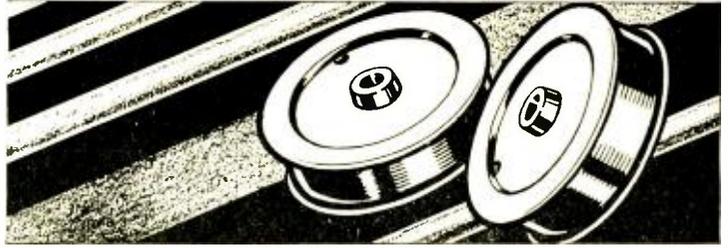
Pure metals and salts for photo-cells.

All Fansteel metals are made in the Fansteel plant, under strict laboratory control. Supplied in all standard commercial forms.

Write for full information and prices.



Fansteel wire doesn't get "mixed" in stock. Carton and Bakelite spool both plainly labeled



The Everyday Tubes of TOMORROW

will be made of
FANSTEEL
WIRE AND METALS

The Fansteel laboratory anticipates the demands of the industry for years to come. It is always developing better metals and alloys for use in tubes. The metals Caesium and Rubidium, for instance, hardly known today, are ready for tubes of the future. Tantalum, used only in large power tubes a few years ago, is now being employed more and more in common receiving tubes—a notable improvement at a saving

Tube makers who use Fansteel metals for *today's* tubes not only are sure of dependable metals, uniform physically, chemically and electrically, but are in close touch with a forward looking research service of practical value.

Manufacturers are invited to write for samples of Fansteel metals—better still, call in a Fansteel engineer.

FANSTEEL PRODUCTS COMPANY, Inc.
North Chicago, Illinois

PHOSPHOR BRONZE

For The Radio Industry

SHEET - ROD - WIRE



Elephant Brand Phosphor Bronze is furnished in sheets, slit to various sizes according to the specific needs of radio manufacturers. Elephant Brand does not fatigue under constant pressure, has great tensile strength, resists corrosion and crystallization, and is of superior elasticity.

Elephant Brand Phosphor Bronze can be supplied in the form of sheets, wire or rod—promptly and to your specifications.



The Phosphor Bronze Smelting Company

2200 Washington Ave.

Philadelphia, Pa.

A GLAD HAND AWAITS YOU AT BOOTH NO. C-30

Resistance for *Every* Radio Need

Once more an old friend greets you at the R.M.A. Trade Show—CLAROSTAT—a friend that has served you from the time of the first B-eliminators struggling for public acceptance, until today when the line voltage problem threatens the successful operation of even the best of radio sets.

And now, CLAROSTAT is better prepared to serve you than ever before—in diversity of products, in engineering personnel, in experience, in production capacity.

CLAROSTAT is more than the name of a single product or even a line of products. It is the hallmark of a specialized engineering service available to you at all times for the solution of your resistance problems. When you specify CLAROSTAT, you specify the correct resistance for your specific requirements. The solution may be—

CLAROSTAT ADJUSTABLE RESISTANCE

Little need of telling you about the original CLAROSTAT—the adjustable, compressible resistor which, in a few turns of its knob, provides a wide range of resistance—silently, smoothly, unfaillingly, and with positive resistance setting when knob is left alone. CLAROSTAT made the first B-eliminators practical. Today, CLAROSTAT adjustable resistors are available in several types ranging from the tiny Grid Leak CLAROSTAT, with 1/10 to 10 megohm range and a rating of several watts, to the giant Super-Power CLAROSTAT in several resistance ranges with a rating of 250 watts, suitable for variable speed motor control and other power applications.

And then there is the complete line of Volume Control CLAROSTATS—100% wire-wound jobs, positive contact, velvety operation, positively noiseless, bakelite case with metal end plate, dust and dirt proof, available in all resistance ranges and with resistance variation matched to any resistance curve. The Volume Control CLAROSTATS are made in single, duo and multiple types and in any resistance value and combination to meet every conceivable single or multiple circuit control requirements.

CLAROSTAT FIXED RESISTANCE

Likewise in the field of fixed resistance has CLAROSTAT set new standards. There are the flat, wire-wound CLAROSTAT resistors, with accurately spaced winding held on special bakelite strip so that turns cannot slip or short. Rounded edges. Neat metal ends. Resistance value plainly stamped. Handy soldering tabs and mounting holes.

If desired, these flat resistors may be supplied with sliding contact. Also with a handy center contact for hum balancing purposes, in the form of the Hum-Dinger CLAROSTAT.

CLAROSTAT flexible resistors supply the need for an inexpensive yet accurate resistance—wire wound on flexible core and covered with high-grade insulating sleeve and provided with lugs.

CLAROSTAT AUTOMATIC RESISTANCE

Lastly, there are the Line Voltage Regulator CLAROSTATS, fitted to any radio set. An all-metal case, complete absence of glass, chemicals, gases or delicate filaments, instantaneous response to voltage fluctuations, long life, fool-proof operation—these and other features distinguish the Line Voltage Regulator CLAROSTAT from all other devices.

And the advantages of automatic line voltage regulation are available to the set with a built-in regulator receptacle, quite as well as to the ordinary set. For there is now offered the Line Voltage Regulator CLAROSTAT, for use in sets provided with a receptacle for line voltage regulation, as well as the *Automatic* Line Voltage Regulator CLAROSTAT which may be inserted in the attachment cord of any standard socket-power radio set.

“There’s a CLAROSTAT for *Every* Radio Purpose”

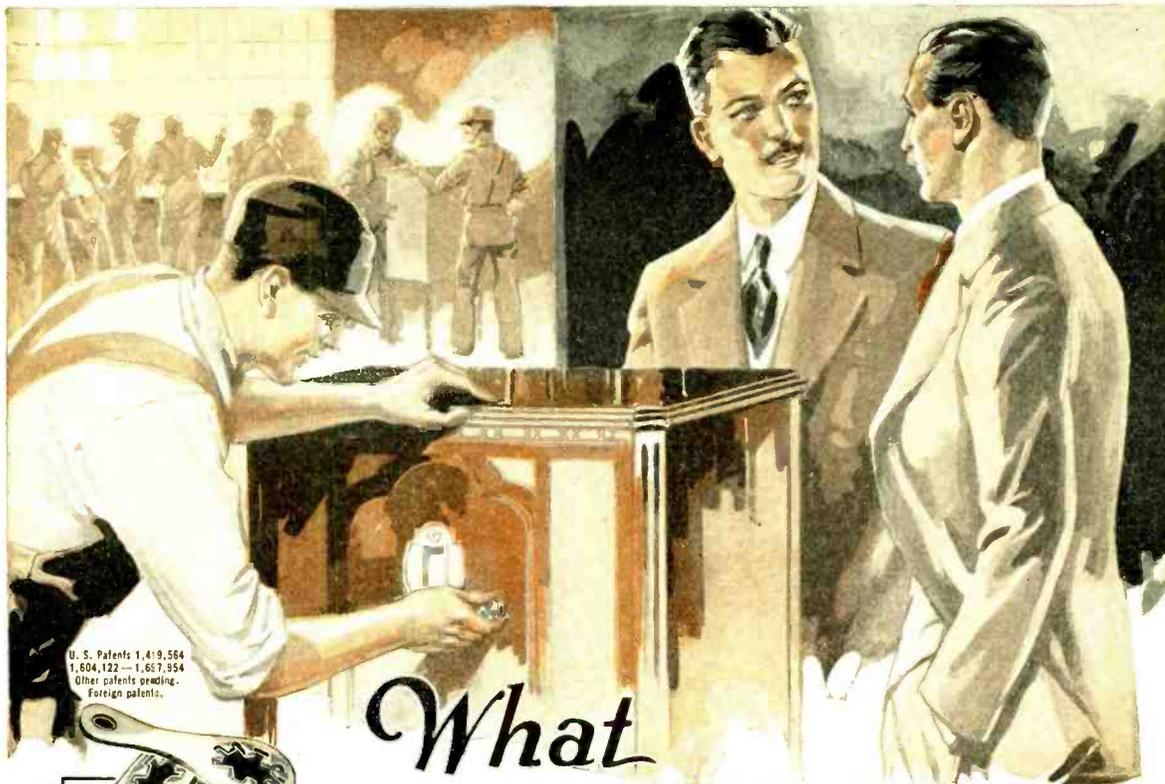
WRITE for data on the complete CLAROSTAT line. Do not hesitate to place your resistance problems before our engineering staff. Better still, if you visit the R.M.A. Trade Show, do not fail to look us up. Our engineers will be on hand to discuss your resistance problems.

Clarostat Manufacturing Company, Inc.

Specialists in Aids to Better Radio

282 North Sixth Street :: :: Brooklyn, N. Y.





U. S. Patents 1,419,564
1,604,122—1,667,954
Other patents pending.
Foreign patents.

What **SHAKEPROOF** means to the Radio Industry



Type 20. Locking Terminals
For Radio and Electrical Work



Type 12. Internal
For S. A. E. and Standard
Machine Screws



Type 11. External
For Standard Bolts
and Nuts



Type 15. Countersunk
For all Countersunk
Screws

EVERY radio manufacturer realizes he is facing a serious situation today. The public is demanding exceptional radio performance at extremely low prices. This means costs must be lowered but it also means that quality must be improved.

That is why practically every leading radio manufacturer is using Shakeproof Locking Terminals to insure absolutely tight connections. They have found by exhaustive tests that the Shakeproof principle has no equal. The twisted teeth provide the strongest contact possible and holds the terminal absolutely rigid thus preventing short circuits or faulty connections. These terminals also cut down production costs and make possible neater assembly work, too!

Shakeproof Lock Washers are what you need under every nut and screw. A test will show that they can improve the performance of your product and reduce service requirements to a minimum. Write for samples today!

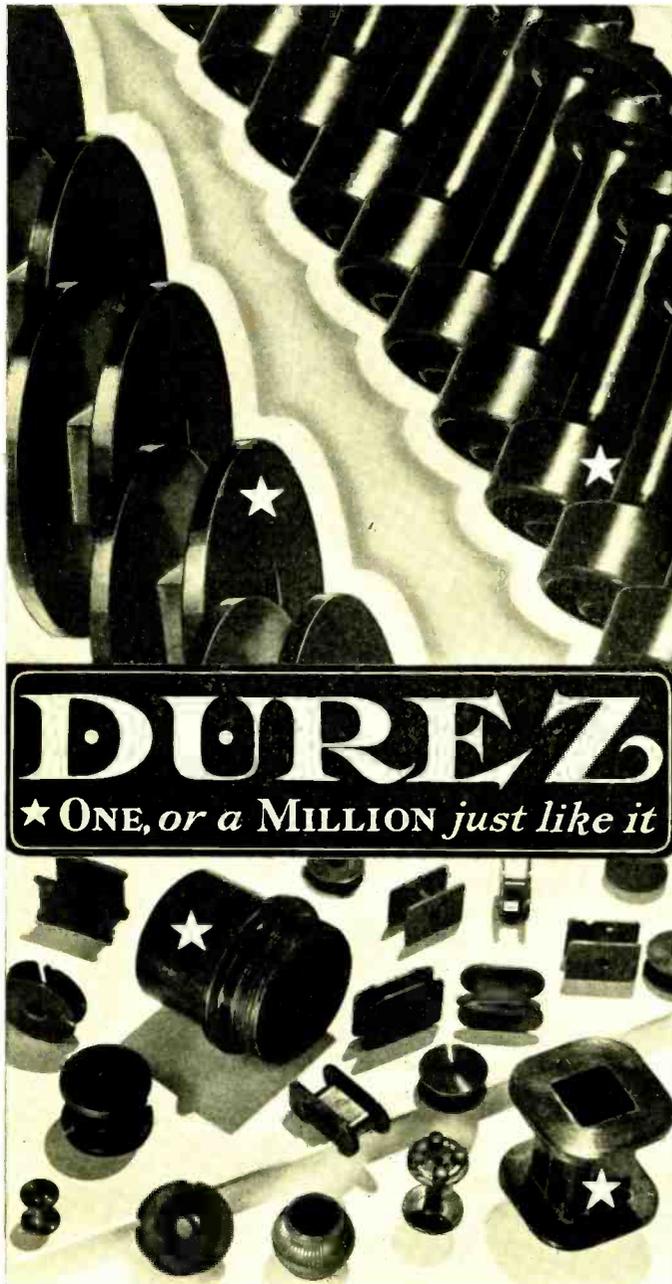


SHAKEPROOF Lock Washer Company

(Division of Illinois Tool Works)

2501 N. KEELER AVE. CHICAGO, ILLINOIS

If you're having trouble with spindles and spools . . . *switch to*



Write for this new, free booklet, "Do It With Durez." Illustrated, it contains complete information about Durez . . . physical and dielectric properties, color ranges, and scores of possible applications.

DUREZ!

You probably are. Ordinary spools absorb moisture. Some shrink with the room temperature, distort under operating stress. Some are heavy and cumbersome. Break easily. Uneven surfaces catch and hold material. If your present material is unsatisfactory from any of these standpoints, switch to Durez!

Durez is a basic molding compound. Spools, spindles, pulleys, and coils made from it are strong, hard, non-brittle. Able to stand heat without distortion. Unaffected by sudden changes in temperature, Durez will not warp. It virtually never splits, cracks or chips even under pressure. Due to its non-conductivity it is ideal material for winding coils.

And Durez is uniform. Every part molded with this perfect compound is the same, whether you turn out one or a million. Each with a smooth surface that will not catch or hold material. No unbalanced pieces. No variation in quality. When threads are required, threads are accurate. Molded, not cut, they seat easily, fit tightly. Studs and reinforcements are inserted in the one operation. . . . Durez spools are light, increasing speed of winding. They run smoothly.

You may not be interested in spools or spindles. But whatever your business, whatever parts you make or use, Durez can probably help you. Investigate! Our engineering and laboratory staff is available for a discussion of your particular problem—even though it be the corrosive action of acids, alkalis, solvents or soldering fluxes. Write to General Plastics, Inc., 65 E. Walck Road, North Tonawanda, N. Y. Also New York, Chicago, San Francisco, Los Angeles.



Now—FROST-RADIO engineers have banished *noise* from wire- wound volume controls!

The necessary use of wire-wound Volume Controls in high gain Radio Receivers has presented fresh problems to the manufacturer of potentiometers and rheostats. Such a unit is required in most circuits with a high resistance of from three thousand ohms to as great as forty to fifty thousand ohms in some instances. In addition, it is necessary that this unit be electrically and mechanically *noiseless in operation*. Previous standards and methods of manufacture having proved to be wholly inadequate, radically new and different materials and processes were required, and it remained for FROST-RADIO Engineers to develop these.

They have designed a new type of winding machine—making possible as many as 432 wire turns per winding inch, using enameled, oxidized or bare wire—as small as .002" diameter. (They consider the use of anything smaller than this to be non-commercial.) This provides as nearly "stepless" resistance progression as is practically possible in wire-wound construction. Means are provided for approximating a hyperbolic curve, if desired, and with exceedingly low values at hop-off at either end.

They have made possible the use of 3/64" thick high-resin-content laminated bakelite in the manufacture of winding strips. These strips are specially processed so that changes in relative humidity have no measurable effect upon them. Because of the thickness of the strip a broad contacting area is provided. FROST-RADIO Engineers have proven that most grades of so-called flexible bakelite have a low resin content between laminations and a relatively high moisture content. They know that with such material as a winding base danger of shrinking exists, with consequent loosening of wire and resulting noise in operation.

They have perfected an automatic device for rounding and polishing the contacting edge of



the wire. This process so perfectly forms the wire edges that there is not one ten-thousandth of an inch difference in height between any adjacent wires. A velvet smooth contacting surface is thus provided.

They have scientifically determined the exact contact pressure to be exerted by the arm to insure smooth, non-cutting and noiseless operation. The use of a special alloy spring tempered phosphor bronze in the making of the contact arm provides a low resistance contact and this unit is so accurately made that the variation in pressure is held to plus or minus six grains.

They have imposed exceedingly close tolerances on all machined parts. Illustrative of this insistence on precision workmanship—the shaft bearing is a reamed hole in brass, normally 3/8" in length and .251" in diameter. The shaft is ground steel needle stock .250" in diameter. This approximates a perfect bearing. The threaded thimble is so rigidly mounted in the container shell as to prevent shaft getting out of alignment when the unit is mounted on panel.

They have exhaustively tested the design and construction of these new units by subjecting them to a "life test" in comparison with competitive controls. *They recommend that all set manufacturers do likewise.* They have proven that the new FROST-RADIO Volume Controls incorporating the principles above described will withstand a fatigue test of two hundred thousand half-cycles, at a speed of thirty per minute, without evidence of wear on wire edge or contact arm, *and that they are as perfectly noiseless at the completion of test as before being subjected to fatigue.*

A complete treatise on the subject of volume controls has been prepared by our research laboratory. It deals exhaustively with the causes and remedies of noise in wire-wound controls. We will be glad to send a copy to any interested engineer.

HERBERT H. FROST, Inc.

Main Offices and Factory: ELKHART, IND.

160 North La Salle Street, Chicago

IMPRESSIONS *and* EXPRESSIONS

By

AUSTIN G. LESCARBOURA

And Now—The Tone Control

AT last! For years many of us have appreciated how simple it is to alter the apparent tone of a loud-speaker. A simple and inexpensive step-by-step condenser, or again the combination of fixed condenser and variable high resistance, will cause more or less slumping of the higher frequencies, thereby obtaining a greater bass effect and a more mellow rendition.

And we have also known of the problems of the average radio dealer in trying to suit varying musical tastes. Some buyers prefer a deep, mellow tone. Others prefer a harsh, sharp, dazzling tone. Again, some rooms, devoid of draperies, carpets and upholstered furniture, require a mellow, deep, subdued tone. Others, heavily furnished and carpeted, require a sharp, crisp rendition, which the room acoustics dull down to pleasing mellowness.

Hence there is no such thing as a universal tone quality. That is why one receiver will sell where another will not, under given conditions of room acoustics and listener tastes. Last season, some sets appeared with tone control adjustments at the rear. The serviceman was the only one who dared make adjustments. And frequently he didn't bother to do so. This year, several sets are being introduced with adjustable tone controls at the front of the set, on the panel, where the listener can adjust tone to room acoustics, listener tastes, and, what is highly important, to the individual program and transmitting station.

The tone control is positively the best merchandising feature introduced in many a moon. As engineering goes, however, it's an old story.

Let's Have Automobile Radio!

COMMENDABLE is the manner in which the radio industry has rallied to the support of the automobile radio idea. Legislators who have even suggested legislating against the use of a radio set in an automobile, have been met, contested, and, we hope, bested.

The radio industry needs automobile radio sets. Here is a vast and logical market which will go far towards offsetting our approach towards saturation in the home radio field. The field is agreeably disposed toward automobile radio, for, like the famous Mary's Lamb, the average man and woman today is prepared to have radio follow wherever he or she may go. And the legislators who have been unfavorably disposed—well, they simply do not know better. There is no greater danger involved in driving a car with radio than without radio. In the latter instance, many a driver falls sound asleep or is reduced to a state of self-hypnosis by constant and monotonous driving. The experienced driver, whose driving has been reduced to a purely routine matter, may certainly drive better with his mind kept active by the varying interest of radio programs, than if bored to death on a lonesome ride.

Let's have automobile radio! Let's get behind the idea! Let's put the legislators straight on what appears to be a genuine boon to safe and sane motoring!

Hand-to-Mouth Production

ONCE upon a time, the radio industry had dealers who stocked goods, jobbers who bought and warehoused merchandise which they sold to dealers, and manufacturers who produced on a given schedule without having to worry about the market. However, some evil influence came along and caused each radio manufacturer to produce frantically, possessed with the idea that he could supply most of the demand himself. Then jobbers began giving up warehouses. They stopped trying to sell. And in time, they became mere order takers. The dealers, seeing how the jobbers played the game, likewise became mere order takers, carrying only a few sample sets on the floor. And today, the manufacturer, seeing how jobbers and dealers play the game, is beginning to take orders and produce only as required.

There are set manufacturers this season who swear that they will produce only two or three weeks ahead of their commitments. There are tube manufacturers whose inventories have been reduced to the point where, if an order is received for 25,000 tubes of any one type, they must frantically assemble the necessary help, grease up and clean off the rusted equipment, and get going on a sufficient number of tubes to fill the order.

Of course this is the natural reaction from wild over-production. But the pendulum may swing too far towards conservatism, thereby introducing higher costs. A little conservatism goes a long way. Too much conservatism may yet prove fatal.

The Open Season for Television

PLENTY of television activities these days. It seems that almost every day, someone, somewhere, somehow, springs something new in television. The Federal Radio Commission is granting licenses here and there. Many transmitters are going on the air. Several interesting radiovisors are being offered to the public. More and better ones are presumably on the way.

Television is not exactly here—in commercial form. But unless we are very much mistaken, it is just around the corner.

Perhaps Not So Bad!

WE hear much about bad business conditions. We are led to believe that the bottom has dropped out of radio as it has presumably out of other industries. We hear pessimists at their best, these days.

And yet many radio manufacturers admit that their volume of business is about the same at this time of the year as it was in 1927 and 1928—really good radio years. Of course we fall far short of 1929, but that was a phenomenal year when production and sales went plain crazy. Perhaps, after all, conditions are not so bad. And if we would begin to think that way, they would soon be better. Why not try?

Visit the De Forest Exhibit at Booths B3 and B4 at the R. M. A. Trade Show—Atlantic City, June 2nd to 6th.



DE FOREST RADIO CO.
AUDION LIFE TEST

Type 427
selected from regular
production
Nov. 14TH 1929

Intermittent Test
15 minutes on; 5 minutes off

TEST NO. 135

Tested at
E_f = 2.5
E_b = 180
E_g = 13.5
Exhaust #6

Date	No. Hours	11-15	11-23	11-29	12-7	12-13	12-23	12-31	1-9	1-17	1-27	3-8	3-14	3-24	3-31	4-5	4-9	4-18
1	100	100	97	100	100	102	100	107	100	102	105	101	99	100	98	99	93	95
2	97	93	99	100	99	100	99	95	106	97	107	102	100	104	105	104	101	97
3	100	98	100	100	100	100	100	104	108	103	103	103	101	100	102	103	102	100
4	93	95	103	105	99	102	100	86	90	105	95	94	91	97	88	93	94	87
5	100	95	100	100	102	100	100	104	102	106	101	103	107	102	101	104	102	95
6	98	97	100	100	101	103	102	106	100	106	101	109	108	105	100	100	102	98
7	105	105	99	105	105	102	106	95	111	110	104	99	107	106	103	105	103	96
8	98	97	100	100	100	100	99	97	97	104	99	104	101	101	101	102	100	100
9	105	99	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
10	48	96	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

HERE is a typical life test on ten type-427 De Forest Tubes, taken at random out of regular stock. The chart shows that after what is equal to three years of normal tube use, every one of the ten tubes is far above the standard requirements for filament emission.

The more exacting the tests the more obvious is DE FOREST quality

PUT De Forest Radio Tubes to the most rigid engineering tests possible. Test for mutual conductance, amplification factor, plate impedance, gas current, grid to plate capacity, filament current consumption and any other standard tube characteristic. We welcome the most exacting tests known to the science of tube testing.

Then examine closely the mechanical construction of De Forest Radio Tubes, the rugged sturdiness of the element assembly, the husky, non-fragile oxide-coated filament—and the improved insulation of the cathode heater which is responsible for the absence of hum, buzz and crackle.

The more exacting your tests, the more clearly you will see why so many radio manufacturers, engineers, wholesalers and retailers—and listeners, too—prefer De Forest Radio Tubes.

In most types of De Forest Radio Receiving Tubes, oxide-coated filament is used, which gives a greater electronic emission—over twice that of the thoriated filament of the same types in other makes.

De Forest Audions are the original make. The first radio tube was invented in 1906 by Dr. Lee De Forest—and De Forest Radio Tubes have been made continuously since that time. Twenty-four years of tube-making research and experience are behind the De Forest product.

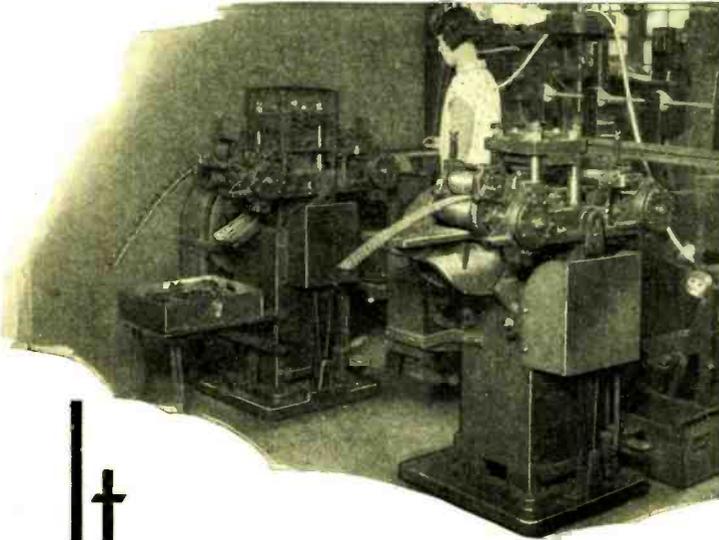
de Forest
AUDIONS
RADIO TUBES

DE FOREST RADIO COMPANY • PASSAIC, NEW JERSEY

Boston New York Philadelphia Atlanta
St. Louis Kansas City Denver Los Angeles

Pittsburgh Chicago Minneapolis
Seattle Detroit Dallas Cleveland

TEXTOLITE LAMINATED



It
**cold punches
 cleanly-smoothly**

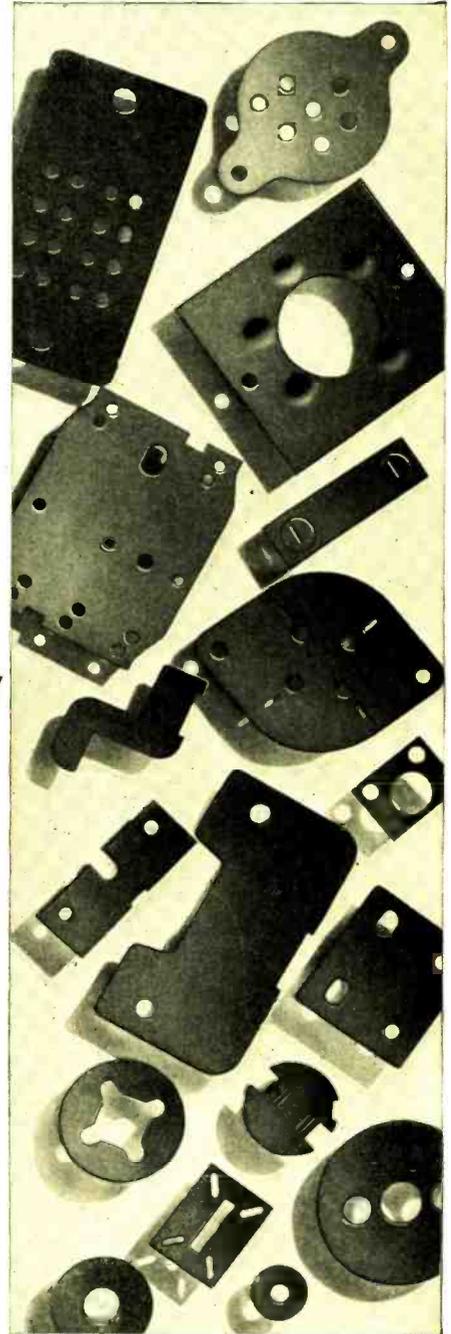
AMONG the many grades of Textolite laminated, General Electric has developed one particularly adapted for audio frequencies and other applications where insulation requirements are not relatively exacting. This grade has unusual facility for cold fabricating: its machinability and electrical properties exceed those of material hitherto available in this class.

Our eastern and western fabricators are available for consultation and are completely equipped to prepare special dies and to manufacture difficult pieces.

There is a Textolite specialist in your nearby G-E sales office.

General Fabricating Co.,
 165 Greenwich Street
 New York City

Electrical Insulation Corp.,
 308 West Washington Street
 Chicago, Illinois



JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY EVENING ON A NATION-WIDE N.B.C. NETWORK

GENERAL  **ELECTRIC** 885-46

SALES AND ENGINEERING SERVICE IN PRINCIPAL CITIES

RADIO ENGINEERING

Production, Administration, Engineering, Servicing

June, 1930

Annual RMA Convention and Trade Show

In Conjunction With Meetings of the National Federation of Radio Associations; National Association of Broadcasters; Radio Wholesalers' Association; Institute of Radio Engineers; Radio Press Organization.

THE entertainment program at the annual banquet of the Radio Manufacturers' Association will be provided by the Radio-Keltr-Orpheum Corporation, it is announced by B. G. Erskine, chairman of the Convention Committee.

The banquet is one of the main features of Trade Show week at Atlantic City, New Jersey, the week of June 2nd, when the sixth annual convention and Trade Show of the Radio Manufacturers' Association will be staged at the new municipal auditorium in that city. The annual RMA banquet will be held Wednesday evening, June 4th, in the grand ballroom of the auditorium.

The announcement that R-K-O will provide the program is in line with the RMA's previous promise that this year's entertainment will be the most elaborate and enjoyable the association has yet staged.

Outstanding stars of vaudeville, musical comedy and radio will headline a three-hour program of music, fun and girls that will be staged in the best R-K-O professional manner. The cost of the production, which will be in the form of a musical revue, will exceed \$10,000, according to Mr. Erskine.

Thirty thousand banquet invitations were mailed to the radio trade

between the 1st and the 15th of May, and it is expected that at least 3,000 diners will be on hand June 4th. This will insure that the 1930 RMA dinner will be the largest radio banquet to date, if not one of the largest banquets ever held in the United States.

30,000 Radio Tradesmen to Attend Annual Show

More than 30,000 members of the radio trade and industry from all sections of the country, will migrate to Atlantic City, the week of June 2nd, to attend the convention and Trade Show, according to H. B. Richmond, president of the Association.

Advance reservations insure a record attendance of well over 30,000 radio dealers, jobbers and manufacturers.

Unusual interest attaches to this year's radio trade exposition, owing to the unusual conditions prevalent in radio at this time. Many old established radio manufacturers have passed out of the picture and new ones have come in to take their places.

Also, several important manufacturers in the electrical and automotive fields who have not entered radio before, will make their debut to the radio trade at the



RMA OFFICERS.

Top: G. Clayton Irwin, Show Manager.
 Centre row: Jess B. Hawley, Chairman, Show Committee; H. B. Richmond, President; B. G. Erskine, Chairman, 1930 Convention Committee.
 Lower row: M. F. Flanagan, Executive Secretary; Morris Metcalf, Chairman, Reception Committee; Bond Geddes, Executive Vice-President.

June show and will display their radio receivers for the first time. Thus, the radio trade will be able to acquaint itself with the new lines prior to their initial presentation to the public in the Fall.

New models of the old-line radio set makers will also be presented for

H. B. RICHMOND, PRESIDENT OF THE R. M. A. SAYS:

"The radio industry has emerged from a most troublesome period, but is now able to look forward with great confidence. The recent disturbance has done much to clear the industry for a more successful and stable future.

"The sets being introduced this season are not characterized by radical changes. To be sure, there are many improvements. One improvement that does not appear on the surface (but which will become plain as the new sets are placed in service) will be a result of careful and thorough factory testing including careful check of all set characteristics in actual performance. The establishment of carefully trained service organizations will also do much to make radio better.

"These worthwhile developments have been aided by the message carried in RADIO ENGINEERING for many months past, which has accurately predicted the current trend."

the first time at Atlantic City. This, too, is for the trade only, prior to public presentation in the autumn.

Those radio manufacturers who exhibit at this year's trade show, Mr. Richmond said, are the ones who have successfully survived the depression of last Fall and may be expected to become the important and permanent nucleus of the radio industry of the future.

More than 200 radio manufacturers will fill the main exposition floor of the new \$15,000,000 civic auditorium with display and demonstration rooms. In addition to display booths, this

year's trade show provides facilities for the first time for demonstration rooms on the same floor and adjacent to the displays. Many exhibitors will also have headquarters and demonstration rooms at the leading Atlantic City hotels, along the boardwalk.

Trade show visitors will also have the privilege of half-fare tickets on the return trip from Atlantic City to their homes, all railroads having agreed to the reduction. Trade show travelers need only request a "certificate" when buying their tickets and have it validated at the show.

Special radio trade show trains and cars are being prepared in many cities, including Chicago, St. Louis, Cincinnati, Cleveland, Detroit, New York, Philadelphia, Atlanta, Columbus, Minneapolis, Buffalo and Boston.

Many specials are being prepared by the National Federation of Radio Associations whose members are located in a number of principal cities. H. G. Erstrom, of Chicago, is directing this work. The RMA committee is headed by Morris Metcalf of Springfield, Massachusetts. Jess B. Hawley, of St. Charles, Illinois, is chairman of the general trade show committee.

Lewis Predicts 1931 Trend

George Lewis, vice president of the Arcturus Radio Tube Company includes in an anticipatory analysis of trade show demonstrations five logical refinements in present radio equipment.

"It is quite possible," declares Mr. Lewis, "that an improvement in radio receivers may be effected with a modification of existing tube types. While such a change will not necessarily lessen the utility of our present sets, the purchaser will receive greater radio value for his money.

"Further developments along the lines of remote control are inevitable in this era of labor saving devices. The receiver that will find the most ready market, is the set that best adapts itself to that after dinner indolence—when programs are at their best and the inclination to move at its lowest ebb.

"Automatic volume control will add consistency and enjoyment in the reception of distant stations with still more receivers. And I anticipate the design of one or more manual, volume con-

BOND GEDDES, EXECUTIVE VICE-PRESIDENT OF THE R. M. A. SAYS:

Increased sales—at a profit—is the aim of every one in the radio industry. Several agencies are engaged constantly in pressure toward this sales goal. Among these are the broadcasters who constantly turn into the air programs which sell radio products.

"Another agency always at work in developing sales is the press, especially the radio trade press, in which RADIO ENGINEERING has been such a prominent figure for almost ten years. Another agency engaged in everyday sales promotion is the RMA, as well as other trade organizations.

"All of these agencies literally work without sleep. Their rank and file includes vast numbers of skilled executives whose busy brains are constantly at work on enterprises to increase radio sales—and at a profit. Fortunately for the radio industry it has an excellent trade press. Its periodicals, with RADIO ENGINEERING one of the leaders in its field, are deservedly of wide influence. It is recognized that the radio trade press is of a high standing among industrial publications and wields a powerful influence. It is a factor in upbuilding the radio industry which is universally recognized, and RADIO ENGINEERING has contributed much during the last decade in the orderly and constructive development of our great industry."

control systems that will control intensity of signals with absolutely no effect on quality (within the limits of permissible tube and speaker loads).

"And it seems logical to look for a radio, phonograph and home movie combination in the more elaborate layouts, utilizing, of course, the common audio amplifying system."

RADIO IN CENSUS IS NOT FOR TAXATION PURPOSES

The radio question in the 1930 census is not being asked for the purpose of taxing radio receivers, according to a statement made by Major Herbert H. Frost, chairman of the merchandising committee of the Radio Manufacturers Association.

A rumor that the radio question in the census is to secure information on which to base a government tax on radio sets was emphatically denied by Major Frost.

"The radio question was inserted in

the 1930 census at the direct request of the Radio Manufacturers Association." Major Frost said, "and the Association is unalterably opposed to any tax on radio. Our sole purpose is to secure information concerning the markets for radio products.

"The question on radio was inserted by census officials after repeated efforts by officers of the Radio Manufacturers Association, including Bond Geddes, executive vice-president, William Alley, merchandising manager, and the Hon. Frank D. Scott, our Washington representative. Their ef-

forts had the full approval and cooperation of important radio broadcasting as well as manufacturing interests, and certainly we would not combine our efforts to obtain something to which we are all definitely and vigorously opposed.

"The information we hope to obtain from the census will give us the first authentic count of the radio audience and will tell us the exact condition of the radio sales and advertising markets in every locality in the United States.

Hot Cathode Vapor Tubes

By Dr. Paul G. Weiller

The Rectifier Situation

ELECTRIC power transmission began with Edison in the eighties, at which time direct current only was used. Abroad, d-c. was still extensively used as late as 1910. In the United States alternating-current multiphase installations replaced d-c. at an early date. Today only a few of the older public service distribution systems still supply d-c.

There always was therefore an insistent demand for some means of converting a-c. into d-c. The logical step was to produce a unit consisting of a motor and a generator directly coupled; the motor-generator set, which to the present day probably furnishes the bulk of the d-c. power consumed, where it is not generated directly as d-c.

The motor-generator is somewhat lacking in efficiency and requires not inconsiderable attendance and maintenance.

Around 1910 the rotary converter gained some popularity. It was an improvement on the motor-generator as to efficiency but required rather more attendance than its older brother.

While there is no objection to improvements by complication within the generating station, any device located at the power consumers plant should require little or no expert care. Hence, the never ending efforts to produce rectifiers without moving parts.

The mercury arc rectifier in a glass vessel appeared approximately at the same time as the rotary converter, but never gained considerable popularity. It was used for a time in battery chargers until it was replaced by the tungar type tube. It remains however to this date a standby in electric railroad service. In fact, lately, large mercury rectifiers in steel tanks are being used for this purpose.

During the past 15 years the kenotron, several chemical rectifiers, vibrating reed rectifiers and dry rectifiers have been placed on the market, for a time meeting with favor, only to relapse finally to limited usefulness each in its special field, circumscribed by the severe limitations imposed by the characteristics of these rectifiers.

Limitations of Rectifiers

The mercury arc rectifier in glass is being made currently up to some 60 amperes. This type of rectifier can be used if properly designed up to a few hundred volts. It requires a rather elaborate accessory installation

and is therefore relatively expensive as to first cost, particularly for small size installations.

While such rectifiers are in use for higher voltages, in some places they do not appear to be popular.

Tungar tubes leave little to be desired up to six or eight amperes and up to 75-volt r.m.s. input. They can be used for somewhat higher voltages but are then apt to give trouble. Tubes up to 30 ampere capacity are being made and sold. The larger sizes have to be used with care and are subject to even narrower voltage limitations.

Most engineers are familiar with the kenotron, or high vacuum hot cathode rectifiers. They are the type generally used in radio, from the small representative, the 280, to the large air-cooled RW60 and the still larger water-cooled types used in transmitters.

The high drop across this type of tube and the fact that it is impracticable to make such tubes to pass more than a few amperes results in their availability for high tension and radio work only.

For a few volts only, with a few amperes current, some chemical rectifiers and the new dry rectifiers as the Elkon and Rectox have gained wide use. At present these cannot be made either for large current or for high voltages.

All of the devices here mentioned and a few others of less importance can be made to operate efficiently only within a narrow margin of voltage and current. None of them is therefore of general utility. Consequently the bulk of a-c. rectification is still being accomplished by motor-generator sets.

Hot Cathode Mercury Rectifier Tubes

When mercury vapor at pressures ranging from about one micron to one millimeter mercury column is present in a hot cathode vacuum tube, the gas is ionized by collision with the electrons emitted from the hot cathode. The charge on the positive ions offsets the space charge. Large space current can therefore be obtained at a negligible voltage drop from cathode to anode.

Early experiments were conducted with tungsten and thoriated tungsten filaments as emitters, seemingly with-

*New explorations
in higher frequencies
possible when oscillators
of large currents and
low voltages available*

out obtaining sufficiently satisfactory results to promise practical applications for such tubes.

Only some two years ago these experiments were taken up again in several quarters and coated filaments were substituted for those made of tungsten. Success was immediate.

Characteristics

The characteristics of high vacuum hot cathode tubes depend largely on their geometric parameters; that is, plate filament spacing, effective plate surface and filament surface. If a grid is present the dimensions of the grid also affect the tube characteristics.

In hot cathode vapor tubes the geometric configuration of the electrode has only a minor influence on their characteristics after the discharge is established. The total drop across the tube varies between 7 and 15 volts for commercial types.

The bulk of the drop is confined to a very small space around the cathode. The drop through the distance between cathode and anode, even when this distance is an inch or more, is negligible in the customary types of tubes with large diameter bulbs. It is however considerable if the discharge is confined to narrow tubes.

A substantial part of the drop is centered around the anode. This is plainly shown by the considerable amount of heat developed at the anode when the latter is of small size. Eight amperes will bring to red heat an anode one inch in diameter made of bright nickel.

The total drop in the tube is affected very little if at all by changing the spacing or the shape and size of filament and anode. It is affected materially by the filament temperature and by the mercury vapor pressure in the bulb. As the latter is dependent on the operating temperature of the tube the drop is, finally, dependent upon that.

The operating temperature is determined by the equilibrium between the heat generated in the filament and in the mercury vapor and the dissipation through the glass of the bulb. The drop therefore depends largely on filament temperature, filament power and the size of the glass envelope.

The breakdown voltage can be made very high in these tubes. The writer has seen some rectifiers of this type in daily use with an inverse peak voltage of 10,000 volts. It is probably possible to exceed this value considerably.

The breakdown voltage seems to depend mainly on the mercury vapor pressure and consequently on the operating temperature and not necessarily on the spacing. It is however very important to make anodes of generous dimensions if high breakdown potentials are desired, as heating of the anodes will cause breakdown at low potentials. It is also important to avoid sharp edges on the anode as these also cause breakdown.

The drop of these tubes varies very little from minimum to maximum load. The drop decreases slightly with increasing load. One type of tube for instance will show a drop of 9 volts at a fraction of an ampere and of 7 volts at 8 amperes, its maximum load.

The current voltage characteristic is therefore a falling one which is important for some of the possible applications of these tubes.

Construction Details

As an engineering problem the design of hot cathode mercury vapor tubes for high voltages and small currents is relatively simple. The most important requirement is low operating temperature which may easily be obtained by making filaments as small as possible and bulbs large.

As the current requirements of radio transmitters, for which purpose such tubes are largely used, are reasonable there is no particular difficulty. The heat which must be generated in the filament and within the gas itself, is entirely a function of the current passing through the tube. Filaments can therefore be made small enough and bulbs large enough without exceeding reasonable dimensions for either. So long as current requirements are moderate and space limitations wide when tubes are designed for ordinary power purposes (for instance for battery chargers) conditions are different.

A replacement tube for the six-ampere tungar rectifier must stand (in some rectifiers used in the moving-picture industry) as much as 12 amperes momentary load without deterioration.

It is a peculiarity of the coated filament that it is quickly destroyed if currents approaching total emission are drawn even during very short periods. It is therefore necessary to fit such tubes with filaments of quite respectable size.

Furthermore, there are some space and price limitations to be recognized. The new tube must fit existing appliances and devices and it must be saleable at a price preferably not higher than that of those now on the market. These considerations cause a limitation of the size of the vessel for the tube.

The finished tube operates at a higher temperature than types intended to rectify very high voltages. In this

way it is possible to use a bulb the dimensions of which will comply with the space limitations of existing devices. As the dimensions of the filament are so different from those used in tubes previously made the technic of coating such filaments must be varied from customary methods to suit the new conditions.

Formulas available for calculating filaments for high vacuum tubes are not applicable to vapor tubes. Because of the absence of the space charge much larger currents may be drawn. The heat dissipation in vapor is greater than in vacuum.

The heavy emission current drawn from the filament has the effect of considerably decreasing the filament temperature. It is therefore necessary to design a filament with a sufficient margin in this respect.

Contrary to vacuum tube practice nothing will destroy filament emission as quickly as low operating temperature. At the present state of the art a filament consumption of six watts per ampere is ample and allows for a 100 per cent overload for short periods. It is probably possible to improve upon these figures without resorting to methods for decreasing the heat radiation from the filament, by employing hollow cathodes.

With the help of such heat economy devices it is evidently possible to go below one watt per ampere in cases where extreme economy is essential.

Efficiency

The efficiency of the rectifier tube in its circuit depends of course on the total voltage. In the case mentioned above there is a filament consumption of six watts per ampere load current, and a drop of seven volts in the tube.

This drop causes power dissipation of six times seven, or, 42 watts. This added to the 36 watts used up in the filament gives a total power consumption of 78 watts.

In a 110-volt circuit the total power consumption at full load would be 660 watts. Of these the 78 watts consumed in the tube are a little over 11 per cent.

If the total line voltage is increased to 220 volts the power loss in the tube remains 78 watts as before, but this is only less than 6 per cent of the total power consumption in the circuit. It is therefore plain that the efficiency of the tube increases in proportion with the voltage employed.

However, even at 110 volts the efficiency of the rectifier tube is better than that of a motor-generator. For very low voltage, as used in electroplating, for instance, the efficiency of a rectifier constructed with these tubes would be of the order of 50 per cent. However, in low voltage practice even the efficiency of motor-generators is very low, and the tube has the advantage of much lower first cost, less maintenance and less supervision.

Availability

It is therefore plain that we have in

the hot cathode mercury vapor tube a rectifier of general usefulness from the lowest voltage used in industry up to 10,000 volts at present, and possibly for even higher voltage in the future. For low voltage practice the fact that the drop within the tube decreases with increasing current is an advantage as it tends to offset the increase in the voltage drop with increasing current in other parts of the circuit. This amounts to an improvement in regulation.

At present high voltage tubes are available for $\frac{1}{2}$ ampere, $2\frac{1}{2}$ and 6 amperes.

While, at present, hot cathode vapor tubes are largely used as rectifiers it is possible to use them as regulators, amplifiers, switch tubes or oscillators by proper modification, either of the tubes or the circuits or both.

It is to be noted that industrial use of high frequencies has been very limited due to the fact that the oscillator tubes at present in use require uncomfortably high voltages and do not permit efficient generation of large currents.

Oscillators which will permit the generation of large currents at reasonable voltages will open up vast fields of exploration and use to high frequencies. It is highly probable that hot cathode vapor tubes will make such applications possible.

ELECTRIC LAMP FIRMS FILE TRUST SUITS AGAINST R.C.A.

Summonses charging the Radio Corporation of America with violation of the Clayton anti-trust act were filed in United States District Court at Wilmington, Del., on April 25, by the Sunlight Lamp Company of Ohio and the Universal Electric Lamp Company. These and similar summonses filed during the last few months are being held up pending result of an appeal taken from the Federal Court to the United States Circuit Court of Appeals at Philadelphia by the Radio Corporation of America.

The R. C. A. has been charged by De Forest Radio Company with violation of the anti-trust act in having in its license contracts, a clause making manufacturers using R. C. A. patents in the building of radio sets equip the sets with R. C. A. tubes. The Federal Court here entered an interlocutory decree against R. C. A., and the latter took an appeal to the Circuit Court.

RADIO SHORT COURSE

A five-day short course for radio servicemen will be conducted by the General Extension Division and College of Electrical Engineering of the University of Florida at Gainesville, Florida, from July 7 to 12 inclusive.

While practically all of the manufacturers of radio receiving sets have conducted classes for their servicemen, this is the first time it has been possible for men to get instruction on the servicing of all types of sets.

Season-Cracking of Metals

By I. V. Williams

Mercurous nitrate and nitric acid solution test for metal parts.

MOST of us have seen badly cracked brass parts which formerly seemed perfectly sound. They may have been ornamental or complicated pieces such as light fixtures, or simple pieces such as flower bowls. This failure is often described by saying that the metal has "crystallized." Actually all metal is crystalline; the failure is not caused by crystallization but occurs between the crystals, thereby revealing the structure and giving rise to this false term. Such failures are now generally attributed to "season cracking."

This is a phenomenon characterized by cracking after manufacture, and often before the application of any external stress, of parts of seemingly sound metals which show good mechanical properties when tested in the ordinary manner. The name "season cracking" is probably applied due to the similarity of this form of failure to the cracking of timber when undergoing seasoning. The name is not truly descriptive and the terms, "corrosion cracking" and "stress cracking," have both been suggested to replace it. Neither of these terms is fully descriptive of the failure, however, and so the change of terms has never been accepted. Nickel silver, high nickel steel (20% nickel), aluminum bronze, and some other alloys are all subject to season cracking but the alloys principally affected are the brasses containing more than 20% zinc. The limits of composition for the other alloys have never been determined.

Fig. 1 is a photomicrograph of one of these cracks showing its intercrystalline path. It was found that the cracking could be avoided by heating the ratchets after assembly 450° F. for four hours.

There are two factors which together cause this failure: a stress in tension in the outer surface of the material and an accompanying corrosion. The stress in the outer surface is usually that left by the manufacturing process though it may be due to externally applied forces. No particular shape of material seems free from this effect. Cracking has been found to occur in parts produced by spinning, drawing, pressing, or rolling. There seems to be a minimum stress limit below which cracking will not occur, and although this limit has not been very well defined for any of the alloys, it has been accepted as lying between 10,000 and 15,000 pounds per

square inch for brasses. It has also been conceded that hard materials will stand a greater stress than will soft materials, probably because of the greater strength of the material. This is offset to some extent, however, by the fact that the same amount of deformation of a hard material will produce a greater stress in the finished part.

The corrosion which is a contributing cause of season cracking is not the type with which we are all familiar but is of a peculiar nature. The failure in almost every instance follows an intercrystalline path as shown in Fig. 1, though it will occasionally cut across crystals which are at right angles to its path. A similar failure has been produced in stressed material by a combination of mercury and ammonia, or their salts, and high humidity. It has been found that in general other reagents are not active in this way. Parts which readily cracked when placed in solutions of mercurous or ammonium salts, did not crack when subjected to the action of acids although they were deeply pitted and eaten through in many places when removed from the reagent. Mercurous salts, especially mercurous nitrate, have been found to be the most active in producing this type of failure. It is probably ammonia and atmospheric humidity which cause season cracking in materials in storage and in service since small amounts of ammonia are always present in the atmosphere, especially in industrial centers.

It has been found that this type of

failure cannot be prevented by covering the parts with lacquers or varnishes since these materials are permeable to the corrosive gases of the atmosphere, and although they will slow up the action, they will not prevent it. It has been found that polishing a surface, probably due to a flowing of the material over the intercrystalline boundaries, will retard the corrosion and greatly reduce the tendency to crack. It is also true that plating the surface will prevent cracking providing a continuous plate is produced. This, however, is very difficult to obtain in practice and as a result is not often used.

Several methods of prevention have been found to be effective. Two of these involve the removal of the stress from the surface layers of the material. The first is known as "springing" and consists of bending the material and straightening it several times, which results in a more even distribution of the stress and removes the concentration of stress in the outer layers. The second method, and the one which has been found to be most effective, is a low temperature annealing at a temperature varying from 300° F. to 600° F. for from two to six hours depending upon the alloy and the work it has received. This is the method that was applied in the example cited. This low temperature heating, which is below the recrystallizing temperature of the material, is high enough to remove the localized stresses left in the material by the cold working without softening it. Plating or polishing, as stated above, will delay corrosion and thus sometimes prevent season cracking for a considerable time.

A fairly well recognized test for season cracking has been adopted. This consists of placing the part to be tested for fifteen minutes in a solution of mercurous nitrate and nitric acid. It is generally conceded that parts which will not crack after this test will give a satisfactory life, and it is also generally held that any part which will crack in this solution will eventually crack in use. Parts such as bolts which will be subjected to external stress should have this stress applied to them while under test as the two factors, stress and corrosion, must always be present to produce season cracking.

—Bell Laboratories Record.



Fig. 1. In this photomicrograph it may be seen how the crack follows the crystal boundaries.

A Noteworthy Development in High-Frequency Measuring Equipment

Description of Signal Generator Equipment.

By H. D. Oakley *

BEFORE touching matters concerning attenuators attention will be directed to certain characteristics of high-gain, high-frequency amplifiers. A familiar example of this type of amplifier is contained in every broadcast receiver. A radio receiver responds to one particular station and (theoretically) is unresponsive to all others. And very often the potentials supplied to the receiver by the desired station are hundreds of times smaller than those supplied by the undesired ones. The values of the potentials infesting one's antenna can cover an enormous range—from a fraction of a microvolt to more than one volt. It is quite obvious then that the service conditions under which a radio receiver is expected to perform are extremely severe and to produce an amplifier which will be even somewhat satisfactory requires very careful design.

After an amplifier has been built it is of great interest to subject it to a series of measurements to determine how closely its actual performance follows that predicted by the design and also to find out what can be done to improve that design. To make such measurements there must, of course, be available apparatus with which it is possible to supply to the amplifier voltages having characteristics exactly the same as those to which it will be subjected in actual service; the principal characteristics being frequency and amplitude. Also the absolute values of the characteristics must be determinable.

The Attenuator

With this apparatus voltages having any desired characteristics can be set up and the values of all the characteristics, except amplitude, can be determined. There must be something between the signal generator and the amplifier with which it is possible to control the amplitude of and to determine the value of the voltage supplied to the amplifier. This something has been given the name "attenuator" because it receives a relatively high voltage and delivers a much smaller one; it reduces or attenuates the voltage. There have been built various forms of attenuators which have performed with varying degrees of satisfaction, especially when aided by correction curves,

experience, and judgment. These have given results in the form of figures, perspiration, and profanity.

There has been developed an attenuator for which those who are most intimately associated with it claim: an extremely wide range of attenuation, ease of manipulation both with respect to making the actual settings and to obtaining the value of the voltage supplied by the attenuator, voltage determinations are made without the use of either correction or calibration curves, and precise results are obtained.

The Mutual Inductor Attenuator

This new piece of apparatus has been given the name "Mutual Inductor Attenuator" because it makes use of mutual inductance to effect voltage attenuation. The principle upon which its design is based is: if a voltage be applied to the primary coil of a mutual inductor the induced voltage in the secondary coil will be a function of the mutual inductance between them; the inductance of the primary coil and not a function of frequency, provided the resistance of the primary is small compared with its reactance. With this principle in mind the ideas back of the attenuator developed in some such manner as this:

If across the primary of a variable mutual inductor there be connected a voltmeter, then there can be applied to this combination voltages sufficiently large to operate the voltmeter, but they may be entirely too great to impress upon an amplifier. Obviously if the amplifier be connected to the secondary of the inductor a voltage smaller than that existing across the voltmeter can be impressed on it. Now if the ratio of the secondary induced voltage to that impressed on the primary be known, and also the value of the primary impressed voltage, the value of the voltage induced in the secondary is known immediately from the product of this ratio and primary voltage. If the voltmeter be correctly calibrated and the ratios for every possible setting of the variable mutual inductor be known, quite a range of secondary voltages may be obtained and their values easily determined from the known ratios and the voltmeter readings. But this range may not be sufficient to meet certain requirements. To extend the range the secondary coil of the mutual inductor can be con-

Radio manufacturers and laboratories now have available a new and useful instrument

nected to the primary of a fixed-ratio inductor and the range extended by the amount of the fixed ratio. If the range still be insufficiently extended this first fixed-ratio inductor can be replaced by another of greater ratio with a corresponding increase of range.

Two Problems

There were two main problems encountered in the development of the attenuator: first, controlling conditions so that there will be supplied to an amplifier only that voltage existing in the secondary system of the attenuator; and second, creating a design embodying these ideas, such that the amount of mental and physical labor required of an operator to make a voltage determination shall be as small as possible.

The importance of the first problem will be evident when one considers that a modern high-gain amplifier can respond to potentials of a few or even a fraction of a microvolt, and that unless special precautions are taken there may exist ambient fields capable of generating in the input circuit of an amplifier voltages many times greater than those intentionally introduced by the attenuator. The reduction of these fields to a value where they cause no appreciable effect on measurements has been accomplished by the practice of carrying on measurement work with the operator and amplifier situated within a room which is completely surrounded by layers of metal screening. This eliminates all fields with the exception of those that may arise from the attenuator itself. To guard against these the attenuator is mounted permanently on the wall of the screened room and very carefully and thoroughly grounded to the screenings. Also the various units of the attenuator are well shielded. The importance of the shielding is evident when one understands that within the attenuator there often exist potentials millions of times greater than those which exist across its output.

The second problem is qualified by the requirements that must be satisfied by the attenuator. The present design is intended to meet the following requirements: maximum attenuation range, five million to one; maximum output potential, one volt; operate without appreciable error over the

* Of the General Electric Company.

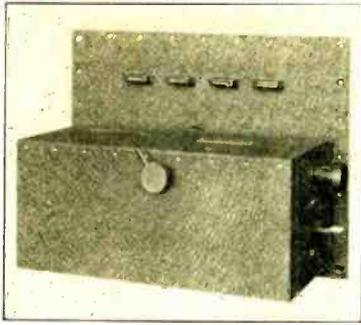


Fig. 1. Mutual inductor attenuator.

broadcast band of frequencies (550-1500 kc.); introduce into circuits to which it is supplying voltage no appreciable resistance or reactance; if possible voltages to be determined without the aid of calibration curves.

Four Main Units

The attenuator as actually constructed consists of four main units: primary voltage control, primary voltmeter, variable-ratio mutual inductor, and fixed-ratio mutual inductors. All the units except the first are located within a metal box. This forms the case of the device and also serves as a shield to prevent stray field from reaching points outside the attenuator. The primary voltage control is simply a resistance box by which the current flowing through and hence the voltage across the primary of the variable mutual inductor can be set to any desired value. The box itself is outside the shielded room but is controlled from within that room.

The primary voltmeter is a thermocouple of special design. The junction is fastened to one end rather than to the middle of the heater. This construction allows one end of the heater and also one side of the meter (connected to the junction) to be grounded. This eliminates any errors that might exist due to the capacity of the meter shunting current around part of the heater.

The variable mutual inductor consists of two D coils. One, the secondary, is fixed; the primary can be rotated through an angle of something less than ninety degrees. D coils are common enough so that a detailed description of them is unnecessary but attention is called to the D coil characteristic because it is of great value in rendering the attenuator direct reading. Fig. 5 is a curve obtained by holding a constant voltage across the primary of a mutual inductor made of two D coils and noting the secondary voltages for various angular displacements of the coils. The ninety degree position is where the two coils are at right angles and the zero position when the two coils are aligned. The curve is a straight line from ninety to about 15 degrees. The attenuator inductor is constructed so that

only that region between 90 and 15 is used, so the dial can be engraved to be direct reading and also a linear scale. When the coils are in the 15 degree position the mark on the dial is 100, and when on the 90 degree the mark is zero. The space between these two points is then divided into 100 equal parts. A calibration curve for the variable mutual inductor would then appear as shown in Fig. 4, a straight line. The coils are inside a metal can (shield) which protects them from external fields and also prevents them from causing disturbances beyond the confines of this shield. Between the coils is an electrostatic screen so there can exist nothing but magnetic coupling between them. The secondary coil leads pass out of the shield into a second shield.

In the second shield can are three coils. One is the common primary of the other two and the combination of the three constitutes two fixed-ratio inductors. The leads of the two secondaries terminate in studs. There is also another pair of studs in some way associated with the primary coil. An inspection of the diagram shows that these studs are really terminations of the secondary leads of the variable mutual inductor.

Output Terminals

Outside the attenuator is a double-contact plug. The leads from this plug are the actual output terminals of the attenuator. Three slots are cut through the attenuator case so that this plug can be connected to any one of the three sets of studs within the attenuator. To avoid any chance for errors when using the attenuator the operation of inserting the plug in the attenuator is supervised by a slide controlled by a knob. On the shaft of the knob are engraved three numbers corresponding with the three plug positions. Only one of these members is visible at any one time and the plug can be connected only to that set of studs related to the visible number; the other two slots being covered by the slide. For purposes of identification these numbers are called the ratio-

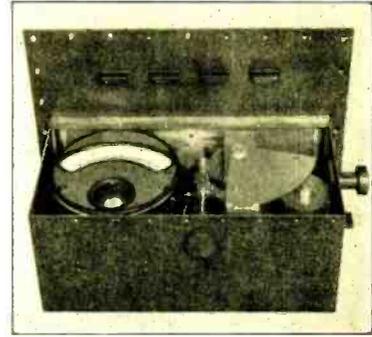


Fig 2. Mutual inductor attenuator without cover.

numbers: they are 1, 100 and 10,000.

The pictures, Figs. 1 and 2, illustrate the locations of the main units. The small cylindrical can in the back center of Fig. 2 contains the voltmeter thermocouple; the microammeter is of course the voltmeter indicator. In the center is the variable-ratio inductor dial. The worm, gear, and knob for setting the inductor to any desired point are also shown. The cylindrical can at the right contains the fixed-ratio inductors and on the upper right-hand side of the case is the knob of the selector slide. A slot is cut in the top of the knob bearing and it is in this slot that the ratio number appears.

Calibration

The calibration is carried out in three main steps: calibration of the voltmeter, checking the inductor scale, setting the fixed-ratio inductors. In explaining these operations the following terms will be used: one coil, 100 coil, 10,000 coil. One coil means that coil to which the plug is connected when the ratio-number one is visible, and it actually is one of the fixed-ratio secondaries. Similarly 100 coil is the other fixed-ratio secondary, and 10,000 coil is the variable-ratio inductor secondary. To calibrate the voltmeter there is connected to the output plug a thermocouple whose readings have been calibrated in terms of voltage

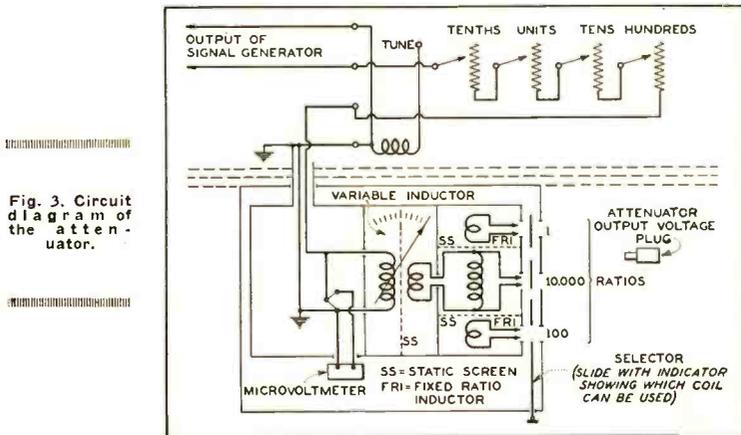


Fig. 3. Circuit diagram of the attenuator.

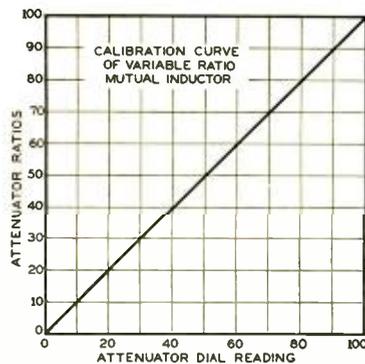


Fig. 4. Variable mutual inductor calibration curve.

across its heater. The plug is connected to the 10,000 coil. The resistance of the heater of the thermocouple is so high (700 ohms) compared with the reactance of the coil (10 ohms max.) that there exists no appreciable error when the voltage across the couple and that induced in the coil are considered equal. This couple will be called the calibrating voltmeter to distinguish it from the attenuator voltmeter. The inductor dial is set on 100. The current to the primary of the attenuator is adjusted until the calibrating voltmeter indicates one volt. There is a resistance in series with the junction and microammeter of the attenuator voltmeter. This resistance is adjusted until the attenuator voltmeter reads full scale. This point is marked one microvolt. The current to the primary is reduced in steps so that readings of 0.95, 0.8, 0.85 volts, etc. are obtained on the calibrating voltmeter and the corresponding points of 0.95, 0.8, 0.85, etc. microvolts are marked on the attenuator voltmeter scale. The markings are carried on down to 0.2 microvolts. After the scale has been calibrated it is taken off the meter, and the required marks and numbers put on. The scale is then replaced and rechecked to make sure its markings are correct. A question may arise as to why the scale is marked in microvolts when the calibrating voltmeter was indicating volts. The answer is because of the way it is intended that the at-

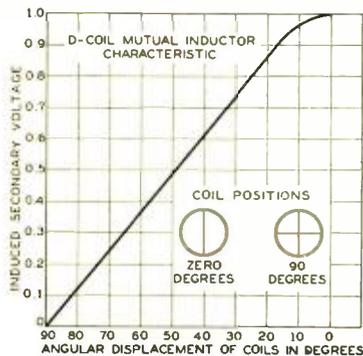


Fig. 5. Characteristic of a D-coil mutual inductor.

tenuator shall be used in service. During this calibration the ratio-number was 10,000 and the inductor dial was set on 100. Now the attenuator has been built to be direct reading so if, when the calibrating meter indicated 1 volt, the same value had been marked on the attenuator voltmeter scale then at some later time when the device was in service someone reading one volt on the scale and multiplying it by 100 and then by 10,000 would have arrived at a value of 10^6 volts for the attenuator output voltage, obviously the wrong answer. But with the voltmeter scale marked one microvolt, the value 10^6 microvolts is correct.

Checking the Scale

Checking the variable inductor scale may be accomplished in a number of ways, but one method only will be explained here. The plug is connected to the 10,000 coil and to the plug is connected some sort of an indicator, usually a crystal meter, and some device for controlling the sensitivity of the combination. The inductor dial is set on 100, the input to the primary adjusted until the attenuator voltmeter reads 0.5 microvolt, and the reading of the crystal meter noted. The inductor dial is then set on 50 and the input adjusted until the voltmeter reads 1.0 microvolt. If the inductor and its dial have been properly set the crystal meter reading should be the same as under the first set of conditions. Checks along any part of the scale can be made in a similar manner and should any deviations be found they will be small if the attenuator has been well made.

The fixed-ratio inductors have been constructed so that they may be varied for purposes of calibration, but after having been set so that their ratios are as desired the coils are locked in place and in service act as true fixed ratios. To the attenuator output plug is attached some sort of indicator, usually a receiver with a tube voltmeter across its output, and the plug is connected to the 10,000 coil. The inductor dial is set on 20 and the input to the attenuator is adjusted until the voltmeter reads 0.5 microvolt. The indicating receiver is adjusted until some convenient reading is obtained on the tube voltmeter. The plug is then removed and connected to the 100 coil. The inductor dial is then set on 100 and the voltmeter reading fixed at 1.0 microvolt. The 100 coil is then turned until the tube voltmeter reads the same as when the plug was connected to the 10,000 coil. Several checks are made to make sure the coil is correctly set. The ratio now between coils 10,000 and 100 is 10.

The procedure described above is followed with respect to the 100 and the one coil, adjusting the one coil until the ratio between the two coils is 10. Now, since the ratio between the 10,000 and 100 coils is 10 and between the 100 and one coils is also 10, it follows that the ratio between 10,000 and one coils is 100. It is exactly the ratio de-

sired between the 10,000 and 100 coils. So, leaving the primary voltage and the variable mutual inductor set at convenient points the attenuator plug is connected first to the one coil and then to the 100 coil. This coil is then adjusted until the reading of the tube voltmeter is the same for the two coils. When this condition is reached the ratios between one and 10,000 and between 10,000 and 100 are both 100. The 100 coil is locked in place. The ratio between the one and 100 coils must now be set to the desired value. At present the ratio is one, but the desired ratio is 100. The plug is connected to the 100 coil, the inductor dial set on 5, adjustments made so that the voltmeter reads 0.2 microvolt, and a convenient reading obtained on the tube voltmeter. The plug then is connected to the one coil, the inductor dial set on 100 and the voltmeter made to read 1.0 microvolt. The one coil is then adjusted until the tube voltmeter reads the same as it did when the plug was connected to the 100 coil. The ratio between the one and 100 coils is now 100, the desired value.

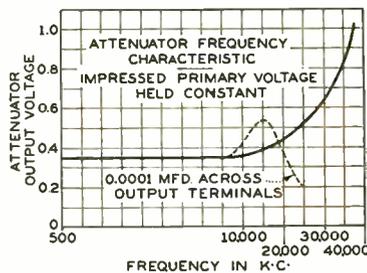


Fig. 6. Frequency characteristic of the attenuator.

As a further check on the correctness of its setting, comparisons can be made between readings obtained in the tube voltmeter with coils 10,000 and 100 and with 100 and one. If the last ratio has been correctly set identical results should be obtained. The one coil is then locked and the calibration of the attenuator is completed.

The determination of the voltage at the output of the attenuator is very easily done—simply the multiplication of three figures: the voltmeter reading, the inductor dial reading, and the ratio-number. For instance, if the voltmeter reading is 0.7 microvolts, the dial reading 36, and the ratio-number 100, then the output voltage is $0.7 \times 36 \times 100$ or 2520 microvolts. Again suppose the values were, respectively, 0.8, 0, and 100, the voltage would then be zero which demonstrates a very useful feature possessed by this attenuator. It is the ease with which a test can be made for detecting the presence of undesired potentials. To illustrate, imagine a set-up to have been made for carrying on a series of measurements and it is suspected that there are present poten-

(Concluded on page 47)

Radio Antennas

By E. F. Martin, Consulting Engineer.

An Introduction to a New Theory Regarding Various Antenna Systems; Their Properties of Transmission and Reception.

Theory of antenna Arrangements to set up Various forms of Radiation

THERE are three fundamental types of antennas: The vertical: the wave, and the loop or coil antenna. It is the purpose in this article to state the advantages and disadvantages of each type; their various uses and adaptability in directional systems of transmission. What is stated for transmission phenomena applies also to reception, unless otherwise excepted.

The vertical antenna is the simplest type of radiator and collector of energy, and although perhaps the most complicated in operation, more can be accomplished with a vertical or a combination than with any other fundamental type. The interaction theory presented is, the writer believes, original with this presentation, and is an entirely new conception of antenna action, and clarifies many obscure points.

As a radiator of energy the vertical antenna is an efficient liberator for all directions at right angles to its plane; that is, its radiation will be equal to all directions except vertically (Fig. 1A). The reason for maximum transmission at right angles for a single vertical wire is exactly the same as for a wire heated to incandescence: the most light will be, under such conditions, at right angles to the heated wire—very little light in comparison will be emitted looking at the wire's cross-section. Alone, therefore, the vertical antenna displays no directional properties. Because it is not an aperiodic structure it must be tuned. It therefore resides in the class of selective circuits, introducing the frequency discrimination characteristic of this class of antennas. Yet, the uses to which the vertical antenna may be put are not as limited as with other types.

The wave antenna, under favorable conditions, displays marked directional characteristics. It comes under the class of aperiodic antennas because it is a fixed structure. It therefore is not a selective circuit, but will respond with almost equal intensity to a wide range of frequencies. Its maximum receptivity or radiation is in its plane, that is to say, in the direction in which it points.

The loop antenna has the advantage of being compact and portable. Be-

cause of its usual dimensions it is apparently undesirable as a transmitter of energy for large distances; but as a directional collector of energy, when associated with the proper equipment, it has great utility and has a wide range of applications.

Polar curves are used to show radiation properties. That is, why antennas are directional and to what extent. They may be either calculated or measured. When measured this is done by the use of instruments showing microamperes per meter, the locations of equal intensity being ascertained and then plotted on polar coordinate paper. When calculated, it is usually by adding or subtracting algebraically the positive and negative radiations in order to derive the resultant radiation.

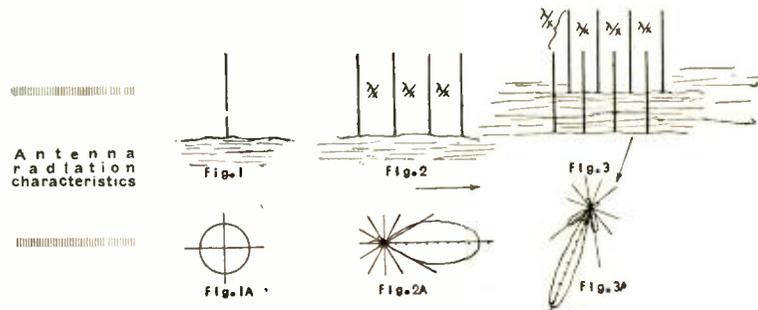
The Vertical Antenna in Directional Transmission

The vertical antenna is becoming popular for short-wave radiation because of its efficiency in the transmission of these waves. The vertical antenna is an inefficient radiator for waves exceeding about 200 meters, although it has been successfully used on slightly longer waves. Generally speaking it is not efficient for such radiations. The construction of the directional or beam type is in one of two forms: the type making use of an array so placed as to produce directive results by wave interaction between the individual antennas (Figs. 2, 3); the type yielding directional results by reflection, and this is accomplished using a paraboloid, the radiator being either at the focus or slightly removed outward (Fig. 4).

Some of the methods of vertical antenna transmission are shown in Figs. 1, 2, 3. They consist of two or more vertical wires separated by a specified fraction of a wavelength apart with relations imposed upon the amplitudes and phases of the currents in each.

When two vertical antennas are excited one-half period of phase and the distance between each antenna is one-half wavelength, there will be a minimum transmission in the direction at right angles to the array (Fig. 6); while when no phase difference exists between antennas, the spacing remaining the same, there will be a minimum transmission in the direction of the array (Fig. 5). As will be seen from Fig. 6 the resulting motion of the interacting waves is twice the amplitude of the individual motion, these motions, combining in phase. But their individual right angle motions (Fig. 6A) are exactly 180 degrees out of phase, therefore a complete cancellation of energy. The action opposite to this is shown in Fig. 5A. As will be seen, the direction in line with the array shows no resultant motion because the individual excitations are exactly 180 degrees out of phase, but in the action or motion at right angles to the direction of the array, we have a resultant motion. It is, however, just the amplitude of a single wave motion because the two do not combine to make an increased resultant, but simply propagate separately, not interfering, and so constitute the wave front.

The polar diagrams corresponding to the particular wave interactions are shown in Figs. 5B, 6B. So that the radiations of all transmitters may be



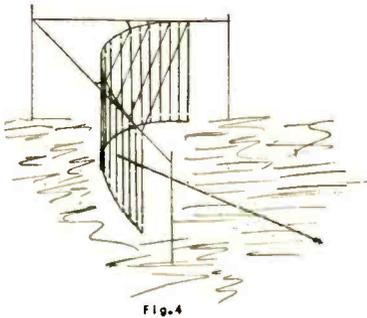
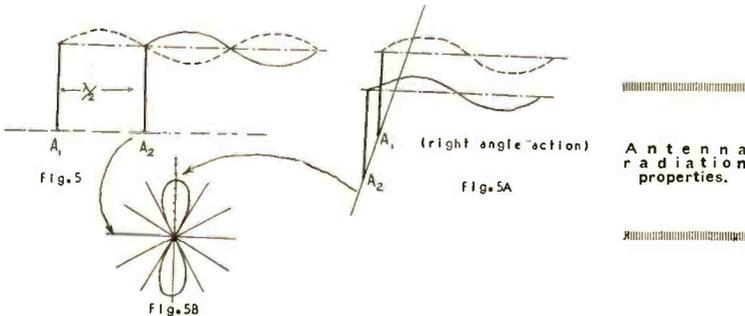


Fig. 4
Directional antenna structure.

shown on the same basis, thus making comparison easy, polar diagrams of radiations are shown in units of one. A radiation that reaches to the figure one will obviously be that of a perfect transmitter. And such cases in practice can never be. It might be said that distance comparisons on these diagrams are in a certain per cent of this "one." This then, regardless of power used, or distance reached in miles, reduces all diagrams of radiation to the same level where they can be compared.



Directive Transmission of the Loop and Vertical Combination or Two Vertical Antennas

The types of radiation produced in Fig. 7 can be produced also by using one vertical wire and a loop antenna, placing the vertical wire at the center of the loop. The two must be fed with equal energy and this energy must be in phase. Other radiations are produced when they are not in phase. The effects on radiation produced by varying the amplitude, that is, the amount of power furnished each antenna of the loop and the vertical wire are shown in Fig. 8, 8A, 8B. The large circle (Fig. 7) is the radiation of the vertical wire (radiation equal to all directions). The two small circles represent the radiations of the loop. The loop energy is in two equal circles because it is the radiation of the two vertical windings. The two horizontal windings have also such a radiation but they are in a different plane, at 90 degrees to the vertical. We can not, therefore, show the energy of the horizontal component on the same

paper. These two radiations then (vertical and loop) are superimposed producing the resultant shown in dotted lines (Fig. 7). As the energy of the loop is made greater (Figs. 8, 8A, 8B) than that of the vertical wire, back end radiation increases and front end radiation decreases, until finally the energy of the vertical wire becomes zero leaving but loop radiation (Fig. 8B). This is as should be expected. Results just opposite to these are produced by decreasing the loop radiation. This allows the radiation circle of the loop to gradually become less as the vertical radiation becomes more and more prominent, until finally nothing is left (when the loop energy becomes zero) but the radiation circle of the loop.

The Vertical Antenna With a Parabolic Reflector

Another form of vertical antenna radiation is that using a parabolic form with the antenna at the focus. These types of construction appear usually in three forms. A parabolic reflector with a wire for radiation at the focus; a parabolic reflector with an array of vertical antennas in the focal line, the first one being at the focus; a parabolic reflector with a ra-

diator is shown in Fig. 9. Further analysis of this action would necessitate investigation of the physics of wave motion. On a polar diagram this directive transmission is represented similar to the one shown in Fig. 3A.

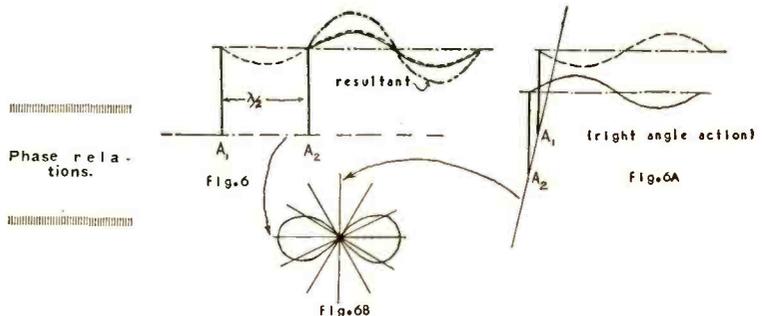
From previous knowledge of wave interaction an inspection of this case reveals that frequencies must be avoided which complete one-quarter of their wavelength in traveling from the radiator at the focus to the apex, or center point, of the paraboloid, if we are desirous of conserving radiation energy. If, however, such frequency be chosen, the emitted one-quarter back-wave will, upon being doubled back (reflected) and passing the focus, be just 180 degrees out of phase with the directly emitted wave thereby adversely affecting the most important, the central, radiation. In fact, any multiple of such frequency will act in a manner similar. This might appear to be an almost unnecessary precaution, the minute motion having but little effect on the entire radiation. This is not so. If little attention is paid to small individual radiations there will be no large radiations. In the next place, this wave cancellation affects more waves or motions than just itself. It will cancel out any waves that occur in other parts of the paraboloid, to fall in the opposite phase.

Recently there has been discussion among engineers as to the efficacy of a radiator placed at the focus of a paraboloid. By experience and experiment it has appeared to these engineers that certain advantages are realized when the radiator is not at the focus, but no one has to date published reasons in support of this. On the other hand there are some definite advantages in placing the radiator at the focus. The writer's stand on this controversy may be summed up as follows: We know that light beams act in a manner very similar to radio waves in this case. We know that, in the case of light radiations, there is only one place where incoming light beams converge after reflection—the focus. It is therefore just so with radio waves, both in transmitting and reception.

The parabolic reflector when in a horizontal position employs a radiator usually placed somewhere in the focal line, never more than a fraction of a

diator in the focal line, but both radiator and reflector constructed horizontally instead of vertically.

The parabolic construction is shown in Fig. 4, its action is quite similar to that of light waves emitted from a reflector. Waves emitted from the radiator proceed out in all directions, the rear ones striking the reflector, are thrown back, and are directed straight out, thus reinforcing the waves emitted longitudinally from the focus. The spreading out action and the reflecting



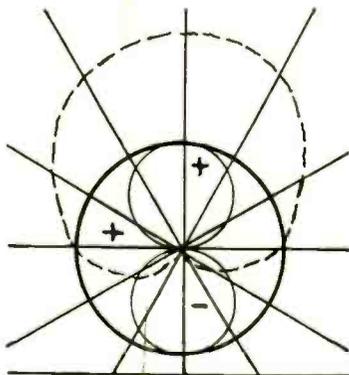


Fig. 7. Resultant of vertical and loop radiation.

wavelength from the focus. Some recent experiments made use of a radiator one-quarter wavelength from the apex of the paraboloid. This may appear to be in contradiction to the previous statement, considering the success of the venture. But, the radiator, in this experiment was not placed at the focus. The condition presented provides that it must be so placed in order to hold true.

The Wave Antenna

A wave antenna may be considered as composed of numerous separate horizontal antennas in the same plane. The simplest form would be one wavelength long and placed in the direction of the desired field. It has equipment for receiving or transmitting at the

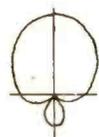


Fig. 8. Vertical antenna and loop antenna. Vert. 1/3 energy of loop.

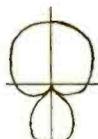


Fig. 8A. Vertical & loop antenna. Vert. 1/2 energy of loop.



Fig. 8B. Radiation from loop antenna.

Effect of increasing energy in the loop.

end farthest from the originating or terminating location (Fig. 10) and the end nearest terminated to ground through an impedance equal to that of the line. Equal to that of the line because reflections occur otherwise. Such actions impair the efficiency of the structure by rendering it bi-directional instead of unidirectional. An antenna constructed on the wave principle is aperiodic, because it is not changeable and also such antennas are not tuned. It is not necessary to tune them. Their length is designed for a

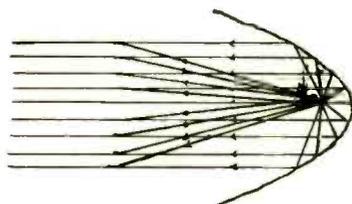


Fig. 9. Spreading effect after reflection.

definite frequency. If another is desired the length must be changed. The antenna is decidedly directional, and when acting as a collector of energy the major response of the antenna is to the horizontal part or component of the incoming wave. The energy radiated from such an antenna system has advantage over the ordinary non-directional type to the ratio of about six to one.

An ideal antenna has no attenuation and has a velocity of propagation equal to that of free oscillations. By velocity of propagation is meant the speed with which the wave on the wire will travel in proceeding from the end of the antenna to the distant receiver (this explanation is for reception, but also is true for transmitting). By free oscillations is meant the wave disturbances traveling in space. Under certain conditions the wire wave will be propagated faster or slower than the space wave, this throws the wire wave alternately in and out of phase with the space wave which accompanies it all along, thus defeating the purpose of the wave antenna. In order to be of use the structure must offer a speed equal to that offered space waves. The theory is that all along the wire the space wave will reinforce the wire wave, thus building its amplitude from a small value at the initial end to a large value many times the original amplitude by the time it reaches the receiving equipment.

It has been shown, by mathematical analysis, that when an antenna of one-quarter wavelength is properly ter-

minated, the same unidirectional results can be obtained. It has been demonstrated, however, that this will not hold true. An antenna of less than one wavelength regardless of the type of termination is definitely inferior to a full wave system.

Conclusion

This article closes with the exposition of directional transmission and reception of a wave antenna. Because of the length over which we have already extended discussion of other types is reserved for a future presentation.

Research on the action of electromagnetic waves may be considered as in the early stages of development. The properties of antenna systems, both in transmitting and receiving, are at best only slightly understood. Since this subject involves wave motions, it is closely allied to physics. The discovery which is needed for definite knowledge of propagation is that of

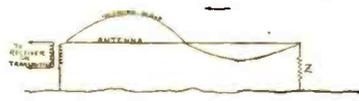


Fig. 10. Incoming Wave in Wave antenna.

electric wave propagation in space. This in turn is allied to the question of light propagation which has perplexed scientists for thousands of years. These theories presented are, we believe, the most logical that have been disclosed so far. Only the discovery of the true method of propagation of waves in space will tell us whether these theories are correct or incorrect.



A NOTEWORTHY DEVELOPMENT IN HIGH-FREQUENCY MEASURING EQUIPMENT.

(Concluded from page 44)

tials other than those obtained from the attenuator. If the inductor dial be set on zero then all evidence of a voltage existing in the set-up should disappear, but if it does not the removal of some forgotten wire which extends from the inside to the outside of the screened room will in the majority of cases eliminate the offending voltage.

Voltage Variations

The curve in Fig. 6 shows how the output voltage varies with frequency when the voltage impressed on the primary is held constant. Over the broadcast range there is no variation; in fact very little is evident until the frequency is above 6000 kc. (50 meters). As the frequency is increased still more the voltage rises and at extremely high frequencies it falls off again. This effect is due to resonance in the secondary circuit of the attenuator, there being present enough accidental capacity to form a resonant circuit when combined with the inductance of the secondary. To check the truth of this statement a small amount of additional capacity was connected across the output terminals of the attenuator and the point of maximum voltage shifted to a lower frequency, exactly the result expected if the effect were one of resonance. This effect subjects the use of the attenuator at very high frequencies to certain limitations but it is hoped that eventually this objectionable feature will be overcome.

The measuring apparatus described in the foregoing was developed by the General Electric Company for distribution by the RCA — Victor Company.



SHORT-WAVE RECEIVERS

In the July issue of RADIO ENGINEERING we shall have an excellent, useful article dealing with modern short-wave radio receivers. This story, by an authority on the subject, will deal with the receivers themselves and with their uses.

Tools for the Serviceman

A General Study of the Testing Equipment Now Available to Those Who Must Service Present-Day Radio Sets Intelligently

By Austin C. Lescarbourea
Mem. I.R.E. Mem. A.I.E.E.

SIMPLICITY in radio operation has been attained at the cost of complication in radio servicing. In other words, the multi-dial radio sets of yesteryear, with scattered batteries, external wiring and exposed components, were relatively simple to service. The average handy-man or tinker could take a look at the mess, stir the components about with his hands, and call it a day's work. The sets usually responded favorably to such rough-and-tumble treatment. Everyone was a radio expert.

Today, the situation is decidedly different. Sets are entirely self-contained; components are sealed in metal cans; the only current-carrying members are usually the sockets, so that all tests must be made through the sockets before tearing the chassis apart. Hence the tinker with pliers

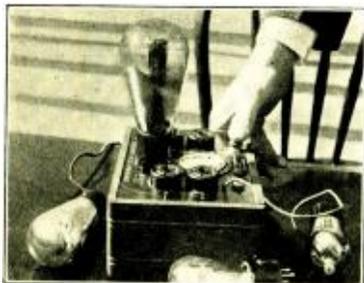


Fig. 1. A typical tube checker or tester, which indicates the mutual conductance of any of the standard type tubes.

and screwdriver is hopelessly at a loss to know what is wrong. Obviously, he must determine the cause of the ailment before plunging into the patient's innards. Whereby the radio testing equipment comes into play and forms the subject matter of what follows.

The man who is really making money in the radio business today, so far as the merchandising end is concerned, is the man with a good radio service department. In past years the main business has been that of selling radio sets. The time will come when the industry will face a situation approaching saturation of the market. This does not mean that we cannot sell radio sets to the public; far from it, a million or two sets will be sold this

year. However, the average radio merchandiser realizes that every home is no longer a prospect for a new radio set. Rather, most homes contain some sort of a radio set, and it is in keeping the existing sets in working order, supplying new tubes and perhaps selling accessories, that the dealer finds his main source of income these days. Hence radio service has assumed an importance never before believed possible.

Tubes Must Be Watched

In radio service, one point stands out preeminently, and that is tubes. The largest proportion of radio troubles in present-day sets may be traced to faulty tubes. In fact, it is practically impossible for any one handling radio sets, even if it be a furniture dealer, dry goods merchant, button-hole maker or what-have-you, to get along without a tube tester. Even in the sale of new sets, without much regard for outstanding sets in the territory, a tube tester is essential since tubes are the foundation of all radio performance.

Instrument manufacturers have done a really commendable job by way of providing tube testing equipment of all kinds, sizes and prices, ranging from the simplest tester to the most elaborate. The usual tube tester provides for the testing of all tubes from the WD-12, or dry-cell tube, up to the -50 type power tube. In most instances it is also possible to test the individual plates of a full-wave rectifier, separately, which is the only accurate method of testing a rectifier of that kind. Most tube testers are made in portable form and are a-c. operated from the usual socket. In some instances the tube testers are provided with a separate chart to indicate the standard readings that should be obtained from good tubes under test, while in other instances the chart may be incorporated directly on the panel of the instrument for immediate reference. The more elaborate tube testers have removable covers to facilitate the use of the instrument on the counter, test bench or in the laboratory.

The purpose of the usual tube tester is to measure mutual conductance, which is the main test for the quality of any radio tube. Mutual conductance serves to indicate the accuracy of the spacing of the elements, the filament emission, the normal plate and grid voltages, and even the degree of vacuum. The operation of the usual tube tester is so simple that anyone can use such equipment. Technical training is quite unnecessary. All the latest models are arranged for testing screen-grid tubes such as the -22 d-c. and -24 a-c. types. Lately, an additional feature has appeared in the form of a pre-heater, or extension socket, which permits of heating the heater type tubes prior to testing, so as to detect any open cathodes as the tube is run through a regular test. By heating the tubes first, then transferring them to the test socket, any faulty heater filament will usually show up, as contrasted to just one heating in the test socket itself.

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General Useful Testers

Tube testers, of course, only determine the good or bad tubes. In addition, it is necessary for the radio serviceman to determine flaws in the radio circuits themselves. For this purpose the set analyzer comes into play. Most of the set analyzers are so arranged as to test tube characteristics when the set is in operating condition. By inserting a plug in a given socket, and taking the tube out of that socket and inserting it in the analyzer set socket, that tube is tested under its own circuit conditions. However, unless the set itself is in operating condition, it is necessary to have a

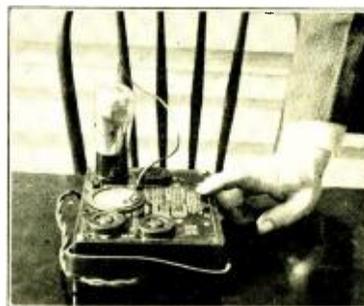


Fig. 2. Tube testers sometimes are provided with separate charts of tube characteristics and sometimes the charts are on the panel.

*Service Managers and
Service men now have
available instruments
for quickly making
accurate tests.*



Fig. 3. Complete radio laboratory in compact form, available for work in the shop or in the field.

separate tube tester to run through the tubes. Also, because of the variables or uncertain factors in the set circuit, the usual set analyzer does not provide as accurate readings for the tubes as the straight tube tester.

The main purpose of a set analyzer is to diagnose the trouble through the sockets. Various readings may be obtained through each socket, and these readings, properly interpreted, determine the cause of the trouble. With separate meters the average radio serviceman would not know where to begin his tests, not knowing where to pick up the different readings, and even if he did get readings, he might not know what they represented in terms of radio trouble-shooting. The usual set analyzer, on the other hand, provides immediate readings from the different sockets of such factors as plate circuit, grid circuit, filament, screen grid, circuit continuity and so on. Most analyzers also include a small internal battery, whereby to obtain an approximate resistance reading for continuity tests.

While perhaps formidable in appearance, the usual set analyzer is simple to use, highly compact for portable use, and available for use in the shop or out in the field. Most of the analyzers are provided with two or three meters, usually comprising an a-c. voltmeter and a multi-scale combination d-c. voltmeter and milliammeter, or again a separate voltmeter and milliammeter as well as an a-c. voltmeter.

Test Panels

For the permanent installation where one man is kept busy on job work in the shop, it is easier and faster to work with a permanent test panel. Such an installation usually is permanent in character and cannot be

carried about, although one manufacturer has hit upon the novel plan of having the main feature of his panel in usual portable form, so that it may be taken out of the panel and carried about for the outside jobs. The set analyzer member fits behind the panel on a pair of adjustable brackets, and its front face with meters is framed in the panel. A terminal block with many plugs is instantly snapped into the many jacks at the side of the set analyzer held by the brackets, completing the panel assembly.

While set analyzers have been limited to diagnosing set troubles and, to some extent, serving as tube testers, it has remained for one manufacturer to develop an assembly which is practically a complete radio laboratory in itself. The basic feature of this assembly which is contained in a compact wooden case with bakelite panel, is possible without the use of battery, d-c. voltmeter, a separate d-c. milliammeter, and an a-c. voltmeter. The d-c. voltmeter is of the high-range, high-resistance type for checking the output of any power transformer with



Fig. 4. A panel testing outfit is recommended for use in the radio shop. In this model the instrument case may be removed for use in the field.

or without load, and before or after rectification. The outfit includes a tube tester which does not derive its power from the socket of the radio set, but rather derives its independent power from the usual a-c. supply, or again from outside batteries. Tubes may be tested by means of an oscillating test, with and without grid bias, while a chart indicates the readings with and without grid bias for tubes that may be passed as satisfactory. Each plate of the full-wave rectifier is separately tested. The oscillator feature of this outfit permits of generating a modulated radio wave for such test purposes as neutralization of a set and aligning the tuning condensers. It provides a radio signal in the absence or uncertainty of broadcast signals, in testing the workability of a receiver. The outfit includes a rejuvenator capable of handling up to twelve tubes at a time by means of external additional sockets. Another novelty is a thermocouple built into the d-c. meter circuit which permits the operator to balance condensers of an entire set by making use of the thermocoupled meter in the out-

put circuit. It is possible to measure capacity of condensers from .2 mf. to 9 mf., and resistances from .1 ohm to 5 megohms. A d-c. continuity test is possible without the use of battery.

Meters for All Purposes

For the more advanced serviceman or the serious-minded radio experimenter, a number of separate meters are available which may be employed for measuring voltage, amperage, wattage, resistance, capacity or other factors. Among the resistance meters which have recently made their appearance, there are several making use of an internal battery in the meter case, which, before it is employed for measuring an unknown resistance, is short-circuited across the meter terminals and the meter set to zero resistance reading. The zero setting is generally obtained by means of a resistance in series, although there is one precision type which makes use of a variable magnetic shunt within the meter proper. There have lately appeared plain flush type meters which are really inexpensive voltmeters calibrated in ohms, and which may be mounted in a small case with a flash-light battery, or again in a testing panel. There are several types of capacity meters available for measuring capacities of from 1 to 15 mf., and practically zero to 1.5 mf. These meters are usually of a laboratory character and not intended for use out in the field.

A radio dealer these days does not get very far unless he is equipped to do servicing, and that means not only the necessary talent but also the essential equipment. Many so-called radio dealers are provided only with tube testers, and when trouble extends beyond the tubes, such dealers are obliged to call in servicemen outside



Fig. 5. The radio serviceman—the professional worker—a radio doctor, and no longer just a plain tinker.

their organization. This is poor practice. First, it holds up a stock set which the dealer may have to lend to the customer while retaining the customer's faulty set, or again it may deprive the customer of his radio pleasure while the set is being repaired. In either event, the customer is not particularly impressed by a dealer who cannot effect a prompt repair on any radio set.

Radio repairs are relatively simple. It is the diagnosis that is the real problem, and then only so in the absence of present-day testing methods. Given the proper testing equipment, the average radio serviceman soon locates the trouble which can be readily corrected. Frequently, it may

be nothing more serious than an open circuit or a poor connection, which once located, is readily repaired. Again, it may be a broken-down resistor or condenser. If there is some doubt as to the value of the resistor or condenser, the exact value may be determined by referring to the service notes of the manufacturer of that set.

Manufacturers' Instructions

Too much cannot be said for the excellent literature now available to those who service radio sets. Every reliable radio set manufacturer publishes service notes or data sheets, giving every necessary bit of information concerning his sets. The literature not only includes circuit diagrams, con-

stants, operating notes, adjustment procedure, and so on, but also a list of parts so that replacements may be readily taken care of by the repair man. Also, the makers of testing equipment are publishing more and more of this sort of literature, which is of decided help to the serviceman in his work. Radio schools are making every effort to place valuable service data in the hands of their students and graduates. In every way, therefore, the serviceman is receiving the cooperation of set manufacturers, and this knowledge, plus proper testing equipment, should go far towards making the radio serviceman a real professional worker—a radio doctor, in brief.

A New Short-Wave Receiver

By Clifford E. Himoe *

THE increasing demand for a compact portable receiver for aircraft, police cars, small boats and other locations where space is limited, led to the development of the new short-wave receiver here described. This set, with its four vacuum tubes, is enclosed in an aluminum case measuring only 5 by 6 by 9 inches. With tubes, coils and battery cable included, it weighs only 7½ pounds.

Four tubes are employed in the new receiver. While the circuit is not unusual, the efficiency with which the components are placed results in excellent sensitivity as well as stable operation. One stage of a periodic radio frequency, using a screen-grid tube, is followed by a split-Hartley oscillating circuit which employs another screen-grid tube as a space charge grid detector, or a straight -12-A, -01-A or -99 type detector, and a two stage transformer-coupled audio amplifier. The first stage of audio-frequency amplification takes a -01-A tube, the grid bias being derived from the minus filament return. The second stage, however, may take practically any type of output tube, as an independent grid bias lead is included in the battery cable.

The tuning range of the new receiver, using the four standard coils with which it is provided, is from 14 to 195 meters. Other coils are available for marine and aircraft work, on wavelengths up to 1000 meters. The coils are wound on thin, threaded bakelite tubing mounted on hard rubber bases with pin-jack prongs for plugging into the socket panel on top of the

receiver. Their characteristics are as follows:

Coil	L1	L2	Wavelength	Threads Per Inch	L1 L2 Spacing
No. 1	3 turns No. 18	3 turns No. 28	14 to 25 meters	6	½ inch
No. 2	7 turns No. 18	3 turns No. 28	23 to 49 meters	11	½ inch
No. 3	18 turns No. 18	4 turns No. 28	45 to 95 meters	11	¼ inch
No. 4	26 turns No. 28	6 turns No. 28	93 to 195 meters	wound tight	¼ inch

The small dimensions of the receiver are made possible by the arrangement of a bakelite sub-panel, which is located ¾ of an inch below the top of the case. From this panel the four tubes are suspended in an inverted position. All the wiring of the receiver is made between the sub-panel and the metal top plate of the case. The leads in the oscillating circuit being extremely short, very stable 10 meter operation is possible. The sub-panel also contains the plug-in coil mounting, grid lead and condenser, plate blocking condenser, 2½ microfarads of by-pass condensers and the filament resistors. The two midget tuning condensers are located just beneath the center of the sub-panel. The two audio transformers are mounted opposite each other on the two end plates of the case, with the resistance regeneration control beneath on the right, and the band condenser and filament switch beneath on the left. No binding post strip is necessary as the battery cable leads are soldered directly to their respective positions in the wiring. All these battery leads, as well as the telephone leads are by-passed to the grounded case of the receiver.

Regeneration is controlled in the deForest receiver by a 500,000-ohm clarostat in series with the battery supply. A 50,000-ohm fixed resistor is shunted across the secondary of the first audio transformer as a precaution against "fringe howl." The tuning circuit incorporates a 100-mm. "band

selector" midget, shunted by a 50-mm. tuning condenser. The aperiodic antenna circuit employs a 5000-ohm resistor. This untuned circuit makes it possible to operate the receiver on any length antenna without changing the calibrations of the tuning circuit. Thirty feet of wire gives excellent results in the laboratory. Any other length will function equally well.

The voltages applied to the tubes are as follows: r-f. plate, 90 volts; r-f. screen-grid, 45 volts; detector plate, 45 volts; detector space charge grid, 22½ volts; 1st audio plate, 45 volts; 1 audio grid, minus filament return; 2nd audio plate, 90 volts; 2nd audio grid, minus 4½ volts. These voltages vary, of course, depending upon the type of tubes employed. The entire set may be dry-cell operated if desired. In this case the deForest audio 422-A may be used to good advantage as the filament current consumption is the same as the -99 type, namely, 60 milliamperes. The entire current consumption of the receiver using two 422-A's, one 499 and one 420-A is .24 of an ampere.

In addition to its industrial and governmental applications, the "amateur" qualifications of the receiver have aroused considerable interest. This receiver is made by the deForest Radio Company and is available on the open market.

* Communications Engineer, de Forest Company.

Radiophone Communication on Air Passenger and Mail Routes

Airways Block Signal System

UNEXPECTED storms and fog belts are no longer dangerous obstacles to pilots flying Boeing System planes over the 2000-mile air mail, express and passenger airway between Chicago and San Francisco Bay, for which the installation of a specially designed radiophone communication apparatus in the mail-passenger and transport planes operating over the route, and the establishment of ground radio stations at regular intervals along the extensive air line, pilots are constantly informed as to weather conditions ahead of them along the entire route.

No matter at what altitude the pilot is flying, nor his location along the airway, he may communicate with ground station operators and receive the latest weather reports and other information regarding flying conditions ahead of him.

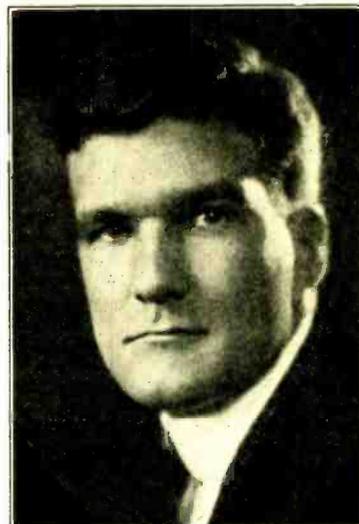
With the increasing development of passenger transportation by air in this country, and in view of the long distances traveled and the varied weather conditions encountered, an effective radio communication system between planes and the ground is extremely valuable. Recognizing the importance of this, Boeing System, operator of the San Francisco-Chicago and Seattle-Los Angeles air mail, express and passenger routes, set about two years ago to develop a radiophone equipment. These years of testing and experimentation have resulted in a workable voice communication system which permits the pilot of a plane in flight to talk with operators at ground stations and also with a pilot of another plane.

The equipment in the plane is effective at altitudes as high as 14,000 feet

and at ranges as distant as 200 miles. Boeing System, which has recorded a total of nine million miles of day and night flying since the inception of its service in July, 1927, developed the radio equipment before the inauguration of its eighteen-passenger trimotored transport service so that the pilots of these large passenger planes would be in constant communication with operators on the ground during the 2000-mile cross-country flight.

The transmitting and receiving equipment for the plane weighs approximately 100 pounds, and is placed in the center or tail of the airplane, depending upon the type of the plane. In the large eighteen-passenger trimotored transports, it is located in the tail. The pilot's helmet has been especially developed for the radiophone system, the earphones and microphone being securely attached to the headgear. A soft rubber plug in each ear with phonettes attached permit the pilot to hear the voice of the ground operator above the sound of the engine. The microphone is constantly before his lips, leaving his hands free for the use of the controls. On the instrument board is a switch, to change the set from transmission to reception.

The equipment for the ground stations weighs approximately 1500 pounds, and is in operation continually. On the transcontinental route, stations are located at Oakland and Sacramento, Calif.; Reno and Elko, Nevada; Salt Lake City, Utah; Rock Springs and Cheyenne, Wyoming; North Platte, Lincoln and Omaha, Nebraska; Des Moines, Cedar Rapids, and Iowa City, Iowa; and Aurora, Illinois. The latter station is thirty miles west of the Chicago airport.



THORP HISCOCK,
Communications Engineer.

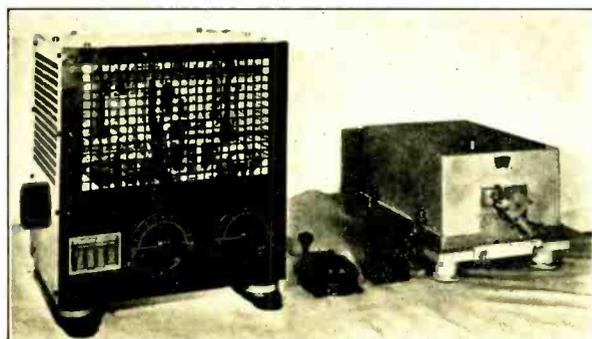
Before the pilot takes off, his set is checked and adjusted. The pilot, once in flight, seldom adjusts the tuning mechanism of the equipment. As soon as the plane is in the air, however, the operator at the ground station tunes in. The pilot usually keeps his set on reception, so that he receives the weather reports, company orders, traffic information and other data being constantly broadcast. When he wants to talk with the ground operator, he switches to transmission. No extra pilot or operator is required for the equipment in the plane.

The ranges of the ground stations and plane sets are approximately 200 miles. When the pilot reaches a point half-way between the station last passed and the one ahead of him, he adjusts his set so that he receives the broadcast of the station ahead. However, Boeing pilots have recently been heard at points as distant as 900 miles.

The plane apparatus is effective at altitudes as great as 12,000 and 14,000 feet. Boeing experimentation ended there because that is the maximum elevation of flight over the transcontinental route, but the sets are workable at greater elevations.

Block Signal System of the Airways

The radiophone communication service adds to the safety of flying. It reduces the number of emergency landings by eliminating uncertainty as to weather conditions ahead, and thus enables pilots to complete a large number of scheduled trips on time. By furnishing the pilot complete flight information, the amount of excess gasoline formerly carried to give the plane ample cruising range when he is uncertain as to weather is materially reduced. Dispatching of planes and giving of traffic orders to pilots is sub-



Radiophone
equipment
for
Boeing
planes.

stantially expedited by means of the radiophone. The communication system is, generally speaking, the block system of the airways.

Many of the accidents occurring on established airways have been caused, directly or indirectly, by adverse weather conditions about which the pilots had little or no information. Many of the dangerous situations in which pilots used to find themselves are wholly eliminated by the radiophone system—being forewarned, the pilots are forearmed. Boeing System is supplementing the Government's weather reporting service with mobile weather stations operating north and south of the transcontinental line to forecast storms approaching the east-west route from the north and south, against which pilots were previously more or less unprotected. These mobile stations have radio broadcasting equipment, and reports on the weather north and south of the line are radioed to the ground stations along the route, which promptly relay the information to the pilots of planes in flight.

The radiophone also serves to aid the pilot in finding an airport blanketed by fog. In a test flight recently made to determine the effectiveness of the equipment, a pilot flew over the Oakland airport when it was covered with fog. There was a 2000-foot belt of fog between his plane and the ground, and the ceiling was 1100

feet. The pilot radiophoned to the operator at the hangar. By shutting off his motor for a moment, officials on the ground determined the location of the plane and informed the pilot, told him that the airport was clear, advised him when to start his glide and brought him into a safe landing on the field. Thus it is evident that the radiophone will play a valuable part in the conquering of fog, heretofore one of the biggest obstacles to regular air transportation.

Another type of radio service maintained on the Chicago-San Francisco route is the directive radio beacon system operated by the Department of Commerce. This service is aimed to keep the pilot on his course during poor visibility.

This type of transmission used employs equi-signal beacons broadcasting the characteristic dot-and-dash signals. When the letter "A" is sent out, the pilot knows he is off his course to the left, while if he hears the letter "N" he knows he is to the right of his course. When the signals blend into the letter "T," he learns he is directly on his scheduled route.

These directional radio beacons are maintained by the Department of Commerce at 200-mile intervals along the airway. The Department also broadcasts regular weather reports.

With the recently developed Boeing System radiophone, it would be

possible for travelers riding in the eighteen-passenger tri-motored transports, flying high over the route between the Great Lakes and the Golden Gate, to talk to city dwellers by routing a call through a terminal station on the route. However, this is a future development, in view of the present requirement laid down by the Department of Commerce that only messages relative to the operation of aircraft and the safety of operations be broadcast. The service is under federal supervision.

Thus, with the development and perfection of radiophone voice communication between pilots of planes in flight and operators at ground stations, air travel over the transcontinental airway to Chicago via Boeing System is made substantially safer. With the completion of the installation on the Chicago-San Francisco route, there will be a similar installation on the Pacific Coast air mail, express and passenger airway between Los Angeles and Seattle, with equipment identical to that used on the transcontinental planes. Ground stations are being established at Los Angeles, Bakersfield, Fresno, Oakland and Redding, California; Medford and Portland, Oregon; and Tacoma and Seattle, Washington. This route, 1100-miles in length, is ranked next to the Chicago-San Francisco line, which is the longest air mail route in the country.

Radio World's Fair, and New York and Chicago Electric Shows

THE sale of electrical household utilities, far beyond the immediate New York and Chicago metropolitan areas, seems destined for considerable improvement, this autumn, now that the manufacturers of such products are to participate in the Radio World's Fair, Madison Square Garden, New York City, September 22 to 27, inclusive, and the Chicago radio show, Coliseum, October 20 through the 26th. The reason for such optimism is found in the experience of radio manufacturers, who, year after year, have consistently noted that the shows, with their attendant publicity, never fail to produce a marked sales stimulation.

With the discontinuance of the annual New York electrical show in Grand Central Palace, news of which has just been announced, manufacturers of household electrical products will feel free to enter wholeheartedly into the New York Radio World's Fair. Since there has not been an electric show in Chicago for many years changes in arrangements for the conduct of the Chicago radio show brought immediate expressions of approval from manufacturers who had heretofore been

denied such merchandising aid.

The two national expositions are among the largest in the world and annually attract a minimum of 550,000 interested persons. So interested are the visitors in products to increase the satisfaction of every day living, that they are willing to pay 75 cents or one dollar admission.

Why the favorable effect of the expositions is not limited to the local and New York and Chicago area, why participation in the events is profitable to manufacturers distributing without as well as within the immediate territory, is due to the importance of the shows as news creating events. Newspaper and syndicate writers, domestic and foreign press association representatives, general magazine and trade magazine writers, cartoonists, newspaper and syndicate photographers and movie men, to the number of 625, covered the New York event, last year, and carried the story to the ends of the earth.

Participation of the National Broadcasting company and the Columbia Broadcasting system, which broadcast all their colorful programs, afternoons and evenings, from a specially constructed studio is another means

of attracting national attention.

Another phase of the expositions, constantly growing in importance, is the provision for trade show hours which assures means of conducting business unhampered by crowds. Between 11 a.m. and 1 p.m. only dealers, wholesalers and manufacturers are admitted to the exposition halls, contacts are easily made and business quickly transacted. During the six days of last year's Radio World's Fair business to the amount of \$30,000,000 was booked.

(Concluded on page 67)

▲ STABILIZATION

Herewith is the pledge made by the Colonial Radio Corporation with reference to the manufacture and sale of radio receivers:

"We pledge ourselves to build dependable radio receiving sets, to sell these sets by fair methods, and to stand behind them after they are sold."

Pledges of this sort if made and kept even by a majority of manufacturers, would go a long way toward the "stabilization" we hear so much about.

The Prior Art*

By E. W. Adams

Important That Application be Filed Before Publication, Use or Sale

NO discussion of patents proceeds very far without some reference to the "prior art" and as the term is not defined in the usual dictionaries, some consideration of what it is, where it is to be found, and its effect on the patenting of inventions should be of interest to inventors and potential inventors.

Unfortunately, the term is not capable of short and accurate definition. Broadly speaking, the prior art is the sum total of human knowledge prior to the present moment. With reference to the patenting of inventions, it is limited to that portion of human knowledge which embraces what has been invented or constructed, or what has been made available to the public by use, patents, or printed publications. It has been designated by a recent commentator as "an indefinite multitude of inventions which were once new but have already become old."

This multitude of inventions, publications, patents, and things which have been constructed or used is widely distributed and is not readily accessible. To find the prior art with reference to a given invention it is necessary to have recourse to certain available sources of information, which may be divided into the patented art, the published art, and the common knowledge and usage of professions or trades.

The patented art is usually a part of the published art although not necessarily so, because patents of some countries are not published. There is no publication of patents in such important countries as Belgium and Italy, for example, and there was a period when there was no publication of patents in France. It is useful, however, to consider the patented art in a separate classification because, quite apart from the publication of patents, the granting of a patent has by statute a very definite effect upon subsequent patents for inventions. A determination of whether an invention is in the patented art involves a search, but fortunately the patents in the major countries are classified.

Classification of Patents

In the United States, the patents are quite finely divided into classes in accordance with the subject matter claimed. In Great Britain, a comprehensive digest of the patents is published in classified form. The German Patent Office classifies according to subject matter each of its patents as issued; this classification, however, is somewhat different from that used in the United States. In France, the patents are classified along broader lines. In other countries, in general,

some attempt is made at a classified index but as most of the important inventions are patented in one of the major countries, a search through the classified files of these countries will give a very comprehensive knowledge of the patented art.

The published art includes the entire field of printed publications. The most fertile part of this field is to be found in the technical and trade journals and the proceedings of the various scientific societies. There are a number of indexes published and useful for this purpose which are familiar to most engineers. These indexes, of course, do not take the investigator to all of the published art but they are very useful in locating the more important publications. Such sources of information as doctors' theses and publications of local societies can only be found by following some definite clue.

Sources of Knowledge of Prior Art

The common knowledge and usage of a profession or trade is reflected in the technical articles, but useful material along this line is also to be found in trade catalogs, bulletins, instructions accompanying apparatus sold, and in correspondence between members of the trade or profession. About the only way to run down this sort of information is to consult with men who have had experience in the particular profession or trade under investigation.

An apparatus, system, or process which has been made and used or sold is presumed to be a part of public knowledge and hence a part of the prior art, although actual knowledge of such manufacture and use or sale may not be nearly as widely distributed as a printed publication. In fact, a single use or sale establishes the existence of the device or process as of the date of such use or sale. In some countries, France for example, prior use or sale anywhere and at any time before the filing of an application for patent is within the prior art. In others, the use or sale must be within the country.

The effect of the prior art on the patent is always one of limitation. In general, the prior art may be considered as the environment of an invention and the extent to which an invention differs from that environment determines the scope, or, as it is often put, the place of the invention in the art. This generalization is, however, of little value unless it is kept in mind that the material embraced in the prior art differs for each invention and its effect is different with respect to the same invention in different countries. It is for this reason that

in speaking of the date of an invention as the boundary line between invention and the prior art, consideration must be given to a particular invention and a particular country.

In determining the prior art with reference to a particular invention, we are concerned not merely with the date upon which the invention was conceived or first took definite form in the mind of the inventor but with the effective date, which is a very different thing. In some countries this effective date is the date upon which the application is filed, and publication of any kind or public use of the invention anywhere prior to this date is considered as prior art. In others, the publication or use must have been within the country to be prior art. In the United States, the effective date is the date upon which the invention is completed. Although the granting of a valid patent may be barred by statute because of publications, patents, public use, or sale subsequent to the date upon which the invention was completed, if an application is not filed within two years, these are statutory bars, and it is erroneous to call them part of the prior art as is often done.

International Convention

In an effort to remove, in a measure, the hardship placed on an inventor by the material variations in the patent statutes of various countries, an international agreement known shortly as the "Patent Convention," has been entered into by most of the important countries of the world. It provides that an application for patent filed in one of the contracting countries within a year of the first filed foreign application is granted an effective filing date corresponding to the actual filing date of the first application. An application filed January 2, 1928, in the United States, for example, entitles the inventor or his assignee to an effective filing date in France also of January 2, 1928, provided the actual filing in France is effected prior to January 2, 1929. Thus publication or use within the "Convention" year prior to the actual filing date in France, is excluded from the prior art by operation of the Convention.

Space does not permit a discussion of the provisions of the patent laws of the various signatory countries making the Convention effective or of the legislation enacted to extend Convention priority over the period of the World War. Under special conditions, such extensions have the effect of excluding much from the prior art which otherwise would be included.

(Concluded on page 67)

* Bell Laboratories Record, March, 1930.

Progress Reported on R.M.A. Patent Pooling

Patent Committee Proposes Intensive Action

SUBSTANTIAL progress in the campaign in behalf of the RMA patent interchange plan is being made according to reports submitted to the RMA board of directors and at a meeting of receiving set manufacturers, by LeRoy J. Williams, chairman of the RMA patent committee.

A new questionnaire on the patent pooling plan is being sent to the RMA members by Chairman Williams, to develop and crystalize sentiment as far as possible in favor of ultimate adoption of patent interchange. The questionnaire follows:

1. Do you believe that the membership should take joint action on the present patent problems of the radio industry?
2. Are you in favor of a central patent department?
 - (a) For investigation of patents and prior art.
 - (b) For joint negotiation or acquisition of patent rights.
 - (c) For assisting in defense of patent suits against members.
3. Are you in favor of the RMA patent interchange agreement?
4. Do you think it would be to the interest of your company to adopt the agreement?
5. Are you in favor of licenses?
 - (a) On a percentage royalty basis?
 - (b) On a flat rate royalty basis?
 - (c) On a paid-up basis?
6. Are you in favor of acquisition of patents of general interest, by RMA?
7. If you are a licensee under a group of patents, are you favorable to patent meetings of such licensees?
8. Would you like to have any further information concerning the agreement? If so, please indicate the nature of your questions.

Following this further canvass of RMA membership sentiment and interest in the patent interchange proposal, which was approved for submission to RMA members at a meeting in Chicago about two years ago, the effort to further press the plan will be made more intensively.

In addressing the set manufacturers' meeting, Chairman Williams retailed how the patent situation was vital to the future of the industry and every unit in it. Citing the hundreds of patent suits being brought involving thousands of patents and millions of dollars of royalties annually, Mr. Williams emphasized his view that "there is no centralized or adjudicated control of the manufacture and sale of radio receiving sets or tubes in this country and such contentions have been repeatedly denied by our courts of appeals in patent matters.

"There is no use," Chairman Williams continued, "in blinding our eyes to the consequences of the present patent situation. Few radio manufacturing companies can survive under the patent burden brought about by the

present attitude of the industry toward patents.

"The patent burden is becoming worse and there is every indication that it is going to be greatly increased if our present passive and indifferent attitude is continued.

"Pooling of patents under the RMA interchange agreement would permit companies to fully cooperate in the disclosures and exchange of information relating to the scope and validity of situations relating to patents in the radio and entertainment fields. It would also result in each company joining the pool, receiving patent rights from all other members, in exchange for granting rights under its own patents. Under such a plan, what company would give more than it would receive from all the rest, both under present and future developments in the radio and entertainment fields?

"The benefits of patent pooling to the industry and to each member of the industry, by wiping out litigation and the tremendous economic burdens of patent payments and royalties, would be of incalculable benefit to everyone involved. Other valuable incidental benefits of interchange of patent information and patent rights would be joint negotiation and joint acquisition of rights under patents of general interest.

"The tremendous value and advantages of joint patent action are clearly apparent. No one has seriously denied these advantages, nor have any substantial objections to the plan been raised."

JUNE CONVENTION MEETINGS

The plans for the coming bi-annual convention of the National Federation of Radio Associations and the Radio Wholesales Association to be held concurrently with the annual convention of the Radio Manufacturers Association and Trade Show at Atlantic City, June 2nd to 8th are now being formulated. It is planned to hold one general meeting for all radio tradesmen in attendance at the convention under the auspices of the National Federation of Radio Associations. There will also be one or two meetings for the radio wholesalers held under the auspices of the Radio Wholesalers Association.

During the convention, committee reports on the progress of the association will be presented to the meetings. It is planned to make the wholesalers meeting on the order of an open forum where wholesalers may have the oppor-

tunity of giving their own opinion and requesting the opinion of other attending wholesalers on many of their problems.



NFRA TAKES ACTION ON LEGISLATION REGARDING AUTO-MOBILE RADIOS

The executive committee of the National Federation of Radio Associations and the Radio Wholesalers Association have started a very important work in watching legislation barring the installation and use of radio receiving sets in automobiles. Adverse legislation for automobile radios has been presented in several states, particularly in the east but in each case the local radio tradesmen have been successful in defeating any ordinance prohibiting the use of radio sets in automobiles.

No cases have been cited where the use of an automobile radio has been detrimental to the best interests of safe driving and it has been shown by many automobile owners that the playing of a radio in the car does not distract the driver's attention.

The use of radios in automobiles is heralded as one of the new developments of potential radio sales and the national organization is taking steps to prevent adverse legislation. Letters are being written to all local associations urging their watchfulness for this particular type of legislation and asking for their cooperation.

C. C. Colby, chairman of the joint national legislative committee from the National Federation of Radio Associations and the Radio Manufacturers Association has been assured of the support of the national organization in watching this type of legislation.

Chemical Rectifiers for Radio Transmission

By Charles Felstead

*Modern filtering makes
the electrolytic rectifier an
inexpensive and practical
source of high voltages
used in radio.*

A RADIO transmitting set, particularly one designed for radio telephone transmission, requires a source of high-voltage direct current for supplying the plate current to the transmitting tubes, in the same manner that a receiving set needs "B" batteries to furnish the plate current for the receiving tubes. Batteries can be, and are, used in radio transmitters to furnish this current; but this is a rather expensive method, as the voltages used generally exceed 500 volts and a comparatively heavy current is drawn by the transmitting tubes. Batteries give the transmitter a very clear and pretty note, as they furnish absolutely pure direct current. However, the price is almost prohibitive, except with very small transmitting sets, as at least ten heavy-duty standard "B" batteries are needed, and they cannot be expected to last much over six months. Direct-current generators driven by alternating-current motors connecting to the power lines are used in most all of the broadcast stations and larger CW transmitting stations; but in that case, also, the first cost of the motor-generator is high, and is too great for the average amateur operator. Most users would prefer to employ some type of rectifier in conjunction with a high-voltage transformer connected to the 100-volt house lighting current; and use the money thus saved to buy larger transmitting tubes.

When continuous-wave (CW) transmission first came to be universally used by the amateurs, supplanting the older spark transmitters, it was necessary for them to find an inexpensive, economical, and easily-constructed means for supplying the necessary high voltage to the transmitter. Making use of alternating-current rectifiers in conjunction with the house lighting

current seemed to be the only alternative.

There are three distinct parts to such a high-voltage supply: the transformer, which steps-up (increases) the voltage from 110 volts to the voltage required by the plate of the transmitting tube; the rectifier for converting the alternating current to pulsating direct current; and the filter system, which smooths out the pulsations in the current passed by the rectifier, and makes it into nearly pure direct-current. There are four types of rectifiers in general use today: the tube rectifier, employing Amrad "8" tubes, Raytheon, Rectron, or similar rectifying tubes, working on much the same principle as the Tungar battery chargers; the mercury arc rectifier; the synchronous rectifier, or synchronous converter, which is a form of commutator driven in step with the alternating current by a synchronous motor connected to the power lines, and which functions in a manner similar to the commutator on a direct-current generator; and various forms of chemical rectifiers, one of which will be described in this paper. The synchronous vibrating rectifier is not used commonly enough to be considered. Rectifiers have now also come into general use for supplying the "B" voltage to receiving sets.

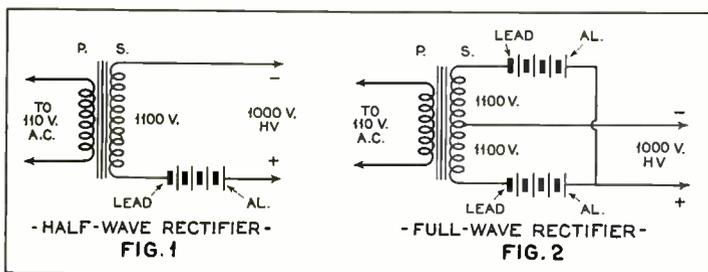
The Chemical Rectifier

Various solutions and combinations of metals can be used in chemical rectifiers with varying degrees of success. Although there may be some doubt as to whether the old stand-by chemical rectifier using lead and aluminum plates immersed in a solution of ordinary borax and water is the very best and most efficient type, it will be de-

scribed in this paper, as it is without question the least expensive and most popular chemical rectifier, and the materials used are the most easily obtained. A considerable number of jars are needed, the exact number depending on the arrangement used, the voltage of the transformer, and whether or not absolutely pure d-c. is desired. The jars can be almost anything from ordinary water tumblers to quart fruit jars. A plate of aluminum and a plate of lead are placed in each jar in a solution of "20-Mule Team" borax. The sizes of the plates and the capacity of the jars are important, and are dependent on a number of factors. These things will all be taken up in this discussion.

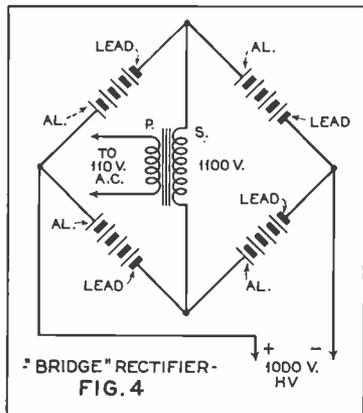
The high-voltage alternating current from the step-up transformer is changed to pulsating direct current by the rectifier, because the rectifier allows the current to pass in only one direction. This one-way passage of the current is due, in the case of the chemical rectifier, to the formation of an aluminum oxide and a gas film on the aluminum plate. The formation of this film is accomplished in the first place by what is called "forming" the rectifier. If only one side of the high-voltage supply is rectified, by using the connection shown in Fig. 1, during one-half of the alternating-current cycle the rectifier passes the current, but during the other half of the cycle the rectifier acts as a very high resistance, due to the film, and allows practically no current to pass. However, if too great a voltage is applied to the rectifier, this film will break down, which will be indicated by bad sparking in the rectifier jar. the rectifier will cease functioning, and alternating current will be passed by it. If the split-secondary circuit shown in Fig. 2 is used, there will be a set of rectifier jars on each side of the high-voltage supply, which will allow both halves of the alternating-current cycle to be rectified. This is by far the most popular rectifier circuit.

But even with this double rectifying circuit, the peaks of the waves in the supply current get through the rectifier, which causes a modulation of the rectifier output at the supply frequency. It is this a-c. "ripple" that makes necessary the filter circuit if a relatively pure d-c. output is expected from the rectifier. In Fig. 3 is shown



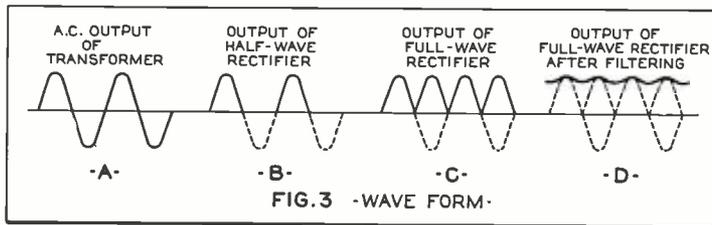
an ideal representation of the wave form in different parts of this rectifier circuit.

With a high-voltage transformer (not center tapped, the "bridge" circuit shown in Fig. 4 may be used. The same number of rectifier jars are used in this circuit as in the circuit shown in Fig. 2. With the "bridge" circuit, the secondary voltage of the transformer need be only half as great as the secondary voltage would have to be if the split-secondary circuit were used. This can be easily understood from an examination of the two circuits. In both cases shown, the output of the rectifier would be in the neighborhood of 1000 volts pulsating direct current. Even though the transformer has a center tap, the circuit in Fig. 4 will sometimes have to be used when the secondary voltage of the transformer is not great enough. As a general rule, amateurs use from 500 to 1000 volts on the plate of a UX-210 (7½ watt) tube, and from 1000 to 2000 volts on a UV-203A (50 watt) tube. The higher voltages represent a considerable overload. We will have to allow for a drop of 100 to 200 volts through the rectifier and filter; so the transformer must have a secondary voltage of from 600 to 4400 volts, depending on the plate voltage desired and the rectification circuit used. The



manner in which the lead and aluminum plates of the successive jars are connected together is shown clearly in the illustrations. In all circuits, the aluminum is the positive end and is connected to the plate side of the filter.

A mistake is sometimes made by constructing lead-aluminum chemical rectifiers by not using sufficient jars for the voltage to be rectified. The result is that the rectifier sparks badly, draws excessive current, is noisy, and does a poor job of rectifying. This has led many who have had experience of this kind to look with suspicion on all chemical rectifiers. Articles have even appeared in authoritative radio magazines which have recommended the use of only one jar for each 75 to 100 volts to be rectified. That is not good



practice. The voltage drop across each jar should not be more than thirty volts; and it is even better to use one jar for each 25 volts, if pure d-c. is desired. Desiring an input of 1000 volts d-c. to the transmitter use is made of the split-secondary circuit of Fig. 2, there may be used a center-tapped transformer with a secondary voltage of 1100 on each side of the center tap, or a total of 2200 volts. Allowing a drop of only 25 volts across each rectifier jar, it will be necessary to connect 24 jars across each half of the transformer secondary, or a total of 88 jars across the entire secondary. On the other hand, if the "bridge" rectifier circuit is used, a transformer with a secondary voltage of only 1100 will be required; although we will have to use the same number of jars. In that case, there will be twenty-two jars in each of the four sets. This may seem like a large number of jars, but they are not hard to construct, and so it is not as bad as it sounds. If C.W. is used entirely, only a very small filter will be needed when as many rectifier jars as this are employed. If voice transmission is used, a good filter system with a rectifier of this size will assure the operator of the minimum amount of ripple accompanying the voice.

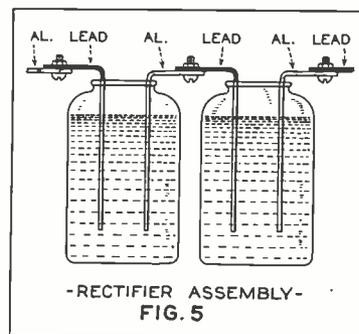
Plates Must Be Large Enough

Another mistake that is sometimes made is to use plates that are not large enough for the current to be rectified. Plates that are too small will cause the solution to heat rapidly and evaporate. One square inch of aluminum and lead should be allowed for each forty milliamperes of current that will be drawn by the transmitter. As high as 100 ma. per square inch can be allowed for intermittent duty; but for continuous operation, forty ma. is the maximum safe value to use. If a UX-210 tube is used with 1000 volts on the plate, a current of about eighty ma. should be figured on. That means that two square inches of aluminum and lead should be immersed in the solution in each jar to carry this current. If a higher power is used in the transmitter, a correspondingly larger surface of aluminum and lead will have to be presented to the solution. To obtain a surface of two square inches, a strip of aluminum one-half inch wide and four inches long, or a strip one inch wide and two inches long may be used. The lead strip should be of like size. An extra two inches of length must be allowed for

bending the plate over and fastening it to the plate in the next jar in the series. The lead and aluminum placed in each jar should be parallel and about an inch apart. They must not be too near the walls of the jar, or boiling of the solution may occur at that point. It is best to leave at least an inch between the bottom of the container and the bottoms of the plates, so that the sediment which naturally collects will not short-circuit the plates. Jelly glasses, tumblers, or fruit jars can be used as the containers, the size depending on the sizes of the plates. Pint Mason fruit jars are excellent for this purpose. The lead and aluminum strips in adjacent jars should be bolted securely together by half-inch long, 8-32 machine screws, as shown in Fig. 5.

Good Grade of Aluminum Used

One difficulty in building a good chemical rectifier is in obtaining chemically pure aluminum. Only the purest aluminum obtainable should be



used, if best results are desired. Plates cut from aluminum that is not pure will not form properly, and will show brown spots, due to the presence of iron, carbon, or other impurity. An excellent grade of pure aluminum can be obtained from old lightning arrester cones. They can be purchased very cheaply from any electric light company, and they have the advantage of being already formed. Most hardware companies sell a select grade of aluminum that is better than ninety-five per cent pure aluminum. The writer purchased some scrap aluminum that was left over from the construction of special automobile bodies from an automobile company, and found it to work very well. The aluminum plates should be about 1/16-inch thick. The thicker they are, the longer they will last, of course. The thickness of the

lead plates does not matter, so thin lead plates are advisable, as they are cheaper in cost.

Description of An Actual Unit

As a practical example, the description of a rectifier the writer built for use with a UV-203A (50 watt) tube is here presented. A center-tapped transformer with a total secondary voltage of 2200 volts was used with an eighty-eight jar rectifier. To carry the plate current for the 50-watt tube, the aluminum and lead plates were made one inch by five inches, with three inches of each plate immersed in the solution. The lead and aluminum sheets were taken to a tinsmith's shop, and the plates cut out and bent and the holes punched by machinery. The cost of this work was very small, and a considerable amount of time was saved thereby. The plates were then put in a strong solution of boiling water and lye, and left in this solution until the shiny surface was eaten from the aluminum. This treatment very materially aids the rapid formation of the plates. The plates should not be handled any more than necessary after this cleaning. The plates were then bolted together and placed in the pint fruit jars. A little more than enough

distilled water to fill the jars was put in a large pan and warmed. Then as much 20-Mule Team borax as the water would absorb was added, and the solution let stand until cool. It is important that distilled, and not tap water be used, and that a thoroughly saturated solution be formed. The jars were filled to within three-quarters of an inch of the tops with this solution, and the rectifier was ready for forming.

When forming the rectifier, it is necessary to connect a resistance in series with the primary of the transformer to prevent burning it up, or blowing the line fuses, as, at first, the rectifier forms an almost direct short-circuit across the secondary. An incandescent lamp should be placed in series with the primary. When the power is first turned on, the lamp will light brightly, but it will gradually dim as the rectifier plates form. Another lamp should then be added in parallel with the first, and left until they both dim. Then an electric iron, heater, or anything that draws considerable current may be connected in place of the lamps. After about an hour or two of forming the rectifier in this manner, the transformer primary may be connected directly to

the line, and the rectifier put into use. Well-formed aluminum plates have a dull, even surface. After it is finished, it is a good plan to put the rectifier in an inclosure equipped with a cover, so that dust and dirt will not get into the solution. As the water evaporates out of the jars, more distilled water should be added to take its place.

When the rectifier is working properly, there should be a uniform dull blue glow, or blue halo, around all of the aluminum plates if they are of pure material. A cell that is dark is usually dead, and is not functioning. The aluminum plates should be removed from dark cells, or cells that spark badly, and new ones substituted. Scintillation or sparking in a cell shows that an over-voltage is being applied to that cell. Quite often, certain cells spark badly because the other cells are dead, and the ones that are sparking are carrying all of the load. In that case, of course, it is the other cells that will have to be changed. The user will have to use his own judgment in replacing elements. A good rectifier will give excellent results over a long period of time with but little care.

How Long Should a Radio Receiver Last?

THE life of a radio receiving set has never been determined definitely though many unfounded conjectures have been made by persons not thoroughly familiar with its construction. Such predictions as were made varied anywhere from two to five years, none of them correct when considering a well-designed and efficiently constructed receiving outfit.

The life of a radio set, say Stromberg-Carlson engineers after a series of tests to determine this factor should, under ordinary conditions, at least equal the human span. This statement is based on the results of careful investigations conducted at the factory in Rochester extending over a period of several years.

The modern receiver, the report reveals, is subject to mechanical wear at only three points which are: the bearings in the variable condensers; the volume control unit and the "on" and "off" switch. While the parts that are subject to mechanical wear are usually designed to be easily replaceable in regular servicing operations, each unit is selected by the aid of "breakdown" tests to give a lifetime of service. These tests operate the moving parts of the apparatus hundreds of thousands of times, which reduced to years of operation represent a life-time of uninterrupted service.

The problem of deterioration by moisture entering the radio receiver is of major importance in figuring the

life of the apparatus. All Stromberg-Carlson sets, for instance, are completely protected from the detrimental action of moisture by sealing all coils and capacitors in metal containers, and through the application of corrosion resisting finishes to the metal work. Furthermore, there are no liquids or electrolytic elements in the construction that might change with time.

Of major importance also is the "factor of safety" provided in the electrical insulation and dielectrics employed in the chassis and the loudspeaker. The highest grade of receivers, such as the Stromberg-Carlson, use a factor of safety that insures against breakdown for all extremes of operation.

Another item of importance in figuring the life of a receiver is the ability of the various resistors to withstand adverse climatic conditions. It has been found by field tests that wire wound resistors, for example, must have a conductor size adequate to withstand the mechanical strains of continued heating and cooling, as well as a vitreous enameled covering over the wire to seal against corrosion and other damaging effects of moisture.

The wiring of the receiver merits particular consideration with regard to soldering, as long efficient life of the receiver depends on the materials used in this operation.

While quick and secure soldering can be done by an inexperienced worker,

when so-called "acids" or soldering pastes and solutions are used, it was early found in telephone apparatus construction that these kinds of soldering fluxes introduced troubles at a later time. Some of these fluxes are conductors for electricity and through creepage along the apparatus terminals or wires cause "cross-talk" or defects in operation. In other cases, the paste collected conducting dust which in time caused electrical trouble.

More than thirty-five years ago, the Stromberg-Carlson Company learned that rosin flux could be used with safety in wiring the most intricate telephone circuits without danger of defective insulation at a later date. Some of these early switchboards are still in use, after 30 years of uninterrupted service. This lifetime experience with satisfactory materials has been extended into the radio receiver field by this manufacturer.

Of course, it is unreasonable to expect a radio receiver to operate efficiently throughout a lifetime without receiving a reasonable amount of attention, any more than one would expect an automobile to run indefinitely without adequate service. Vacuum tubes are among the most important considerations in this respect. Their occasional replacement should be practiced if the maximum efficiency is desired at all times. Even one slightly defective tube will have a detrimental effect upon the operation of the set as a whole.

Modification of Superheterodyne Receivers

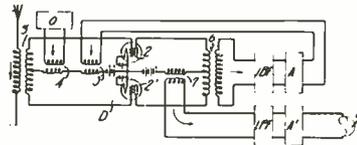
Double Detection Improves Selectivity

By S. R. Winters

IN the double-detection or superheterodyne type of radio receiver it is customary that the incoming high-frequency wave be impressed on a frequency converter which reduces the wave to an intermediate frequency and, after modulation, the intermediate-frequency wave is impressed on a second frequency converter or detector, which yields a signal in the broadcast band. Now, according to a patented receiving circuit of John F. Farrington of Flushing, New York, and Edwin H. Smythe of Chicago, Illinois, the same frequency converter or detector circuit is used for consolidating the modulated waves of the received signal with the locally-generated waves—and this same detector circuit translates the consolidated waves into a signal of the broadcast-band frequency.

This newly patented superheterodyne circuit, patent rights to which have been assigned to the Western Electric Company, also embodies the balanced or push-pull characteristic. In this particular, the intermediate frequency circuit is connected between the input and output circuits, the connections being made symmetrically with relation to one circuit and differentially in its identity with the other, thus aiming to obviate singing effects. The component parts of this single-frequency converting or detecting circuit, as illustrated in the diagram, are: a radio receiver, including antenna; a balanced detector; a band filter; a low-pass filter; and two radio amplifiers.

The balanced detector has two three-electrode vacuum tubes. The auxiliary grids of these tubes are associated with the terminals of the secondary winding of an input transformer, the primary winding of which is incorporated in the antenna circuit. The mid-point of the secondary winding of the first transformer is connected through the secondary windings of two other trans-



Farrington - Smythe superheterodyne receiver circuits.

formers to the cathodes of the two tubes. The plates of these two tubes are associated with the terminals of the primary winding of an output transformer. The mid-point of this primary winding is connected through the primary winding of still another transformer to the cathodes of the two tubes. The secondary winding of this output transformer is connected through a band filter, to the input circuit of one of the audio amplifiers.

The band filter employed is that described in United States patent No. 1,227,113. This filter is represented as being able to pass currents of a frequency intermediate to the incoming radio frequency and the signal frequencies and currents within either the upper or lower sideband of that intermediate frequency. At the same time, it is supposed to suppress currents of higher frequencies. The low-pass filter likewise is intended to pass currents of the signal frequencies and to suppress currents of higher frequencies.

As illustrated in the circuit diagram, this improved and simplified superheterodyne functions in this wise: The desired signal from a certain broadcasting station is picked up in the usual way. The chosen signal of modulated radio waves is impressed, through the first transformer, upon the input circuits of the balanced detector. These modulated radio waves interact with the waves from the locally-generated source in the detector. This action produces in the

secondary winding of the output transformer a current having components with frequencies equal to the sum and difference of the incoming and locally impressed frequencies, each modulated by the signal frequencies.

The signal-modulated radio waves are reproduced in the secondary winding of the output transformer. The band filter blocks the passage of these waves to the amplifier. The radio waves produced by the local generating source and impressed on the common branch of the detector input circuits are balanced out in the primary winding of the output transformer. Thus they are not admitted to the secondary winding of the latter. While, it is true, the waves from the local generator are reproduced in the secondary winding of the output transformer the low-pass filter is a bar to their passage to the audio amplifier. On the other hand, currents of an intermediate frequency modulated by signals, are chosen by the band filter and delivered to the audio amplifier.

Speaking of the advantage of superheterodyne receivers in general and of this one in particular, the designers of this circuit state: "Since the signal-modulated intermediate-frequency waves are greatly amplified by the first amplifier, a greatly amplified signal is obtained from detection of such amplified-signal modulated intermediate-frequency waves. Therefore, the amplitude of the signal resulting from double detection is many times greater than that of the signal resulting from direct detection of the incoming signal modulated high-frequency waves. Consequently, the double detection receivers shown in this diagram are highly selective, since any low-frequency currents resulting from direct detection of any incoming interfering high-frequency waves are negligible, compared to the desired amplified signal resulting from double detection."

RADIO ENGINEERS MEET IN CANADA

The Toronto Section of the Institute of Radio Engineers announces that the first international I. R. E. convention will be held in Toronto on August 18th to 21st, with headquarters in the King Edward Hotel.

The executives and members of the Toronto Section have been active in radio affairs and as a result, this is one of the fastest growing sections of the Institute.

Technical papers of great interest to

all radio engineers will be presented and discussed during the convention. Inspection trips have been arranged to allow delegates to see how radio apparatus is produced in Canada. A special technical exhibit of component parts will be one of the features of the convention. Shopping tours, sight-seeing trips and other entertainment have been arranged for the ladies.

It is estimated that approximately 600 delegates will come to Toronto for this convention which is expected to be one of the most outstanding

meets in the history of the Institute.

The Canadian radio manufacturers have co-operated in making it possible to hold this convention in Canada and with their assistance, and the cooperation of the Institute as a whole, the convention will be a huge success.

The Toronto Section of the I. R. E. was formed in the year 1925, at which time Donald McNicol, then vice-president of the Institute went to Toronto to get the new unit established. Charles L. Richardson was the first Chairman of the Section.

The Standard Signal Method of Measuring Receiver Characteristics*

By C. T. Burke

THE "standard signal" method of rating radio receivers has met with general acceptance since its proposal several years ago. This method of receiver evaluation requires an accurately known voltage of known degree of modulation adjustable over a wide range, including values of very small magnitude. The input to the receiver is adjusted until a standard output power is obtained and the input voltage is taken as a measure of the receiver sensitivity.¹

The functional diagram of Fig. 1 illustrates the arrangement and use of the equipment required by these tests. The output of the modulated radio-frequency oscillator is passed into an attenuator consisting of a resistance network so designed that its attenuation over the operating frequency range can be calculated from its constants. The attenuator is coupled to the receiver through a dummy antenna of prescribed constants. The power output of the receiver is measured by any one of several satisfactory methods.

The method of measurement outlined above forms the foundation for a

put as the separation between the reception of grounds and return conductors. Leakage is reduced to a minimum and there is no "pickup" from the generator.

One or More Stages May Be Measured

The same principle of measurement and type of equipment can be used in investigating the operation of portions of the receiver circuit. Thus a single radio-frequency stage or the entire radio-frequency amplifier could be measured, or detector characteristics could be investigated.

The principal component of the equipment required for these tests is a modulated radio-frequency oscillator provided with means for adjustment of its output voltage to known values over a wide range. The essential requirement of a generator for this purpose is that it produce an accurately known voltage between its output terminals and nowhere else. It is readily realized that if the receiver picks up energy from the generator in addition to that measured at its input terminals, the test will be of no value. The first

attenuator assembly, but also the location of grounds and return conductors.

The General Radio Company in cooperation with the Radio Frequency Laboratories, Inc., brought out its original standard-signal generator, the type 403, in June of 1928. This instrument provided a modulated output in the broadcast range adjustable between 2 and 200,000 microvolts. Complete shielding of the generator permitted its use with unshielded receivers.

While the Type 403 standard-signal generator proved entirely satisfactory for the uses for which it was designed, development work directed particularly at the elimination of its three principal limitations was continued. First, and probably most important, it was not readily adaptable for use at frequencies outside the broadcast band. Second, the radio-frequency oscillator was required to deliver so much power that external batteries were necessary, which seriously impaired the usefulness of the instrument for such purposes as field-strength measurements where portability is an important con-

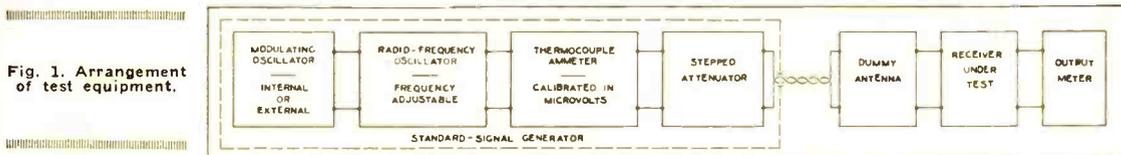


Fig. 1. Arrangement of test equipment.

complete test of receiver performance. In establishing the rating of a receiver, a series of sensitivity measurements at frequencies including the entire operating band would be taken. Selectivity curves, i.e., curves of sensitivity for signals differing in frequency by increasing amounts from that to which the receiver is tuned, at a number of frequencies throughout the band can be plotted from data obtained in the same manner. The output of the radio-frequency oscillator is adjusted as the oscillator frequency is changed in small steps, so that the receiver output is kept constant. The frequency to which the receiver is tuned, the frequency of the oscillator, and the voltage input to the receiver are recorded. From these data, a selectivity curve may be plotted showing the strength of interfering signal required to give the standard out-

two requirements of the generator are, therefore, adequate shielding and a means of adjusting and accurately determining its output voltage over a wide range including very small magnitudes. The problem of shielding, while quite troublesome, involves only the application of known principles.

It is necessary to obtain output voltage of a few microvolts. Since there is no known method of measuring such voltages directly, it is necessary to attenuate a measurable voltage by means of a calculable network in order to obtain voltages of this magnitude. The design of an attenuator which is accurate at broadcast frequencies is a problem of considerable difficulty. The voltages involved at the lower ends of the attenuator are so small that minute pickups and ground currents will greatly affect the output voltage. The design of such an attenuator involves not only the design and layout of units which will have negligible reactance in themselves, and between units in the

consideration. Third, the elaborate shielding made the process of changing tubes or making other adjustments inside the generator excessively involved.

As a result of this program, the new Type 403-B standard-signal generator was placed in production last summer. The most radical design change was the lowering of the power in the oscillating circuits. The older model used 112-type tubes with 135 volts on the plate, and its radio-frequency oscillator delivered 100 milliamperes to the attenuator system. In the Type 403-B, 12-type tubes were used with a plate-battery voltage of only 45 volts; the input to its attenuator was only 5 milliamperes. This reduction in level of the power input to the attenuator accomplished two of the objects of the redesign. Since the amount of shielding largely depends upon the power level in the oscillator circuit, the change permitted a very extensive simplification of the shielding system. The smaller batteries could be placed in-

* General Radio Experimenter.

¹L. M. Hull, *Proceedings of the Radio Club of America, October, 1928*; I. R. E. Yearbook, 1929, pp. 106-128.

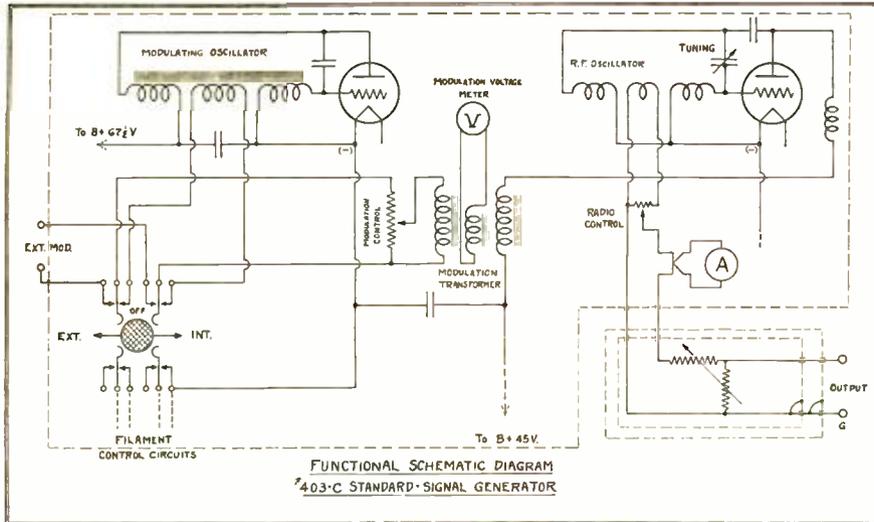


Fig. 2. Circuits of signal generator.

side of the instrument without increasing the cabinet size. The oscillating circuit was also redesigned to permit the use of plug-in coils, thus extending the frequency range of the instrument.

Development work on the generator, particularly on attenuator systems, was actively continued, even after manufacture of the new instrument was started. The problem of attenuator design is peculiar in that it is more difficult to check the performance of attenuators at low output levels than to design them. The attenuator system had a total voltage attenuation ratio of 20,000 to 1 with minimum outputs of a few microvolts at radio frequencies. There is no known method of measuring a microvolt of alternating current directly. All methods of measurement of voltages of such magnitude are comparison methods and involve at least as great a possibility of error as does the attenuator system being checked. Four methods of comparison are available. Two attenuators of different construction but identical ratios may be connected in cascade. As the attenuation of one is increased and that of the other is decreased by the same amount, the output should remain constant. The validity of this method rests on the reasonable belief that two attenuation systems of different construction would not have compensating errors at all attenuations and at different frequencies. It is subject to the disadvantage that there is no direct indication as to which attenuator is responsible for any error that may appear.

Another method varies the current input to the attenuator as the attenuation is changed. This method is necessarily confined to a limited range of attenuation steps, since the current input to the attenuator must be kept within the operating range.

A third method of attenuator calibration is to observe the output of a radio receiver as the input is increased. This involves a knowledge of the detector characteristic of the receiver

amounting to a calibration of the receiver. The difficulty of such calibration without a source of known input voltage is obvious.

A fourth method is to heterodyne the output of the attenuator under test, and amplify it at a lower frequency. An attenuator, calibrated at the lower frequency included in the low-frequency amplifier, is used to check the high-frequency attenuator.

All four methods depend upon an unknown receiver characteristic to determine the amount of difference in the two voltages compared. If there is no difference, however, the receiver characteristic does not enter the measurement except when the third method is used.

Range Includes Fourteen 2 to 1 Ratios

It is the opinion of those most familiar with the problem that it is impossible to obtain a voltage attenuation ratio of 2 to 1 at 1000 kilocycles with a smaller probable error than 1 per cent. The range of the attenuator used in the standard-signal generator includes fourteen 2 to 1 ratios. The probable error of such a system may, therefore, be about 15 per cent. It should be noted that this is a limitation of the method of checking the attenuator, not necessarily of the attenuator itself.

With improved methods of checking the attenuators, several sources of error were discovered, necessitating changes in the attenuator system. Coupling to the attenuator leads was found to exist, as well as coupling between input and output sections of the attenuator, which had a total voltage attenuation ratio of 20,000 to 1 in a single shielded compartment. It was also found that heavy currents flowing in the shielding about the attenuator set up fields which coupled into it.

Several measures were adopted to overcome these difficulties. The use of a type of concentric conductor in

which the low potential side of the circuit forms a shield for the high potential side eliminated the trouble due to voltages induced in the wiring. Capacity coupling between the two ends of the attenuator was eliminated by dividing it into two sections and shielding them from each other. The entire assembly was then placed in a separate shielded compartment electrically isolated from the main shielding except for a connection at one point.

With the new attenuator, which is a conventional L-network, a maximum total probable error in the attenuator system of less than 15 per cent is indicated. In other words, the error in the smallest output voltage due to the attenuator is less than 15 per cent if all of the individual errors between steps were cumulative. The possible cumulative error, of course, decreases as more sections of the attenuator are removed from the circuit to obtain the higher voltages.

The Type 403-C standard-signal generator, as the latest design of the new instrument has been designated, consists essentially of a modulated radio-frequency oscillator. The tuning range covered by five coils extends from 15 to 1500 kilocycles. In addition to the main tuning condenser, a secondary frequency control is provided for use

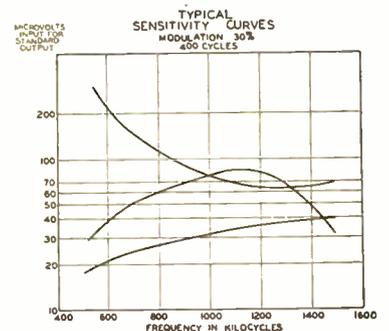


Fig. 3. Sensitivity curve.

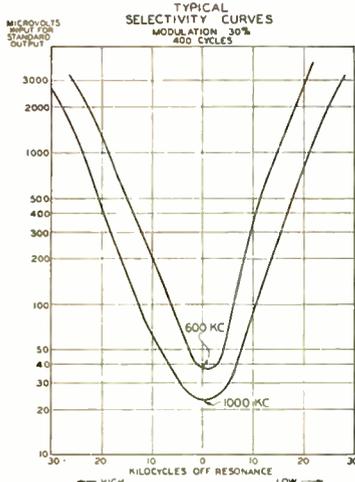


Fig. 4. Selectivity curve.

in taking selectivity curves, where a small change in frequency is desired. This control consists of a copper sector which moves in the field of the tuning coil and changes its inductance.

Since the frequency change due to this adjustment results from a change in inductance, the percentage change in frequency for a given setting is not directly affected by the setting of the main tuning control, which changes the capacity in the circuit. Modulation is provided for with a 400-cycle vacuum-tube oscillator included in the generator. Terminals for external modulation with input leads properly filtered to eliminate radio-frequency leakage are also provided. The external oscillator should be capable of maintaining about 15 volts across 2500 ohms in order to produce 30 per cent modulation.

Input Measured in Microvolts

The input current to the attenuator is read on a thermocouple meter cali-

brated in microvolts, and the attenuator is calibrated as a multiplier. The attenuator has a non-reactive output impedance of approximately 10 ohms at all steps except the two corresponding to greatest output voltage.

The entire assembly is enclosed in a shielded cabinet. Filter circuits are included in the leads to the meters, making screening in front of the meters unnecessary. The instrument can be used with unshielded receivers without any pickup from the generator. The most sensitive receivers available have failed to detect any signal voltage when connected to the generator with the generator output switch set at zero.

A standard dummy antenna made in accordance with the specifications of the Institute of Radio Engineers is available. Its constants are:
 Inductance . . . 20 microhenrys
 Capacitance . . . 200 micromicrofarads
 Resistance . . . 25 ohms
 The effective height is taken as four meters.

The Type 403-C standard-signal generator requires two 12-type vacuum tubes for operation. Space is provided in the cabinet for the necessary batteries; i.e., 1.5 volts for the filament, and 45 volts and 67.5 volts for the plates of the radio- and modulating-oscillator tubes, respectively.

The Type 403-C standard-signal generator possesses the features required for the measurement of receiver characteristics with facility. The voltage of the output system is continuously variable over a wide range. Leakage is reduced to a minimum, permitting the measurement of very sensitive receivers. Selectivity curves may be rapidly run by use of the fine adjustment on the frequency control. The use of external modulation makes overall characteristics readily obtainable.

The curves of Figs. 3, 4, and 5 are illustrative of the type of receiver data that is obtainable with the signal generator. The effect of side band cutting is noticeable on the audio-frequency characteristic of Fig. 5.

While the standard-signal generator is used extensively in receiver testing, both in the laboratory and the production line, its uses are not limited to receiver performance tests. Another wide range of usefulness of an instrument of this sort, producing a known voltage of small magnitude, is in the measurement of the radio-field intensity (field strength) of transmitters. The portability of the instrument, with all batteries contained in the cabinet, is of particular advantage in this connection.

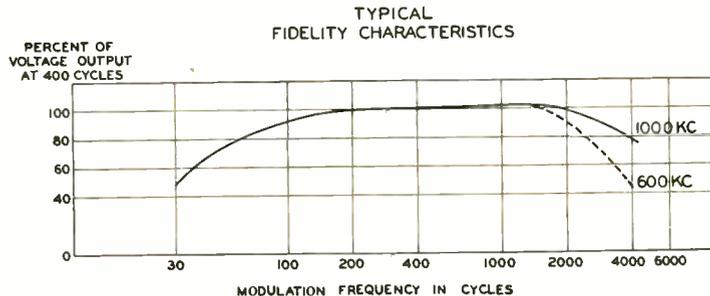


Fig. 5. Fidelity curve.

COMMERCIAL ELECTRIC POWER COMPANIES' EARNINGS FROM RADIO

It has been determined that for modern radio receivers the average commercial electric power used amounts to about 100 watts per receiver. Taking the average power cost at 7½ cents per kw., and the average daily use per receiver as 3½ hours, this totals about \$9.45 per receiver per year.

In the Washington hearings held recently on the Department of Commerce's annual supply bill, W. D. Terrell, chief of the radio division stated that there are ten million receivers in use in the United States. The National Electric Manufacturers Association estimates 7,100,000 receivers in operation. The figures from this source might be expected to be very conservative. Another source of statistics

reports that there are 11,800,000 receivers in use. However, taking a figure of but 5,000,000—one half of the Department of Commerce's total—as consuming commercial electric current, for direct operation or for battery charging, we arrive at the astonishing total of \$47,250,000.

In addition to this there is a very large increase in the commercial lighting load as the result of millions of lights being used for several hours each evening while radio receiver owners listen-in on broadcast programs.

Studies on the cost of operating radio receivers have recently been made by the Stromberg-Carlson Company of Rochester. They find that a typical one of their receivers consumes a maximum of 90 watts (as much power as is used by two 45-watt electric light bulbs). This is a cost of about nine-

tenths of a cent per hour, figured at the rate of 10 cents per kw. hour. Figured on the same basis, this company's No. 654 radio-phonograph combination can be operated for nine-tenths of a cent per hour for the radio set only, and one and two-tenths cents per hour when operating the phonograph (maximum of 120 watts).

In addition to the set owner's contribution to power company's earnings there is the considerable cost of broadcast station electric power. All-in-all the "Public Service" companies do very well with this by-product of radio.

At a time when unemployment was so widespread that the national and state governments had to bend all effort toward remedy, February, 1930, the output of the electric light and power industry was 3 per cent higher than in February, 1929.

Measurement of Loudspeaker Impedance Under Operating Conditions

In Loudspeaker Operation When There Is a Decided Response Peak, It Is Desirable to Make Current and Impedance Measurements.

* By R. R. Ramsey and George M. Urey †

DURING the past year or two a great amount of interest has been taken in the performance of loudspeakers, audio transformers, and choke coils. Often the inductance or impedance is measured at one or more frequencies using one of the standard methods such as the a-c. impedance bridge. The assumption is then made that this is the value of the coil when used in the receiving set.

It is well known that the inductance, B , of an iron core coil depends upon the field, H . This means that the inductance or the impedance of an iron core coil depends upon the current in the coil. This is true whether the current is a-c. or d-c. The magnetic modulator which is used to modulate the output of a high-frequency Alexander alternator depends upon this effect. In the magnetic modulator the inductance of the coil in the radio-frequency circuit in which the modulator is placed is changed by means of a direct current.

In the case of a loudspeaker the impedance increases with the response of the speaker. Measurements show that the current decreases or the impedance increases when there is a decided response peak in the loudspeaker.

To obtain the response curve of a loudspeaker one must have rather elaborate apparatus such as an amplifier and a microphone and these must give uniform response for all audible frequencies. After these have been obtained and calibrated one must have a sound-proof room, one in which the

walls are perfect absorbers of sound of all frequencies. It is practically impossible to get a room free from reflection and standing waves. Since this is true one is never sure but that perhaps some of the characteristics of the response curve are due to the room.

Since this is a relation between response and impedance one can predict the response fairly accurately from the impedance curves. At least all decided resonance peaks will show up. However, the curves must be made under the exact conditions which exist in the circuits in which the apparatus is used.

In Fig. 1 the connections are shown in which a beat frequency oscillator is used to generate an a-c. e.m.f. of any desired frequency from 30 cycles to 10,000 cycles. Fig. 2 gives the circuit in which Western Electric constant frequency records and a phonograph are used as the source of e.m.f. These records can be obtained giving frequencies from 30 cycles to 10,000 cycles. This connection is seen to be the usual connection of a high impedance loudspeaker connected in the plate circuit of the power tube of an amplifier which is connected to an electric pickup on a phonograph. The only change is that d-c. and a-c. milliammeters are connected in series in the output circuit and a vacuum tube voltmeter is connected across the terminals of the loudspeaker.

The vacuum tube voltmeter, since it is the "leaky grid" type, takes no load and measures the a-c. potential across the terminals of the loudspeaker. The d-c. milliammeter measures the direct current through the coil and the a-c. thermo-meter measures the root-mean-square of the d-c. and a-c. components of the current through the coil. From these readings the value of the alter-

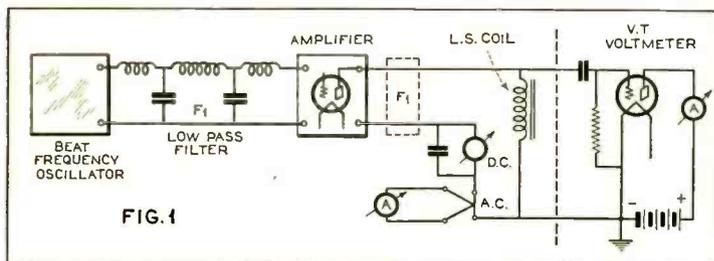
nating current is calculated by the method explained later. The impedance is the ratio of the alternating current to the alternating e.m.f.

In using the method certain precautions must be taken. Low-pass filters 10,000 cycle cutoff must be placed in the circuit to cut off any radio-frequency current which may be generated in the oscillator or amplifier. In Fig. 1 such filters are shown diagrammatically at F_1 between the oscillator and the amplifier and schematically at F_2 in the plate circuit of the amplifier. In Fig. 2 a filter is used in position F in the plate circuit of the amplifier. Without a filter the vacuum tube voltmeter may show an e.m.f. when the oscillator or phonograph record is inactive. This potential as measured by the vacuum tube voltmeter may diminish when the audio e.m.f. is applied. The explanation for this extra potential is that the oscillator or amplifier may generate radio-frequency current which produces no audible effect in the speaker but which causes a large e.m.f. at the terminals of the speaker.

In this connection it may be related that recently a student picked up on a short-wave receiver excellent music from a resistance coupled amplifier which was used to amplify phonograph music. The tuning was very sharp in the neighborhood of 20 meters wavelength. The resistance coupled amplifier in this case was a short-wave transmitter. This suggests that the quality of many amplifiers might be improved if filters were used in front of or behind the amplifier. Perhaps filters in both positions would improve the quality.

Method of Making the Measurements

The measurements were made in the following manner. The amplifier was first energized. This sent a direct current through the speaker and the milliammeters. The readings of both instruments were read to note if both meters read the same on direct current. (Some thermo-meters do not read correctly with direct current while they may read correctly with alternating current. A meter must be used which will read the same with current in either direction.) The source of audio e.m.f. was then turned on and the amplifier was adjusted to give good response in the loudspeaker. The vacuum



Connections of a beat-frequency oscillator to generate frequencies from 30 to 10,000 cycles.

* R. R. Ramsey, Professor of Physics, Indiana University; Author of "Experimental Radio" and "The Fundamentals of Radio."

† George M. Urey, Engineer R. O. A. Photophone Co.

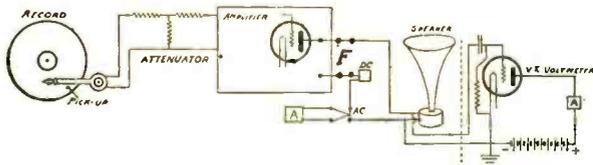


Fig. 2. Constant-frequency record used as e.m.f. source.

tube voltmeter was read and the readings of the two current meters were read. The d-c. meter reads the direct-current component of the current while the thermo-meter reads the root-mean-square of both the direct current and the alternating current. This is the root-mean-square of $I_{d.c.} + I_{a.c.} \sin \omega t$.

This root-mean-square is

$$\sqrt{\frac{I_{d.c.}^2 + I_0^2 \sin^2 \omega t}{f \cdot 2\pi \cdot \omega \cdot d \cdot t}}$$

which is equal to $\sqrt{I_{d.c.}^2 + I_{a.c.}^2}$. Since the d-c. is known from the d-c. meter we have $I_{a.c.} = \sqrt{[I_{d.c.}^2 + I_{a.c.}^2] - I_{d.c.}^2}$ from which the value of the alternating current can be calculated. Then the impedance, $Z = E_{a.c.}/I_{a.c.}$.

The theory can be checked with ordinary 60-cycle current using ordinary alternating-current instruments if one measures the impedance of a large air core coil by means of this method and then again by means of alternating current alone. With air core coils the impedance is the same with both methods. The direct current does not change the permeability of air.

Fig. 3 gives two curves in which impedance in ohms is plotted against frequency plotted on logarithmic paper. The upper, dotted line shows the values when measured with alternating current alone. The lower, heavy line curve shows the values of the impedance of the same speaker when measured under operating conditions using constant frequency records as diagrammed in Fig. 2.

The average impedance is lowered by the direct current. The forms of

Fig. 3. Impedance plotted against frequency.

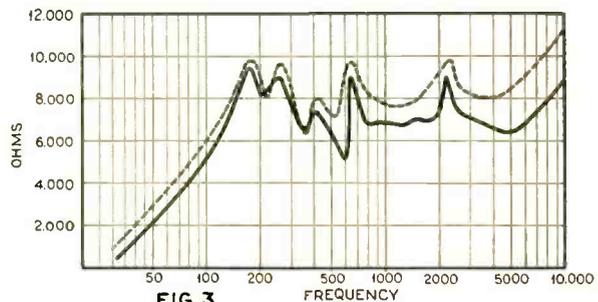


FIG. 3

the two curves are much the same but the variation of the impedance is increased by means of the direct current. Between 150 cycles and 5000 cycles the greatest variation of the dotted line is from 6100 ohms up to 9750 ohms or a variation of 3650 ohms. The greatest variation of the full line curve is from 5100 ohms to 9500 ohms or a variation of 4400 ohms. If we assume that the average impedance with alternating current is 8000 ohms the fluctuation is 3650-8000 or 45 per cent. If we assume the average impedance with both currents is 7500 ohms the fluctuation is 4400-7500 or 57.5 per cent.

From the above results it will be seen that if one wants to know how a particular coil performs it is necessary to make measurements using the exact circuit in which the apparatus is used in practice.

The Loftin-White Direct-Coupled Amplifier

By John Dunsheath

Some Students Have Gained the Idea That The Loftin-White Amplifier is Simply a Variation of the Early Resistance—Capacity Hookups. This Article in an Original Manner Describes the Difference.

SOME students of radio amplifier circuits casually viewing the diagrams of the Loftin-White hookup have at the outset had the notion that the principle resembled closely ordinary resistance-capacity coupling; or, resistance coupling.

Perhaps reference to Fig. 1, will enable the student better to understand the principle of this new amplifier and how it differs from others.

The inductances in transformer coupling, and the condensers in resistance coupling have tendencies to distort the notes or audio frequencies in audio-frequency amplifiers.

Loftin and White desired to do away with such inductances and condensers, designing an amplifier that would

faithfully reproduce and amplify all of the notes. The inventors desired to connect directly from the plate of the first tube to the grid of the second tube, but such connection made the grid of the second tube of the same d-c. potential as the plate of the first tube. If the older method of connection were used the cathode of the second tube would then be at a lower value of direct-current than its grid. Loftin-White avoided this condition by raising the cathode of the second tube to a potential higher than the plate of the preceding tube. Incidentally, of course, they raised the plate of the second tube to a still higher potential.

The resulting difference in d-c. potential as used in Loftin-White direct

coupling, and those used in resistance and transformer coupling, are indicated in Fig. 1. The grid of the first tube (G_1); cathode of the first tube (K_1); screen-grid (SG); plate of the first tube (P_1); grid of the second tube (G_2) and plate of the second tube (P_2) indicate the relative potentials of these elements with reference to the voltages at the left.

The left portion of Fig. 1 shows the relative d-c. potentials of the elements in the Loftin-White direct-coupled arrangement. The right portion shows the relative d-c. potentials in the transformer or resistance coupled amplifiers. Comparison of the right and left portions will show the relative d-c. potentials in the L-W as compared to resist-

ance or transformer coupling.

It may be noted that the d-c. potentials in the L-W amplifier are always on "the up and up" while d-c. potentials in resistance and transformer coupled amplifiers step up, up, down, up, up.

There is, of course, more than this to the Loftin-White amplifier. By avoiding phase shifting caused by condensers (experienced with resistance coupled amplifiers and the inductance in transformer coupling) the L-W arrangement provides for feeding back neutralizing currents to reduce hum from power sources. The inventors also found how to automatically control the difference in d-c. potentials between G_1 and K_1 to care for strong or weak carrier currents, or audio currents, that may be applied to G_1 and K_1 , for, odd as it may seem, the device worked out to be either a radio detector and audio amplifier or simply an audio amplifier.

Fig. 2 shows a circuit assembly of the Loftin-White amplifier. The power units contain two 2.5-volt windings and one 5-volt winding. They also contain a high voltage center-tapped winding for the full wave rectifier. The vari-

This unusual sketch illustrates progressively steps of amplification.

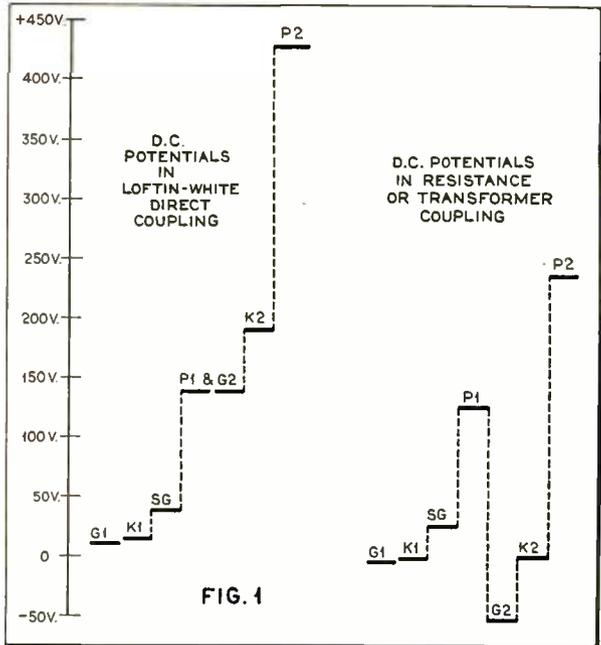
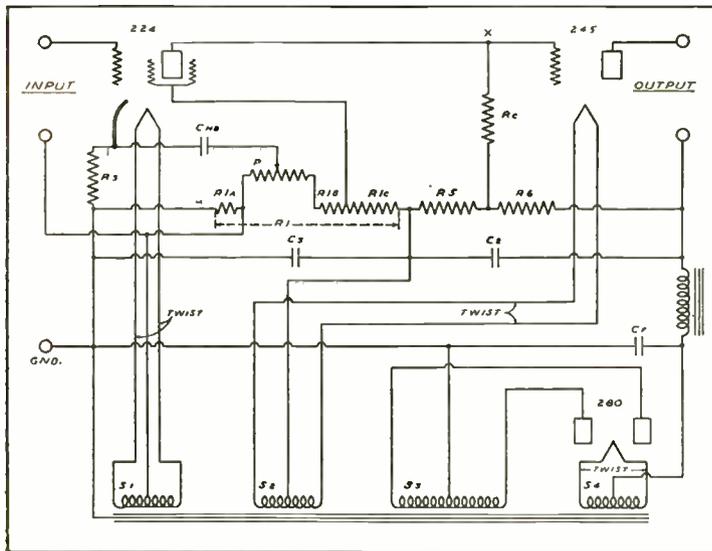


FIG. 1



ous resistance units shown are specially made as to values.

Although the amplifier resistance values are not noted in the circuit diagram herewith, these may be procured from kit manufacturers who specialize in these units.

The Loftin-White direct-coupled amplifier system clearly yields a stage gain of impulse energy greater than that obtained with transformer coupling. Many laboratories are now experimenting with the direct-coupling system to ascertain its value for the amplification of voice and music sounds.

Fig. 2. General wiring of the circuits of the Loftin-White direct-coupled amplifier. The input terminals are on the left, the output on the right.

MANY STEPS FOR EFFICIENT VACUUM

The removal of the free gas is but the first step in the making of an efficient vacuum tube, it is stated by an engineer of E. T. Cunningham, Inc.

Modern pumping methods have brought this process to a high degree of speedy efficiency. The most important task is the elimination of the gases retained in and on the glass and metal parts of the tube.

This requires the use of heat and internal bombarding, in cooperation with continued pumping, to coax these

more stubborn gases from the tube interior. Tubes are exposed to high temperatures while pumping and as a result the gases are freed and removed.

After this process, however, there may remain the minute quantities of gas upon the metal parts which have not undergone any noticeable temperature increases, due to the vacuum creating a barrier to heat reaching the metal parts of the interior.

This is the point where the internal bombarding process enters. Induction from a high-frequency induction

coil placed over the tube also is used. Both processes heat the interior metal parts to an intensive degree. The released gases are removed by the pumping method.

CHROMIUM PLATING

Chromium plating, electro, as a finish, cannot be polished but reflects the surface on which it is plated. Steel is first copper plated and then nickel plated, then chromium. The nickel is polished before chromium applied. Brass does not need the copper and nickel preliminary plating.

The Photoelectric Cell at Work

Many Uses for New Device

New Device Uses Light to Control Machinery

THE interruption of a beam of light controls the operation of industrial machinery and other devices by utilizing a new device, the photoelectric relay, announced by the General Electric Company as an addition to its standard line of control equipment. The new relay is essentially a vacuum tube device, and uses both the photoelectric tube and the plotron.

Many industrial or other operations in which a change of light is involved can be controlled by the new relay. In addition, many operations which can be arranged to cause a change of light can be so controlled. A machine, for example, which travels in a certain direction for a certain distance and is then stopped or reversed, is a typical application. When the traveling mechanism reaches its limit it would interrupt a beam of light falling on the photoelectric tube and thus cause the control device to function.

Another example of application is in counting items such as bags of material, or boxes, where mass production is involved. As each item passes through the essential beam of light it causes the photoelectric relay to operate, and actuate a magnetic counter. Vehicles passing a definite point can be counted in like manner. An example of this application is found in the Holland Tunnel where automobiles are counted by the photoelectric relay.

A third type of application would be sorting packages according to size, shape or reflecting power. Other examples would be stopping a paper machine when the paper breaks, aligning the paper on the rolls of the same machine, turning electric signs or signals on or off, depending on the intensity of the outside light; reflecting packages on conveyors, and operating bag piling mechanisms.

Controls Illuminated Signs

The use of the photoelectric relay to control lights or illuminated signs according to the intensity of daylight is an interesting one. In an office or factory building it is always desirable to have a certain minimum light for the workers. During the day time, when the daylight intensity is high, no artificial lighting is needed. By using the new relay, the artificial lights can be turned on automatically when the daylight intensity falls below the predetermined minimum.

This new relay, Fig. 1, is designed for use in controlling an electric circuit in response to an increase or decrease in the amount of light falling on the photoelectric tube. The manufacturer lists the following advantages resulting from its use:

1. It operates without shock or resistance to the progress or movement of the object which actuates it, or without impairing the accuracy of delicate mechanisms.
2. It can be located remotely from the equipment controlled, thus permit-

ting mounting in small space around automatic machinery.

3. It is adjustable in sensitivity.
4. It can be used outdoors by mounting in a watertight enclosing case.
5. It is easily installed, and its operation is easily adjusted or changed.
6. It can be operated at high speeds, 100 times a minute being an approximate maximum.

For some applications it may be necessary to select carefully a suitable light source and optical accessories, but for many cases the light source may be a domestic Mazda lamp with or without a simple reflector and shield.

The standard electric supply for the relay is 110/120 volts, 60 cycles, alternating current. The device may, however, be built for other frequencies or voltages, and a similar device for operation where only direct current is available can be obtained.

The operation of the relay is described technically as follows: With a voltage of proper polarity and magnitude applied between the two elements of the photoelectric tube, the current it passes is proportional to the amount of light shining on it. This current (of the order of a few microamperes) is amplified by a plotron. The sensitive relay is connected in the plate circuit and is energized or de-energized in accordance with the amount of light shining on the photoelectric tube. The contacts of the relay control the coil circuit of the contactor. When the relay in the plate circuit of the amplifier is energized, it will first open its normally-closed contacts and then close the normally-open contacts. This relay, therefore, either makes or breaks the coil circuits of the contactor depending on how it is connected.

When the contactor is de-energized approximately ten watts is required by the device, and when the contactor is energized approximately 30 watts is required.

Electric Eye Prevents Prison Breaks

When a model of a prisoner creeping up a model prison wall came within the range of vision of an "electric eye" a revolver trained on the prisoner was fired and a belt on the prison wall sounded a general alarm. This interesting application of the electric eye, demonstrated by E. H. Vedder of the Westinghouse Electric and Manufacturing Company was

Hardly a Week passes that a new use is not found for the new Wonder Cell.

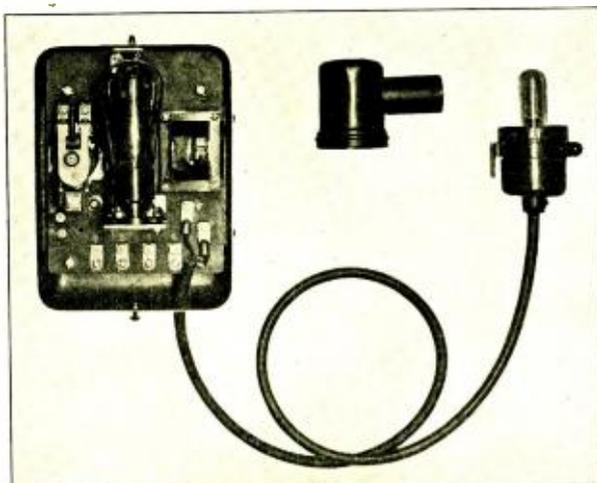


Fig. 1. Relay operated by Photo electric cell. (General Electric Co.)

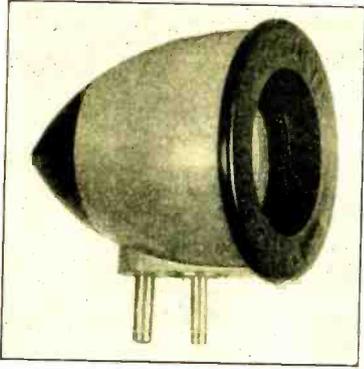


Fig. 2. Photolytic cell of the Arcturus Company.

demonstrated before the Illuminating Engineers of Boston. In addition this device might have turned on a system of flood lights and set off a battery of machine guns or even a barrage of rear gas. The protective field available seems unlimited, it is only necessary to select the severity of the method to be used.

This was the first demonstration of how science may thus stop the ever-frequent prison breaks. This use of the "electric eye" is only one of its many possible applications. The mechanism involved for the prison demonstration was relatively simple. At one end parallel to the prison wall and near the top a small and scarcely noticeable beam of light shined steadily into the "electric eye" which was mounted at the other end. When desirable an invisible beam of ultra violet light may be employed. Any interruption to this beam though ever so slight causes the desired sequence of events to occur with lightning-like rapidity. The interruption of light causes the flow of current through the "electric eye" to cease. The impulse thus created, amplified through a grid-glow tube, operates the relays. These in turn pull the trigger of the revolver

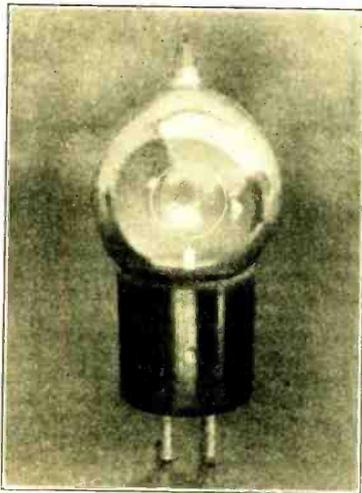


Fig. 3. Photocell of the Jenkins Television Corp.

and set off the electric bell or whatever other devices have been installed.

The "electric eye" is a photoelectric cell, and purely a light sensitive device. If voltage is applied and light made to fall upon it a current passes by means of electronic emission from the cathode to the anode. This current is very small but may be amplified by a grid-glow tube to enable it to operate commercial relays.

The "electric eye" has made possible numerous operations previously thought to be impractical. The field for its application is almost unlimited. It has aided in the perfection of talking motion pictures, television, fire alarms, and many other applications.

It may be applied to initiate any operation that may be controlled electrically. This light beam that controls the apparatus may be either direct or reflected. For example, a puff of cigarette smoke between a light source and the cell or even the reflection of light by different shades of color are sufficient to start the operations controlled by the cell.

Electric Eye Signals Plane Crossing Field Boundary

A late development of the photoelectric cell contributes to the safety of blind flying by reducing the hazard of making a landing through a ground fog. George Lewis, vice-president of the Arcturus Radio Tube Company, describes the device upon which his engineers are working.

"The combination of radio and marker beacons has contributed much to the safety of blind flying, in leading the pilot directly to his terminal field. And the use of a sensitive barometric altimeter as recently demonstrated at Mitchell Field, brings the safe blind landing into the realm of possibility. It remains, however, to mark accurately the boundary of the field for the pilot concentrating upon his instruments, as he must do when flying blind. The pilot cannot look over the side of his plane—a useless waste of time anyway, for, in a heavy ground fog, there is nothing for him to see. Science, however, has provided a third and highly sensitive eye in the photoelectric cell, which, with associated apparatus, can be depended upon to inform the flier that he has crossed the border of the field, and may flatten out for the landing.

"A series of photoelectric cells are placed along the field boundary and the plane is equipped with a special neon light projector, throwing a wide beam downward. From an altitude of fifty feet, this light will penetrate a thick fog, and cast a line of light upon the ground at right angles to the plane and sufficiently long to cut at least one cell. The flash of light actuates a radio transmitter that sends an unmistakable signal, received on the standard airplane beacon receiver, and the pilot knows that a safe, smooth runway is beneath him."

Adds Accuracy to Analyses

The accuracy of blood and other physiological analyses, which often depends upon the accuracy of color observation on the part of the analyst, has been enhanced by the development of an artificial eye which can be carefully calibrated in reference to sensitivity to different colors.

The human eye, almost invariably suffers to an extent from color blindness. Some persons are more color blind than others, and most of us will find that one eye sees objects at a slightly different shade than the other. This can be noticed by looking at a highly colored picture first with one eye and then with the other. Color blindness, slight or even acute, has little effect upon our success in life, if we are lawyers, automobile mechanics and about seventy-five per cent of all possible trades and professions. But when it comes to blood and other physiological analyses, where color is often a determining factor, an electric eye, such as the photoelectric cell, which never suffers from color blindness, or even retinal fatigue (which may affect even the normal eye) is a considerable contribution to the accuracy of results.

"The photoelectric eye can detect color differences beyond the sensitivity of the best human eye, and can relay its decision to amplifying apparatus that will indicate the color or variation from a standard color on a printed tape for a permanent and accurate record.



Fig. 4. Photocell of the De Forest Company.

Printing Plates

Applications of the photoelectric cell or electric eye include the preparation of printing plates or engravings directly from the copy itself. The actual copy, whether it be type matter, drawing or photograph, can be placed on a drum and revolved past a photoelectric cell optical system. The dot of variable light reflected from the copy to the photoelectric cell, actuates the photoelectric cell, which in turn operates an electrically operated engraving tool working directly in soft metal such as zinc, producing the final printing plate.

THE PRIOR ART

(Concluded from page 53)

Sufficient has been said of the more striking differences of the patent statutes in the more important countries to indicate that to obtain complete patent protection on an invention, certain precautions should be observed with reference to publication, public use, or sale. Unless these precautions are observed it may well happen that in one or more countries the invention will be prematurely added to the prior art.

The safe procedure, if world wide patent protection is contemplated, is to make sure that applications for patent are filed in all countries where protection is desired before the invention is either patented, published, used, or sold in any country. If circumstances do not permit following this preferred procedure, the first filed application should precede publication, use, or sale, and the remaining applications should be filed within the Convention year.



THE LAW OF LIBEL AND SLANDER IN RADIO BROADCASTING

INTRICATE legal problems, which have been growing up on all sides with the growth of broadcasting, were outlined recently by A. L. Ashby, vice-president and general attorney of the National Broadcasting Company, in an address at the New York University School of law.

"Defamation over the radio," he said, "is oral as between the person speaking into the microphone and the radio listener and constitutes slander, not libel. But, if the announcer or speaker reads a written defamation before the microphone, there would be elements of both slander and libel, the same act being the utterance of slander and the publication of a libel. In some states, notably California, statutes have been enacted making defamation by radio punishable as a crime. Slander by radio may reach millions of people, even more than by newspapers and magazines. Most of the laws relating to slander do not make it punishable as a crime, the criminal provisions being limited to libelous defamation.

Held as Contempt of Court

"It has been held in a case arising in California that oral utterances made over a radio broadcasting station calculated to prejudice the conduct of a pending criminal trial was contempt of court by the speaker. Probably the broadcasting station would in such case not be liable, but if the station's announcer should make an unlawful statement, the broadcasting organization would undoubtedly be guilty of contempt of court."

The question of the right to re-broadcast is in litigation at present. A suit is pending to test the right of a

hotel to use a master receiving set and relay programs to hotel rooms.

"Although it is impossible to copy-right an idea, a character or a title to a work in the United States," continued Mr. Ashby, "the infringements of such ideas, characters and titles, may give rise to a right of action. Broadcasting organizations are frequently confronted with claims of infringement of titles of programs, characters in programs and the infringement of ideas claimed to have been originated by some other party. It generally develops that the other party's idea was not original. A more serious question is presented when an author is engaged to write dramatic sketches for radio presentation when that author originates the idea on which the sketch is based, builds the characters and names them, and is later discharged. Suppose the broadcasting organization continues with the same type of sketch under the same title using the identical characters."

Binns Won \$10,000 Damages

The right to re-enact events concerning the life of a living person is another legal problem. Jack Binns, the wireless operator of the *Republic*, who stuck to his post signalling for help and became the hero of the first use of radio for rescue at sea, obtained damages of \$10,000 from a motion picture concern for an unauthorized portrayal of him "for purposes of trade."

"The facts are so analogous in this case to the radio program re-enacting events in the lives of living persons," said Mr. Ashby, "that it would seem that the broadcasting of such a program would be a misdemeanor in New York and subject the parties to an action for damages and injunction."

Mr. Ashby criticized the Federal radio act on the ground that it did not provide an adequate appeal process.

"There has been considerable discussion," he said, "as to whether or not a broadcasting station has a property right in the channel which it is using which cannot be taken away without due process of law. Although it may well be that a station has no property right in any particular channel as against the regulatory powers of the United States, I am of the opinion that that station has some right—the right of a prior user. This right of the prior user cannot be taken away by a subsequent user or a new applicant, provided the prior user continues to serve public convenience, interest or necessity. The doctrine of the prior user has been firmly embedded in the analogous cases relating to utilities, such as telegraphs, telephone, power and light."

On the question of Federal censorship Mr. Ashby said: "Congress was wise in withholding the power of censorship, for it is too strong a power to delegate to any commission or department. There is no censorship of the press and there should be none of radio. After all, the public is the best censor."

GENERAL RADIO BUILDS NEW RADIO-FREQUENCY LABORATORY

In line with its general policy of progressive expansion, the General Radio Company of Cambridge, Mass., has recently broken ground for a four-story building which will increase its plant capacity 60 per cent. This addition will be devoted largely to research laboratories and to special forms of production on radio-frequency apparatus for use in research laboratories.

The consideration of a suitable site for this building disclosed the fact that testing methods have developed so rapidly that today it is no longer possible to set up a laboratory in a convenient place. Special facilities for the maintenance of frequency standards to an accuracy of two parts in ten million, were sought by the General Radio engineers in planning the new laboratories. Sensitivity readings must be reliable to closer than a microvolt. This precision work calls for laboratories so located and constructed as to render them free from external disturbances. The new building is being constructed with these and other considerations in mind.

Although the new addition will be ready for use by September 1, a month or two more will be required for the establishment of the laboratories which are to be equipped with the most advanced facilities for research in radio frequencies. Meanwhile, the personnel of the General Radio Company is being augmented to assure the necessary talent for the utmost utilization of the facilities about to be devoted to the solution of many radio research problems.



RADIO WORLD'S FAIR, NEW YORK AND CHICAGO ELECTRIC SHOWS

(Concluded from page 52)

During the shows manufacturers acquire new distributors in various parts of the country and in foreign countries as well. Decisions are made with dispatch because hesitant wholesalers are able to inspect all leading lines under one roof, in a relatively short interval. Wholesalers in turn are satisfied with the manner in which dealer accounts are closed.

G. Clayton Irwin, Jr., general manager of the Radio World's Fair and the Chicago radio show, said that the suggestion to enlarge the scope of the expositions originated with radio manufacturers who also produced other electrical products.

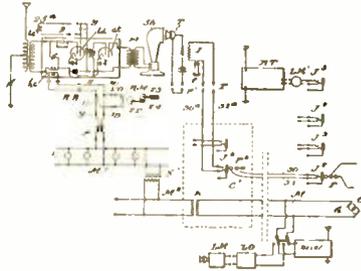
"When they began to market additional products," said Mr. Irwin, "it was quite natural for the manufacturers to seek the merchandising aid which they knew the expositions afford. Electric refrigerators, electric clocks, electric ventilators, vacuum sweepers, washing and ironing machines, they felt, should prove just as responsive to inspection by a high grade audience as radio.



RADIO TELEPHONE SYSTEM

Edward E. Clement, of Washington, District of Columbia, Assignor to Edward F. Colladay, of Washington, District of Columbia, U. S. Patent No. 1,754,877. (Issued April 15, 1930.)

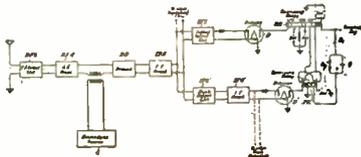
This invention relates to radio wire systems of broadcast distribution, with special reference to the use of electric light, power, railway or other wired circuits, so that the wires may be employed for transmitting modulated waves, metering, and other purposes. A radio wire system of broadcast distribution comprising a wired system or network, and subscribers'



Instruments provided with antenna circuits and connections to said wired network, said circuits and connections being combined on the input side of a detector to heterodyne and produce modulated beat waves on the output side of the detector, together with means at a central point for broadcasting modulated waves over the wired network, and other means for broadcasting simultaneously, properly related unmodulated waves through the ether.

REDUCTION OF ATMOSPHERIC INTERFERENCE

Leo A. Kelley, of Elmhurst, New York, Assignor to American Telephone and Telegraph Company, a Corporation of New York, U. S. Patent No. 1,752,344. (Issued April 1, 1930.)

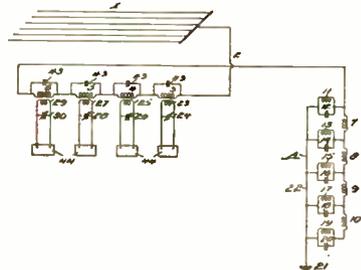


This invention relates to radio or wire telegraph systems, either radio or on wires and more particularly to arrangements for suppressing atmospheric disturbances in such systems.

RADIO RECEIVING SYSTEM

Louis Cohen, of Washington, District of Columbia, Assignor, by Mesne Assignments, to Federal Telegraph Company, a Corporation of California, U. S. Patent No. 1,753,308. (Issued April 8, 1930.)

This invention relates to an improvement in antennas for the reception of radio signals.



Free books on patent and trade-mark law can be obtained by our reader's upon request to Radio Engineering or direct to Richards & Geier. Copies of the patents described on this page may be obtained through the above mentioned firm of patent attorneys.

ELECTRO-ACOUSTIC DEVICE

John Preston Minton, of White Plains, and Abraham S. Ringel, of Brooklyn, New York, Assignors to Radio Corporation of America, a Corporation of Delaware. (Issued March 18, 1930. U. S. Patent No. 1,750,900.)

This invention relates to acoustic devices and more particularly to electro-acoustic devices of the so-called

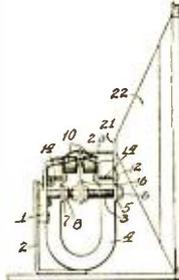


loudspeaker type. The invention further relates to sound reproduction and amplification methods.

LOUDSPEAKER UNIT

James P. Quam, of Chicago, Illinois, U. S. Patent No. 1,750,648. (Issued March 18, 1930.)

This invention relates to a loudspeaker unit and particularly to an electromagnetic device which is adapted to be connected with electrical apparatus,



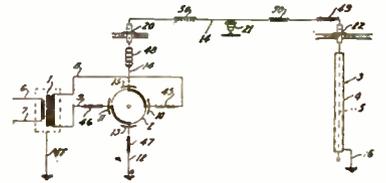
such as radio receiving apparatus, to effect the movement of a vibrating member, such as a cone, whereby electrical vibrations are translated into atmospheric vibrations of such frequency that they are audible to the human ear.

APPARATUS FOR THE PREVENTION OF HIGH-FREQUENCY RADIATION

John J. Jakosky, of Los Angeles, California, Assignor to International Precipitation Company, of Los Angeles, California, a Corporation of California, U. S. Patent No. 1,754,627. (Issued April 15, 1930.)

This invention relates to the prevention of radio interference caused by electromagnetic radiation of high-frequency oscillations in complex electrical circuits which include means tending to produce such oscillations.

In combination with an electrical precipitation installation, mechanical rectifying means, an electrical

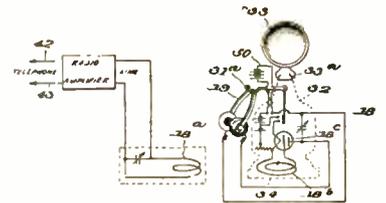


circuit connected to said rectifying means for supplying alternating current thereto, an electrical circuit connected to said rectifying means and to said precipitation installation, said circuits including a plurality of capacity branches in connection with said rectifier and including portions providing effective radiating means.

RADIO DESK SET

Edward E. Clement, of Washington, District of Columbia, Assignor to Edward F. Colladay, of Washington, District of Columbia, U. S. Patent No. 1,754,880. (Issued April 15, 1930.)

The main object of the invention is to provide a light and compact receiving set, capable of being moved about, within limits, at the convenience of

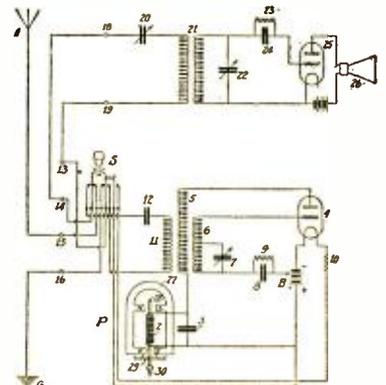


the user. A further object is to provide a set mechanically free but electrically connected so that movement of the same will be unhampered as by conductor cords or similar mechanical connections. Another object is to provide a combination set having both loudspeaker and earphone attachments with automatic switchbook control.

PHONOGRAPH ADJUNCT FOR RADIO SETS

Julius Weinberger, of New York, N. Y., Assignor to Radio Corporation of America, a Corporation of Delaware, U. S. Patent No. 1,754,293. (Issued April 15, 1930.)

The invention concerns electric phonographs and combined radio receivers and electric phonographs and has for its principal object the provision of an electric phonograph in which the vibrations of the stylus will cause modulation of the output of a high-frequency oscillator combined with a radio receiver for detecting the modulated oscillations.



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News of the Industry

THE CLAROSTAT LINE AT THE RMA TRADE SHOW

Resistors in every type, size and range will be the keynote of the exhibit of the Clarostat Manufacturing Company of Brooklyn, N. Y., at the RMA Trade Show this year. Long identified with the production of resistors, this organization plans to do its share at the coming gathering by way of solving some of the pressing problems of the radio industry, particularly by way of reducing servicing costs.

The center of attraction at the Clarostat booth will be in the line voltage ballast and regulators. This organization is now manufacturing line voltage regulating devices both as built-in features and as accessories for any radio set, as a means of reducing tube replacements to a minimum, and eliminating the common danger of power-pack breakdown. Both general types are in the form of sturdy metal cartidges with perforated casings, designed for rapid resistance adjustments in keeping with sudden line voltage fluctuations, and provide voltages within the 5 per cent specified by tube manufacturers over a wide range of line voltages. The accessory type, known as the automatic line voltage regulator Clarostat, is arranged with prong base and receptacle top, so as to be inserted between attachment plug and usual screw base or wall outlet, for any socket-power radio set. It not only protects the radio set against the evils of excessive line voltage, but also provides sufficient operating voltage by changing its resistance as line voltage drops.

The Clarostat exhibit will also include the well-known Clarostat variable resistors, ranging from grid leaks to 250-watt units, together with strip resistors, flexible resistors, volume controls of all kinds, and other radio components essential to the production of present-day quality radio sets.

AEROVOX OHMMETER

The Aerovox Wireless Corporation, 70 Washington Street, Brooklyn, N. Y., in March, 1930, issued a bulletin describing a simple and efficient ohmmeter for resistance measurements. Those interested may procure copies by writing to the company.

TCA AN ACTIVE FACTOR IN RADIO CIRCLES

E. J. Dykstra, general sales manager for Transformer Corporation of America, Chicago, Illinois, recently returned by plane from Portland and other west coast cities, via Los Angeles, and reports a lively interest in Clarion radio on the part of the western jobbers.

Mr. Dykstra said, "My trip through the marketing centers of the west was extremely gratifying from the point of enthusiasm evinced on every hand over Clarion radio. There is a distinct feeling among the trade not only west of the Rockies, but throughout the entire country that Clarion radio is going to be a big factor in radio this year.

"The prevalence of this opinion is perhaps best borne out by the generally ready acceptance of the TCA line by the country's leading radio jobbers. We are well past the "announcement stage" and our district managers are now coming in to the factory from various distributing zones, accompanied by interested jobbers—many of whom have left us with a signed TCA distributor contract—and a mighty enthusiasm for the TCA line."

TCA's four story plant with 200,000 square feet of factory floor space, we hear, is now completely laid out for large scale production.

Labor-saving automatic machinery, which was especially designed for the TCA plant, will establish a new low-cost production figure, probably unequalled at the present time in any radio plant in the United States.

One of the outstanding installations is an entirely automatic cadmium plating plant. This mammoth machine is entirely automatic, requiring a force of three men, who are engaged merely in racking and unranking the metal stampings. The capacity of this machine is 2500 complete chassis per day, including base, tube shields, coil shields, condenser shields, speaker parts, partitions, etc.

A radio-phonograph combination will be announced at the R.M.A. Show and will list at \$199.00, less tubes, complete with standard Clarion eliasis, electro-magnetic pickup and electric motor.

BOES HEADS RADIO SALES ORGANIZATION

Walter W. Boes has recently been elevated to the position of general sales manager of the Radio Products Company, Dayton, Ohio.

Mr. Boes has been associated with radio sales work for the past six years. Previous to that time he

was connected with two prominent communication companies and during the war was an officer in the U. S. Army Signal Corps. Immediately upon the cessation of hostilities, Mr. Boes was attached to the American Relief Expedition under the leadership of Herbert Hoover.

Under the leadership of Paul F. Jackson, chief engineer, constant development and research work is being done to keep "Daytad" service instruments abreast of the times and develop new instruments to meet the service needs of the ever-increasing demands of the radio industry.

RADIO DATA CHARTS

An excellent 82-page booklet entitled "Radio Data Charts," by R. T. Beatty, has been issued by "The Wireless World," Dorset House, Tudor Street, London, England. The work contains 75 charts of radio engineering data of direct use to designers of radio receivers. Each chart is accompanied by a page of clear description. The booklet is priced at \$1.50.

PRESSURE AND TEMPERATURE MEASUREMENTS

The C. J. Tagliabue Mfg. Co. of Brooklyn, N. Y., has announced the acquisition of the American Tobacco Company property on Park Avenue, extending from Nostrand Avenue to Sanford Street in Brooklyn.

The Tagliabue Company has been industrially prominent in Brooklyn for many years and in moving from Bush Terminal, its present location, another great stride in its progress is apparent.

TAG Industrial and laboratory instruments are known and used the world over. Among these should be mentioned indicating, recording and controlling instruments for temperature, pressure, humidity, time, condensation and liquid level, laboratory and industrial thermometers, hydrometers and oil testing instruments.

GENERAL CABLE REORGANIZES DISTRICT SALES OFFICES

A new field sales policy has been made effective by General Cable Corporation, by the establishment of eighteen district and territorial sales offices, and the assignment of the entire district sales personnel of Dudlo, Rome, Safety and Standard Underground divisions to these new territories.

Until this change, the sales organizations of the four divisions had functioned in parallel, maintaining the industry contacts which each had established over many years of service. Subsequent to the formation of General Cable in 1927, the industry made increasing use of the combined manufacturing and engineering facilities of the corporation, through the channels of the individual divisions. This reorganization of sales forces further consolidates these facilities and makes them more readily available.

The identities of the thirteen companies comprising the four operating divisions will be continued as manufacturing and shipping units. All present trademarks will also be continued.

Resident engineers will be located in the district and territorial sales offices. They will represent locally the headquarters consulting engineering staff, which has been recently organized by General Cable to coordinate for all wire and cable users the engineering knowledge and the experience in design and application of all divisions of the corporation.

SPAHN SPECIAL SALES MANAGER FOR PACENT

Pacent Reproducer Corp., manufacturers of talking picture equipment, through its president, Louis Gerard Pacent, has announced the appointment of Robert H. Spahn as special sales manager, effective May first. Mr. Spahn, who has had many years experience in the piano field, will direct sales for the corporation in the non-theatrical field. Coincident with Mr. Spahn's appointment to direct sales in the new field embracing clubs, schools, educational institutions, lodges, camps and similar places where sound equipment is rapidly finding favor, the Pacent Corporation started an intensive sales drive in the non-theatrical field.

Mr. Spahn will have his headquarters in the home office of the corporation in the Film Center building, 630 Ninth Avenue, New York City, but considerable out of town work is anticipated.

MOTOR CAR RADIO FILLS NEW WANT

That probably no two inventions of our age have contributed so much pleasure and happiness to the

average every-day man, woman and child as have the radio and the automobile, is the opinion advanced by M. A. Fowler, Assistant Pacific Coast division manager of the American Bosch Magneto Corporation, manufacturers of automotive equipment and Bosch Itadio.

"With the change in living and working conditions came more leisure; with the change in distribution and selling methods came the change in buying habits; now they can ride and play as they pay," continued Fowler. "The American public is essentially pleasure and comfort loving. Anything that promises entertainment, comfort, pleasure, makes an instant appeal. Every thrift budget these days has its specific allowance for entertainment and recreation.

STROMBERG-CARLSON HOLDS ANNUAL SALES MEETING

One hundred representatives of the Stromberg-Carlson Telephone Manufacturing Company left their Annual Sales Conference, May 4th, after a three-day convention, acclaiming the meeting the greatest ever held by the company.

Every session of the conference was held at the plant in Rochester and the Annual Banquet, heretofore held in a hotel, was given in the plant dining room.

Optimism in regard to the future radio and telephone markets was evident throughout the conference and the representatives expressed the opinion that 1930 would be a better radio and telephone year than 1929.

The general theme of the conference was the sales expansion program which was started by the company some time ago. New merchandising plans were taken up and thoroughly discussed at the meeting.

TULLY AND HAUGH RESIGN FROM STEINITE

John C. Tully, Chicago, has resigned as president of the Steinite Radio Company and its subsidiaries and Arthur T. Haugh, Rochester, N. Y., has resigned as general manager of the entire Steinite group and as vice-president of Steinite Mfg. Company. Mr. Tully's resignation became effective April 15th and Mr. Haugh's a few days later. The two accepted the command of Steinite less than two months ago when Steinite creditors, including the banks, selected them to rescue the then badly involved concern.

In announcing his resignation Mr. Tully said: "I have resigned the presidency of the Steinite Company, which I recently assumed at the request of creditors, as a result of conditions which are not such as to justify any further connection with the organization." "When ways and means to begin Steinite's operation on a sound basis were not forthcoming I felt I could no longer be useful in the situation," was Mr. Haugh's comment.

Both Mr. Tully and Mr. Haugh are directors of the Radio Manufacturers' Association; the latter a past president. The former, for seven years, until his sale to the Brunswick Co., was president and treasurer of Bremer-Tully Mfg. Co.

STROMBERG-CARLSON NET EARNINGS BREAK RECORDS

Net profits for 1929, after provision for Federal taxes, interest, reserves for depreciation, and all other charges in keeping with the soundest accounting practices, were \$1,070,055.53. The previous record year was 1926, when profits totalled \$971,282.97.

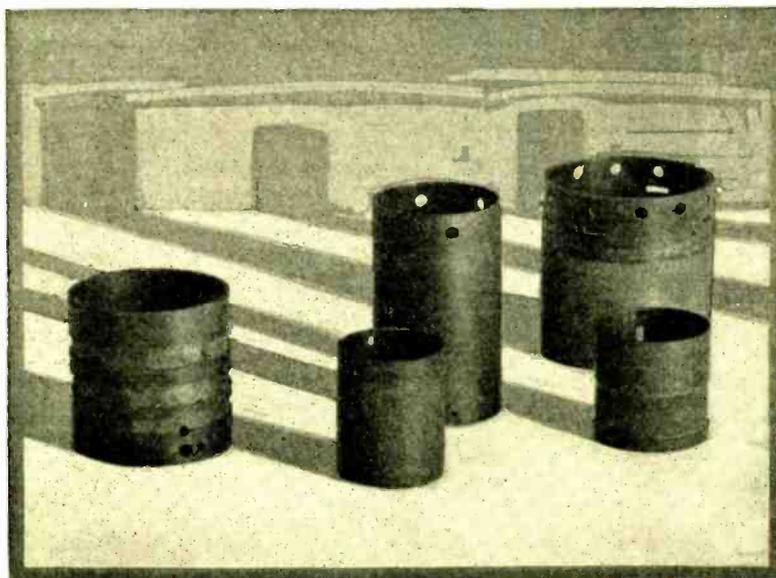
Notwithstanding the fact that the first six months of 1929 presented a new peak in the business of the nation, January business this year was 80 per cent. greater in volume than the corresponding month last year. February this year was greater by 40 per cent. than February, 1929, and March, up to the present time, is running 30 per cent. ahead of March, 1929.

DRY CONDENSER PATENT GRANTED TO EDELMAN

On April 8, 1930, the U. S. Patent Office issued a patent to P. E. Edelman for dry type electrolytic condensers and their use in power packs. The following licenses have been issued for this patent: To The Potter Co. for all types of such condensers; Galvin Mfg. Co. for "A" condensers and eliminators; Elkon Works, Inc., for "A" condensers; Ward Leonard Electric Co. for circuit arrangements. The patent has been assigned to E. Banning, Chicago, Ill.

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THE high dielectric and mechanical strength and low power factor of Micarta tubing has made it the foremost material for use in coil forms and similar radio parts. The accurate cutting, punching and threading of these forms by the Micarta Fabricators Inc. is an additional assurance that Micarta coil forms will provide the maximum efficiency and reliability.

This is also true of Micarta plate and rod in such applications as terminal strips, sub and

tube panels, connector plates and drum-dial connecting shafts.

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T 31246

TUNE IN THE WESTINGHOUSE SALUTE OVER THE N. B. C. NATION-WIDE NETWORK EVERY TUESDAY EVENING.

NEW ADVERTISING MANAGER FOR PEASE

C. D. McCormick, formerly assistant advertising manager of the C. F. Pease Company, 813 North Franklin Street, Chicago, Illinois, manufacturers of blue-printing machinery, blue-print paper, drafting room furniture, etc., has been appointed advertising manager to succeed W. Earle Pashley, now second vice-president and assistant sales manager. Mr. McCormick has been with the company for over four years and was previously connected with the Illinois Glass Company, Alton, Illinois.

POLYMET DOES IT

The Polymet Company, 829 East 134th Street, New York, has issued a new engineering manual. This book contains coil data not heretofore published, and much information of engineering importance on condensers, resistances and mountings. Copies may be procured by radio executives writing on company letterhead.

TRAVEL CHAMPIONSHIP OF INDUSTRY CLAIMED

With more than 125,000 miles behind him during the past nine months, the traveling championship of the radio industry is claimed by Gordon W. Volkebant, radio engineer with the Sparton Radio organization, and he wants to hear from challengers.

During this time Volkebant has been in 14 states, Canada, Mexico and Cuba. He has contacted 90 per cent of the Sparton distributors in their own cities, and has repeatedly used all four major forms of transportation: rail, air, water and automobile. He doesn't include the shoe-leather travel.

A typical example of how Volkebant rolls up the mileage was furnished when he carried Sparton's Model 589 into all kinds of out-of-the-way places for tests, before it was introduced. He personally conducted tests ranging from Florida to Mexico and from Cuba to Northwestern Canada.

N. S. TOBEY APPOINTED DUBILIER SALES MANAGER

Announcement of the appointment of N. S. Tobey as general sales manager of the Dubilier Condenser Corporation of New York City, is made by its president, W. H. Lipscomb.

Mr. Tobey comes to the Dubilier Condenser Corporation after a varied naval, engineering and sales experience.

COLEMAN JOINS STOKES

J. C. Coleman, formerly with the J. P. Devine Co., has recently joined the sales organization of the F. J. Stokes Machine Co. of Philadelphia, Pa. He is assigned to the chemical process equipment division.

CANADIAN BROADCASTING LEGISLATION

The House of Commons at Ottawa agreed on April 9 to Premier Mackenzie King's motion that all matters connected with the radio broadcasting situation and problems, also the report of the royal commission on radio broadcasting, be referred to a special committee. The Minister of Marine and Fisheries said afterward that no legislation would be considered until the committee's report is received.

BROADCASTING IN THE PHILIPPINES

At the end of 1929 there were two long-wave and one short-wave broadcasting stations operating in the Philippines. On October 12, 1929, a short-wave station started operation as a relay station in Manila. At the same time, a long-wave station was opened at Cebu. According to local official statistics there are 1936 home radio receiving sets, including approximately 600 newly installed sets. Unofficial but reliable estimates indicate that this total registration figure is low and place the total at 2,300 sets. Radio programs offered have improved and interest in radio continues on the increase.

ERLA ENTERS TENTH SUCCESSIVE YEAR

The Electrical Research Laboratories, manufacturers of Eria radio receivers, are now entering upon their tenth successive year in the radio industry.

Old timers will remember way back when Eria Reflex kits were worth their weight in gold and represented the last word in quality radio merchandise. Since that far away day the Eria organization has grown, not by leaps and bounds, but in a manner consistent with conservative business policies. Eria's many years of experience in design and manufacturing of radio receivers is outstandingly reflected in the wonderful quality and performance of their new models, which are to be announced at the Radio Manufacturers Association Trade Show, June 2nd to 6th, at Atlantic City.

OXFORD MOVES

The Oxford Radio Corporation announce the removal of their factory and general office to 2035 West Pershing Place, Chicago, Illinois. They are now operating at the new factory and expect to be able to give their customers good service from this central location.

The Oxford line this year will include five different sizes of speakers 9 inches, 11 inches 12½ inches Auditorium, 14 inches and the Jumbo which is 15 inches high. Oxford engineers have worked

hard on the development and improvement of their models and believe that their new line incorporates everything that any customer might ask for in an electrodynamic speaker.

The Oxford Auditorium and Jumbo series are especially designed for heavy duty use. Field coils and all parts are built to give perfect reproduction at all volumes.

CARBON RESISTORS

The Speer Carbon Company, Saint Marys, Penna., is supplying to various radio manufacturers resistors ranging from 20 ohms to many megohms, in one to 5-watt capacities. This company also makes sparking and distributor resistances for automobile radio use.

J. L. LEBAN, GENERAL SALES MANAGER FOR VAN HORNE TUBES

J. L. Leban, well known in the radio industry, has assumed complete control of sales for the Van Horne Tube Company, Franklin, Ohio.

Associated with Leban is D. M. Kasson, president of the company, and well known in the radio field; Dr. J. S. Van Horne, one of the industry's leading authorities on vacuum tubes; and E. T. Flewelling, pioneer radio engineer and inventor of short-wave equipment and radio service instruments.

The Van Horne Tube Company recently introduced their copyrighted "Certified" idea to the trade. This new departure in radio tube sales provides an individually plotted characteristic curve for every tube. This chart is packed with the tube and the unit carton wrapped and sealed to guarantee the purchaser that he is receiving a tube, especially tested, and recorded in accordance with recognized standards.

PHILCO JUNKET

Philco has taken a siphload of executives, jobbers and prominent radio salesmen on a trip to Burma, on the 19,000-ton Royal Mail liner "Areadian." The party will return in time to attend the R. M. A. show at Atlantic City, June 2-6.

GRIGSBY-GRUNOW APPOINTMENTS

At a meeting of the board of directors of the Grigsby-Grunow Company, April 14, B. J. Grigsby, who has been president since the company was organized, became Chairman of the Board of Directors. He will continue as chief executive officer. W. C. Grunow, who has been vice-president, was chosen president of the company.

Vice-presidents were chosen as follows: Herbert E. Young, vice-president in charge of sales; Duane Wannmaker, vice-president in charge of advertising; H. E. Kranz, vice-president in charge of engineering; and A. C. Winnan, vice-president in charge of purchases. J. L. Overlock was elected vice-president and treasurer, R. R. Trimarco, formerly assistant secretary-treasurer, was elected secretary.

DORMAND S. HILL OPENS SALES OFFICE

Dormand S. Hill, for some years vice-president of H. H. Frost, Inc., and later director of sales for Silver-Marshall, Inc., has organized a merchandizing company to represent radio manufacturers in the mid-west territory. Headquarters will be in the Michigan-Ohio Building, Chicago, Illinois.

DE FOREST STARTS PATENT SUIT AGAINST CARDON

Suit has been instituted in Michigan by the DeForest Radio Company, of Passaic, New Jersey, against the Cardon Phonocraft Company, having factories in Jackson, Mich., in which the DeForest Company charges the Cardon Company with infringement of two DeForest patents covering the well-known feedback or regenerative principle.

According to James W. Garside, president of the DeForest Company, the Cardon Company is employing the so-called "high-frequency bombardiers" for producing and perfecting the vacuum needed for radio tubes. The DeForest patents, claimed to be infringed by the Cardon Company, cover any device for generating high-frequency currents through the intermediary of the well-known DeForest audion and associated feedback circuits.

CROSLY DISTRIBUTOR WRITES DEALERS

Albert C. Finley, secretary of the H. D. Taylor Company, Crosley distributor in Buffalo, New York, has sent a folder to the dealers in his territory, in which he brings out some very interesting facts, that "Woolworth, Grant, Kresge—all great merchants with great fortunes made in selling popular-priced volume merchandise."

In his letter he says: "Did you ever stop to think that the dealer franchise for the Ford car is the most valuable and sought after franchise in the whole automotive field? And yet the dealer's profit on the Ford car is only 17½ per cent. And automobiles on which the profit is 30 per cent and 40 per cent go begging for good dealers. Why? Because there is more money, easier sales, quicker turnover in popular-priced merchandise.

"The same is true of the Crosley radio franchise. Today you have the greatest chance of all to sell to the small income family a radio that their pocket-book can buy and pay for.

"Introduce this popular priced line to your territory. You will get inquiries from which you will sell \$90 and \$75 sets as well as \$55 sets."

ANNOUNCEMENT OF MOVE

The All American Mohawk Corporation announces the completion of their move of their entire factory to the great Wurlitzer plant at North Tonawanda, N. Y., and a change of address of the Chicago office. From where sales and advertising are handled, to 2330 Bally News Building.

The offices of E. R. Farney, president, and J. H. Wimberly, Jr., advertising manager, are retained in Chicago.

All matters pertaining to the factory production, auditing and other executive offices are maintained in North Tonawanda at the factory where the complete Lyric radio receiver and cabinet are made and manufactured.

THEY SPECIALIZE IN RESISTANCE

Resistors for every radio purpose—that is the slogan of the engineering staff of the Clarostat Manufacturing Company, Brooklyn, N. Y., who will be on hand at the RMA Trade Show to talk resistance with everyone visiting the Clarostat booth.

It was the original Clarostat or compressible type variable resistor that made the B-battery eliminator practical and paved the way for the present socket-power radio sets. This device, covering a wide resistance range in several turns of its knob, permitted of matching the output of the B-eliminator to the various plate circuits of the receiver. And what is more, it stood the gauntlet, day in and day out. Today, Clarostat variable resistors are available in all types and sizes from the diminutive grid leak to the giant super-power for power applications up to 250 watts. Clarostats are finding many applications outside of radio, such as in talking pictures, motor starting and controlling systems, dimming a large number of lights, window display controls, electric sign controls, and so on.

The Clarostat engineering staff has developed a large line of fixed resistors, including the flat strip and flexible types. Also a complete line of volume controls which, by means of special machinery winding on tapered strips and also variably spacing of the turns, can be made to match any resistance curves.

And now comes the line of Clarostat ballast or line voltage regulators, made both in cartridge form for a built-in feature, and in plug form for attachment to any socket-power radio set, thereby overcoming the only remaining variable and questionable factor in modern broadcast reception—the line voltage.

CORNISH WIRE LINE READY

The Cornish Wire Company, 30 Church Street, New York City, announce that their new catalog showing a complete line of radio wires, antenna kits and B-battery arresters, will be off the press shortly with revised prices that will be very attractive to jobbers and dealers.

After considerable research work, this company is now offering a complete line of hookup wires for manufacturers. Shielded wires are also included in the line.

GOAT COMPLETING LINE OF RADIO TUBE PARTS

In our December, 1929 issue we announced the formation of a subsidiary of The Fred Goat Co., Inc., Brooklyn, under the name of Goat Radio Tube Parts, Inc., with plant and offices at Bush Terminal, Brooklyn, for the purpose, as its name implies, of concentrating upon the manufacture of tube parts which had expanded so that there no longer was sufficient space for it in the Fred Goat Company's plant on Dean Street.

At that time, the subsidiary company was known among tube manufacturers largely for its screen-grid tube parts, partly because of having developed a new method of completing (without spot welding) the assembled 224 shield.

But even at the time of its formation many millions of other tube parts had been turned out, and since then it has ceaselessly increased its production capacity, until within a very few weeks from now, according to Edward F. Staver, secretary, the company will be in position to supply practically every stamped and formed part entering into any type of standard receiving tube, including a complete line of plates, and carbonized plates not excepted.

HARRY WISE WITH MARTIN ZATULOVE

Martin Zatulove, president of the Martwel Corporation, 1501 Broadway, New York City, has just announced the addition of Harry Wise as vice-president of the concern.

Paul S. Weil is still identified with the Martwel Corporation as their representative in the metropolitan district. In addition to this he has been appointed advertising manager of the Cable Radio Tube Corporation of Brooklyn, N. Y., manufacturers of Speed tubes—one of the lines represented by Martwel.

RESISTANCE REPLACEMENT GUIDE

The International Resistance Company, 2006 Chestnut Street, Philadelphia, Penna., has issued a hand-somey gotten up resistance replacement guide in booklet form. The information contained in this work is of particular value to service managers.



Do think of
TRANSFORMERS

is to think of
THORDARSON

**TRANSFORMER
SPECIALISTS**
Since 1895 « «



- Microphone Transformers
- Line to Tube, Tube to Line, Line to Line
- Mixing Transformers • Coupling Trans-
formers • Filter Chokes
- Audio Transformers • Impedance
Matching Transformers • Power
Compacts
- Speaker Coupling Transformers
- Complete Amplifiers



Catalog of new Replacement Power and Audio Transformers will be sent upon request

Thordarson Electric Manufacturing Company

Huron, Kinsbury and Larrabee Streets, Chicago, Illinois, U. S. A.

NEW RADIO EQUIPMENT FOR CANADIAN NATIONAL RAILWAYS

Over 210,000 passengers listened to radio broadcasts received on the trains of the Canadian National Railways during 1929. Fifty-four cars are now equipped with radio apparatus. The latest development is known as "train lined radio" in which two cars receiving programs from a single set are linked together. Twelve new observation lounge cars and twelve compartment cars for transcontinental service are now being built. They will be equipped with "all-electric" radio-phonograph combination sets. The programs will be received in the lounge car and relayed to a loudspeaker and 36 head sets in that car, as well as to 22 head sets in the adjoining compartment car. There will be two head sets in each compartment and chambrette (single berth compartment) and three in the drawing room.

CONE SPEAKERS

Discussing the factors contributing to electrodynamic speaker efficiency Ray H. Manson, chief engineer of the Stromberg-Carlson Company, recently stated:

"For high efficiency, a cone should be made of comparatively thin and rather lively material, but a large plain cone of this sort "rattles" so badly as to be out of the question. However, the cone may be made so rigid by properly corrugating it that it will be immune to paper rattle and be highly efficient. The corrugations, moreover, are serviceable in other ways, for by properly choosing their width, spacing, and depth, some of the cone resonances may be reduced and others shifted up or down in the frequency range. This gives the designer opportunity to improve the uniformity of the response without sacrifice of efficiency.

NATIONAL UNION TUBE RESEARCH UNDER WAY IN \$500,000 PLANT

A \$500,000 manufacturing plant and research laboratory at 57 State Street, Newark, N. J., has been turned over by National Union Radio Corporation to Dr. Ralph E. Myers, famous vacuum tube engineer, for intensive research in the production of new developments in tubes, according to an announcement by E. A. Tracey, first vice-president of National Union.

"We have placed unlimited funds at Dr. Myers' disposal," Mr. Tracey said. "He has secured the most modern equipment and is working night and day concentrating on the perfecting of radio tube manufacturing, so that we may turn out on a large scale basis the finest radio tube that science can devise.

"The radio tube business, we believe, has reached the stage where research must take a leading share in furthering the industry. There was a time when both sales and production held the spotlight. That phase is past. Like aviation and the motor industry, radio tube making has entered the scientific race for perfection."

GERL OF COLONIAL RADIO CORPORATION VISITS CHICAGO

Joseph Gerl, general sales manager of the Colonial Radio Corp. was in Chicago in April making plans for the distribution of Colonial radios in the vicinity of Chicago during the 1930-31 season.

Colonial Radio has made solid strides in Chicago since its introduction last year. Now that the corporation's facilities have been augmented through its combination with the interests of Valley Appliances, Inc., even greater activity is anticipated in this territory.

GRIGSBY-GRUNOW PATENTS

Commenting on a news dispatch from San Francisco appearing in April 10 newspapers with regard to the decision of the Federal District Court at San Francisco in a suit by the Magnavox Company for patent infringement involving a certain type of dynamic loudspeaker, Wm. C. Grunow, vice-president of Grigsby-Grunow Company, said:

"The San Francisco suit was brought against Frederick H. Thompson Company of that city, a distributing firm handling Majestic products. Grigsby-Grunow Company, however, is not a party to the suit. We understand that the Thompson Company will appeal the decision to the United States Circuit Court of Appeals immediately and obtain a stay of further action pending the appeal. No injunction, however, has been issued against Grigsby-Grunow Company.

"The suit by the Magnavox Company was based on an alleged violation of their patents on a certain type of dynamic speaker. The Majestic clutura dynamic speaker is of an entirely different principle and its design in no way conflicts with that of the Magnavox type speaker."

LOUDSPEAKERS INSTALLED IN STATE HOSPITAL

Radio has brought to the 1000 inmates of the eastern Oregon state hospital for the insane through the installation just completed, a battery of 21 loudspeakers fed from a single, stock model Bosch console radio receiver.

The work involved the stringing of a mile and a half of wire. Three days were required to make the installation.

Marked improvement in the condition of some of the patients was noticed at once, according to the superintendent of the hospital. Even the more restless ones calmed down perceptibly and listened to the programs. Familiar tunes brought tears to the eyes of some of the inmates. Nearly all showed a marked interest in the educational broadcasts.

SPARTAN ACTIVE

Forty prominent radio dealers in Birmingham heard E. T. H. Hutchinson, Spartan sales manager, give a detailed explanation of merchandising plans for the coming year, during his recent swing through the south. They were assembled by the United Auto Supply Company, distributors for the Birmingham territory.

On this trip Mr. Hutchinson covered St. Louis, Nashville, Chattanooga, Atlanta, Birmingham, and Richmond, Virginia. From the latter point he went to New York for a conference with Spartan distributors in the metropolitan center.

ESCUTCHEONS AND DIALS

The Crowe Name Plate and Manufacturing Company, 1749 Grace Street, Chicago, has issued Bulletin No. 30 listing and illustrating escutcheons, dials, control devices, tuning scales, number plates and drums, for use in manufacturing radio equipment.

DE FOREST COMPANY MANUFACTURES AND SELLS TRANSMITTER TUBES

In an announcement given out by J. W. Garside, president of the DeForest Radio Company, Mr. Garside says:

"Taking advantage of its original patent rights in the oscillator and transmitter fields, the DeForest Radio Company of Passaic, N. J., is busily engaged in handling orders for transmitting tubes and complete transmitters. Substantial orders have recently been placed.

"The DeForest patent rights cover the building and sale of transmitting equipment for non-fall communication purposes, thereby permitting the company to supply municipalities, shipping companies, broadcasters, railroads, power systems, Government departments and other organizations not engaged in handling radio traffic for toll. A large staff of engineers has been organized to handle the transmitter activities of the DeForest organization, including the development of transmitting tubes and their application. Experimental transmitters are in operation both at Passaic and at Jersey City, as part of the DeForest developmental work."

STEVENS FEATURES PHONOGRAPHS, AMPLIFIERS AND SPEAKERS AT RMA SHOW

Several striking novelties of particular interest to radio manufacturers seeking new sales appeals for their products, will be featured at the booth of the Stevens Manufacturing Corporation of Newark, N. J., during the RMA Trade Show.

First and foremost, the Stevens organization, long identified with the development of loudspeakers and diaphragms, will exhibit striking innovations in the sound reproducing art. The new Stevens bortex diaphragm, with concentric corrugations extending from practically the apex to the mounting rim, will be shown. This diaphragm permits of reproducing an exceedingly wide range of tone frequencies with an absolute minimum of distortion. There will also be shown the complete Stevens dynamic units employing this improved diaphragm: in the 7-inch and 12-inch sizes.

The new 33 1/3 r.p.m. turntable for the large 16-inch records employed for recorded broadcast programs and also for synchronized film sound reproduction, will be shown. This turntable is of exceedingly simple design, employing the Stevens-Sibley phonograph motor which drives the disc through a positive friction drive. A deep well thrust bearing insures against the wobbling of the turntable. The speed is accurately maintained despite a wide range of line voltage fluctuation.

IMPOSSIBLE TO TRANSLATE MANY RADIO TERMS, SO ENGLISH IS USED

Radio tubes may be "tubes" in the United States, but in most foreign countries they are known by quite different names. In France the natives ask for "lamps" when they require this important part of every radio receiving set. The German name for a radio tube is "rohre," and in many lands they are called valves.

A chat with C. J. Hopkins, manager foreign department, The Crosley Radio Corporation, reveals many interesting facts about radio expressions used abroad. The swift and sensational growth of the radio business brought into existence many new technical terms. As most of this development has been done in the United States, the English language is employed.

A number of English words have been incorporated in the "mother tongue" of many countries, as it was impossible to translate them. For example, "screen grid" is called screen grid in Italy, Spain or China. This also applies in such radio terms as "push-pull," "pickup," et cetera.

A number of expressions used in this country, however, have an entirely different meaning abroad. In England, radio means the message which is broadcast, and the receiving set is always referred to as a wireless set and never as a radio. In France a radio set is a "poste."

L. S. BRACH ACQUIRES NEW FACTORY

The L. S. Brach Manufacturing Corp., pioneer manufacturers of lightning arresters and other radio accessories, for many years located at 127-129 Sussex Avenue, Newark, N. J., has acquired new manufacturing premises. The new factory, located at 51-63 Dickerson Street, Newark, which is thoroughly modern in appointments, has a fifty per cent increase in space over the former location.

DR. MINTON JOINS O'NEIL MANUFACTURING CORPORATION

Raymond L. O'Neil, president of the O'Neil Manufacturing Corporation of West New York, New Jersey, pioneer builders of licensed radio loudspeakers, announces the appointment of Dr. John Minton to the vice-presidency of the company, and director of engineering.

Dr. Minton is a noted consulting radio and acoustic engineer with offices and laboratory in White Plains, N. Y. Dr. Minton has been vice-president and chief engineer of the United Radio Corporation and later chief engineer of the Peerless Division of the United Reproducers Corporation. Under Dr. Minton's direction and through his inventive and development skill the Peerless magnetic and dynamic speakers were produced. Dr. Minton is perhaps among the very few noted loudspeaker and acoustic engineers of the country and his recognition through his Peerless achievements is acknowledged both here and abroad.

Dr. Minton's engineering and inventive skill will be carried over to the O'Neil Manufacturing Co. and his new loudspeaker developments promise to exceed what he did for Peerless. Under his supervision and direction the O'Neil Manufacturing Co. will greatly improve and enlarge their products and will be in position to meet the requirements of the most exacting loudspeaker requirements in the fields of radio, phonographs and talking movies.

SPEED TUBES

The Cable Radio Tube Corporation, 81-90 North Ninth Street, Brooklyn, N. Y., will announce at the RMA show, this year a structural change in its product which will create a sensation.

This year the results of long planning and missionary work on Speed tubes will make themselves manifest.

During 1929 this company outgrew one plant, and is now occupying five, with a capacity daily production of approximately 30,000 tubes. There is every indication that manufacturing facilities will have to be greatly increased before the year is out.

Shipments are now made from warehouses located in Brooklyn, Atlanta, Chicago, St. Louis, Los Angeles, San Francisco, and Portland, Oregon, affording overnight service to practically any locality.

Speed representatives are permanently located in thirty or more important cities, giving like service to all sections.

The company maintains a large force of field men and sales engineers who constantly circulate throughout all territories rendering valuable assistance to Speed jobbers.

HESTON-NORTH TO REPRESENT STROMBERG-CARLSON IN CINCINNATI

Cincinnati and its environs will be adequately represented for the Stromberg-Carlson Telephone Manufacturing Company by the firm of Heston-North, Inc. Their offices and display rooms are located at 702 Chamber of Commerce Bldg., Cincinnati.

Charles E. Heston, one of the members of the firm, is a native of Rochester, where he was connected with the Stromberg-Carlson Company as sales engineer, assistant sales manager, export manager, supply manager and sales representative for Southern Ohio and Kentucky over a period of twenty-eight years.

His familiarity with Stromberg-Carlson products should be of infinite value to the newly formed organization.

Charles H. North is of Cincinnati, in which town he has a background of more than twenty years' experience in the phonograph and radio business.

Part of these twenty years was spent with the Victor Talking Machine Co., where he occupied the post of assistant manager of the contract department. Following this connection he became secretary and treasurer of the Ohio Talking Machine Co. of Cincinnati, which office he held until a few months ago.

GARNER & COMPANY NEW PACENT AGENT IN CHICAGO TERRITORY

Fred Garner & Company of 126 North Clinton Street, Chicago, Illinois, have been appointed manufacturer's agent for the Chicago territory for the Pacent Electric Company.

The Chicago territory, now covered by the Garner Company, comprises the entire state of Indiana, practically the entire state of Illinois, the extreme eastern part of Iowa and the eastern half of Wisconsin.

ROLLER-SMITH APPOINTMENT

Henry N. Muller Company, First National Bank Building, Pittsburg, Penna., has been appointed district sales agent for Western Pennsylvania, Eastern Ohio and West Virginia, of the Roller-Smith Company, New York.

DAYRAD INSTRUMENTS insure greater profits in your Service Department

The visits of your service men to the homes of radio owners bring orders for new tubes, better speakers and other radio merchandise. There are many reasons why your Service Men should be equipped with DayRad Instruments for testing all makes of radio sets and tubes. We mention here the three dominant reasons why—

- (1) Because with DayRad they can make every conceivable test—
- (2) Because all DayRad Instruments are simple, accurate and up to the minute—
- (3) Because they cost less than any other reliable instruments for the purpose—

Measure DayRad by the scope of service rendered, compare them in every detail with other types at higher price; the weight of evidence is all in favor of DayRad. This is true of DayRad Analyzers, Tube Checkers, Ohmmeters, the new DayRad Automobile Set Analyzer, the new DayRad Grip Dip Meter Unit, and the DayRad Test Panel.

ALL THESE DAYRAD INSTRUMENTS WILL BE ON VIEW AT R. M. A. TRADE SHOW ATLANTIC CITY, JUNE 2-6.

If for any reason you do not attend the Show, write now to Dayton, address below, for descriptive circulars.



DayRad Automobile Set Analyzer

Voltmeter resistance 5000 ohms per volt
 Six D. C. voltage scales—0-1-5-10-20-100-200
 Milliammeter scales—0-.4-10-20
 One selector switch
 Double ohmmeter range
 Self contained continuity tests
 All ranges available for external use
 Dealers Net Price **\$66.00**

A. C.-D. C. Radio Set Analyzer

One selector switch
 A. C. Volts—0-4-8-160-800
 D. C. Volts—0-20-100-200-600
 Resistance 1000 ohms per volt
 D. C. Mills—0-20-100
 Separate tests on 280 rectifier plates
 Self contained continuity test
 Resistance and capacity tests
 All ranges available for external use.
 Dealers Net Price **\$58.50**



DayRad Grid Dip Meter

Combining Oscillator, Grid Dip Meter and Output Meter.
 For aligning and neutralizing radio frequency circuits either individually or overall. Visual indicators on out-put meters. No external batteries required. Operates from 110 volts. 60 cycle line. Light and portable.

Dealers Net Price **\$37.50**

Prices on other voltages and frequencies on request.

DayRad Type B Tube Checker

Operates from 110 volt A. C. line
 No rheostats—no adapters
 Tests all standard radio tubes as well as Kellogg, Cardon.
 Wired for pentode testing.
 Indications for good, fair and poor tubes engraved on panel.
 Simple, Accurate, Complete
 Dealers Net Price **\$22.75**



DayRad Ohmmeter

Designed especially for measurement of resistors commonly used in Radio power packs, grid suppressors, bias resistors, etc. The indicating meter is a highly sensitive galvanometer. The dial is easily readable and the resistance under test can be instantly determined.
 Net Price to Dealers **\$25.00**



All DayRad Instruments are equipped with genuine D'Arsonval movement meters.

DayRad's Location at Atlantic City

Visitors to the R. M. A. Trade Show will be cordially welcomed at our two locations.

Be sure to see the complete DayRad Line of Service Instruments including Tube Checkers, Counter Checkers, Set Analyzers, Ohmmeters, Grid Dip Meters, Test Panels and Portable Combinations.

**BOOTH NO. C-29
 Demonstration Room No. C.C.-4**

THE RADIO PRODUCTS COMPANY

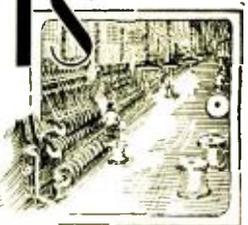
Write Dept. E.

Fifth and Norwood

Dayton, Ohio



NEW DEVELOPMENTS OF THE MONTH



AMPLION ANNOUNCES IMPORTANT NEW PRODUCTS

The Amplion Corporation of America, 133 West 21st Street, New York City, has recently placed on the market a new transverse current microphone, a microphone input amplifier, a novel double unit connector for attaching several dynamic units to the same horn, a special type exciter and a new 12-ft. exponential horn.

The transverse current microphone is especially adapted for use in broadcasting stations and for public-address systems. In this type of microphone, the current flows across the face, instead of in the conventional way, from a button attached to the diaphragm through the carbon granules, into a stationary button. In the transverse microphone, the current is forced across the face of the device by providing two carbon electrodes located near the periphery of the diaphragm, diametrically opposite each other. Between these electrodes, a shallow channel has been cut, approximately 1 1/2 inches wide and 3/4 inch deep. This channel is filled with a special type of microphone granule, held in place by a thin silk membrane, made of treated silk .002 inch thick. When sound impinges upon the membrane the granules adjacent are disturbed. This changes their resistance and as a result, modulates the direct current flowing through the column of granules. In this manner a remarkable fidelity of tonal reproduction is realized, without agitating the carbon electrodes. These serve only to make a quiet, constant electrical contact with the granules, thus assuring a minimum of granular noise.

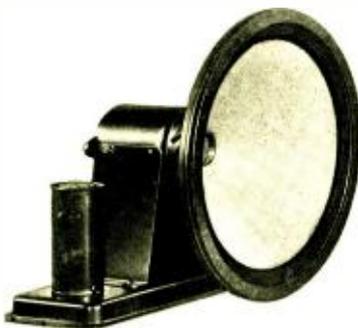
NEW 1930 JENSEN LINE COMPRISES THREE DYNAMICS

Three new electrodynamic speaker units comprise the 1930 Jensen line which will be shown and demonstrated for the first time at the annual RMA Trade Show to be staged at Atlantic City.

According to Jensen engineers these new speakers are greatly improved, both mechanically and electrically, over the models built last year and all deliver a finer tone quality, have greater sensitivity, and are capable of handling a greater volume without distortion or overloading, provided of course the energy delivered to the speech coil is undistorted.

One of the new units has a 12-inch cone while the other two have cones of 10-inch diameter.

The new 1930 concert unit, which has a 10-inch cone, is specifically designed for use with conven-



tional amplifier systems in radio receiving sets. The principal improvement in this new speaker is in the cone construction and the use of a supporting ring or skiver which is of molded one piece construction. The magnetic field coil and housing in this unit are more compact than in last year's model but designed to insure a maximum amount of sensitivity with a minimum of current dissipated in the field winding. Field coils in this unit can be supplied with any resistance value up to 7000 ohms. The regular units are to be equipped with an input transformer designed for operation with type 245 or smaller power tubes connected in push-pull.

CONDENSER TRANSMITTER CONTROL

A highly developed condenser transmitter control panel, Type 3-A, designed solely as a terminating and control device for the three condenser transmitters, has been introduced by Jenkins and Adair.

A NEW DECORATIVE FINISH

A new and very interesting decorative finish in a clear lacquer product has been introduced in "Prismlac," manufactured by Maas & Waldstein Company, Newark, N. J. Its simplicity of handling by ordinary spray methods and the beautiful decorative effects obtained on smooth surfaces show promise of very wide application. Clear, colored or bronze finishes may be obtained. "Just spray and watch it crystallize" is the description given by the manufacturer.

The fact that "Prismlac" air dries in about one hour gives it a decided advantage over baking finishes. In comparison with a three coat crackle finish it shows a decided saving in material and labor as well as providing a novel finish.

In solid colors "Prismlac" has the advantage of entirely obliterating, in one spray coat, such defects as drawing marks, spot weldings or file marks on stamped steel parts, for example, on radio chassis and cans.

Clear Prismlac is used on lustrous polished metal articles and novelties to make them attractive.

Full information and details on its application to any particular product will be gladly sent by Maas & Waldstein Company to any interested manufacturer.

NEW TERMINAL CLIP

The new screen-grid terminal clip that the F. J. Zierick Mfg. Works of 68-72 E. 131st Street, New York City have added to their line of radio hardware has three ears which make contact on almost the full surface of the screen-grid tube.

It has just the desired amount of spring so as to hold the tube firmly and yet not too tight to injure the tube when removing or placing terminal clip in place.

This clip has corrugations which hold the insulated wire while it is being soldered. It can be made of spring brass or phosphor bronze, electro tinned cadmium or nickel plated.

NEW POLYMET TRANSFORMERS

Polymer Manufacturing Corp. is exhibiting for the first time a complete line of audio transformers power transformers for both 25 cycle and 60 cycle circuits, and choke units.

These transformers have been designed to correspond with standard practice and are available either in stock forms, or, for manufacturer's use. Slight variations in windings and corresponding voltage output can be promptly arranged without delaying production deliveries.

Inasmuch as Polymer, through ownership of the Strand & Sweet Mfg. Co., produces its own magnet wire, and has very large coil winding facilities at its Colton division at Easton, Pa., the company is fabricating transformers "from the ground up."

R. C. A. RADIOTRONS

R. C. A. Radiotron Company has brought out three new vacuum tubes for radio receiver operation. A general purpose tube, —23D; power output tube —231 and screen-grid tube —232. These are 2-volt tubes for battery operation. Current consumption, respectively is 60 ma., 150 m. and 60 ma.

BINKS NEW HU-RO OUTFIT

The Binks Manufacturing Company, 3114-40 Carroll Avenue, Chicago, announces the completion of a new product—the Binks Hu-Ro painting outfit.

This unit, which operates without an air compressor, receives its air pressure from any auto, truck or tractor engine.

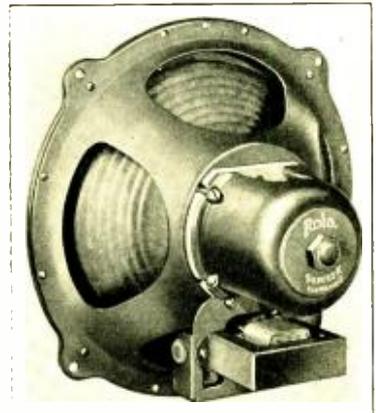
By simply removing two spark-plugs from the cylinders of the motor, inserting the two air-power air pressure valves, each one of which is attached to three feet of air hose jointly connected to the main air hose by a "Y" connection, the motor started and allowed to idle, there is produced a free passage of air on the downward stroke of the piston. The upward stroke compresses the air drawn in and supplies it to the spray gun in ample volume and pressure for good results.

This outfit is indispensable for applying paints, lacquers and varnishes to all surfaces.

It is a complete unit equipped with a container which accommodates a five gallon can of paint; a check valve on the container; twenty-five feet of air hose; twenty-five feet of material hose between the gun and container; has the Binks No. 33 spray gun attached to a quart size detachable pressure cup and the double valve hook-up furnished has twenty-five feet of 3/4 inch air hose with "Y" connection and two three feet lengths of hose with valve connections on each end.

ROLA INTRODUCES NEW SERIES OF UNITS

The Rola Company will introduce at the June RMA show what it considers the finest series of units in its history. Combining compactness, simplicity, and high safety factors with a frequency range heretofore believed unattainable, these new units may well be hailed as Rola's master achievement. Extraordinary simplicity of construction has sub-



stantially lowered manufacturing costs and, consequently, selling prices—still maintaining Rola dependability and structural sturdiness.

A remarkable moving coil structure, employing several new patentable features, is one of the outstanding developments of this year's models.

Model "K" will be furnished in two sizes: the large standard measuring 11 inches in diameter, with a depth of 5 1/2 inches, and the smaller size measuring 9 1/2 inches by 5 1/2 inches.

BALSAM-WOOL ACOUSTICAL BLANKET

The Wood Conversion Company, 360 North Michigan Avenue, Chicago, Illinois, reports that its balsam-wool acoustical blanket is being used everywhere to correct acoustics to insure satisfactory sound reproduction in theatres.

THOMAS ANNOUNCES ENTIRE LINE

C. F. Rapp, of the Thomas Engineering & Manufacturing Company, located at St. Charles Ill., recently announced that the company, in addition to supplying many of the large receiver manufacturers with condensers, coils, transformers, chokes, power packs, etc., have launched a complete line of two and three stage amplifiers, to be known as Thomas Amplifiers.

Thomas amplifiers are admirably suited for installations that require distortionless reproduction and enormous volume, such as theatres, dance halls, clubs, churches, schools, parks, dining rooms, music studios, and large homes. Additional speakers or a microphone may be attached as desired for making announcements. They may also be used in sound amplification systems, call systems, amusement parks, recording studios, for amplifying public speeches and many other uses.

PIERCE-AIRO D-C CHASSIS

Pierce-Airo, Inc., 117 Fourth Ave., New York City, announces a screen-grid direct-current chassis designed to utilize d-c tubes, to be known as model D-C-273. The construction of the D-C model is the same as the Pierce-Airo A-C, 724, but designed so that with the same a-c tubes it will operate on direct current.

The chassis uses three screen-grid tubes and has specially designed selected control tuning with highly efficient double push-pull amplification and humless filter circuit. The radio-frequency assembly is completely shielded with a special bridge circuit compensated antenna. Provision is also made for automatic phonograph attachment.

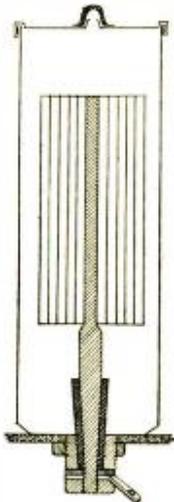
See The Acracon Exhibit At the RMA Show in Atlantic City—Booth C-2



THIS IS THE NEW



ELECTROLYTIC CONDENSER



DESIGNED especially to meet requirements specified by several leading manufacturers, this new Acracon Electrolytic Condenser possesses many new features which simplify chassis assembly, speed production, and lower manufacturing costs. Mechanically and electrically perfect, it is a worthy addition to the Acracon line. Here are 15 noteworthy characteristics:

- | | |
|-----------------------------------|--|
| 1. Capacity 8 mcfd. | 9. Long Life |
| 2. Peak voltage 440 volts | 10. Leakproof construction |
| 3. One hole, single nut mounting | 11. No surface corrosion |
| 4. Anode connection under chassis | 12. Electrode free from gas accumulation |
| 5. Compactly built | 13. Leakage less than .2 milliamperes per microfarad |
| 6. Neat appearance | 14. Lower power factor |
| 7. Rigid internal construction | 15. Size 1½" x 4¾" high |
| 8. Self healing | |

CONDENSER CORPORATION of AMERICA

259 Cornelson Ave., Jersey City, N. J.

Factory Branches in

Chicago

Cincinnati

Los Angeles

Toronto

Wax Impregnated Condensers—Oil Impregnated Condensers—By Pass Condensers—Electrolytic Condensers—Power Condensers—Transmitting Condensers

S. S. W. MOLDED RESISTANCES

A new type of resistance unit, which has many advantages, characteristics and qualities, is a product of the research laboratory of The S. S. White Dental Mfg. Company, Industrial Division, 152 W. 42nd St., New York City.

The S. S. W. resistance units are molded from special binder and conducting material, the finished units being non-hygroscopic. The strength insures them against breakage and all end contacts and lugs are molded permanently into the resistance material. They have a positive coefficient of heat and are thereby insured against self destruction through overloading. The nature of the resistance material is such that they will not change in resistance value when used within their rated wattage.



At present, they are supplied in two standard types, five flat types and one special hexagonal type, rated at 1 watt, 1.25 watt and 3. watts. Units of large capacity are in process of development and manufacture.

ELECTROLYTIC CONDENSERS

The Condenser Corp. of America, of Jersey City, N. J., is practically doubling plant facilities to speed production of new by-pass and electrolytic condensers which the company recently added to its line. Executives of the Condenser Corporation state that they have long realized the usefulness and need for an efficient condenser of the electrolytic type which they have perfected. Due to a delay in securing patents to protect several exclusive features, only a preliminary announcement has been made to date. It has been revealed that the new "Aeracoon" electrolytic condenser will be of the single 8-mf. type. The unit is to be mounted with single nut, all connections being made below the chassis. This construction was decided upon after a careful study of production and assembly methods, because it will eliminate the necessity of covering the condenser to conceal unsightly wiring above the chassis. Another important characteristic is the absolute absence of surface corrosion which greatly determines the life of this type condenser and has heretofore caused much trouble. C. C. Meredith & Co., of 45 Jarvis Street, Toronto, Canada, have been appointed Canadian factory representatives. In addition to Toronto, the company has factory representatives in Chicago, Los Angeles and Cincinnati.

RESISTANCE UNITS

The Shalcross Manufacturing Company, Collingdale, Penna., writes:

"We will manufacture for the trade in general a new type of resistance known as our type 'T' which is designed to provide a means of mounting without employment of clips by the employment of angle bracket terminals. Soldering terminals can be supplied instead of the angle brackets.

"Our prices will change—some high resistance values we manufacture will increase in price and some of the lower values we manufacture will decrease in price. The price of our new type 'T' will be the same as the new prices of our standard type 'M'.

"We also intend to announce in June, probably at the time of the Radio Show at Atlantic City, a new type of wire wound resistor ranging in value up to 100,000 ohms. This unit will be popular in price. It will be about the size of a grid leak with flexible wire terminals and a tolerance of 5 per cent plus or minus."

HEAVY DUTY RHEOSTATS AND POTENTIOMETERS

The DeJur-Amaeco Corporation, 418 Broome Street, New York, announces a new line of heavy duty rheostats and potentiometers in 5, 15, 40 and 75 watt sizes.

Adequate air cooling is provided in all types, and the wattage ratings are very conservative. The bakelite employed in the mounting and insulating parts is of a special composition, molded with heat resistive qualities.

NEW DEVICE APPLIES BAND-PASS PRINCIPLE TO STATION INTERFERENCE ELIMINATION

Since the introduction of 10-cc. separation of broadcast stations, the problem of interference has been an urgent one for thousands of radio listeners. Those in the neighborhood of local stations have experienced special difficulties and many of these fans have reported reception of nearby stations over ten, fifteen, and even twenty degrees of the tuning dials. Even the most modern receivers are often unable to cope with such conditions, without some external aid.

Realizing this situation, Mr. Alex G. Heller, chief engineer of the Insuline Corporation of America, has invented a novel form of station selector, based on

the band-pass principle. This new device, known as the Accraturator, successfully and practically applies principles hitherto held possible only in theory. The Accraturator was designed after a careful study of the characteristics of tuned circuits. Both theoretical and experimental data show that if two tuned circuits are utilized and that if the constants of these are correctly chosen, it is possible to combine the response frequencies and to obtain what is known as a "flat top" characteristic.

The Accraturator "accepts" a definite range of frequencies, "rejecting" all others. In this way, it acts as a true station selector, separating stations as desired.

SHORT-WAVE RECEIVERS IN SECTIONAL UNIT FORM

Sensing the growing importance of short waves in the broadcasting and communication fields, together with the demand for more elaborate and efficient receiving equipment than has heretofore been available, C. R. Leutz, Altoona, Pa., now announces two new short-wave receivers.

Unit construction typifies these short-wave receivers. This arrangement allows maximum flexibility and permits of using two, three or four units together as complete receivers. The simplest arrangement would be simply the detector stage and audio unit combined. To this combination may be added the first r-f. stage, and later the second r-f. stage. For maximum range and audibility, the complete four units are suggested.

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Each unit is in its individual aluminum case, with hinged top and sloping front panel. The cases afford double shielding between units, so essential in high-frequency receiver design. Each r-f. stage is in a separate compartment. The detector stage is also in a separate compartment, while the three audio stages are combined in a fourth compartment. This is the basis for perfect isolation between the various tuned circuits, which are arranged for maximum and uniform efficiency over the entire wide frequency range.

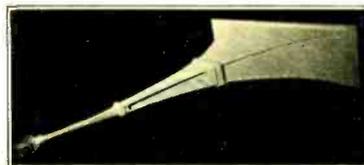
MAGAZINE FEED AUTOMATIC POST GROOVER

The first automatic hopper feed production post groover ever built has been developed and placed on the market by the S. A. Woods Machine Co., manufacturers of woodworking machinery, Boston, Mass., and it is expected that this machine will revolutionize the manufacture of grooved posts for radio cabinets, case work, bookcases and all other wooden furniture using posts.

It is a very high production motor-driven machine, entirely automatic, with hopper feed, eliminating the use of shapers in the grooving of wood posts. Compared with a shaper which is hand fed and cuts only one groove at a time very slowly, this new automatic Woods post groover will cut two grooves at one operation, automatically feed each piece into and through the cutters, and produce at least five times as much work as a shaper. It insures not only increased production, lower manufacturing costs, greater uniformity and better quality of work, but will save considerable money in machine investment, save floor space and save labor, because one of these machines will do the work of many shapers.

AMPLION MEETS ANY REQUIREMENT

The accompanying picture is of a new speaker designed specifically to the specifications laid out by one of Amplion's customers for use with portable equipment mounted on a truck. This is a good example of what the Amplion engineers can do in the way of designing special apparatus to suit special requirements. This horn has an air-column length of 7½



feet. The width of the bell is 6 feet, and the height is 19 inches. These odd dimensions were necessary as the buyer wished to attach this horn to the top of his truck. In this manner he made use of the full width of the truck and at the same time kept the total height within the limits required for proper clearance of trolley wires and bridges, etc. The Amplion Company is located at 133 West 21st Street, New York.

RELAYS FOR PUBLIC-ADDRESS SYSTEMS

A complete line of all purpose relays is manufactured by Struthers Dunn, Inc., 139 North Juniper Street, Philadelphia, Penn. The line includes relays for tube testing circuits and for public address systems.

DUST AND DIRT RESPONSIBLE FOR RECEPTION NOISES

One of the weak points of the average radio set is the volume control. When it is realized that a resistance of thousands of ohms is required for distortionless volume control, and that an amplification of thousands of times takes place between the circuit and the powerful loudspeaker, it stands to reason that the slightest uncertainty of contact causes tremendous noises. Many sets sound like the rumble of thunder when the volume control is adjusted. The serviceman, called upon to repair the set, simply cleans the contact and the wire turns. Dust and dirt may be the cause of noise in wire-wound devices, although poor design may also cause uncertain contact and therefore noise. In the case of non-wire devices, noises may arise from uncertain or poor contact or conduction in the resistive material employed.

By enclosing the wire winding and the contact member, given the proper design in the first place, dust and dirt may be eliminated as the most common source of noise in the usual radio set. The better types of volume control are now enclosed, so that no dust and dirt can reach the working parts.

AN AUTOMATIC LINE VOLTAGE REGULATOR PLUG

For the purpose of providing the usual socket-power radio set with correct and uniform operating voltage at all times, in addition to protecting tubes and power pack from excessive voltage strains, the Clarostat Mfg. Co., Brooklyn, N. Y., has developed the automatic line voltage regulator Clarostat. This device may be applied to any standard 110-volt radio receiver.

The device is in the form of a compact plug and receptacle for ready inclusion in the power line to the radio set. The perforated metal shell contains the automatic resistance unit. The device is not a fixed resistor, nor a resistor provided with taps for a variety of voltage conditions. Rather, it is an automatic ballast or self-compensating type of resistor, which offers high resistance to high line voltages, and very little resistance when the line voltage is at normal or below normal, thereby maintaining the applied voltage at the proper and uniform level. Because of the special winding and free air circulation, the device is highly responsive to all voltage fluctuations.

DAVEN RESISTORS

The Daven Company announces a new Super Davohm wire-wound resistance unit. The new resistor is made to meet the demand for a fine wire-wound unit to be rugged as to construction, compact as to size, neat in appearance and easily mounted.

The new Super Davohm differs from the standard unit made heretofore in various ways. The length has been considerably decreased and the winding space has been increased to accommodate a heavier wire insuring a greater safety factor. The wire ends are firmly wound around and carefully soldered to the tinned lugs. The soldered contacts are protected from being broken and also put through a special cleansing process, making a clean, perfect contact free from acids and corrosives which cause open or noisy resistors. The lugs are absolutely rigid—they cannot turn or fall out; but one may bend them in an upward or



downward position without affecting the unit. Another feature is that the new Super Davohm has a 100 per cent insulated clearance hole for a 6/32 machine screw which runs through the entire length of the coil. This feature enables one to easily attach the resistor to any part of the apparatus without fear of a short or drain.

This new Super Davohm is also made with center taps as desired at any value. This unit saves time, space and labor. Some of its characteristics are as follows: Guaranteed accuracy within 1 per cent, plus or minus, closer tolerance if required, temperature coefficient is .0001, negligible inductance, minimum distributed capacity. The spool is strong, will not break or chip. They can be had from .25 of an ohm to 10 megohms or more.

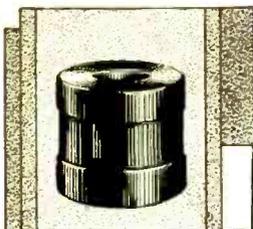
PHILCO TO MAKE OWN RADIO TUBES

The Philadelphia Storage Battery Company, manufacturers of the Philco radios, is going into the radio tube business. J. M. Skinner, vice-president, announced that Philco tubes will soon be available through Philco dealers everywhere.

The decision to manufacture its own tubes is in line with Philco's policy of balancing each article that goes into the Philco set, so that the set owner may have as near perfect reception as possible.

DIALS AND CONDENSERS

Precise Products, Inc., Rochester, N. Y., has issued an engineering data sheet containing useful information on condenser and control assemblies for receiver operation.



Patent Applied For

Now!

THERE IS A NEW COIL FOR DYNAMIC SPEAKERS INCA

USERS of dynamic speakers will find that the new INCA field coil supersedes the achievements of the past. It is a better coil, containing many departures from the conventional. The insulating sheath *completely seals the coil*. This affords mechanical and electrical protection to the winding—and *creates as near a moisture and water-proof coil as it is possible to make*. Still another appreciated innovation is the ingenious arrangement of the terminals, permitting the furnishing of these coils *with or without external leads*. The new INCA product is a marked improvement in the coil art, contributing to the economy and efficiency of dynamic speaker production. Samples of this coil, wound to your own specifications, will be gladly furnished without obligation.



INCA

Inca engineers will be glad to confer with you on any of your copper wire or coil problems

INCA MANUFACTURING CORPORATION

Copper Wire Products Fort Wayne, Indiana

EASTERN OFFICE: Newark, New Jersey — — Industrial Office Building

WESTERN REPRESENTATIVE: A. S. Lindstrom, 274 Brannan Street, San Francisco, California

Division of NATIONAL ELECTRIC PRODUCTS CORPORATION

ANNOUNCING

AN EACH IN HIGH FREQUENCY RESPONSE
 GREATER SIMPLICITY—SAFETY—STRENGTH
 REINFORCED BASS RESPONSE

The New
ROLA

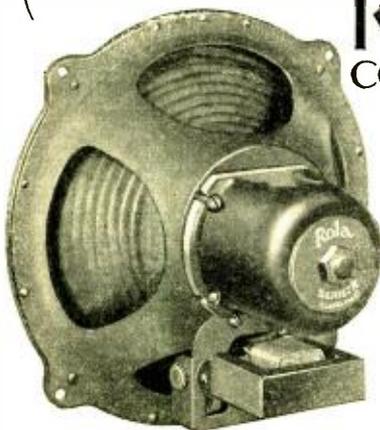
Series K

**Electro-Dynamic
 Reproducing Units**

A frequency range believed unattainable has been realized in this new Rola series.

The significance of this development in tone reproduction is further amplified by a higher mechanical safety factor, by greater compactness and increased structural stamina.

See these new Rola models and hear them demonstrated both at the Ritz-Carlton Hotel and the Auditorium, June 2nd. R.M.A. Show. Auditorium. Booth No. A-6. Demonstration Booth CC-11.



The
ROLA
 COMPANY

2570 E. Superior Ave.
 Cleveland, Ohio
 Oakland, Cal.
 45th & Hollis Sts.



The
New Weston
 MODEL 555
COUNTER TUBE CHECKER

Here is a valuable scientific instrument for dealers in radio supplies whose business prestige has been built upon selling only thoroughly inspected products. Testing radio tubes with this rapid and accurate checker insures customer satisfaction and prevents "comebacks"—profitless transactions which every dealer should seek to avoid.

Equipment of Model 555

- 1—Sockets for UX, UY and A. C. screen grid tubes.
- 2—A six-point filament voltage dial.
- 3—Four push button switches for making all the required tests.
- 4—Two 3 1/4" diameter instruments—an A. C. voltage indicator and a tube test meter.

Service Features of Model 555

Checks all tubes, A. C. and D. C., including '80 and '81 type rectifier tubes. Tests A. C. screen grid tubes and both plates of the 280 type rectifier (one at a time) without adapters. Indicates shorts between the filament and cathode.

See this new model at our Booth or in our Lecture Room at the Hotel Traymore during the R.M.A. Convention — or write to factory for full particulars.

WESTON ELECTRICAL INSTRUMENT CORP.
 612 Frelinghuysen Avenue, Newark, N. J.



"ROUND ROBIN"

\$1.

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Felt.

**Our Experts
Will Help Solve
Your Problems**

Today . . . felt is playing an important part in radio manufacture.

And . . . the problems pertaining to its application have, in no small measure, been solved through the technical department of Western Felt Works.

In considering your own needs — we shall be pleased to extend the services of our experts — as well as the entire facilities of our Manufacturing Division.

Immediate delivery may be called for on any of the following cut and ready to use items:

- Speaker Felt Cushions
- Cabinet Packing Felt
- Cabinet Conveyor Felt
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- Felt Washers, Gaskets.

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FELT WORKS**

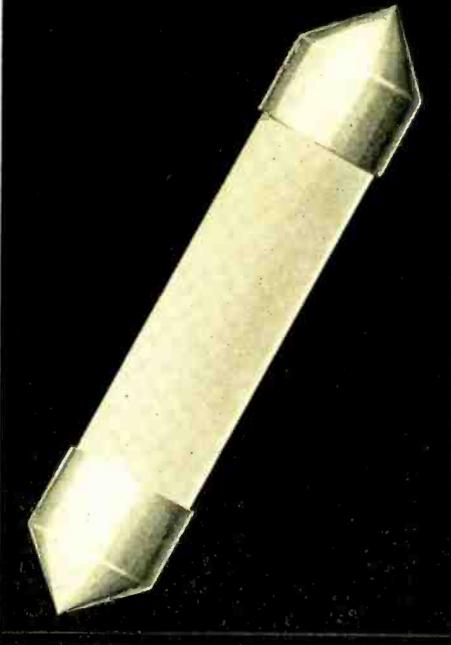
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A NEW ISOLANTITE[®]

developed exclusively for
**metallized
resistors**



A new ceramic insulator known as Isolantite B77 developed by the Isolantite Company of America in cooperation with the International Resistance Company is now available to all fabricators of metallized resistors.

In the metallized resistor assembly this new Isolantite provides a tightly sealed housing which is strong, non-porous, extremely accurate and which possesses the highest electrical insulating qualities. This new composition is one of several Isolantite insulating materials, each created for a specific application by an organization long experienced in ceramic manufacturing.

The International Resistance Company not only uses large quantities of Isolantite, but recommends it to its fabricating licensees for similar use. We invite inquiries concerning this or any other application of Isolantite.

*Process Patents

Isolantite Company of America, Inc.

BELLEVILLE, N. J.
New York Sales Offices
551 FIFTH AVENUE NEW YORK, N. Y.

THREE TUBE FACTS

... that help
your dealers
demonstrate
sets

by George Lewis,
Vice - President,
Arcturus Radio
Tube Company

1

When your sets are equipped with Arcturus Blue Tubes there's no annoying delay in starting... the program is there in 7 seconds. This kind of QUICK ACTION helps make sales.

2

CLEAR TONE, free from hum or background noises, is a certainty with Arcturus Tubes.

3

Arcturus Tubes insure lasting satisfaction. Their ability to withstand overloads has given them the world's record for LONG LIFE.

Critical engineers, checking Arcturus performance, know the advantages of these Arcturus features. They realize that Arcturus Tubes insure top-notch demonstrations... the kind of demonstrations that lead to sales.

Why not make sure that your set benefits by the *proved performance* of Arcturus Blue Tubes?

ARCTURUS RADIO TUBE COMPANY,
Newark, N. J.

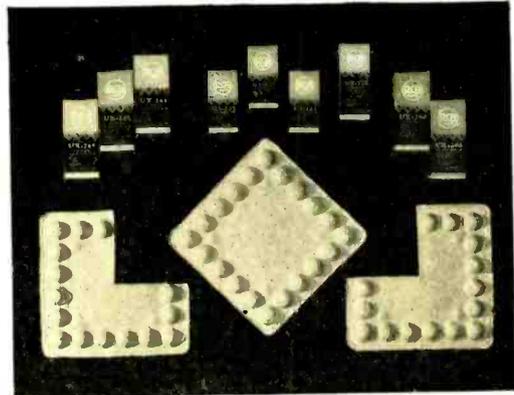
ARCTURUS

Quick Acting

RADIO TUBES



HOLED-TITE INTERIOR PACKING FOR
KITS OF 5 TO 12 TUBES



THIS IS EVERYTHING NEEDED TO PACK
A 9 TUBE KIT ready to place into corru-
gated carton.

TUBE KITS Now Packed The Holed-Tite Way

Prevents breakage, costs less, requires smaller shipping carton, simplifies packing, *eliminates mussy excelsior.*

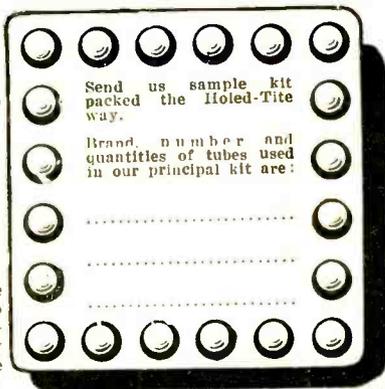
HOLED-TITE
TRADE MARK NEW YORK

Radio Tube Pads
Holed-Tite Packing Corp.
100 E. 42nd St., New York, N. Y.
Affiliated with International Paper Co.

Simplify your
kit packing
problem. Pin
coupon to let-
ter-head and
MAIL AT
ONCE

**"PROTECT
the
HEART
of the
RADIO"**

Holed - Tite
moulded pulp
pads are stand-
ard in use by
most large tube
manufacturers.





ANNOUNCES NEW IMPROVED

GROUP ADDRESS
EQUIP MENT



featuring Amplion's
column weather-

new giant air
proof—

12 ft. SPEAKER
CAN BE HEARD MORE THAN
A MILE AWAY

The Amplion units in this 12-foot horn can handle 50 watts of audio power without distortion or breakdown.

New standardized methods and weather-proof materials now make possible, any size or design of horn at considerably less cost than formerly.



New Amplion
12-ft. Air Col-
umn Speaker will
accommodate 2 Am-
plion horn units.

3,000 People Listened To This Speaker

1200 feet away from the horn during the
daily flying activities at

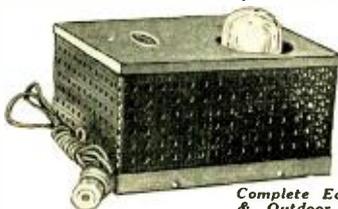
ROOSEVELT AVIATION FIELD
LONG ISLAND, N. Y.

And every word is heard with perfect fidelity

An example of an Amplion
made-to-order trumpet horn.
Width 6 ft. Length 7½ ft.
Height 19 inches.



New Amplion Tube Exciter



Type EL22
Will handle 6 Am-
plion horn units at
one time.

Delivers 16 volts at
25 amperes.

Complete Equipment For Indoor
& Outdoor Sound Installations.
Catalog on Request.

Amplion Corporation of America
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133 West 21st Street New York, N. Y.

PROVED
PERFORMANCE



EVEREADY RAYTHEON
TUBES FOR TALKING
PICTURES, TELEVISION
AND ALL INDUSTRIAL PURPOSES

THESE tubes have firmly established their position in the fields of talking pictures and television, and in the greatly broadening field of industrial usage.

The Eveready Raytheon Foto-Cell is a long-life tube for talking pictures, television and industrial purposes, such as control of illumination, automatic counting, paper-testing, color matching and others. It comes in several standard types, or can be made to specification.

The Eveready Raytheon Kino-Lamp is the first television receiving tube developed commercially that will work with all systems. Each tube is carefully tested.

We welcome inquiries from every one interested in talking pictures, television and Foto-Cell applications of any nature.

★ ★ ★

The Eveready Hour, radio's oldest commercial feature, is broadcast every Tuesday evening at nine (New York time) from WEAJ over a nation-wide N. B. C. network of 30 stations.

NATIONAL CARBON COMPANY, INC.

General Offices: New York, N. Y.

Branches: Chicago Kansas City New York San Francisco

Unit of Union Carbide **UCC** and Carbon Corporation



Trade-marks

DAVEN



Type TA



Type TB



Type TC



Type TD



Type TE

Announces

AN ENTIRELY
NEW PRODUCT

TAPPED SUPER- DAVOHM RESISTORS

Daven resistor specialists have developed tapped Super-Davohm wire-wound resistors with as many terminals as required. Rigid tinned terminals, cannot turn or pull out—100% insulated—center hole of unit will clear a 6/32 screw. Can be mounted anywhere without fear of shorting.

CHARACTERISTICS

Non-inductive; temp. coefficient 0001; minimum distributed capacity; moisture-proof; non-corrosive contacts; compact; rugged; guaranteed tolerance 1% plus or minus (closer tolerances at slight additional cost); units from .25 ohm to 5 megohm, or in tapped multiples up to 15 megohms or more.

Patents applied for

THE DAVEN COMPANY

RESISTOR SPECIALISTS

General Office and Factory

158-160 Summit Street

NEWARK, NEW JERSEY

Improve
Your Receiver
with

Potter

Quality

Condensers

By-Pass
Filter and
Filter Blocks

THE SCIENTIFIC CONTRIBUTION TO RADIO

The Ideal Filter Block

The Potter Electrochemical Condensers are characterized by proven durability, permanence of capacity value, low energy loss and small bulk. They are substantially free from surge breakdown troubles due to inherent self-healing properties.

Difficulties due to instability of dielectric film and evaporation common to "wet" type condensers have been overcome.

As a result of elaborate experiments, the Potter Electrochemical Condenser consists of a compact roll of prepared aluminum sheets separated by a thin layer of organic dielectric forming material. Absolutely nothing containing water is employed in the structure, so there is nothing to evaporate. The chemical ingredients are non-aqueous and prepared non-hygroscopically, so that all troubles formerly due to presence of water in structure of this class are avoided.

The condensers act more like wax impregnated paper and foil condensers than any chemical type condenser heretofore known. The losses are exceedingly small and the condenser will retain a charge for an appreciable time.

(Edelman Patents)

Quotation and engineering data upon request.
Write us at once.

The Potter Co.

North Chicago, Illinois

A National Organization at Your Service.

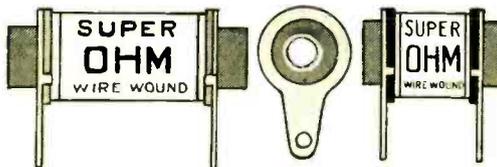
Resistors of extreme accuracy
for exacting requirements—
all types.

Super Ohm

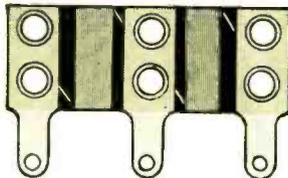
Where closer tolerances are
required Super-ohm Resistors
are being selected.



Liquid Porcelain Coated
Voltage Dividers—
acid-proof, oil-proof, fire-proof



SELF-INSULATING RESISTORS
Ideal for Fader or Volume Controls



BAKELITE STRIP RESISTORS

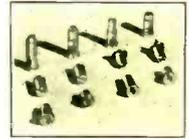
Send your specifications. Samples
Shipped in 24 HOURS.

SUPERIOR RESISTOR CORP.
334 Badger Ave.
Newark, N. J.



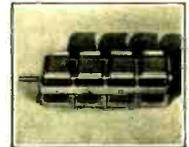
Combine

High Speed
Production



Look plugs die cast at
an average rate of 18,000
per day.

Perfect
Accuracy



Limits held on 4 gang
condenser rotor. Centre
distances between blades,
plus or minus .001".

Strength &
Durability



40 parts of the pin ticket
machine illustrated were
die cast. Unusual strength
and durability, essential
to the proper operation of
the machine, were among
the properties contributed
by the Allied Process.

Beauty &
Fine Finish



Desk lighter die cast by
Allied—an example of the
beauty and fine finish that
is obtained by the Allied
Die Casting Process.

AT

LOW COST

and you have some of the advantages
the Allied Die Casting Process offers
you in addition to uniformity, prompt
deliveries and complete engineering co-
operation in the production of parts to
your exact requirements.

Allied engineers will gladly consult with
you regarding your production and die
casting problems.

Allied Die Casting Corp.

43d Avenue from 38th to 39th Streets
LONG ISLAND CITY,
New York.

ANNOUNCING NEW DESIGNS IN RADIO TUBE PARTS

TUBE manufacturers will welcome this announcement of our newly designed parts which meet the requirements made necessary by improved vacuum tube design.

Our engineers being thoroughly familiar with tube design and manufacture and knowing the problems of the manufacturer in making tubes of consistently high quality, anticipated the changes in part specifications. Thus we are able to offer at this time an improved line of plates, getter cups, collars, oxide coated filament and cathodes of the same quality and accuracy that has won such an enviable reputation for our products.

Our engineering staff will be pleased to help manufacturers in developing or adapting standard or special radio tube parts to meet individual requirements.

*Write Today for Our New
Illustrated Catalog and
Latest Price List!*

RADIO PRODUCTS CORP.

Factory and General Office
548 South 11th St., Newark, N. J.

**Leading Producer
of
Radio Frequency Chokes
ANNOUNCES**

INCREASED CAPACITY

With present production facilities of thousands of RF choke and antenna coils daily in expectation of a big demand, Meissner will be in maximum production by early summer.

Immediate delivery is thus assured on any reasonable quantity of RF choke or antenna coils; also facilities for producing in quantity paper-section coils for radio transformers, speaker coils, X-ray, clock, and ignition coils.



COILS

—for practically every purpose—stock and special—wound on automatic machines to exact number of turns you specify. Precision inductances for quantity production.

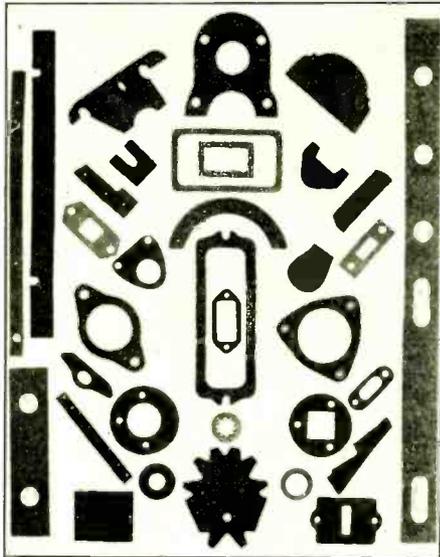
TURN COUNTERS DESIGNERS OF SPECIAL COIL-WINDING MACHINERY

And unusually prompt delivery on any special coils made to customers' specifications.

When you need first quality coils, a lot of coils, or special types of coils in a hurry, depend on Meissner—a source of supply adequate to your needs where "quality" and "service" are something more than catch words.

MEISSNER
MANUFACTURING COMPANY
522 S. Clinton St., Chicago, Illinois

VERSATILITY OF FELT



THE largest manufacturers of felt in the world can supply you with cut parts to meet any specification.

Washers, wicks, gaskets and bases—all felt. You owe it to yourself to investigate the possibilities of this universal product.

Felt is daily solving hundreds of engineering and manufacturing problems. Avail yourself of the intelligent cooperation offered by the American Felt Company.



American Felt Co.

NEW YORK + SAN FRANCISCO + BOSTON
DETROIT + CHICAGO + PHILADELPHIA + ST. LOUIS

FIND OUT TODAY!

AMERICAN FELT CO. R-4-30
315 FOURTH AVE., N. Y. C.

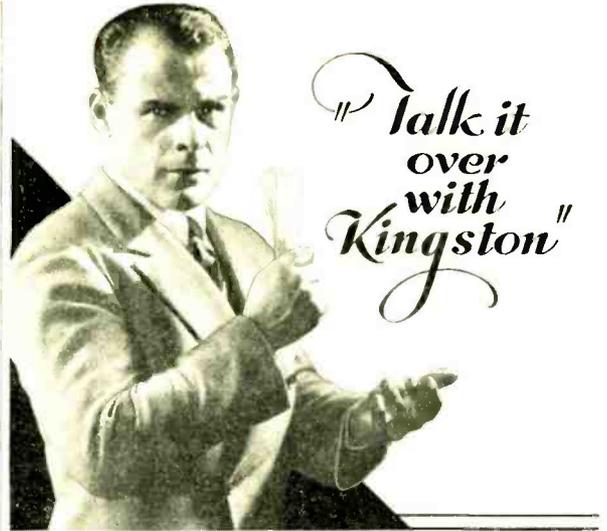
We are interested in the use of felt.

Send sample for.....

Have your representative call.

Name

Address



KINGSTON CAN help you with your production problems!

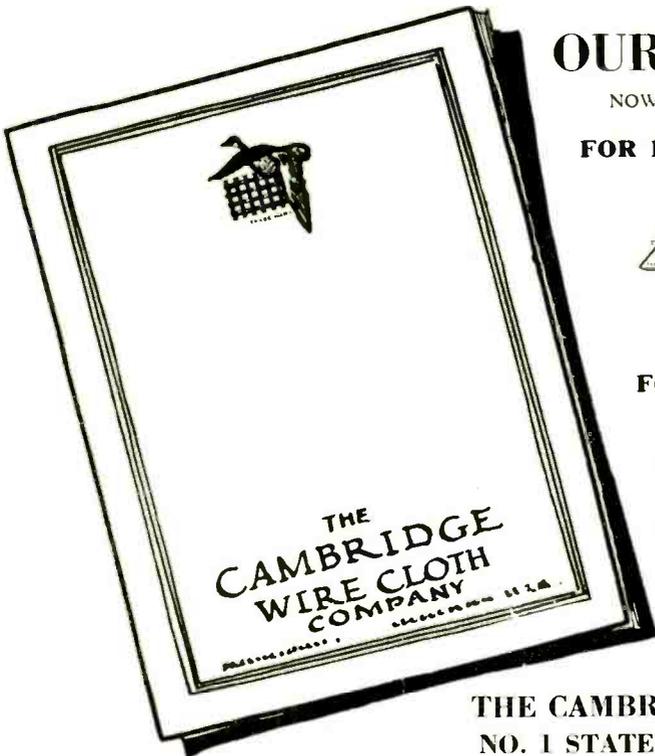
The manufacturer who specifies Kingston products has a right to demand more than uniformly high quality. Kingston engineering service is a definite part of the obligation.

Kingston's resources and experience qualify them to solve your problems in the production of power transformers, filter condensers, filter reactors and other radio products.

Kingston will welcome an opportunity to talk it over with you.

**KINGSTON
PRODUCTS
CORPORATION**
KOKOMO, INDIANA
U.S.A.

KINGSTON RADIO POWER EQUIPMENT to manufacturers specifications



OUR NEW CATALOG
NOW READY FOR FREE DISTRIBUTION
FOR RADIO TUBE MANUFACTURERS

FOR ALL INDUSTRIES

THE CAMBRIDGE WIRE CLOTH COMPANY
NO. 1 STATE ROAD, CAMBRIDGE, MARYLAND

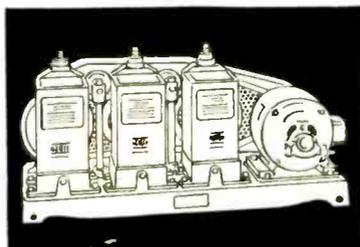


WIRE CLOTH MESH
Cut to any width strip.
Raw edge or with our
new **DOUBLE LOCK**
selvage edge.



CAMBRIDGE SPIRAL
flexible, woven wire
belts. For conveying
products thru ovens,
furnaces, washers and
similar equipment.

Pioneers in pumping equipment for exhaustion processes. Cenco Megavacs and Hyvacs have become the basis for much of the technique now approved by leading High Vacuum Engineers. Today they answer, as no other vacuum pumps can, two requisites in the production of those products demanding a high degree of exhaustion. First. Cenco Megavacs and Hyvacs give immediate low pressures sustainable throughout progressive stages of production;



CENCO
MEGAVAC
PUMPS

**MEET TWO RE-
QUIREMENTS
OF MODERN
TECHNIQUE IN
HIGH VACUUM
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second, they insure a vacuum as high as .1 micron. Cenco Megavac pumps are made in both single and triple unit models. A descriptive booklet, "High Vacuum Engineering," will be mailed you at your request.

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Pumps, for the exhaustion
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| RADIO TUBES | PHOTO-
ELECTRIC
CELLS |
| X-RAY TUBES | |

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General Etching and Mfg. Co.
 MANUFACTURERS OF
ETCHED AND LITHOGRAPHED METAL PRODUCTS
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— ART BRONZE —
ESCUTCHEONS

Simple or intricate formations. Excellent facilities in our large and modern plant



NAME PLATES

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Various etched, lithographed and embossed metal products and specialties.

Send us your inquiries

M&W.C. 1876

LACQUERS ENAMELS

MAHOGANY PRISMLAC No. 52

Some of the leading Radio manufacturers are using M & W Mahogany Prislac No. 52 on the chassis and other stamped steel parts for the following reasons:—

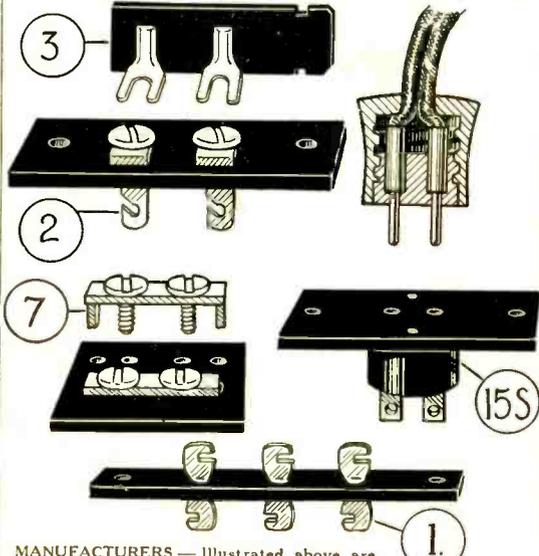
- 1—One Coat Finish.
- 2—Hides Imperfections.
- 3—Air dries in about One Hour.
- 4—Produces a Beautiful Crystalline Finish.
- 5—Available in Solid Colors.
- 6—The Ideal Production Finish.

Your inquiry is invited.

Maas & Waldstein Company
 Executive Offices and Plant 438 Riverside Ave., Newark, N. J.
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The border of this advertisement is a photographic reproduction of M & W Prislac.

Howard B. Jones
 2300 WABANSIA AVE. CHICAGO, ILL.



MANUFACTURERS—Illustrated above are a few of the many electrical connecting devices we are supplying to the Radio and electrical industry. Let us figure on your requirements.

See our exhibit—Booth D-10, at the 4th Annual RMA TRADE SHOW, Atlantic City, June 2nd to 6th, 1930.

Standard the
 World Over

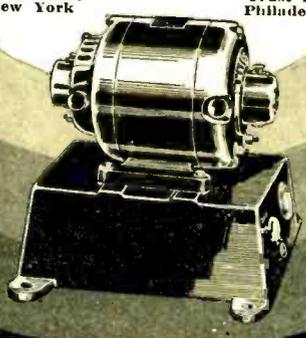
JANETTE Rotary Converters

Argentina, Mexico, Uruguay, Australia, England, Belgium, New Zealand—everywhere—you'll find JANETTE Rotary Converters in the same leading position which they occupy in the U. S. A. Wherever there's a D.C. to be changed into A.C. for the operation of radio sets and phonographs you can be sure that somewhere around is a JANETTE Converter—doing its job faithfully without ripple, hum or noise.

Standard units for 32, 115 or 230 volts D.C. input 110 volt, 60 cycle A.C. output.

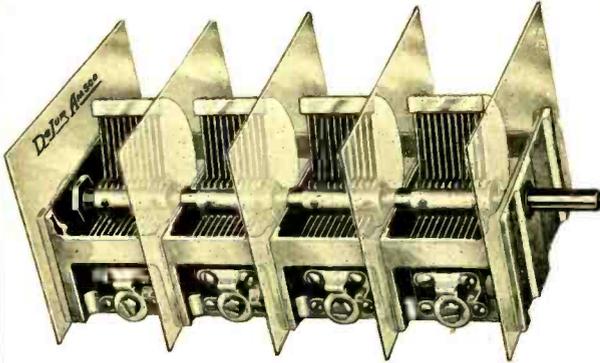
Write for Bulletin 1229-C.

JANETTE MANUFACTURING CO.
 550 West Monroe St., Chicago
 Singer Bldg., 149 Broadway, New York
 Real Estate Trust Bldg., Philadelphia



A PRODUCT OF EXPERIENCE

DeJur-Amsco



COMPLETELY SHIELDED CONDENSERS

Developed Especially For Screen Grid Receivers

The development of DeJur-Amsco Condensers parallels the development of the radio receiver. It is the constant aim of this organization to produce the most perfect tuning unit consistent with the

production costs of commercial receivers. That we have been successful is evidenced by the fact that DeJur-Amsco Condensers are now used by many of the leading commercial set manufacturers.

Write us for engineering data and complete specifications for our new condenser. Samples on request.

Available in Double, Triple, Quadruple and Five Gangs.

We are also making special condensers for automobile radio and portable receivers.

See the DeJur-Amsco Display at the R.M.A. Trade Show Atlantic City Booth No. D-14

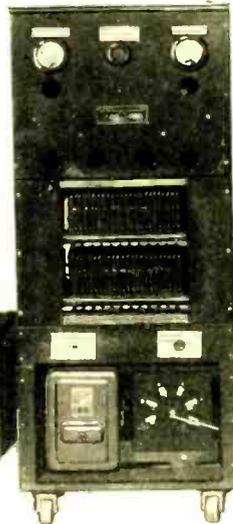
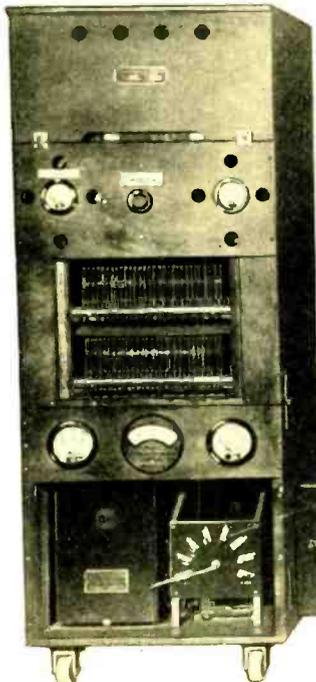
DeJur-Amsco Corp.

Fairbanks Building
BROOME & LAFAYETTE SIS., NEW YORK CITY

LEPEL BOMBARDERS

Laboratory High Frequency Metal Melting

FURNACES



A Size for Every Requirement

Tunable to Peak Efficiency

LEPEL HIGH FREQUENCY LABS., Inc.

39 West 60th St., New York

all-Steel Mailing Table



No. 3040. Sheet steel. 16-compartment sorting top, removable shelves or trays. Locking door hinged on top, if desired. Table top stands 30" high from floor, 33" deep and 41 1/2" wide, 16-gauge sheet steel. Legs, 1 1/2" angle steel. Finish, olive green enamel.

EFFICIENCY is simply productive manpower. Give your employes the proper tools, equipment for conserving time, effort and thought. Mailing tables are only one of hundreds of efficiency aids made by us for plant and office use. They are light-weight, absolutely rigid, space-saving and a life-time investment. Ask for Representative — or catalog "C-RE"

Special Angle and Sheet Steel Equipment also Built to Your Specific Needs.

ANGLE STEEL STOOL COMPANY
Agents in All Principal Cities
PLAINWELL, MICHIGAN

EVEREADY RAYTHEON B-H TUBES FOR "B" ELIMINATOR UNITS



Type B-H
125 m. a.
at 300 volts

HERE is the original gaseous rectifying tube, that is standard in over one hundred makes of "B" eliminator units. In fact, most "B" eliminators are designed for the famous B-H.

This Eveready Raytheon B-H Tube uses, instead of a filament, ionized helium which, steadily, supplies millions of electrons a second, over and over. A rectifying tube of sustained voltage through a long life of reliable efficiency.

Try a new Eveready Raytheon B-H — and note your superior reception.

Note to experimenters: If you require a dependable source of powerful D. C., you will find the Eveready Raytheon B-H adaptable to many purposes.

* * *

The Eveready Hour, radio's oldest commercial feature, is broadcast every Tuesday evening at nine (New York time) from WEAJ over a nation-wide N. B. C. network of 30 stations.

NATIONAL CARBON COMPANY, Inc.

General Offices:
New York, N. Y.

Branches:
Chicago Kansas City
New York San Francisco

Unit of Union Carbide and Carbon Corporation



Trade-marks

The better sets of
RADIO MANUFACTURERS
are brought to perfection through

J

INDUSTRIAL TAPE

THE increased number of intricate parts now essential in the more modern radio chassis have correspondingly increased the need for tape made in varying thickness and width. Johnson's Industrial Tape may be secured in widths from 1/4 inch to 36 inches and in thickness from .008 inches up, either in standard length of 36 to 60 yards or in individual packings. Adaptable for loudspeakers, coils and general uses.

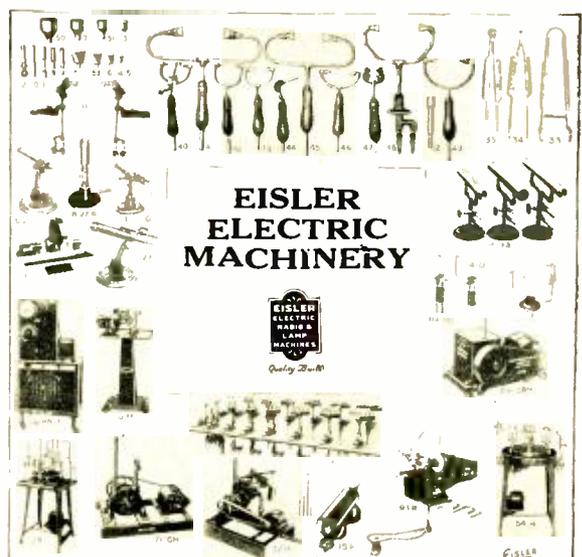
*Have you seen the new Johnson's Tape Dispenser?
Holds full size roll of tape up to 1 1/4 inches wide.
Enables you to cut any length of tape instantly.
Eliminates pre-handling—no waste.*

Testing Costs You Nothing

JOHNSON & JOHNSON, New Brunswick, N. J. R. F. J.
Please send free sample roll of Johnson's Industrial Tape and information on the Tape Dispenser.

Name _____
Company _____
Street and No. _____
City _____ State _____

**RADIO TUBE MACHINERY
INCANDESCENT LAMP MACHINERY
TELEVISION TUBE MACHINERY
NEON SIGN MACHINERY
GLASS WORKING MACHINERY
HIGH VACUUM PUMPS
ELECTRIC SPOT WELDERS
LABORATORY GLASS BURNER APPARATUS**



**EISLER
ELECTRIC
MACHINERY**

Send For New "C" Catalog
EISLER ELECTRIC CORPORATION
760 So. 13th St. Newark, N. J.

MOLY



WIRE

The Ideal
TUBE LAMP WIRE

ELMET Molywire is a proven product, known for its uniformity. Wound on moulded spools of which we are the originators. Our plant at Lewiston, Maine is most modernly equipped to fulfill your individual requirements efficiently. Molybdenum sheet, thickness .0008" and up, is one of our specialties.

GREETINGS

To The

RMA

American Electro Metal Corporation

Executive and Sales Offices
65-67 Madison Ave.
New York City

Screen Grid Wire Cloth



with

Unfailingly Accurate Mesh

The requirements of Screen Grid Tube manufacturers for a wire cloth with an unfailingly accurate mesh are perfectly met in "Buffalo" Wire Cloths. Constructed from the highest quality materials obtainable, they are woven on improved power looms to insure uniform selvage and absolutely accurate mesh.

Tell us your requirements. We will gladly furnish estimates and samples.

Buffalo Wire Works Co., Inc.
(Formerly Scheeler's Sons, Est. 1869)
588 TERRACE BUFFALO, N. Y.

KESTER FLUX-CORE SOLDER



Ready to Use

EXACT

No more soldering failures—Kester eliminates the guesswork of separate fluxes. Its simple, sure operation will speed your work and increase your soldering efficiency. Profit by using Kester Flux-Core Solders in your industrial soldering processes.

A special solder, designed for your particular purposes, will effect a great improvement in your present methods of construction, installation and repairs. Let our experts analyze your specific needs and recommend the exact solder for your use. Consultation imposes no obligation; write our research department today.

KESTER SOLDER COMPANY
4224 Wrightwood Ave. Chicago, Illinois
Incorporated 1899 Formerly Chicago Solder Co.

AT ATLANTIC CITY

See our Research Engineer, P. C. Ripley, at the Civic Auditorium, Booth No. 50, Section B, June 2nd-6th, inclusive.



KESTER

FLUX-CORE

SOLDER

ACID-CORE ROSIN-CORE PASTE-CORE
METAL MENDER RADIO SOLDER



Specifications wanted...

TO make it short and to the point, we want your business. We've been specializing in the manufacture of high grade transformers, condensers and radio-electrical accessories for years. Our large, well equipped factory is now supplying some of the more important manufacturers. We feel that our quality and service will fit YOUR needs. Why not let us figure on your special requirements immediately? Specifications are all we need, then we will make full recommendations and quote prices.

**Condensers
Condenser Blocks
Coils
Transformers
Chokes
Power Packs**

CONCOURSE

ELECTRIC COMPANY, INC.
294 East 137th St.  New York City

Super Akra-Ohm

Wire Wound

Resistors

are vital for Radio, Audio, Visio and Industrial applications of the Electronic Tube.

Super Akra-Ohm Resistors are manufactured in any value from 0.01 ohms to 10 meg-ohms. They are carefully designed to insure an accuracy of one per cent and a constant permanency of calibration. They are especially adapted and highly recommended for Laboratory Standards, High Voltage Regulators, Telephone Equipment, Television Amplifiers, Grid and Plate Resistors, etc.



TYPE "M"



TYPE "T"

TYPE "T" is manufactured with soldering terminals or angle brackets. This type is designed to meet an increasing demand for a unit that can be readily mounted in precision electrical instruments, high-grade testing apparatus and high-grade radio sets.

These can be produced in quantities for a low price without sacrificing the accuracy and durability that characterize Super Akra-Ohm Resistors.

Let us know your Resistor requirements. We manufacture a type for every purpose. Samples and prices sent on request.

Shallross Mfg. Company
ELECTRICAL SPECIALTIES
700 PARKER AVENUE
Collingdale, Pa.
ALWAYS SUPER AKRA-OHM ACCURATE | ACCURATE HIGH-INDUCTIVE WIRE WOUND RESISTORS

In 1906 - -

De Forest, working in the realm of physics, invented the vacuum tube. Acheson, meanwhile, laboring in the field of chemistry, first produced Colloidal Graphite.

It is fitting that these two products, born simultaneously, are, after a quarter of a century, intimately associated in the radio industry.

Colloidal Graphite is indispensable in the efficient drawing of tungsten and molybdenum. It discourages grid emission and finds utility as a "getter."

Colloidal Graphite is also a valuable resistance material for grid leaks and volume controls and serves as a long life lubricant for variable condensers and other moving radio parts.

ACHESON OILDAG CO.

Manufacturers of "Aquadag" and "Oildag" brands of Colloidal Graphite.
PORT HURON, MICH.



The Patterson Radio Tube Socket

The Socket with Positive Contact

Perfect insulation with "G. E." TEXTOLITE — Lowest resistance and capacity — Tubes will not unseat from vibration.

A Socket which simplifies the problems of the Set Assembly, meets the needs of the present type of tube and which is produced to give the greatest efficiency at the lowest cost — Samples and full details on request.

ELECTRICAL INSULATION CORPORATION
308 W. Washington Street, CHICAGO, ILL.
Distributors and Fabricators of "G.E." TEXTOLITE

Quality Satisfaction —
Price Satisfaction —

IGRAD

Fixed Condensers

By-Pass Units Filter Units High Voltage Units

All Sizes and Combinations

Quality demonstrated by satisfactory performance for several years in many of the best sets.

Let us figure with you—

Representatives in larger cities

IGRAD Condenser & Mfg. Co., Inc.

CONDENSER
SPECIALISTS

Rochester, N. Y.

Congratulations
to the Radio
Industry
now holding the
Sixth Annual
R.M.A.
Convention

Molybdenum
wire—sheet—rod

Tungsten Alloys
filament—wire—rod—ribbon—coils

Trimet
lead in wire

Cathodes and
Radio Wire
coated and uncoated ribbon and
wire

Refractory Metal
Contacts
all types

Write for
Our New
Handbook
of Callite
Products for
the Radio
Industry

Callite Products Co., Inc.
Union City, N. J.

Whatever your resistance problem, the International experimental laboratory and its specialized staff stand second to none in ability to solve it.

DURHAM Resistances are made in all values for all electrical work. Samples and complete engineering data on request.

DURHAM METALLIZED
RESISTORS & POWEROHMS
INTERNATIONAL RESISTANCE CO.
2000 Chestnut Street, Philadelphia, Pa.

PYROXYLIN LACQUERS

THAT
HOLD CUSTOMER
CONFIDENCE

Accepted for every use throughout industry as the highest standard of lacquer excellence since 1884.

The facilities of our Service Laboratory equip us to work out any finishing problem and enable us to render you valuable assistance without cost.

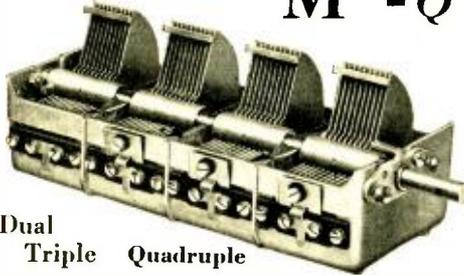
THE pioneering spirit which has lifted Zapon Pyroxylin Lacquer to their present pinnacle of leadership, made them a standard bearer of matchless uniformity, quality and economy, is consistently pledged to a policy of progress that will hold customer confidence by sheer reason of superiority.

Absolute control over basic raw materials and chemical processes give Zapon an unrivaled advantage in continuous advancement, service and leadership.



THE
ZAPON COMPANY
STAMFORD
CONN.

The New "M"-Q



Dual
Triple Quadruple

HAMMARLUND

For Manufacturers

HAMMARLUND Quality at a PRICE! A two, three or four-gang condenser with every feature a manufacturing asset. Stamina, accurate matching, fine finish and good looks—plus a price that appeals to careful buyers.

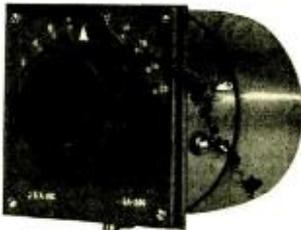
Write us your needs. Hammarlund cooperation and facilities are yours for the asking. Address Dept. RE6.

HAMMARLUND MANUFACTURING CO.
424-438 W. 33rd St., New York

For Better Radio
Hammarlund
PRECISION
PRODUCTS

JENKINS & ADAIR, INC. VARIABLE ATTENUATOR

Types GA-200 & GA-500



For Use in Broadcasting Station, Control Room, Studio, Sound Stage, Recording Room and Laboratory.

In an audio circuit between an output and an input of equal impedance, it is often desirable to place a variable volume controlling device which is calibrated, and which in itself produces no distortion. This takes the form of an H-type resistance network, and has long been familiar in telephone practice.

The Jenkins & Adair Variable Attenuators are variable H-type networks, ranging from 0 to 20 DB. in steps of 2 DB. They are highly accurate instruments, making them suitable for laboratory measurements as well as commercial broadcast and recording work. Two types are built, adapted to 200 ohm and 500 ohm circuits. They are identical in size and mechanical construction as well as in price. They are very heavily built, and good for years of hard service.

Price (in U.S.A.)..... **\$85.00**
F.o.b. Chicago.

Send for Bulletin No. 10 giving full description and uses.

JENKINS & ADAIR, INC.
ENGINEERS

3333 Belmont Ave., Chicago, U. S. A.

British Office: 76 Old Hall St., Liverpool, England.
40 Buckingham Gate, Westminster, London, SW 1, Eng.
French Office: 16 Rue de Cheateaudun, Asnieres, France.



The MADISON

ILLINOIS AVENUE

Overlooking Boardwalk and Ocean



"A Hotel Distinctively Different"



UNEXCELLED COLONIAL

HOSPITALITY

JUST COMPLETED IN

ATLANTIC CITY

Fireproof



Showers & Baths

Throughout



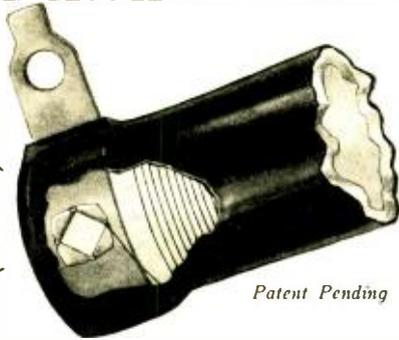
Now Ready for YOU!

From \$4.00 Daily. European Plan

From \$7.00 Daily. American Plan

FETTER & HOLLINGER, Inc.

Eugene C. Fetter, Mgr. Dir.



Two New Contacts for You

Our Catalog
Shows our products and it brings simplified Resistance Computing Tables available nowhere else so far as we know. Write us for it—and ask too for a description of the New HH Contact.

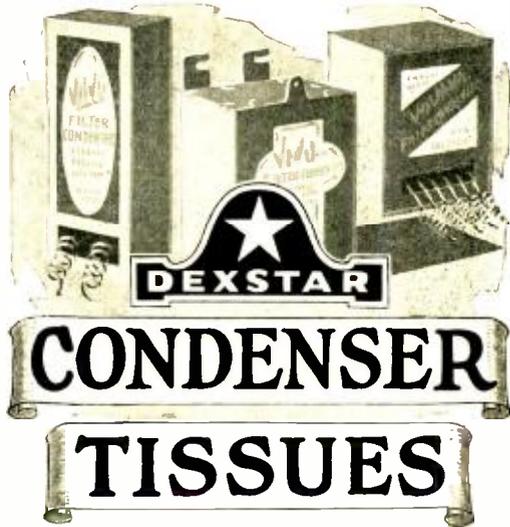
ONE of them is shown above—the new Eyelet Contact that is now a standard part of every HH RESISTOR. It has been universally approved by Electrical and Radio Engineers for its effective reduction of contact resistance through increased, fixed contact areas between wire and terminal.

The other new contact is the one that we welcome between your organization and ours. We are making RESISTORS for an impressive list of leaders in the industry. There are definite reasons why you should be among them. May we tell you what they are?



RESISTORS

Hardwick, Hindle, Inc.
221 Emmet St. Newark, N. J.

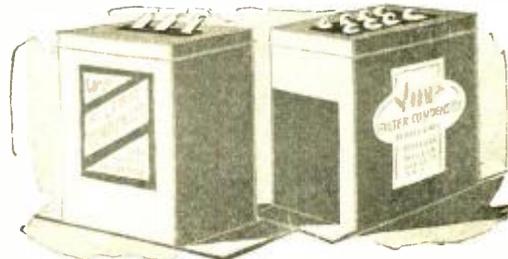


NO Radio set is any better than its weakest link, and the weakest link is very often a filter Condenser. No Condenser is any better than the thin strips of Insulating Tissue which separate the layers of metal foil. A pinhole or a speck of metal in the Condenser Tissue means a breakdown of the Condenser, with the entire set put out of commission.

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Fairmont Aluminum Co.
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Fairmont Aluminum Co.
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General Radio Co.
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Jenkins & Adair, Inc.
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Meissner Mfg. Co.
Polymet Mfg. Co.
Thordarson Elec. Mfg. Co.
Transformer Co. of Amer.
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Meissner Mfg. Co.
Samson Elec. Co.
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Concourse Electric Co., Inc.
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Meissner Mfg. Co.
Polymet Mfg. Corp.
Transformer Corp. of Amer.
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Westinghouse Elec. & Mfg. Co.
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Easton Coil Company
Polymet Mfg. Corp.
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Easton Coil Company
General Radio Co.
Hammarlund Mfg. Co.
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Meissner Mfg. Co.
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Easton Coil Company
Inca Mfg. Co.
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General Radio Co.
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Amrad Co.
Condenser Corp. of America
Concourse Elec. Co., Inc.
Dongan Electric Mfg. Co.
Dubilier Condenser Mfg. Co.
Igrad Condenser & Mfg. Co., Inc.
Polymet Mfg. Corp.
Potter Co., The
Sprague Specialties Co.
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Amrad Corporation
Condenser Corp. of America
Polymet Mfg. Co.
Sprague Specialties Co.
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Amrad Co.
Concourse Electric Co.
Condenser Corp. of America
Dongan Electric Mfg. Co.
Dubilier Condenser Corp.
Igrad Condenser & Mfg. Co., Inc.
Kingston Products Corp.
Polymet Mfg. Corp.
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Hammarlund Mfg. Co.
Polymet Mfg. Corp.
Scovill Mfg. Co.
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Hammarlund Mfg. Co.
Scovill Mfg. Co.
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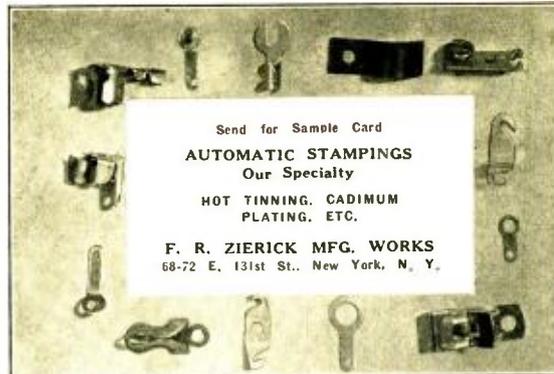
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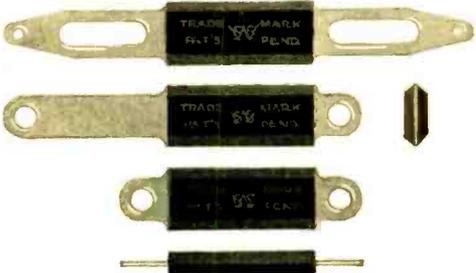
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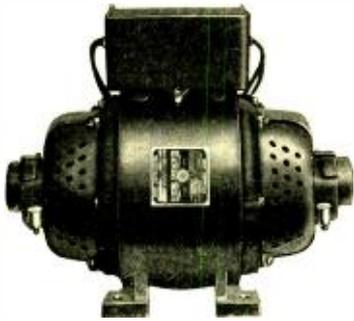
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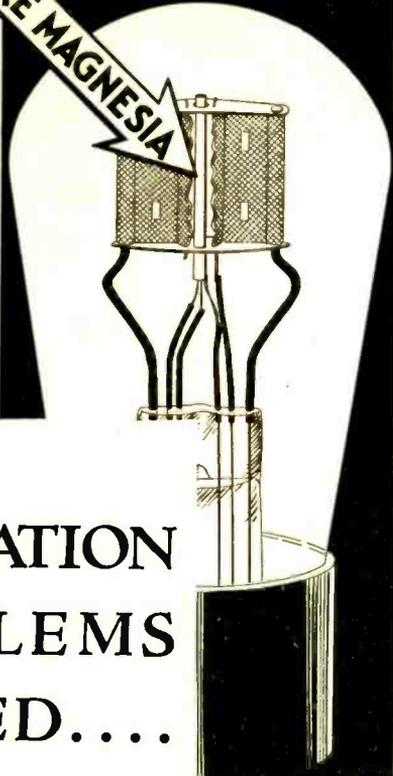
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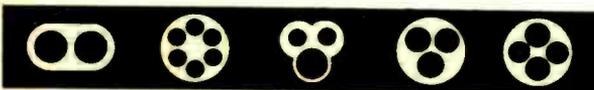
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