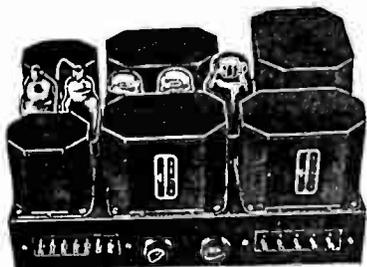




and now . . . The Newest 1935 Development from  
the UTC Engineering Laboratories

## the Varitone\* Audio Transformer

A universal audio input transformer giving continuously variable low end,  
high end, or low and high end equalization.



VT-1—Designed to work from a  
single plate or low impedance mi-  
crophone line to one or two grids.

List price \$8.50

Net to Dealers \$5.10

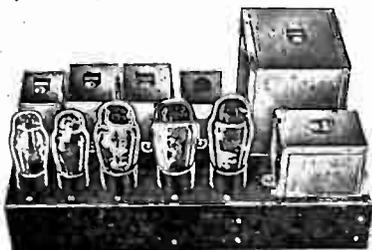
Affords 15DB controllable correc-  
tion of low and high frequency re-  
sponse, high frequency response, or  
simultaneous correction of low and  
high frequency response.

High Fidelity 245 A Prime Receiver Amplifier using the VARITONE  
Typical components for use in a popular priced high fidelity receiver amplifier  
using the VARITONE as an input source.

Units used are the VT-1, PA-132, PA-245, PA-22, PA-44 which list at \$39.50

UTC NIKLSHIELD units are  
now available in amplifier  
Kit form.

Typical Niklshield 2A3 Double  
Push Pull Amplifier



\*Patent applied for.

DISTRIBUTED BY

Radio Supply Co.      Radio Television Supply Co.  
Pacific Radio Exchange      Radio Specialties Co.

Complete Warehouse Stocks in Los Angeles

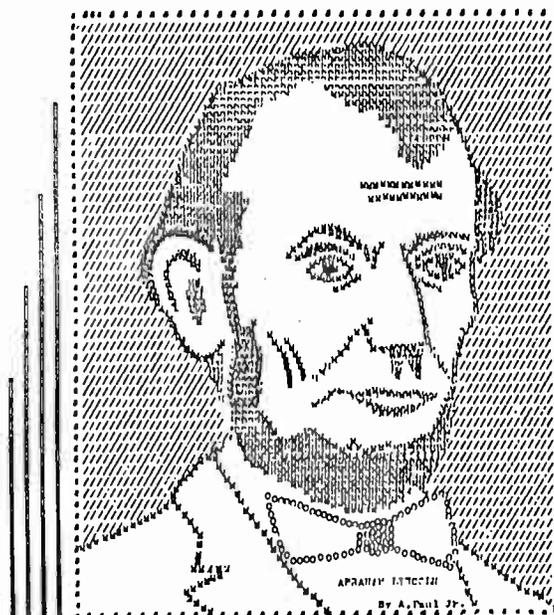
Use - UTC - for - Quality

# United Transformer Corp.

U-T-C Representative, C. R. STRASSNER, 1341 South Hope Street  
Richmond 6301

# « THE » "TECHNICIAN"

FEBRUARY, 1935



## Standard Parts

AND

## Radio Accessories

Exclusively for Dealers and Service Dealers

### Radio-Television Supply Company

1701 SOUTH GRAND AVE.

LOS ANGELES

Excellent Parking Facilities Away from the Congested Downtown Area

# Merchandising Radio Service

The most important asset a Radio Service Dealer can have is a trade built up of satisfied customers. This is accomplished to a great extent by the dealer's own service ability. In addition to this, he must have:

1. UP-TO-DATE EQUIPMENT.
2. A FULL LIBRARY OF TECHNICAL INFORMATION.  
He must know how, or learn how to:
3. RUN A BUSINESS EFFECTIVELY;
4. EXPAND HIS ACTIVITIES.



DEALERS DISPLAYING THIS SIGN ARE RECEIVING HELP FROM THE NATIONAL UNION RADIO CORP., ON ITEMS 1, 2, 3 AND 4.

New Tube Testers, Analyzers, Oscillators; New Manuals filled with technical information every dealer must have; Business Forms to help the dealer in his work, and lots of helps that will get the dealer NEW BUSINESS.

We will be glad to explain how NATIONAL UNION can help YOU, without cost. . . Ask us, or write for New Tube Characteristic Sheet; Gives full information on all types, and gives valuable information on their interchangeability.

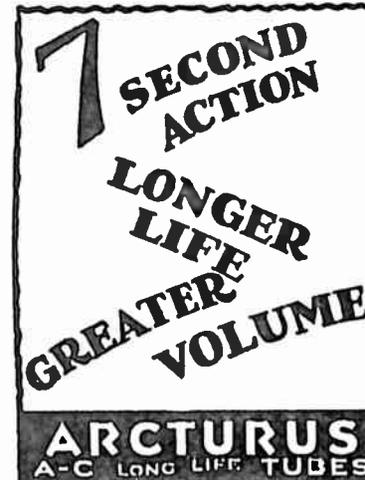
## Kierulff & Company

1133 VENICE BOULEVARD  
Fitzroy 5111  
Los Angeles

335 WEST G STREET  
FRANKLIN 7221  
San Diego

### — INDEX —

Distress Merchandise .....	Page 5
By Norman B. Neely	
Resistor Studies and	
Developments .....	Page 9
Eng. Staff, Henry L. Crowley & Co.	
Little Known Facts About	
Patents .....	Page 10
By Benjamin Chromy	
Book Review .....	Page 11
By Edw. H. Guilford	
Service Kinks .....	Page 11
Reading Sensitivity of Radio	
Receivers .....	Page 12
By Eng. Staff, Triumph Mfg. Co.	
Electrical Measuring	
Instruments .....	Page 14
By C. Clifford Adams	
Traveling the Territory	
With Milton .....	Page 20
Questions and Answer.....	Page 21
The Cover This Month.....	Page 21
Radio Interference Bureau.....	Page 22
By W. F. Grimes	
Changing a House Set (RCA-Victor	
R-28-P) to an Auto Radio.....	Page 26
By W. F. Daley	
Classified Ads .....	Page 28
A New Opportunity for	
CRTA Members .....	Page 30
By A. Paul, Jr.	



**M. D. EALY**

CONSIGNMENT AGENT

PROspect 9810

1214 Venice Blvd. Los Angeles

We Carry At All Times

Most Complete and Biggest Assortment of

## RADIO PARTS

— In The West —

All The Nationally Known Makes of

REPLACEMENT PARTS

TEST EQUIPMENT

PUBLIC ADDRESS SYSTEMS

RECEIVERS AND TRANSMITTERS

WHOLESALE TO DEALERS AND SERVICEMEN ONLY

## Radio Supply Co.

912 So. Broadway

Los Angeles, Calif.

Phones VAndike 3178 - 3179 3170



# Rider's Manual V ... Is Ready!

JUST AN IDEA of how extensively Volume V covers the field. This is a partial list of the manufacturers in Volume V.

Name	Quantity of Models	Name	Quantity of Models
Aerostat	9	Hudson Ross	5
Air King	6	Insuline	6
Allied	21	International	19
Ansley	6	Kingston	10
Atwater-Kont	36	Lafayette	26
Audiola	11	Lang	6
Autocrat	6	Larkin	3
Balkelt	7	Lewol	5
Belmont	16	Mission-Boll	6
Bosch	19	Montgomery-	
Colonial	16	Ward	13
Crosley	26	Noblitt-Sparks	11
Detroit	7	Philco	19
Dewald	24	Pilot	10
Echophone	6	Radolek	13
Edison-Bell	7	RCA-Victor	63
Elec. Spec.		R.K.Labs	4
Export	6	Sears Roebuck	56
Emerson	13	Sentinel	26
Empire	8	Sparton	16
Eria	12	Stewart Warner	38
Fairbanks-Morse	23	Supreme Inst.	9
Federated		Tatro	6
Purchaser	27	T.C.A.	12
Ford Motor	4	Webater	8
Fordson	7	Wells Gardner	12
General Electric	40	Westinghouse	11
Gillilan	13	Weston Inst.	20
Grunow	19	Wilcox Gay	13
Halsion	6	Wurlitzer	8
Horn	5	Zenith	21

Send for Our FREE monthly House Organ, "SUCCESSFUL SERVICING"

Patronize Your Distributor

**John F. Rider, Publisher**  
1440 BROADWAY, NEW YORK, N. Y.

NEVER before in the history of Radio has such a stupendous compilation of technical servicing material been collected between two covers. Expense was not spared to make Rider's Volume V all-embracing in its scope. Sets are explained even more lucidly than those of yesteryear, for complications galore are incorporated in 1935 receivers. Seeing is believing—prove to yourself that Rider's Volume V is without doubt the servicing sensation of the year—better than any other manual—the absolute peer!

Rider's Volume V has  
More schematics . . . more chassis layouts . . . more I-F. peaks . . . more alignment data . . . more trimmer locations . . . more circuit descriptions . . . more socket layouts . . . more parts lists . . . assembly wiring diagrams . . . more and better everything than any other manual!

946 Models 1200 Pages  
112 Manufacturers

Volume I . 1000 pages . \$7.50  
Volume II . 800 pages . \$6.50  
Volume III . 1070 pages . \$7.50  
Volume IV . 1040 pages . \$7.50  
Volume V . 1200 pages . \$7.50  
Servicing Superheterodynes . . \$1

Sold With A Money-Back Guarantee

# The "TECHNICIAN"

Official Publication of the Certified Radio Technicians' Association, A Corporation  
An Organization of Competent, Qualified and Trustworthy Radio Technicians for the Purpose of Advancing the Radio Art and for the Protection of the Public.

A. PAUL, Jr., President JOHN L. VINCENT, Vice-President  
V. KARL HATFIELD, Secretary-Treasurer

NORMAN B. NEELY  
Editor - Manager



1656 N. Serrano Street  
Los Angeles, California

\$1.50 Per Year

15 Cents Per Copy

Vol. II

FEBRUARY, 1935

No. 6

## EDITORIAL

By The Editor  
"Distress Merchandise"

Due to the collapse, in part at least, of honest price structures during the past few years of industrial depression, an evil practice has sprung up amongst unscrupulous jobbing houses and dealers. The reliable manufacturers who have spent many years' time and considerable money and energy in establishing a trade name which stands for honest values, conscientious service and fair dealing have found themselves facing unfair competition in the shape of fly-by-night concerns who manufacture items supposedly of similar value to those of the old-line companies but which are offered to the trade at ridiculously low prices.

Eastern mail-order houses have flooded the country with catalogues containing many "bargains" consisting for the most part of salvaged, discontinued, factory second and orphan items. Manufacturing concerns have come into existence over-night to manufacture inferior products under misleading names in an effort to secure by fair means or foul some of the dollars spent by service technicians and dealers for replacement parts. These jobbers and manufacturers of distress merchandise make and sell condensers whose voltage and capacity ratings are exaggerated—resistors whose power ratings and values are misrepresented—power transformers whose characteristics and load capacities are overstated. Radio tubes which in truth are factory seconds or worse have been offered at ridiculously low prices. This list of misrepresented items could be extended to fill many pages but the alert service technician and dealer need only reflect upon his past ex-

periences to realize the extent of this practice.

It must be realized that it never has been, is not and never will be possible to get something for nothing. Beware of off-brand items or supposedly fresh stock items of well-known brands at prices which obviously are lower than reason dictates! This distress merchandise is not always poorly manufactured and incorrectly rated but often consists of the products of worthy manufacturers which by devious means have come into the hands of these shady merchandisers. These products may actually be factory rejects or they may be warehouse stocks which have been damaged due to age, climatic conditions, fire or rough handling. These items, then, which their own manufacturers would not represent as worthy of bearing their first-class labels, are offered to the trade as the original high-grade merchandise which the name thereon would have the purchaser believe.

The only method of protection which the purchasing trade may use and which will be to the mutual benefit of all honest members of the trade is to deal only with reliable firms and then only purchase reliable products. Of Course, the production of reliable, quality and first-grade products is not limited necessarily to the old companies. Many new companies have been formed, due to industrial readjustment and the need for improved manufacturing processes to meet the advance of the radio art. It is not difficult for the most part, however, to differentiate between reliable concerns.

(Continued from page 19)

"GIVE THE CUSTOMER A BREAK"

# Carron Speaker Cones

A COMPLETE LOCAL STOCK OF REPLACEMENT CONES is now at your disposal. EXACT DUPLICATES of every speaker cone on the market are available at standard discounts.



CARRON CONES are of moulded one-piece seamless construction. In most cases these Cones are far superior to the originals. They are exact mechanical and electrical replacements.



Avail yourself of this means of making extra profits. In addition to replacement of damaged units, CARRON CONES will improve the frequency response and over-all tone quality of ANY SPEAKER.



"Don't Let an Old Dried Out or Warped Cone Spoil a Perfect Repair Job"



Get Our Complete Catalog

## CARRON MFG. CO.

LOCAL DISTRIBUTORS

ELECTRIC PRODUCTS SERVICE

1358 SOUTH GRAND AVENUE

LOS ANGELES

PRospect 3681

## Micamold



- Through the years Micamold has been our leading condenser and resistor line.
- We have sold tens of thousands of Micamold units to the trade in this territory.
- They have proven their dependability and our claims of quality by years of trouble-free operation.
- We are indeed proud to have been chosen to represent them.

RADIO SPECIALTIES CO.

1816 West 8th Street, Los Angeles, Calif.

## ORIGINATORS OF PRACTICAL RADIO ENGINEERING INSTRUCTION



(Part of editorial reprinted from the June issue of The "Technician".)

What are the requirements of an efficient, modern radio service technician? He must have an extensive fundamental knowledge of electricity and radio. He must have some means of keeping continually in step with the rapid progress of the industry. Inasmuch as radio becomes more complicated in theory and practice day by day he must have some means of extending his general engineering knowledge. He must have connections to assist him repulse the underhanded attacks of unscrupulous and unqualified competition. He must have extensive equipment and the where-with-all to maintain it in step with the constant improvement and changes in standard and custom built equipment.

The next question is how is one to provide himself with all these things? An enterprising, energetic man with an education considerably above the average and experience can, at substantial expense, manage to maintain himself and provides these requisites individually.

... see

\*MR. GUILFORD

... write

MR. RIETZKE

... send

FOR CATALOG

## Complete Illustrated Catalog FREE!

Write today for your copy of this new 44-page booklet . . . It will answer all questions and show every detail of our organization and equipment, and complete description of all courses.

E. H. RIETZKE, President

# Capitol Radio Engineering Institute

14th and PARK ROAD N. W.

Dept. T2

Washington, D. C.

★ California Representative:  
EDWARD H. GUILFORD  
1656 North Serrano—GR. 0755

Mr. Guilford, member of CRTA, will be glad to be of assistance to you in answering inquiries and describing courses.

## RESISTOR STUDIES AND DEVELOPMENTS

By ENGINEERING STAFF, Henry L. Crowley &amp; Company

High-Gain amplification as well as the handling of substantial wattages in present broadcast receivers invites microscopic examination and ultra-critical analysis of resistors used. It is not so much an optical matter, though a true microscopic study of resistor structure does reveal the "inside story". Rather it is a matter of practical results, since the microscopic structure of any resistor soon tells its own story through radio and electrical tests and usages.

A study of standard radio resistors reveals three broad classes in general use: (1) Wire-Wound; (2) Carbon-coated or film; and (3) Carbon composition, or molded type.

From the cost standpoint, the first, or wire-wound category can be disregarded so far as more general applications are concerned.

The second division or so-called carbon coated type calls for a thin film of carbon deposited on a glass or porcelain rod or tube. In some instances this coating is spiralled to vary the resistance, but the spiral form is relatively rare today. The coating or film is exceedingly thin and therefore quite fragile. Adhesion of film to supporting surface is difficult to control; contact is extremely delicate; transfer of heat energy depends on mechanical limitations of the whole assembly. The current-carrying capacity must necessarily be a function of the area or cross-section, so that when the resistance is increased solely by cutting down the thickness of the film, already very thin, it follows that the current-carrying capacity is impaired and the current density tremendously increased. This gives rise to overheating and localized stresses, and leads to ultimate failure and bad characteristics.

The third class is the so-called carbon stick or composition type, comprising a mixture of a very small percentage of conducting material, carbon, and an insulating material, molded under relatively low pressures. In actuality such a structure consists of a number of semi-round pebbles touching each other with point contacts. Therefore the path and the areas through which current may travel are greatly reduced by the large bulk of insulating particles and still further reduced by the point-contact conditions.

Just so long as resistors were employed in circuits of modest gain and low wattage values, the microscopic structure of

their conducting mass was of no particular concern to radio men. High-gain circuits and the handling of considerable power, however, have focused attention on the current-conducting path of resistors, which is but another way of referring to the microscopic details of such components.

These tremendously enlarged photographs of resistor structures reveal many voids, irregularities in the mass, uncertain contact between particles, and a general lack of homogeneity. The mass is frequently revealed as being porous rather than solid. Contact between particles is point-contact only. Consequently the current-carrying cross-section is truly microscopic in its proportions, and the current density of necessity runs very high in such areas and through such point-contacts.

The foregoing assumption has been proven by studying, under the high power microscope, the action of units under both normal and excessive loads. Glowing points of light have been observed, demonstrating conclusively the intense microscopic current density. Naturally such points tend to alter their characteristics both physically and electrically. A further study of resistance values under mechanical loads and the changes noted under such loads have been in accordance with the above facts.

With such considerations in mind, we have sought to develop a resistor which, technically and practically, would overcome the objections already cited. First, instead of a background material of very high insulating value, we have substituted a background or bulk material which in itself is a resistance material. To vary this mass and thereby secure the desired resistance values, another resistance material of lower value is introduced. The entire mass, after it has been reduced to absolute uniformity, is subjected to tremendous pressure and extruded through dies into continuous rods. The mechanical details of such extrusion are in line with many years of experience in this particular method of fabrication which we have followed in the production of ceramic insulators and parts.

The end result is a solid, uniform, compact current-carrying mass. The entire cross-sectional area carries current. There are no voids, no point-contacts, no variations in composition. Photomicrographs disclose an absolutely solid structure quite unlike the craters and pitted surfaces of

(Continued from page 18)

## LITTLE KNOWN FACTS ABOUT PATENTS

By BENJAMIN CHROMY, Attorney-at-Law

(Continued from last month)

### PART TWO

Now turning back to the examiner in the Patent Office, after he has studied the invention and claims and before he has made the search for prior patents, he must analyze all of the claims to determine just what each covers or defines. This is necessary because one claim may define an invention that is slightly different from that defined by the next claim. Let us assume for the present that in considering the foregoing claims to the audion, the examiner found a prior patent (or publication) showing a cathode, a grid and an anode structure all mounted in an envelope of glass. He could reject the first of the foregoing claims as being anticipated by this prior patent. But he could not properly reject the second claim on this prior patent unless the grid electrode shown in the prior patent was a control electrode. Thus one prior patent may be used to reject some of the claims of the application and yet fall short of meeting the invention defined by the other claims.

The claims that are rejected by the patent examiner may be amended, canceled or rewritten or an argument urging their patentability may be submitted to the patent examiner. Often claims are thus changed or argued over many times and many letters are exchanged by the patent attorney and the patent examiner before claims acceptable to both are submitted by the attorney and allowed by the examiner. The allowed claims are then printed in the patent specification together with the description of the invention.

Let us consider the meaning of this claim writing and why it is considered so important. As was brought out in the foregoing paragraphs there are a large number of patents covering radio apparatus and circuits. Quite a number of these patents are directed to vacuum tubes. Some of these patents are for different types of tube electrodes, different "getters," different electron emitting substances, different electrode arrangements, glass seals and so on. When the patent is issued the invention covered by that patent is defined by the claims were prepared by the inventor's attorney and taken up with the patent examiner prior to their allowance. Thus the drawing of the patent may show a complete vacuum tube structure and the specification may describe this structure, yet the claims may

be so worded that only a certain type of grid electrode is covered by the patent.

In considering more clearly, the two claims drawn to the three element tube in the foregoing paragraphs, we see that these claims do not define any special type of envelope and no special type of cathode, grid (control electrode) or anode. This indicates that the invention covered by these claims is broadly and basically new. The claims are not directed to any improvement in the tube itself but they are directed to the three element tube, per se.

After the development of the three electrode tube by deForest came numerous improvements in the tube structure. A large number of these were patented, however, the patents covering these improved tubes were all dominated by the basic patent on the three element tube during the life of this latter patent and any person making, using or selling one of these improved tubes, without a license under this basic patent, would be an infringer.

At this point it must be emphasized that this basic patent, if the claims were not properly prepared, might be avoided by subsequent improved three electrode tubes. Therefore too much care can not be given by the inventor or his attorney to the preparation of the patent specification, particularly the claims.

The claims should not be drawn in a verbose style; no superfluous description should be used since this limits their scope and renders them less inclusive. Of course, it is very desirable for certain technical reasons, also to have limited claims allowed in a patent application. However, the claims that really measure the scope of the patent are usually, with few exceptions, the claims that describe the invention in the least possible descriptive and limiting words.

The subject of patents for inventions is a broad one and difficult to discuss briefly and it is sincerely hoped by the author that the readers of this article will bear this in mind. It is further sincerely hoped that this article will prove interesting if not instructive.

### MOSER IN NEW CLIMES

Mr. A. J. Moser, formerly with the Technical Service Laboratories, is now Service Manager with the Santa Monica Branch of the Herb Grischow Electric Appliance Company.

## BOOK REVIEW

By EDW. H. GUILFORD

Short Wave Radio Handbook—Dent—Radio & Technical Publishing Company—45 Astor Place, New York City—\$1.00.

Amateur experimenters who are especially interested in short wave reception will find this handbook valuable in building experimental short wave receivers.

The subject of short waves is covered very completely in this handbook and the subject of various types of receivers is handled in an understandable and easily read manner. The book is amply illustrated with many diagrams, graphs, charts and tables, containing information valuable in building up experimental short wave sets.

Recommended especially for the amateur experimenter.

High Fidelity Receiver Design—G. S. Granger—Manson Publishing Co.—521 Fifth Avenue, New York City—50c.

This is the third of three booklets covering the development of the modern receiving set from its earliest stages to present high fidelity design. In this booklet the subject of perfection in fidelity is thoroughly covered. High fidelity requirements, practical considerations, band-pass filters, oscillators, intermediate-frequency amplifiers, etc., are thoroughly discussed from the viewpoint of design and service.

The series of three booklets is recommended to all radio technicians as part of their radio library. The complete series of three booklets may be purchased for \$1.00.

## LABORATORY PROCEDURE

Starting in this issue there will be published excerpts from the Signal Generator Handbook and shop notes prepared by the engineering staff of the Triumph Mfg. Company. This book, furnished with the Triumph Signal Generator, contains in condensed form valuable definite procedure for attacking service operations by laboratory methods where such is advisable. In cases where laboratory practice is not directly applicable mention is made as to why and suggested changes made. This booklet most apparently was prepared by men who not only know engineering, but also know how to repair radio sets. This manual may be secured free of charge by writing The Triumph Co.

## SERVICE KINKS AND PET EQUIPMENT

EDITOR'S NOTE: Through the kindness and courtesy of Mr. H. K. Bradford, president of the Capitol Radio Research Laboratories, we are able to publish the following material taken from the manual, CASE RECORDS OF BROADCAST RECEIVER REPAIRS.

### ZENITH 750—DEAD

If the grids of the I.F. tubes become red hot look for a shorted I.F. transformer. This is caused very often by the leads of one winding touching those of the other.

### WESTINGHOUSE WR-5 — IMPROVING SENSITIVITY

Remove the shield from the first I.F. transformer.

### SPARTON 120 — OSCILLATES WHEN WARM

If the receiver functions correctly until it becomes hot increase the value of the by-pass condensers across the cathode resistor. Sometimes it is necessary to employ a condenser as large as one microfarad to obtain stability.

### R.C.A. R-74—INTERMITTENT. OSCILLATION & MOTORBOATING

This trouble is usually caused by a dirty contact between the rotors of the tuning condensers and the chassis. Inspecting and cleaning the wiping contacts will clear up the trouble.

### ATWATER KENT 55 — WEAK AND DISTORTED RECEPTION

Carefully test the two resistors shunted across the speaker field. Their center-tap goes to the input transformer secondary center-tap.

### CROSLY 58, 59 — HUM

Replace the 1 megohm resistor in the 47 series grid circuit which connects to the high voltage secondary tap.

### ECHOPHONE S-3 — IMPROVING

Replace the secondary grid voltage resistor with a 200,000 ohm unit. Also replace the 0.1 mfd. screen by-pass condenser, as it often causes trouble due to opening.

### LYRIC J—DISTORTION

Usually caused by opening of the 500,000 ohm resistor near the power transformer. It is center-tapped, replace with two 250,000 ohm units in series.

### MAJESTIC 20—SIZZLING AND FRYING

The tone control is usually responsible for this trouble. Open the chassis at the rear left side where the tone control is located and simply clip the condenser. For tone control replace this condenser with a .03 mfd. 600 volt tubular type.

## READING SENSITIVITY OF RADIO RECEIVERS

By ENGINEERING STAFF, Triumph Mfg. Co.

Reading sensitivity of radio receivers is a very important measurement for many reasons. Perhaps one of the most important of which to the serviceman is that he may make measurements before and after servicing a receiver and therefrom may calculate definitely how much improvement he has accomplished in the sensitivity of the receiver.

Set up the receiver and connect the signal generator to antenna and ground binding posts of the set (it is usually considered good practice to use a standard dummy antenna in these tests). In the broadcast band readings should be made at 600, 1000 and 1400 K. C. This is standard practice.

The Institute of Radio Engineers standards have been set so that 50 milliwatts output audio power is deemed Standard Output. The sensitivity of a receiver is gaged from the input required across the antenna and ground (in microvolts) to cause an output power of 50 milliwatts in the speaker.

In practical work in the field, it is felt that 50 milliwatts is too low an output to be easily read over meter indication of general noise level. Service output meters are not easily read at 50 milliwatts as a rule.

For the field for home receivers it is recommended that an output of 200 milliwatts (.2 watt) be used as Standard Output. To override noise level and provide a clearly read indication. In the case of

automobile receivers it has been fairly common practice to adjust the input to the set being measured until the output is a half-watt at the speaker and then read the input in microvolts. Some manufacturers consider 4 or 5 microvolts fairly good sensitivity for auto radios so tested. The following table is given as a guide to judge output power from ratings in volts on the output meter. The scale indicates different interpretations for different voice coil impedances since the output indication varies with varying voice coil circuit impedance. In this connection it is a good average rule to figure impedance of the voice coil at 400 cycles, about 20 per cent greater than the D. C. resistance. For example, if a voice coil D. C. resistance measured 5 ohms, the impedance might be figured as 6 ohms.

Adjust the attenuator controls until the Standard Output reading is shown as mentioned above. This reading may be determined by referring to the table and transposing the voltage readings on the scale to the audio power reading corresponding to the voice coil impedance, then read and note the attenuator setting—let us assume 10 microvolts. Then the sensitivity of the receiver is 10 microvolts at 200 milliwatts, output at that particular frequency. As above stated these measurements should be made at 600 KC, 1000 KC and 1400 KC for the broadcast band.

Table of Voltage Indication on High Impedance A.C. Voltmeter for Wattage Output

Voice Coil Impedance	.2 Watt	.5 Watt	1 Watt	3 Watt	5 Watt	20 Watt
2	.633v	1. v	1.41v	2.44v	3.16v	6.33v
3	.775v	1.25v	1.73v	3. v	3.27v	7.75v
4	.895v	1.41v	.2v	3.46v	4.46v	8.95v
5	1. v	1.58v	2.24v	3.86v	5. v	10. v
6	1.1v	1.76v	2.44v	4.25v	5.46v	10.1v
8	1.262v	2. v	2.82v	4.9v	6.31v	12.62v
10	1.41v	2.24v	3.16v	5.48v	7.06v	14.1v
12	1.55v	2.44v	3.46v	6. v	7.74v	15.5v
14	1.67v	2.64v	3.74v	6.47v	8.35v	16.7v
16	1.78v	2.82v	4. v	6.92v	8.95v	17.8v

In 1933 the expenditures of United States tourists in foreign countries amounted to about \$292,000,000 as compared with \$446,000,000 spent in 1932 and \$821,000,000 in the peak year of 1929.

The Sparks-Withington Company of Jackson, Mich., reports that buying interest is keener this season than in any season during the past three years. This company reports that inquiries favor all-wave sets.

## TELEPHONE STATISTICS

There are 87,678,000 miles of telephone wires in use in the United States. Germany comes second with 15,200,000 miles, Great Britain next with 10,500,000 and Canada has 5,089,000.

All the 17,424,406 telephones in the United States are operated by private interests, while all those in Germany (2,960,401) and all those in Great Britain and North Ireland (2,146,409) are government systems. Of the 1,261,245 telephones in Canada, 205,711 are in government systems and 1,055,534 are operated by private interests.

The total number of phones in the world is 32,941,570, of which about 13,500,000 are automatic or dial phones. Approximately half of these automatic phones are in the United States. These figures are for the year 1933.

In 1932 there were 25,500,000 conversations in the United States; 2,162,586 in Germany, 1,530,000 in Great Britain and North Ireland and 2,346,573 in Canada.

## CHARLES SEXTON WEDS ACTRESS

The radio industry of Southern California was taken by surprise when it learned that Charles (Charlie) F. Sexton had eloped with Bunny Bronson, stage and screen actress, Friday, February 8. Charlie and Miss Bronson made a sudden and quick trip to Yuma, Arizona, where the marriage ceremony was performed. The newly-weds returned to Beverly Hills, where they expect to make their home. Mr. Sexton is the owner of the Radio Products Sales Co.

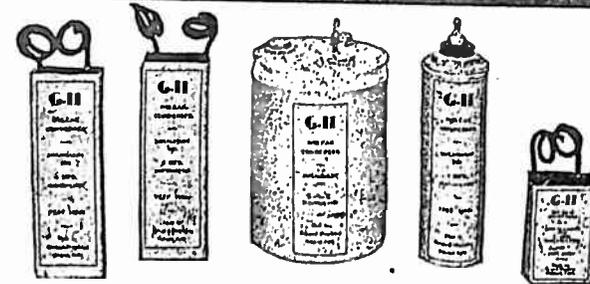
Cupid certainly must have used a lot of elbow grease and an extra special arrow to mortally wound Charlie, who has been a confirmed bachelor for years. However, Valentine's Day, the beautiful spring weather and Bunny Bronson's charms all at once must have been a little too much for Charlie. We know that we speak for the entire radio industry of Southern California when we wish the newly married couple all the success and happiness possible for their future.

# G-H

CONDENSERS

and

RESISTORS



## 1500 Volt Flash

G-H ELECTROLYTIC REPLACEMENTS "CAN TAKE IT"

Revolutionary new process skyrockets G-H sales. These sensationally different DRY electrolytic replacement paper-wound condensers are made of finest quality linen tissue and aluminum foil . . . sealed in Halowax. Thoroughly moistureproof. Takes 1500 volt flash. No current leakage. All capacities and standard shapes.

STANDARDIZED G-H LINE includes new quality Carbon Resistor and sensational 600 volt Tubular-Pigtail Condenser now smaller than ever.

ASK YOUR JOBBER  
FOR DETAILS

GIRARD-HOPKINS  
OAKLAND, CAL.

## ELECTRICAL MEASURING INSTRUMENTS

By C. CLIFFORD ADAMS, Laboratory Superintendent  
Quality Electric Company

(Continued from last month)

### PART THREE

#### DYNAMOMETER INSTRUMENTS

When current is caused to flow in a conductor, there is set up about the conductor and on a plane perpendicular to it, a magnetic field which is proportional to the current flowing. If 2 conductors carrying current are placed near each other but not in parallel, the magnetic fields about them will react upon each other in such a manner as to tend to become parallel. The reacting force will be proportioned to the field about the 2 conductors. The reaction is communicated to the conductors as a force tending to place them in a position parallel to each other.

In the Electrodynamometer type of instrument, the conductors are replaced by the field and moveable coils. The field coils are held in a fixed position. The moveable coil is pivoted so that its only possible motion is rotation. It is placed between the field coils. When current is caused to flow in both the field and moveable coil circuits, the moveable coil will tend to rotate, the tendency being to place itself parallel with the field coil. The force causing this rotational motion is counter-balanced by the mechanical force exerted by the springs attached to the moveable coil staff. When a balance of forces occurs, the moveable coil motion is stopped and the coil retains its new position until a further change takes place in either the moveable coil or field coil currents. By having the pointer attached to the moving coil staff and properly calibrating scale over which the pointer will move, the instrument can be used for measuring the reaction effect of the coils upon one another.

If in a D.C. circuit the field coils are caused to carry the current of the circuit and the moveable coil has impressed on it the potential of the circuit, the instrument will indicate the product of the value of the current and voltage, which is the power of watts; since in a D.C. circuit the instantaneous values of current and voltage are the same for all consecutive periods of time.

In an A.C. circuit the conditions are slightly different owing to the characteristics possessed by such a circuit, namely reactance. Reactance is caused by the presence of inductance or capacity in the circuit.

Instantaneous values of voltage and current are continually changing from a

maximum positive to a maximum negative, passing through zero and all the intermediate values. This cycle is repeated, the frequency of repetition in a second determining the frequency of the circuit. This process is conveniently pictured by a curve known as a Sinusoid. If the circuit is composed of resistance only, the current and voltage sinusoids reach their maximum positive and negative points at the same instant and pass through zero simultaneously. By introducing inductance in the circuit, the current curve reaches maximum at time later than does the voltage curve, the interval of time depending on the inductance and frequency of the circuit. This difference in time is expressed as an angle and is called phase displacement. Its effect on the power of the circuit is to reduce the value of the power for the same value of current and voltage as compared to the power in a purely resistance circuit. The power is represented by a curve derived by plotting the products of the instantaneous values of current and voltage. The wattmeter indicates the average value of these instantaneous values of power. The actual or time power is equivalent to the product of the volts and amperes multiplied by the power factor which is always less than one.

The wattmeter to indicate correctly an alternating, as well as direct current, must have the potential circuits practically free from internal inductance. Therefore, great care must be taken in the design of the coils and their relation to one another as well as to the surrounding parts of the instrument, so that inductance is eliminated to the greatest possible extent.

In the Polyphase wattmeter there are two sets of field coils and two moveable coils mounted on the same staff, and pointer will indicate the product of the average instantaneous values of power in the polyphase circuit.

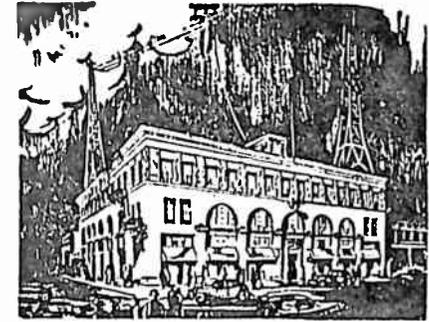
Dynamometer instruments are also made as ammeters and voltmeters. In ammeters the field coils are similar to those of the wattmeter but also have a resistance in series with them which carries the full current. The moving coil is connected across this resistance and gets its current from the drop produced by the current to be measured. In the voltmeters, the fields are wound with a greater number of turns and smaller wire than the ammeters or wattmeters field

(Continued on Page 27)

# NATIONAL Radio and Electrical School

The largest Trade School in the West. Located in Los Angeles for over 30 years. Now offers complete, practical training in:

Radio—  
Television—  
Talking Pictures—  
Broadcasting—  
Commercial Operating  
and  
General Electricity



Modern, up-to-date equipment, all actually operating and available to the student to use in learning his trade. Expert instructors. At this institution, you receive friendly, sincere cooperation that makes success assured.

For the man already engaged in Radio work, who is ambitious to go ahead, National offers a particularly valuable opportunity through advanced training.

IN ADDITION, those who find that they need more Electrical knowledge than they have been able to acquire through previous Radio Training and experience will find a definite means to increased income through the outstanding, time-tested Electrical Training offered here.

Laboratories and Studios always open to inspection. We cordially invite you to visit the school at your convenience, without the slightest obligation. We shall be pleased to discuss your plans with you and to offer you every possible assistance toward the realization of your ambitions.

**National Radio and Electrical School**  
4006 S. FIGUEROA STREET  
Tel. Century 29061 LOS ANGELES, CALIF.



# AEROVOX means

Of course there's business to be done today. But skill, materials and prices must be right. Mediocrity, inferior goods, high prices, are out. The buyer dictates. He insists on what he wants . . . service, quality, price . . . in short, full value.

That's why you must be interested in the AEROVOX Single Source of Supply feature. It means a complete line of essential radio components . . . fully proven in quality and reputation . . . and at unbeatable prices even though quality is second to none.

Remember, too, the Single Source of Supply feature means just one order for your condenser and resistor requirements . . . one postage stamp . . . one book-keeping entry . . . one call or shipment . . . one check in payment. Thus pennies, nickels, dollars are saved. And it's such savings these days that decide between profit and loss in the radio business.

## Do You Get the Research Worker?



A monthly publication of practical radio data for practical radio workers.

Contains material not to be found in any other radio publication.

Indispensable to radio service man, laboratory worker, engineer, experimenter and "ham."

Only 50c per year . . . twelve issues . . . just to cover cost. Subscribe today!

### COMPARE PRICES — and QUALITY!

Aerovox engineering spells quality. And Aerovox mass production spells low price. Remember, Aerovox list prices are in most instances considerably lower than competitive makes, particularly when quality is compared. Why pay more? Or why sacrifice quality? Don't jeopardize your trade!



# One Source of Supply

## for CONDENSERS

Largest and smallest alike—with everything in between . . . all types—electrolytic, paper, oil, mica . . . for all purposes—servicing, remodeling, new assemblies, laboratory and experimental work, actual production.

## for RESISTORS

And also for resistors . . . from large adjustable grid leak for powerful transmitter, to tiny vitreous-enameled wire-wound resistors and also carbon resistors for receiver repairs or construction . . . all standard sizes, wattage ratings, resistance values.

## for PRACTICAL DATA

Not only does Aerovox supply dependable condensers and resistors, but its engineering staff tells you how to use them to the best advantage. Such information is available through the AEROVOX RESEARCH WORKER . . . the cream of the crop of practical radio information . . . sold at cost or only 50c per year. Remember, only 4c per month for data that will make and save many dollars for you. Write for sample copy!

### SEND FOR NEW 1935 CATALOGUE

Covers entire Aerovox line . . . condensers and resistors. Also sample copy of Research Worker. And be sure your name is on our mailing list.

### PACIFIC COAST REPRESENTATIVES

W. C. HITT  
1341 So. Hope St.  
Los Angeles, Calif.

R. R. BEAN  
2124 Smith Tower Bldg.  
Seattle, Wash.



# AEROVOX CORPORATION

83 WASHINGTON STREET, BROOKLYN, N. Y.

Sales Offices in All Principal Cities

## IMPORTANT PHYSICS RESEARCH IN 1934

Professor J. Clay's experiments with cosmic ray measurements made at a depth of over 800 feet in the Red Sea supported the belief of Dr. W. F. G. Swann, Bartol Research Foundation, Franklin Institute, that swift cosmic ray particles do not ionize matter they penetrate.

A Transmutation of elements was obtained by Irene Curie-Joliot and F. Joliot as a result of their discovery of artificial radioactivity. They later observed the emission of neutrons three hours after the bombardment of atoms.

Doctors B. Decaux and J. B. Galle, of the Paris Academy of Sciences observed a difference of almost 10 per cent between the steady daytime rate and the fluctuating night rate for the transmission or short radio waves.

A source of protons nine times as prolific as any previously known was found by Doctors E. S. Lamar and Overton Luhr of the Massachusetts Institute of Technology. This source is an electric arc operating in hydrogen at low pressure between an incandescent filament and a neighboring metal electrode.

A Soviet scientist, Prof. Bontch-Bruevich, experimenting at Murmansk, reported that the "radio roof" of the atmosphere is higher in polar than temperate regions.

The shortest radio waves ever produced were used by Doctors Cleeton and Williams of the University of Michigan in measuring the size of ammonia molecules.

## CARRON CONE LINE COMPLETE

Electric Products Service, local distributors for Carron replacement speaker cone line, advise us that in addition to their large stock of over a hundred different types of replacement cones, they now have a large shipment in transit which will complete the line covering practically every make and type of cone in use today. We understand this will be the most complete speaker cone stock available to the service man west of Chicago and highly commend them on making complete facilities available to the service men of this territory. Complete listings of these cones may be obtained from the Electric Products Service.

## RESISTOR STUDIES

(Continued from page 9)

the usual molded resistor. In fact, a cross-section of the new resistor structure resembles that of a gun forging. The current-carrying area is large and non-microscopic, as borne out by the electrical characteristics.

A study of these new units under mechanical loads indicates that the resistance value remains constant. This is a most significant fact. Microscopic study under normal and excessive wattages fails to disclose any light points or point-contacts with excessive microscopic current density.

The method of attaching terminals or ends to these extruded lengths has also been the subject of long technical study and engineering development. It was desired from the start to secure a uniform and positive area of contact and then place on this area a metal surface which in itself would have sufficient strength and rigidity to be fully dependable. The coating of the ends of the rod with fine particles of metal has achieved the first goal. The second has been met by placing on the end of the rod, over the metal-coated surface, a solid piece of metal in the form of a cap to which the pigtail is integrally attached.

In physical appearance the new resistors present a solid extruded mass—homogeneous, rock-hard and conductor throughout. The surface is velvety smooth and provides ideal heat radiation. Diameter and length remain uniform over wide range of resistance values.

Wattage ratings are exceptionally conservative since sizes have been kept standard rather than reduce the bulk in keeping with the greater wattage dissipation of the unique conducting mass.

Units have been in actual existence and on test for several years, and in final form for more than one year. The most exhaustive tests have been applied. All loading has been applied initially at double wattage, with no effect on the value of the unit. Increased loads have been applied in the presence of elevated temperatures, yet the units have shown no changes in value. Temperature coefficient is practically negligible at any operating temperature. A 1000-hour steam box test for moisture variation indicates a change of less than 2 per cent in resistance value whereas 15 per cent variation is not unusual. The noise component is well below the average of non-wire resistors. Life tests indicate exceptionally long service life, with very gradual and practically negligible change in resistance.

## DISTRESS MERCHANDISE

(Continued from page 5)

either old or new, and the racketeering group to which we have been referring.

Their methods of doing business, their price structures, their media of advertising, their willingness to serve the trade, all tend to indicate their true standing in the industry. In the past when business has been none too brisk, it most certainly has been a great temptation to servicemen and dealers and manufacturers of radio receiving equipment to employ parts which, although represented as standard, are offered at considerably lower prices than those to which the trade has been accustomed. However, by bitter experience it has been learned that attempting to increase the margin of profit by such methods actually reduces overall profits.

The industry then, as a whole, must combine in an effort to stamp out this practice of misrepresenting radio merchandise and ensnaring members of the trade by using a few cents extra margin as bait. Particularly from the standpoint of the service technician is the continued satisfaction of customers important. Repeat business in the service field is the keynote of success and progress. Only by using first-class merchandise and conscientious effort, combined with technical knowledge, can this end be accomplished.

The main problem then, seems to be the ability on the part of the purchasing trade to spot this distress merchandise when it is offered for sale and if it be wise, shun it as it would a poisonous reptile, as in truth, the use of such products will quickly prove fatal to the success of any business enterprise.

## NIKIRK ADDRESSES CRTA

Thomas E. Nikirk of Pacific Radio Exchange delivered a paper on Volume Indicators before the regular meeting of the Certified Radio Technicians Association Monday evening, February 11. Mr. Nikirk's talk as well as being highly interesting and informative from the standpoint of a technical description of the development and use of power level indicators was made even more appealing to the members and guests present by his demonstrations with actual equipment. This equipment included three different types of power level indicators, cathode ray oscilloscope, a beat-frequency oscillator and a high frequency reproducer or "tweeter."

Preceding Mr. Nikirk's paper, Mr. Edw. H. Guilford, Educational Director of the CRTA and West Coast Representative for the Capitol Radio Engineering Institute, delivered another talk in his series of lectures dealing with fundamental mathematics.

## NEW TRIUMPH DISTRIBUTORS

The Triumph Manufacturing Company has recently appointed two new distributors in San Diego and two in Los Angeles. The Coast Electric Company and the Western Radio & Electric Company of San Diego and the Pacific Radio Exchange and M. D. Ealy of Los Angeles are now carrying a stock of Triumph equipment and are showing the new Model 400 Tube Tester.

The name California is the name of an imaginary island, very near an earthly paradise, in "Las Serges de Esplandian," a romance of chivalry written in the first few years of the sixteenth century. The name was bestowed upon this territory by the Spanish Conquistadores.

## SERVICEMEN!



\$4.75

STEP AHEAD

of the rank and file—

with CASE RECORDS

OF BROADCAST RECEIVER REPAIRS

- ELIMINATE GUESS-WORK IN YOUR SERVICING!
- DON'T PUZZLE YOUR PROFITS AWAY!

- ADD 10,000 Hours to your experience!

Your work is already done and recorded for you in "CASE RECORDS." This 12" loose-leaf binder contains 1,500 alphabetically and numerically arranged "CASE RECORDS" of SUCCESSFULLY COMPLETED SERVICE JOBS! Each "CASE RECORD" tells all details for satisfactory repair.

SUPPLEMENTED QUARTERLY FREE for 1 year. 108 receiver makes . . . 3,000 models. . . the FASTEST Technique known to the Profession!

Enclosed find \$4.75 for which kindly send me "CASE RECORDS" immediate refund on return of Manual

CAPITOL RADIO RESEARCH LABORATORIES INC.  
1503 21st St., N. W., Washington, D. C.  
H. K. Bradford, President and Technical Director

Name .....  
Address .....

## TRAVELING THE TERRITORY WITH MILTON

And once again, friends and people, we're off to a flying start around the territory. Are yuh travelin'?

To Philip Johnson, who holds down the service fort at Hancock Music in Pasadena, we are indebted for this hypothetical question. "Phil" asks: How many letters are there in the average word; and, if so, how many words in the average letter?

They tell us that Bill May, out at San Bernardino Furniture in San Berdoo, is feeling 20 pounds lighter. Yesir, Bill just had a wisdom tooth removed, and is now displaying his operation to all and sundry who exhibit sufficient interest to go exploring.

The news has been brought to us that Ray Rusthoi, of Manhattan Radio Shop in Manhattan Beach, is about to become a papa. We're waiting for those cigars you'll be passing around, Ray!

We doff our hat in respect and admiration to Miss Rita Gulick, whose knowledge of transcriptions is well appreciated at the Famar Recording Studios on Hollywood Blvd. This capable person not only can make recordings single-handed of entire orchestras and choirs, but can install coupling transformers in an amplifier line even though the only instructions available are verbal ones over the telephone. Look to your larels, men; a modern Portia is in our midst!

When walking into Lovinger's Radio Studio on North La Brea, one wonders whether he is in a radio store or in some comfortable living room. To make things feel still more "homey" there is the aquarium with rare imported specimens of water life; and off to the left is Polly the Parrot, which, just like a microphone, repeats exactly what it hears. But we still maintain that there are no more sociable people in this little world of ours than Mr. and Mrs. "Andy."

Out at Hansen Music in Beverly Hills even "Bill" Hansen himself is in a quandary. Certain instructions for the installation of recording needles stated that one type of needle must be installed in pickups at 2 degrees from vertical. "Bill" still is undecided as to whether it should be 2 degrees Fahrenheit or Centigrade.

El Viajero se vale de esta oportunidad para saludar a sus muy apreciados amigos en la casa Calderon. Muy buenos dias, senores; y muy buenas las tengan las noches tambien.

Kenneth Landgraf of the BT Radio Shop has the right idea. Just like the man who buys his wife a washing machine so that they can take in washing, so has "K. G." bought a new set of equipment which "the Missus" can read so that she can repair the sets he brings to the shop. It's a system, that's what it is, it's a system.

From now on "Pat" Breyde, whose little shop is located out West Adams way, will depend on matches for lighting his tobacco. As Pat touches the tender tip of his nose, he ruefully admits that somehow these improvised lighters just don't seem to want to work.

Word comes to us from the Arcade Radio Shop over the ocean waves at Catalina that Andy Baylor has been teaching table etiquette to perspiring radio servicemen. More competition for Emily Post!

It seems that Johnny Scales, who watches the meters flicker at KFWB, has gone 5 meter conscious. Johnny's one ambition now is to put KFWB on the air on 5 meters just to show that great oaks from little transceivers grow.

And so long, people! Here's hoping that the fasting and abstinence during the Lenten season won't reduce the avoirdupois too much. Hasta luego!

## MIKE SENSITIVITY

Three different degrees of sensitiveness for microphones is even more necessary now than it was a few years ago, say officials of the Universal Microphone Co. at Inglewood, Calif. a firm which has pioneered in the field of microphones from instruments "tailored and designed" for individual use, to the "mass production" of standard microphones. There are three degrees for Universal instruments . . . M for medium, S for sensitive and D for damped.

Microphones, point out Universal engineers, cannot be made to perform all functions perfectly. Microphones of certain grade and quality, even with the utmost in frequency response, cannot be made for use in a P. A. system and then changed to studio or recording use and function properly in all cases.

## TECHNICAL QUESTION AND ANSWER DEPARTMENT

Conducted by CHARLES MILLER

Q Can two electrolytic condensers be used in series for replacement in high voltage packs?

A. It is a risky practice at best. If electrolytics must be used in series, each should be shunted by a 50M to 100M resistor to divide the voltage equally between sections.

Q. I have a Splitdorf using a single 81 rectifier. Although the tube is OK and the transformer is putting out rated AC plate voltage, the B voltage is only 125 volts.

A.....Check for an open condenser at the input to the filter.

Q. I have a capacity meter calibrated for 60 cycles. Would the calibration hold if I were to use a 5-6 ratio autotransformer to raise the line voltage for use on 50 cycles.

A. The calibration should be sufficiently accurate for ordinary service measurements.

## THE COVER THIS MONTH

The typewritten portrait of Abraham Lincoln appearing on the cover of this issue of The "Technician" brought to light unexpected talent of A. Paul, Jr., President of the Certified Radio Technician's Association. Investigation revealed the fact that similar portraits by Mr. Paul previously appeared regularly in the Hearst papers, Motion Picture Magazine and other publications. We are sure you will agree that this work is most interesting and, of course, we are always glad to note unusual accomplishments of of readers and members of the local radio industry.

## SYLVANIA IN FIELD

Hygrade Sylvania Corporation is happy to announce the appointment of Mr. W. G. Patterson, who will be in the California territory cooperating with the factory and Mr. E. P. Demorest of Sylvania Pacific Company in sales promotion work.

Mr. Patterson's work will be largely devoted to dealers throughout the territory and it is felt that his cooperation will make the tie between the dealer and Hygrade Sylvania Corporation still stronger. Mr. Patterson has had considerable experience in this type of work and we understand his chief hobby is attractive window displays and snappy merchandising ideas.

Mention The "Technician" when answering advertisements—It identifies you.

a complete

**PARTS STOCK**

of

**ALL LEADING LINES**

Replacement Transformers

Condensers

Resistors

Volume Controls

Sockets Etc.

We respectfully solicit your patronage

**Leo J. Meyberg Company, Inc.**

335 W. Washington Blvd.

Los Angeles  
PRospect 9255

## RADIO INTERFERENCE BUREAU

MR. W. F. GRIMES, Chief Engineer Radio Interference Engineering Bureau

(This column is a regular feature and each month will consist of a report of interesting cases and activities of the RADIO INTERFERENCE ENGINEERING BUREAU. To report interference Phone Trinity 1244).

During the year 1934 this Bureau investigated 3,455 reported conditions of unsatisfactory radio reception. It is interesting to note that a majority of the conditions found responsible for poor radio reception fall in three (3) groups.

There were 639 cases of receiver trouble which consisted, in general, of defective tubes, defective condenser assemblies, misalignment of amplifier stages, defective resistors and condensers, and one or two cases involved crystal detectors.

There were 697 cases of incorrect installation, a great many of which were due to the fact that the receiver was being used with no antenna whatever or the antenna binding post was connected directly to a ground.

There were 500 cases of trouble involving power equipment, practically all of which have been cleared by the power companies involved and rechecks have indicated that the trouble cleared.

The remaining located sources of trouble are of interest in that a very considerable number were traced to thermostats used for operating sign flashers, heating pads, fish warmers and other types of temperature regulators.

### "AGE IS NOTICEABLE ON THE INSIDE OF HE HEAD AND NOT ON THE OUTSIDE"

Today employers ask, "What do you know?" rather than "What is your age?" A good point to remember always is that "age is noticeable on the inside of the head and not on the outside." Forget your age. You are as old as you feel. The only important thing of consequence is whether you are ready to accept responsibility.

# RADIO . . .

## IN ALL ITS BRANCHES

### MOST COMPLETELY DIVERSIFIED STOCK IN THE WEST

DISTRIBUTORS OF NATIONALLY KNOWN LINES

PARTS — SUPPLIES — SOUND EQUIPMENT  
TUBES — AMPLIFIERS — TEST APPARATUS

**PACIFIC RADIO  
EXCHANGE, INC.**  
729-731 SO. MAIN ST.  
LOS ANGELES, CAL.

Phones—TRinity 2926 — 2927 — 2928

# PACKARD-BELL

FOREIGN —

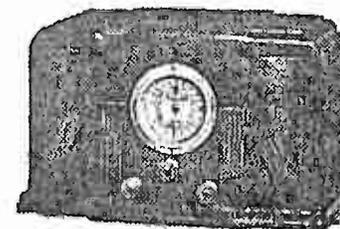
AMATEURS —

AEROPLANES —

POLICE —

## \$21.95

LISTED PRICE



— COMPARE THIS PRICE —

Certainly You'll Agree It's REAL VALUE

FIVE NEW TYPE TUBES . . . AEROPLANE DIAL . . . COVERING FOREIGN  
. . . AEROPLANE . . . AMATEUR . . . POLICE RECEPTION . . . ALSO  
STANDARD BROADCAST

One of the Most Handsome Cabinets You've Ever Seen

— ANOTHER OUTSTANDING VALUE —

# Packard-Bell Co.

LOS ANGELES

1320 So. Grand Ave.

Phone PRespect 0151

## GLENDALE DEALERS

At the monthly meeting of the Radio Service Dealers of Glendale, held on Tuesday evening, Jan. 29, five new members were sworn in to the oath and signed up. A large turnout was a surprise to the chairman and 28 of the 30 members were present.

The business of the evening consisted of a vote on whether or not to increase service charges in Glendale City limits from 75 cents to \$1.00, a two-thirds vote was for retaining the present 75 cent fee. John L. Vincent stressed the necessity to affiliate with the CRTA in view of the forthcoming license for Technicians.

The matter of identification of shops was discussed, Vincent offered the suggestion of numbering each shop permanently, such number to be used in marking work estimates on chassis for repairs. The numbers were drawn and recorded, a number within a ring for each shop having estimated on a job.

Members agreed that to discuss the job as done by a competitor, was out of order unless details or conditions affecting the job were known and then the customer was to be informed in a manner not detrimental to the competitive shop.

## G-H POPULAR

The line of paper replacements for electrolytic condensers by the Girard-Hopkins Company of Oakland, California, has proven very popular with service technicians. These units, which will stand a surprising peak voltage are exact duplicates in the matter of size and filtering ability and have the advantage of not drying up or losing their value with age. This company produces a full line of such replacements which are handled by all leading jobbers.

## DEPENDABLE METER SERVICE

On All Makes and Types of Instruments

### FACTORY SERVICE FOR

Supreme — Triplett — Dayrad — Clough-Bregle

Complete Stock of Latest Type Meters and Test Equipment

## ELECTRIC PRODUCTS SERVICE

1358 S. Grand Ave., Los Angeles

PRospect 3681

## CASH SWINNEY RECOVERING

Cash Swinney, well-known and loyal CRTA member, who was severely injured recently, is reported to be on the road to recovery. Although his injuries were painful and rather extensive, he is past the danger point and is receiving visitors.

He will be confined to bed at the Queen of the Angeles Hospital for some time and will greatly appreciate visits from his friends and fellow members.

## NEW TYPES OF METERS

Electric Products Service factory service and distributors for Triplett instruments advise that two new instrument types are now available in the line. First the double instrument as used by Triplett in their new Model 1200 volt-ohmmeter is now available as a separate double instrument, and can be had in either the two movement ranges as used in the volt-ohmmeter unit, or in any other combination of movements either AC or DC. Thus allowing one to group any two instruments in one dual case. Second, a new model Square case instrument known as the model 421 series. The flush mounting case measures approximately four inches square and provides the same scale length that was heretofore only obtainable in five inch and larger types of meters. This line is obtainable in all ranges the same as the model 321 round case.

## NEW PACKARD-BELL

Packard-Bell announces a new 5-tube superheterodyne with many outstanding features at a surprising list price. This new 5-tube super is housed in an especially designed and attractive walnut cabinet, is equipped with tone control, airplane dial, automatic volume control and other modern improvements. It should enjoy extensive sales.

# HAND-EE Grinder

*quicker  
better  
jobs*



Weighs 1 pound. Plug in any light socket and do 1001 jobs.

**\$10.00**

and up Postpaid U. S. A.  
With 3 wheel shapes Free.  
Order today.

Do away with slow hand work. Grinds, routs, drills, carves, sharpens, cuts, engraves.

— Ask for FREE Booklet —

For shop, home or tool kit. (Model A), A. C. or D. C. operation, 110v., 13,000 r.p.m. Order on 5-day trial. Satisfaction guaranteed.

NEW Master Craftsman's Set—17 useful accessories to grind, drill, polish, sand, cut, carve, engrave, etc. . . . Prepaid \$5.00.

**Chicago Wheel & Mfg. Co.**  
112 SOUTH ABERDEEN STREET  
CHICAGO, ILL.

## CHANGING A HOUSE SET (RCA-VICTOR R-28-P) TO AN AUTO RADIO

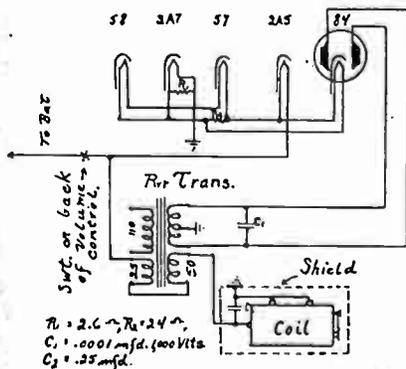
By W. F. DALEY

**EDITOR'S NOTE:**—The following is a description of an interesting experiment in re-wiring a standard 5-tube superheterodyne for use as an automobile receiver. The experimental model was designed for use with a 12-volt system but a different connection of the filaments would adapt it to use for any D-C voltage.

The first thing is to install a five-prong socket in place of the four-prong socket for the rectifying tube, 84. The cathode connection goes to the filter system, and the high voltage transformer secondary leads going to the plates of the 84, across which is connected the 1,000 volt .0001 mfd. condenser. The condenser is for the purpose of by-passing the R.F. generated in the secondary before the 84 gets heated up throwing a load on the secondary. The R.F. might burn some of the insulation by arcing in the transformer and cause trouble or noisy reception sometime.

The next thing is to arrange the filament circuit to operate on the car battery. The experimental model was designed for a twelve-volt system so the filament circuit was adapted to that voltage using the circuit as shown. The resulting voltage across each tube being 2.5 to 2.75 volts excepting in the case of the 84 tube there is about 5.5 volts.

This circuit is fundamentally a series circuit. The law for a series circuit states that THE CURRENT THROUGHOUT THE SERIES CIRCUIT IS THE SAME. We know that the 57 and 58 each must have one ampere of current, the 2A7 0.8 ampere, the 2A5 1.75 ampere and the 84 0.5 ampere. The 57 and 58 tubes



Drawn by W.F. Daley.

are put in series, and the 84 tube and resistor  $R_1$  in parallel with them so they would take 1.75 amperes: 2A7 in series with that combination with resistor  $R_2$  in parallel with the 2A7 so that it will take 1.75 amperes. The 2A5 is put in series with the rest of them. The total current taken by the tube filaments is 1.75 amperes.

The next thing of consideration is the "B" eliminator that will work on 12 volts. About every shop can find a spark coil in the old junk box. Solder a wire shorting the secondary of the spark coil. Then connect the 2.5 volt windings and the 5.0 volt windings of the power transformer in series, making sure that said windings are connected in the proper relation to each other so that they will not buck one another. Then the battery is connected to the power transformer as shown, and the other end of the coil is grounded. The spark coil should be completely shielded. Put it in a can and pack with sound absorbent material in order to deaden the mechanical vibrations set up by the vibrator. The lead coming from the spark coil should be by-passed by a 0.25 mfd. condenser to filter the R.F. generated by the vibrator and the shield should be grounded to the set. You can easily adjust the vibrator for the least amount of noise, least current consumption and greatest output of voltage by adjusting the vibrator nut. The vibrator adjustment is not critical.

The battery current coming to the set passes through the switch on the back of the volume control before it reaches the filaments and power transformer.

### RADIO SPECIALTIES TAKES RAYTHEON

The Radio Specialties Company announces its appointment as distributor of Raytheon 4-Pillar Tubes. The company is carrying a complete stock and will be most happy to discuss the attractive terms with its customers. Drop in or ask any Radio Specialties salesman for a copy of the new Raytheon Technical Data Chart. It is one of the most complete and informative charts of its kind available. Radio Specialties will be glad to supply this chart free of charge to those who inquire.

### ELECTRICAL MEASURING INSTRUMENTS

(Continued from page 14)

coils, and the fields and moving coil are connected in series. A resistor is connected in series with the instrument so that the current flowing is reduced to the proper value.

These instruments are made in a variety of ranges but are limited as to frequency range, 133 cycles being the average limit unless special adjustments are made which would allow somewhat higher frequencies to be used.

#### MOVEABLE IRON

In the moveable iron on Electromagnetic instrument, the principle of operation is that of magnetic repulsion. If two pieces of soft iron are suspended in a solenoid and a direct current passed through the solenoid, the pieces of iron will tend to repel each other because the polarity of each piece will be the same. Now if you reverse the current, the action will be the same, but the polarity of the iron pieces will be reversed. If this reversal is rapid enough, the iron pieces will stay apart until the current flow is stopped. Now if one piece of iron is held stationary and current passed through the coil, the piece that is suspended will tend to be repelled. If the moveable piece is pivoted so that it can only move by rotation, then when current is passed through the coil, the moveable piece will rotate, and if a pointed is attached to move over a scale, the movement will be proportional to the square of the current passing through the coil.

In an ammeter the current passes through a relatively heavy conductor in the form of a coil. The size of the conductor and number of turns depends on the range of the instrument. In the voltmeter a large number of turns of a comparatively small wire make up the coil. In order that low resistance of the coil might not permit an excessive current to flow when the instrument is connected to the circuit, a resistance is placed in series with the coil so that the current flowing through it is reduced to the required value.

(To be continued)

Officials of the Smithsonian Institution say the principle of the telephone was discovered on June 2, 1875, and the first conversation over the telephone was held on March 7, 1876. The patent was granted on March 10, 1876. Elisha Gray was given credit for having invented the telephone in 1876.

### CONCENTRICALLY-WOUND ELECTROLYTIC CONDENSERS

Further accentuation of the compactness for which the electrolytic type condenser is already renowned is made possible by an ingenious concentric winding for multiple-section units, according to Howard Rhodes, Chief Engineer of the Aerovox Corporation.

"A further reduction in the physical sizes of electrolytic condensers is brought about by winding two or more sections into a single roll," states Mr. Rhodes.

"If there is a common negative terminal for two or more condenser sections composing the concentric unit, then the condenser is referred to as being 'concentrically wound common negative'. If there is a common positive terminal for the sections, the resulting unit is termed as 'concentrically wound common positive'."

### N. U. EXECUTIVE

Mr. Hutchins, vice-president of the National Union Radio Tube Company, was a recent visitor to Los Angeles and attended the CRTA meeting, Monday evening, February 11. Mr. Hutchins addressed the CRTA for a few minutes on the subject of merchandising and selling service. His straightforward manner and pleasing personality caused him to be a visitor to the CRTA which members will not soon forget.

### TUBE CHECKERS

— and —

### SET ANALYZERS

Repaired or Rebuilt—

All types of instruments  
 Repaired or Calibrated  
 Shunts or Multipliers made up  
 for any instrument

PROMPT — ACCURATE  
 RELIABLE SERVICE

Authorized Service Laboratory  
 for Weston Electrical  
 Instrument Corp.

Quality Electric Co.

Tel. TRinity 5981

812 S. San Pedro Los Angeles

## CHANGING A HOUSE SET (RCA-VICTOR R-28-P) TO AN AUTO RADIO

By W. F. DALEY

**EDITOR'S NOTE:**—The following is a description of an interesting experiment in re-wiring a standard 5-tube superheterodyne for use as an automobile receiver. The experimental model was designed for use with a 12-volt system but a different connection of the filaments would adapt it to use for any D-C voltage.

The first thing is to install a five-prong socket in place of the four-prong socket for the rectifying tube, 84. The cathode connection goes to the filter system, and the high voltage transformer secondary leads going to the plates of the 84, across which is connected the 1,000 volt .0001 mfd. condenser. The condenser is for the purpose of by-passing the R.F. generated in the secondary before the 84 gets heated up throwing a load on the secondary. The R.F. might burn some of the insulation by arcing in the transformer and cause trouble or noisy reception sometime.

The next thing is to arrange the filament circuit to operate on the car battery. The experimental model was designed for a twelve-volt system so the filament circuit was adapted to that voltage using the circuit as shown. The resulting voltage across each tube being 2.5 to 2.75 volts excepting in the case of the 84 tube there is about 5.5 volts.

This circuit is fundamentally a series circuit. The law for a series circuit states that THE CURRENT THROUGHOUT THE SERIES CIRCUIT IS THE SAME. We know that the 57 and 58 each must have one ampere of current, the 2A7 0.8 ampere, the 2A5 1.75 ampere and the 84 0.5 ampere. The 57 and 58 tubes

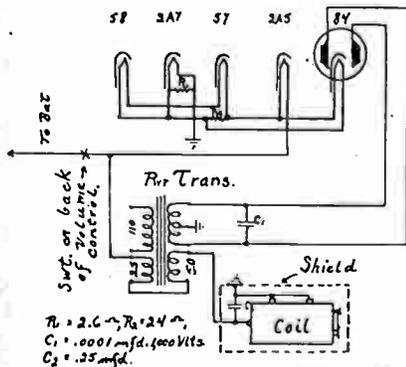
are put in series, and the 84 tube and resistor  $R_1$  in parallel with them so they would take 1.75 amperes; 2A7 in series with that combination with resistor  $R_2$  in parallel with the 2A7 so that it will take 1.75 amperes. The 2A5 is put in series with the rest of them. The total current taken by the tube filaments is 1.75 amperes.

The next thing of consideration is the "B" eliminator that will work on 12 volts. About every shop can find a spark coil in the old junk box. Solder a wire shorting the secondary of the spark coil. Then connect the 2.5 volt windings and the 5.0 volt windings of the power transformer in series, making sure that said windings are connected in the proper relation to each other so that they will not buck one another. Then the battery is connected to the power transformer as shown, and the other end of the coil is grounded. The spark coil should be completely shielded. Put it in a can and pack with sound absorbent material in order to deaden the mechanical vibrations set up by the vibrator. The lead coming from the spark coil should be by-passed by a 0.25 mfd. condenser to filter the R.F. generated by the vibrator and the shield should be grounded to the set. You can easily adjust the vibrator for the least amount of noise, least current consumption and greatest output of voltage by adjusting the vibrator nut. The vibrator adjustment is not critical.

The battery current coming to the set passes through the switch on the back of the volume control before it reaches the filaments and power transformer.

### RADIO SPECIALTIES TAKES RAYTHEON

The Radio Specialties Company announces its appointment as distributor of Raytheon 4-Pillar Tubes. The company is carrying a complete stock and will be most happy to discuss the attractive terms with its customers. Drop in or ask any Radio Specialties salesman for a copy of the new Raytheon Technical Data Chart. It is one of the most complete and informative charts of its kind available. Radio Specialties will be glad to supply this chart free of charge to those who inquire.



Drawn by W.F. Daley.

### ELECTRICAL MEASURING INSTRUMENTS

(Continued from page 14)

coils, and the fields and moving coil are connected in series. A resistor is connected in series with the instrument so that the current flowing is reduced to the proper value.

These instruments are made in a variety of ranges but are limited as to frequency range, 133 cycles being the average limit unless special adjustments are made which would allow somewhat higher frequencies to be used.

#### MOVEABLE IRON

In the moveable iron on Electromagnetic instrument, the principle of operation is that of magnetic repulsion. If two pieces of soft iron are suspended in a solenoid and a direct current passed through the solenoid, the pieces of iron will tend to repel each other because the polarity of each piece will be the same. Now if you reverse the current, the action will be the same, but the polarity of the iron pieces will be reversed. If this reversal is rapid enough, the iron pieces will stay apart until the current flow is stopped. Now if one piece of iron is held stationary and current passed through the coil, the piece that is suspended will tend to be repelled. If the moveable piece is pivoted so that it can only move by rotation, then when current is passed through the coil, the moveable piece will rotate, and if a pointed is attached to move over a scale, the movement will be proportional to the square of the current passing through the coil.

In an ammeter the current passes through a relatively heavy conductor in the form of a coil. The size of the conductor and number of turns depends on the range of the instrument. In the voltmeter a large number of turns of a comparatively small wire make up the coil. In order that low resistance of the coil might not permit an excessive current to flow when the instrument is connected to the circuit, a resistance is placed in series with the coil so that the current flowing through it is reduced to the required value.

(To be continued)

Officials of the Smithsonian Institution say the principle of the telephone was discovered on June 2, 1875, and the first conversation over the telephone was held on March 7, 1876. The patent was granted on March 10, 1876. Elisha Gray was given credit for having invented the telephone in 1876.

### CONCENTRICALLY-WOUND ELECTROLYTIC CONDENSERS

Further accentuation of the compactness for which the electrolytic type condenser is already renowned is made possible by an ingenious concentric winding for multiple-section units, according to Howard Rhodes, Chief Engineer of the Aerovox Corporation.

"A further reduction in the physical sizes of electrolytic condensers is brought about by winding two or more sections into a single roll," states Mr. Rhodes.

"If there is a common negative terminal for two or more condenser sections composing the concentric unit, then the condenser is referred to as being 'concentrically wound common negative'. If there is a common positive terminal for the sections, the resulting unit is termed as 'concentrically wound common positive'."

### N. U. EXECUTIVE

Mr. Hutchins, vice-president of the National Union Radio Tube Company, was a recent visitor to Los Angeles and attended the CRTA meeting, Monday evening, February 11. Mr. Hutchins addressed the CRTA for a few minutes on the subject of merchandising and selling service. His straightforward manner and pleasing personality caused him to be a visitor to the CRTA which members will not soon forget.

### TUBE CHECKERS

### — and — SET ANALYZERS

### Repaired or Rebuilt—

All types of instruments  
 Repaired or Calibrated  
 Shunts or Multipliers made up  
 for any instrument

PROMPT — ACCURATE  
 RELIABLE SERVICE

Authorized Service Laboratory  
 for Weston Electrical  
 Instrument Corp.

### Quality Electric Co.

Tel. TRinity 5981  
 812 S. San Pedro Los Angeles

### Classified Advertisements

#### For Sale or Trade—

I. R. E. proceedings for 1929, 1930, 1931, 1932, 1933, 1934. Radio Art, 2924 N. Broadway. CApitol 5542.

EDISON phonograph with diamond needle and 45 records. All in first-class condition. Archie E. Clark, 510 E. Stanford Ave., Garden Grove, Calif. Phone 720.

ACME 1000 V Condensers, hi. volt. power trans., auditorium speaker, service osc., portable tube tester. Radio Art, 2924 N. Broadway. CA. 5542.

#### For Sale—

COMPLETE public address system, composed of the following: Class B 46 amplifier, 3 stage TRF tuner, Western Electric Double Button Mike, stand and 30 feet of cord. "T" Fader for Radio, Mike and Phonograph. 10" Jensen Speaker with baffle. Thordarson Transformers used throughout. Practically new. Will sell for \$100, \$50 down, balance in 60 days. Also three-year file, QST, 1929, 1930, 1931, all in good shape. Sell for \$3. Archie Clark, 510 E. Stanford Ave., Garden Grove, Calif., Phone 720.

#### Laboratory Service—

All types of laboratory measurements and calibration of electronic devices and component parts. Dr. John F. Blackburn, Consulting Physicist. GRanite 8179.

### DAYRAD Radio Service Equipment

Represented by  
**FRANK A. EMMETT CO.**  
1341 South Hope St.  
Los Angeles, Calif.  
Richmond 6301

## MAKE THESE *Vital* TESTS BEFORE YOU BUY AN ELECTRIC REFRIGERATOR



**SMELL**

Smell the refrigerant. Grunow's Carrene, the liquid refrigerant, has no obnoxious odor.



**HANDLE**

Handle Carrene and you'll find it's almost the same as handling safe crystal clear water.



#### TRY TO SET IT ON FIRE

Grunow refrigerators are beautiful. They are reasonably priced and are sold on convenient terms. Let us demonstrate.



## Grunow SUPER-SAFE REFRIGERATOR

Distributed by  
**Watson & Wilson, Inc.**  
711 MITCHELL PLACE, LOS ANGELES



# 34,000 Service Men Have Sent for *This* Book

Get your copy for 10c

● Yes! 34,000 radio service men have learned the way to take the guess work out of tube application . . . because that's how many have sent for this latest Sylvania service help, a complete technical manual, with 104 pages crammed full of useful information.

This book will increase your profits, because in it you will find the latest technical pointers that are so necessary for your job. When you've studied this book, you'll find it far easier to recognize tube and set troubles . . . and more important . . . how to solve these problems to get fine, sure performance.

Complete data on all tubes are included in this booklet, including types 15, 18, 25S, 25Y5, 46B1 and 182B. It also gives descriptions of over 90 types of tubes, with 150 cuts and diagrams.

You'll find this book so useful that you wouldn't take \$10 for it once you've looked through it, and yet it's yours for only 10c in stamps! Send today . . . and begin now to take advantage of this new Sylvania service help.



## Sylvania

The Set-Tested Radio Tube

Factories:  
SALEM, MASS... EMPORIUM, PA.  
ST. MARYS, PA. . CLIFTON, N. J.  
Warehouse Stocks In:  
Portland, Ore.. Atlanta, Georgia,  
Philadelphia, Pa.. Salem, Mass.  
Denver, Colo., Los Angeles, Calif.  
New York, N. Y.



Copyright 1934 H. S. C.

HYGRADE SYLVANIA CORPORATION  
Emporium, Pennsylvania (C-20)

Please send me the new Sylvania Technical Manual. I enclose 10c in stamps.

Name .....

Address .....

City..... State.....

## A NEW OPPORTUNITY FOR C. R. T. A. MEMBERS

A. Paul, Jr., President, CRTA Members of the Certified Radio Technicians Association will be interested to learn that the National Schools, at Figueroa and Santa Barbara streets, are sponsoring a special course of instruction in radio for members of the association.

The training is to be given without charge, to members of this organization with the compliments of Mr. J. A. Rosenkranz, President.

The subjects dealt with at the meetings are to be arranged according to the preference of those who attend. In other words, the members are to be given their choice of material to be presented so that the various subjects covered will be most closely related to their daily work.

The class will meet every two weeks at 8 o'clock, on Monday evenings. The first class will meet on Monday evening, March 25.

In addition to the class work, the school offers consultation privileges. Any question may be noted on a post card and mailed to the school. It will be completely answered at the next meeting.

Inasmuch as the National Schools have been so gracious as to place the facilities of their institution at our disposal in this way, it is hoped and expected that every member will show his appreciation by taking advantage of the opportunity.

These meetings will be helpful to everyone attending. The National Schools have long been known for the complete and practical nature of their training. The school instructors who will direct this special course are regular members of the National faculty. They understand the subject from beginning to end, and just as important, they are experienced in the art of directing the work of others.

## NEW TROYS

The Troy Radio Mfg. Company announces a 1935 line of Troy radio receivers including 4 to 12-tube, all-wave, A-C, D-C, AC-DC, air-cell battery and 32-volt types in table and console cabinets featuring the airplane dial. New circulars are available showing in detail the complete line of receivers manufactured by Troy, one of the most complete lines of its kind on the Pacific Coast.

## MEYBERG PARTS DEPT.

The Leo J. Meyberg Company has installed a complete parts department, featuring RCA Factory Parts and Test Equipment and many other well-known parts lines, including: Aerovox, Tobe, Kenyon, General Transformer, Ohmite, Centralab, Carter and many others. They are also stocking Weston, Dayrad and Supreme test equipment.

## NEW RACKS AND PANELS

The Pacific Radio Exchange announces many additions and improvements to its attractive line of racks and panels for construction of all types of amplifiers, transmitters and test equipment. The additions include crackle-finish portable equipment cases in various sizes and with a large variety of panel and chassis types. Panels are available for the racks either plain, perforated or with tube and meter holes.

## NEW — 1935 ALL-WAVE SETS



"Western made for Western Reception"

## METER AND TEST EQUIPMENT HEADQUARTERS

All the Latest Types in Stock

SUPREME — TRIPLETT — TRIUMPH — BEEDE  
CLOUGH-BRENGLE — DAYRAD  
WESTINGHOUSE

Distributed and Serviced by

## ELECTRIC PRODUCTS SERVICE

1358 S. Grand Ave., Los Angeles

PRospect 3681

# AT LAST!

— A POPULAR PRICED TUBE TESTER THAT READS —

## Dynamic Mutual Conductance

THE MODEL 400 TUBE TESTER BY TRIUMPH

Neon Leakage Indicator Shows Leaks as High as 3 to 5 Megohms  
Individual Element Short Test — Spare Socket  
Needs No Line Regulator Between 100 and 130 Volts  
Separate Tests on Diode or Triode Sections of Multi-Purpose Tubes  
Tests All Rectifiers — Simple to Operate  
Beautiful Appearance — Counter and Portable Styles  
Also Provides Emission Test

— A REAL TUBE MERCHANDISER —

At a Price Which Makes It Possible for Every Business and Every Technician  
to Possess a Real

## DYNAMIC MUTUAL CONDUCTANCE TESTER

CALIF. NET PRICE **\$36.20** PORTABLE or COUNTER

— A Price All Can Afford — A Tube Tester for the Most Exacting —

## REDUCED PRICE!

To enable all progressive technicians, service laboratories and factories to avail themselves of the use of a real laboratory signal generator the Triumph Model 100 Generator has been reduced to the Very Low

NET PRICE OF **\$31.25** DELIVERED

This Generator Is Being Used in the Laboratories and on the Production lines of Leading National and California Manufacturers and in Research Laboratories.

WRITE FOR YOUR FREE COPY OF THE  
TRIUMPH SIGNAL GENERATOR HAND BOOK and SHOP NOTES

TRIUMPH MFG. CO., 4017 W. Lake Street, Chicago

See These Distributors for Demonstrations

RADIO SPECIALTIES COMPANY      PACIFIC RADIO EXCHANGE  
M. D. EALY      ELECTRIC PRODUCTS SERVICE  
WESTERN RADIO & ELECTRIC CO., San Diego  
COAST ELECTRIC CO., San Diego

California Representative:

NORMAN B. NEELY, 1656 North Serrano Street, Los Angeles