SERVICE

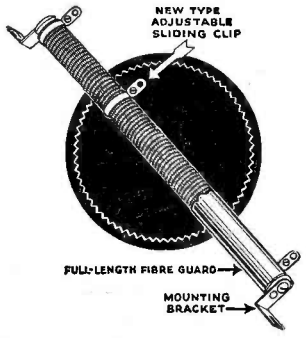
—

A MONTHLY DIGEST OF RADIO AND ALLIED MAINTENANCE

(See page 239)

PER COPY
20 CENTS

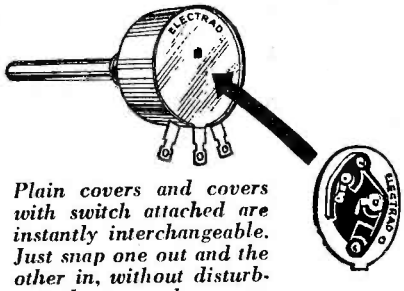
JULY
1933



You Can't Compare Ordinary Resistors With TRUVOLTS

1. TRUVOLT patented construction permits air-cooling, larger wire, greater radiation and longer life.
2. TRUVOLT double-spiral winding gives better electrical contact.
3. TRUVOLT sliding clips permit accurate adjustment to exact voltages.
4. TRUVOLTS have 1,000 volt insulation.
5. TRUVOLTS have a full-length fibre guard to prevent injury from contact with tools or hands.

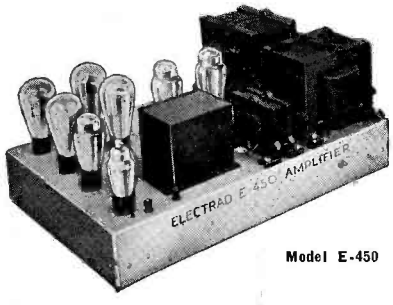
No Other Resistor Has These Advantages



Plain covers and covers with switch attached are instantly interchangeable. Just snap one out and the other in, without disturbing the control connections.

Replacement VOLUME CONTROLS

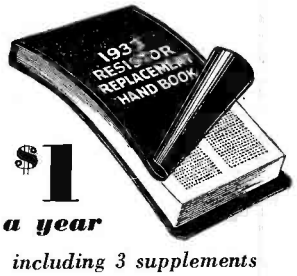
An outstanding feature of these volume controls is their adaptability. Only five types are required to service 799 standard receiver models. End covers are interchangeable with power-switch assembly. Long *aluminum* shafts are easier to cut to desired length.



Model E-450

Direct-Coupled AMPLIFIERS

ELECTRAD Amplifiers are world-famous for high output, rich tone and economical operation. Four models cover every private and public amplifier need, from 1.6 watts to 21.9 watts of undistorted power. List price, $32.50 to $195.00, *less tubes.*



$1 *a year*

including 3 supplements

THIS BOOK *will pay for itself every day!*

Now in its second edition, this helpful book has won the praise of thousands of service men. 122 pages of up-to-the-minute service data. *Sold on a 10-day trial, money-back guarantee.*

Here's HELP *for the* Service Man

MANY thousands of service men rely on ELECTRAD, because ELECTRAD has never failed them.

ELECTRAD service to service men includes not only the design and manufacture of the highest quality of Resistors, Volume Controls and Amplifiers for every purpose—but also cooperation in the solution of special service problems.

Publication of the ELECTRAD RESISTOR REPLACEMENT HAND BOOK, *at less than cost,* is just one of the many helps ELECTRAD is providing for more than 12,000 busy service men.

Mail Coupon for your copy of the new 1933 ELECTRAD catalog and circular describing the 1933 Hand Book.

175 Varick St., New York, N.Y.

ELECTRAD INC.

ELECTRAD, INC., 175 Varick St., New York

Please send me your complete 1933 catalog. .....Check here for circular describing the 1933 Hand Book.

Name .....

Address .....

..... S-7

SERVICE

A Monthly Digest of Radio and Allied Maintenance

JULY, 1933
Vol. 2, No. 7

EDITOR
John F. Rider

MANAGING EDITOR
M. L. Muhleman

Editorial Contents

Advertising Director

FRANK TIBBITTS
1440 Broadway, N. Y. City
Telephone: CHickering 4-4542

Published monthly by

John F. Rider Publications, Inc.
1440 BROADWAY
NEW YORK, N. Y.

Officers

JOHN F. RIDER, President and Treasurer
M. L. MUHLEMAN, Vice-President
J. SCHNEIDER, Secretary

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription price $2.00 per year in the United States of America; 20 cents per copy. $3.00 per year in Canada and foreign countries; 35 cents per copy.

THE ANTENNA...

THE NATIONAL RECOVERY ACT

ALL of you have read and heard a great deal about the National Industrial Recovery Act, sponsored by President Roosevelt and his "Brain Trust." Although this Act was but recently signed by the President, it has created a great deal of activity in all major fields of industry and has aroused a tremendous amount of enthusiasm. The Act has as its purpose the hastening of the return to prosperity. Instead of waiting for the long drawn-out process of readjustment, the President deemed forced action far more beneficial in the effort to bring about immediate improvement in industrial activity and employment.

WHAT IT MEANS TO YOU

We are naturally interested in learning how this gigantic movement is going to benefit us, the radio service industry—what it will mean with respect to employment, increased wages and improved working conditions. Likewise we wish to know just what is being done to further the movement. Some of these questions can be answered.

The National Industrial Recovery Act will have a definitely beneficial effect upon the radio service industry. It is going to reduce the number of men now engaged or dabbling in service work. This condition will be brought about by increased employment in other fields. At the present time, the radio service field is overcrowded with men from other fields of activity—men who know a little about radio through past experimentation and set building and who turned to servicing as a means of earning some money when their former fields of activity became stagnant. There is another class of man working in the radio service field—the man who was a junior or a regular engineer in radio or an allied field, and who also turned to service work when his former employment ceased.

The National Industrial Recovery Act is rehabilitating other industries. The men who left these industries and embarked upon service will leave the latter and go back to their first loves—at least, most of them will do so. Some will undoubtedly continue servicing. As far as the radio service field is concerned and the men seriously engaged therein, we can offer thanks to the Administration in Washington for their efforts to create jobs even if they have to move Heaven and Earth to do so. And lest you forget—jobs *are* being created!

SERVICING ON THE MEND

Any sizable exodus of men from the service field into other fields will definitely improve the status of the Service Man. It means that the part-time men and the tinkerers will depart to be heard from no more. No more will they interfere with your trade. No longer will they constitute the fly in the ointment. All the good fortune to them when they are able to return to their original professions where they can make a good living and be free from the grievances we have had to heap upon them. Before long, you are also going to be freed from the activities of the cut-price artist and the beginner who would work for next to nothing.

The rejuvenation of buying power and the reduction of the number of Service Men will be of definite advantage. Set owners will have money for repair work and there will be fewer men to do the jobs. More receivers will be sold and fewer men available for installation. All this means greater employment and higher incomes.

Speaking about more sets sold and more sets serviced, you will be interested to learn of one directly related activity. It is the result of the National Recovery Act and is an activity on the part of the Radio Manufacturers Association, better known as the RMA. This offering of cooperation is outlined in the feature article in this issue of SERVICE. Read this story and learn how you as a Service Man fit into the picture—how definite action is being taken to bring you greater income and more employment.

RADIO HAS A SLOGAN

The RMA has developed a slogan in connection with the "Rebuild Radio Prosperity Campaign" described elsewhere in this issue. This slogan is illustrated on the front cover. Memorize this slogan—talk this slogan and what is behind it. Use the illustration on your stationery, or in other manners. The radio industry has developed it for you and it is up to you to do all that you can to spread it from Maine to California and from Canada to the Gulf.

"Reach for the Joy of Living with Radio" is an excellent slogan. It means just what it says. Radio has become a part of every man's, woman's, and even child's, life. Entertainment, education, thrills, mystery, love—all are found via radio. Our radio public should not be permitted to take radio for granted as they have in the past. Millions of dollars have been spent and will be spent each year to provide the finest entertainment and talent. Radio is no longer a novelty. It is something we need in our everyday life. See to it that you spread this gospel.

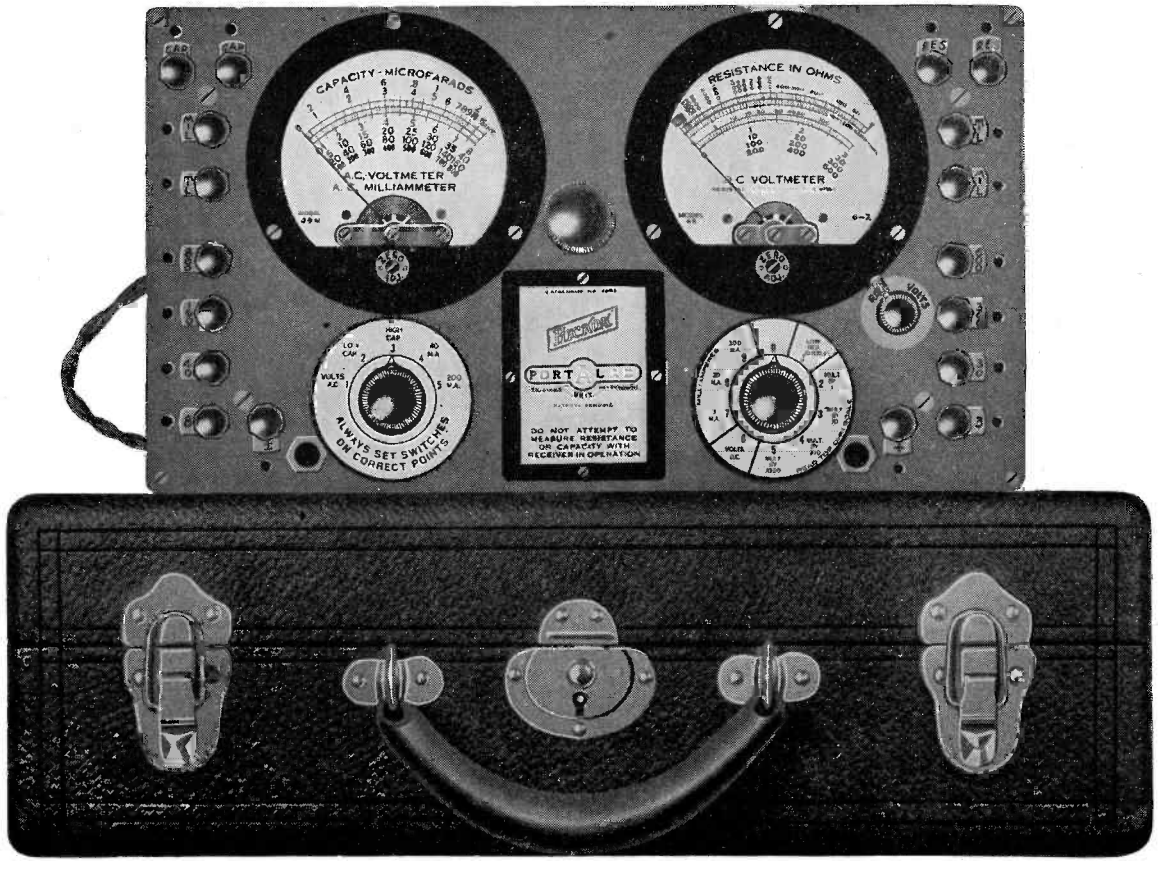
You have been complaining of so few service jobs because people did not spend. The government is seeing to it that they will spend, by creating jobs, incomes, confidence and enthusiasm. That which you could not do, they are doing for you. It is up to you to get behind the RMA campaign with every ounce of energy in order to contribute your share towards reviving the radio industry—and in a hurry.

There is one thing which you should bear in mind; the efforts of the Administration in Washington and the RMA, are being made for immediate recovery! Do all you can to arouse confidence, enthusiasm, buying power, and prosperity will be immediate!

John F. Rider.

PORT A LAB
INDIVIDUAL UNIT MEASUREMENT
Patents Pending

TWENTY RANGE
POINT TO POINT
NEW---RADIO SET TESTER



All Bakelite—Walnut Panel—Chrome Trim—Size 12" x 7" x 3¼"

A PORTABLE PRECISION LABORATORY

Special Size (4¼ Dia.) Easy Reading Meters — Highest and Lowest OHM Readings
Ohmeter Not Battery Operated — No Rectifiers in A. C. Meters

A PLAIN STATEMENT OF FACTS CONCERNING THE PORT-A-LAB AND THE HICKOK METHOD OF INDIVIDUAL UNIT MEASUREMENT

This method is Imperative with today's Receivers and definitely Supersedes all previous methods of testing, requiring a Service Instrument having:

WIDE RANGE OF APPLICATION TO INDICATE HIGHEST AND LOWEST POSSIBLE OHMS — ¼ OHM TO 20 MEGOHMS—MICROFARADS—HENRIES—A. C. AND D. C. MILLIAMPERES AND VOLTS. ALSO FRACTIONS THEREOF.

The unit SHOULD NOT BE BATTERY OPERATED, NOR EMPLOY RECTIFIER TYPE METERS, as the former run down and the latter wear with use, resulting in loss of meter calibration.

The Port-A-lab employs neither. The Ohmeter operates with TUBE TYPE RECTIFIER (tube mounted inside case), NO BATTERIES. The A. C. Meter contains NO RECTIFIER TO CHANGE IN VALUE AND LOSE CALIBRATION. Attachment is made to A. C. Line. Voltage Adjuster for precise Calibration, always independent of Line Fluctuation. A HICKOK DEPENDABLE FEATURE.

Extreme Visibility and Extra Large Meters with Special Length Scales, Easy to Read — are essential, as in the Port-A-lab, to read ALL FACTORS and MINUTE FRACTIONS THEREOF, to meet TODAY'S SERVICE DEMANDS.

The Port-A-lab is the result of Extensive Research and Practical Application in the field of Service to provide:

SPEED — ACCURACY — GREAT TIME SAVING — TRUE REPAIR ESTIMATES — NO ERRORS — SIMPLIFYING OF SERVICE PROBLEMS — ENHANCED PROFITS AND INSURED CUSTOMER CONFIDENCE.

DEALERS

Write for Bulletin 27A. New important information.

The Sum of These Facts Merits Ownership and the Immediate Adoption of the Hickok Method of Point to Point Radio Set Testing as Embraced in the PORT-A-LAB, STATI-K-TESTER and COMPACT-A-LAB

Tests All Sets — including New Seven Prong Tubes

List Price, Model 4953, Complete.....$125.00
Dealers' Net Price, Model 4953, Complete.... 75.00
List Price, Carrying Case (Not Essential).... 10.00
Dealers' Net Price, Carrying Case (Not Essential) $6.00

West Coast Prices Slightly Higher

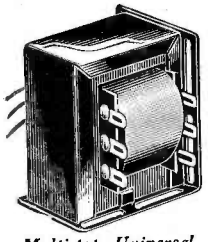
THE HICKOK ELECTRICAL INSTRUMENT CO. **10514 Dupont Ave., CLEVELAND**

Announcing

SERVICE ENGINEERS'

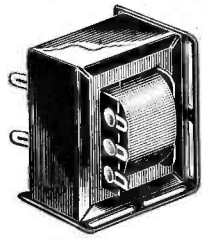
POWER UNIT EMERGENCY STOCK

Only Four Models
FOR 90% OF ALL RADIOS



Multi-tap Universal Output Transformer

"GENERAL" MULTI-TAP UNIVERSAL POWER TRANSFORMERS

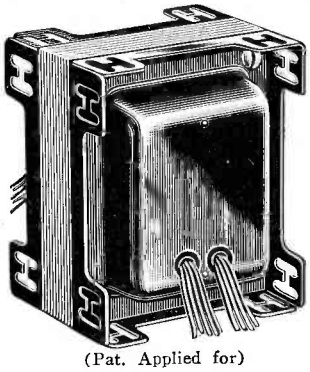


Universal Audio

These replacements may be installed as permanent equipment as far as electrical characteristics are concerned; or if the set owner insists on an Exact-duplicate, ***physically*** as well as electrically, the "GENERAL" Multi-tap Universal can be installed temporarily to give ***immediate renewal of original performance,*** until the Service Engineer can obtain an Exact-duplicate.

"GENERAL" gives prompt service on Exact-duplicates for any model, any make set—from stock or through our rebuilt service department.

"GENERAL" Multi-tap Universals, through a combination of varied taps on Four Models, provide the current values for any combination of tubes in any 4 to 10 tube set. The important consideration in replacing power units is *how many tubes,* and their current requirements—***not what tubes or what set.***



(Pat. Applied for)
Multi-tap Universal Power Transformer

IMMEDIATE SERVICE
Is Your Way to Get the Service Business AT GOOD PROFIT

The varied combinations available in the Four Models "GENERAL" Multi-tap Universals provide the current values for any of 1377 models of sets, ***as accurately as the original units***—considering the variation in lighting current of different localities.

The units are of the ***fully enclosed type and meet the specifications of sets approved by the Underwriters Laboratory.*** They are finished in dull satin black. "GENERAL" quality workmanship and appearance of product stands unsurpassed—having for years supplied to set manufacturers the power units for many of the most popular radios.

Here Is the EMERGENCY STOCK YOU NEED for Quick Service

Four Models "GENERAL" Multi-tap Universal Power Transformers

No. 1814 (for 4 tubes)

2—24, 27, 35, 55, 56, 57, 58, 2A6, 2A7, 2B7.....2.5v—5.25 Amp.
1—45, 46, 47, 59, 2A3, 2A5, 2.5vC.T.—1.75 Amp.
or 1—82.....2.5v—3.0 Amp.
1—80, 80M, 83, 5Z3..5.0v—3.0 Amp.
High voltage—
650 volts C. T. at 50 M. A.

No. 1816 (for 5 or 6 tubes)

3—26's .....1.5v—3.15 Amp.
or 3—24, 27, 35, 55, 56, 57, 58, 2A6, 2A7, 2B7, 90.....2.5v—5.0 Amp.
1 or 2—27 .....2.5v—3.5 Amp.
2—45, 46, 47, 59, 2A3, 2A5, 2.5vC.T.—3.0 Amp.
or 2—171A.....5.0vC.T.—0.5 Amp.
or 1—80, 80M, 83, 5Z3, 5.0v—3.0 Amp.
1—82 .....2.5v—3.0 Amp.
High voltage—
650 volts C. T. at 60 M. A.

No. 1818 (for 7 or 8 tubes)

4—26's .....1.5v—4.20 Amp.
or 4—24, 27, 35, 55, 56, 57, 58, 2A6, 2A7, 2B7, 90.....2.5v—7.0 Amp.
1 or 2—27 .....2.5v—3.5 Amp.
2—45, 46, 47, 59, 2A3, 2A5, 2.5vC.T.—3.0 Amp.
or 2—171A.....5.0vC.T.—0.5 Amp.
or 1—80, 80M, 83, 5Z3, 5.0v—3.0 Amp.
1—82 .....2.5v—3.0 Amp.
High voltage—
650 volts C. T. at 80 M. A.

No. 1820 (for 9 or 10 tubes)

6—26's .....1.5v—6.5 Amp.
or 6—24, 27, 35, 55, 56, 57, 58, 2A6, 2A7, 2B7, 90.....2.5v—10.5 Amp.
1 or 2—27.....2.5v.—3.5 Amp.
2—45, 46, 47, 59, 2A3, 2A5, 2.5vC.T.—3.0 Amp.
or 2—171A.....5.0vC.T.—0.5 Amp.
or 1—80, 80M, 83, 5Z3, 5.0—3.0 Amp.
1—82 .....2.5v—3.0 Amp.
High voltage—
650 volts C. T. at 100 M. A.

UNIVERSAL AUDIO TRANSFORMER

Model 3205—For push-pull or straight Audio; also for AC or DC Sets.
Universal Mounting Bracket

MULTI-TAP UNIVERSAL OUTPUT TRANSFORMER

Model 1337—combination of various taps provided in this unit makes it possible:—
To feed from single or push-pull output stage.
To any voice coil from 2 to 30 ohms in 2 ohm steps:—Universal electrically as well as physically.

FREE! "GENERAL" Illustrated and fully descriptive BULLETIN!

with complete list of 1377 models and makes of radios on which you can replace power units out of a stock at an investment of only $23.25 (list) in "GENERAL" Multi-tap Universals.

GENERAL TRANSFORMER CORPORATION

502 So. Throop Street Chicago, Illinois

MAIL THE COUPON AT ONCE!

Fill out the coupon and mail it today or wire us for full information regarding "GENERAL" Multi-tap Universals.

GENERAL TRANSFORMER CORP.
502 S. Throop Street,
Chicago, Ill.

Please send free Bulletin of "GENERAL" Multi-tap Universals and list of Radios on which they can be used for replacements.

Name .....
Address .....
My Jobber Is.....
Street.....
Address .....

THE NEW DEAL IN RADIO

A HIGHLY organized campaign to find a new prosperity for the entire radio industry, from manufacturer down to dealers and Service Men, has been staged and is now well under way. This campaign is under the leadership of the Radio Manufacturers Association and the plaque on the front cover of this issue of SERVICE carries the slogan which will eventually reach the ears or eyes of both the "listening" and the "non-listening" public.

RADIO PROGRESS WEEK

The campaign is to consist of two parts—an intensive sales drive during the month of September, and a week of special broadcasting from October 2 to 7, which will be known as Radio Progress Week. The organizing of the radio industry for cooperation in this huge program will begin immediately. Through the cooperation of the broadcasting studios, the advertising agencies and the national advertisers, special programs will be developed that will have unusual popular appeal. Radio Progress Week will pass in review before the public the scope, the diversity and richness of modern radio broadcasting, and create a public appreciation of the dramatic part it plays in the life of today as a source of entertainment, a promoter of education, a liberator of thought and an influence of progress. In addition, regular broadcasting features of the week will be given a Radio Progress flavor and special local programs will be arranged in many cities. The National Broadcasting Company and the Columbia Broadcasting Company have pledged their hearty cooperation.

NEW OPPORTUNITIES

The Rebuild Radio Prosperity Campaign comes at a time of improved conditions. It will ride along as a part of the radio industry's cooperation with the plans laid down by the National Industrial Recovery Act. It therefore has every chance to succeed.

There are now approximately six and three-quarter million homes using radio sets that are obsolete, and thirteen million homes that have no radio at all, but the radio industry cannot expect to sit back and let the returning prosperity pour new business into its lap. For every other industry is going to be out after these same dollars from the family budget. Automobiles, refrigerators, travel, clothes, and other strong personal appeals will be scrambling for attention. John and Mary are going to buy first *the thing that they have come to desire the most.* It is therefore important that everyone connected with the radio industry do everything in their power to impress upon the public the truth behind the slogan, "Reach for the Joy of Living with Radio."

PULLING TOGETHER

So the radio industry is entering a season of better business with an intense competition to fight, and it is not a competition between radio manufacturers or radio distributors or dealers or Service Men as in the past four years of sweat and tears. It will now be a competition with other industries that will be out energetically selling the home market. Therefore the radio industry must organize to throw its united strength into the market place, first and strongest, so that radio will be the thing that John and Mary will buy. Everyone in the industry is going to pull together for the common good—and the radio industry is going to get its just share of the consumers' dollar.

CAMPAIGN OBJECTIVES

The Rebuild Radio Prosperity Campaign will have two objectives. First, to canvass every radio owner and put his set into condition, by installing new tubes, parts or accessories, or to replace it with a new set. Second, to canvass all prospects for new receivers. Through the coming months local committees will be organized in all cities, so that manufacturers, distributors, dealers and Service Men will be prepared and ready to play their part in the concerted sales drive through the month of September. The cooperation of all branches of industry in all communities will be sought, and since every manufacturer, distributor, dealer and Service Man has his eye in this awakening market and plans to do his utmost anyway to increase his business, the R. M. A. is confident that the industry will respond enthusiastically to secure the benefit that will come from massing the strength of industry.

The spectacular broadcasting which will feature Radio Progress Week will serve as a bait for sales and service. People will be urged to get ready for this week of special broadcasting, and it will be a strong incentive right up until the end of September. After the week is over, it will still be a powerful selling argument because of the popular interest which will be aroused. The slogan will continue to be featured.

SERVICE AND SALES HELPS

In this campaign, the R. M. A. will take the initiative and carry the burden. It is realized that in order to make the campaign really effective, all Dealers, Jobbers and Service Men should be supplied with circulars and display material for the purpose of catching the public eye. A number of display cards and posters have been designed for use in store windows, and also attractive circulars and stickers which the

The "Rebuild Radio Prosperity" Campaign is now in full swing. "Radio Progress Week" is coming. Now is the time for every Service Man to prepare himself for the sales and service drive. This campaign will mean dollars and cents to you. Don't miss out on this. Get going!

Service Man can use effectively in his neighborhood. This material can be purchased at cost. All necessary information can be obtained from the committee in your locality, or your local distributor. Should you have any difficulty in obtaining display material, or circulars, write to SERVICE, and we will see to it that you get what you need.

YOUR CHANCE

Of course, the prime objective of the campaign will be to awaken a new popular enthusiasm for the present dependability of radio equipment, the prefection of its tone quality and control, and the scope and artistry and excellence of modern programs. By two months' careful preparation the campaign will develop a selling intensity in September that would not be applied without organized enthusiasm. This intensified selling will create an added volume of business that would not mature without this urgent appeal.

This campaign should double your chances. In the first place, the advertising and the Radio Progress Week will create the desire in the public to have their receivers in suitable condition for the best reception of the programs. This means servicing and replacement business. In the second place, many people who do not have radio sets will purchase them, and with more sets in use there is bound to be installation work, more servicing as time goes on. In any event, a good part of the business to be had is going to go to the Service Men who contact the public during the campaign and sell them on the idea of modern reception.

THE I. R. S. M. DRIVE

The Institute of Radio Service Men has not been asleep at the switch. Realizing the importance to the service industry of improved broadcasting and programs, and the development of public appreciation, the Institute of Radio Service Men and the National Association of Broadcasters have formed a committee to represent their respective associations on the Joint Radio Industry Committee on Public Relations. A definite program is being set up.

The Joint Radio Industry Committee on Public Relations has as its purpose the restoration and maintenance of good will among the radio listening audience and the constructive promotion of radio in an institutional manner to *sell* the public on radio as a means to sell radio to the public. It is based on the principle that a satisfied set owner constitutes a friend of the radio industry, represents a group of listeners for the broadcasters, is a client of a Service Man, and a potential prospect for products made by the manufacturers and sold through the distribution channels. It is planned to put into effect a consistent, continuous, constructive, promotional campaign. All this will of course add just so much weight to your own efforts in the service field.

MILLIONS WILL BE SPENT

Millions of dollars will be spent upon service work during the coming fall and winter. See that you get yours. Never before has there been such an active campaign on the part of the radio and affiliated unit manufacturers. Never before has there been any such campaign which meant so much direct and immediate financial returns to the service field.

Get behind this drive! If you cannot sell a new receiver to a man, service the one he now owns. If you feel that service work alone is not justified and the man cannot afford a new and expensive receiver—modernize his present set by the inclusion of new type tubes, secondary speakers, tone compensation or tone controls, and so on. Set owners are going to be in a receptive mood due to the influence of the campaign. The rest is up to you.

ESTIMATING AMPLIFIER GAIN

If the occasion should arise that an amplifier of unknown gain is available, it is usually a simple matter to estimate the gain simply by knowing what tubes and what type of coupling is used. As an example, suppose a transformer-coupled pre-amplifier employing two type 30 tubes is to be used and you wish to know its gain. Usually the input and output impedances will be given either on the name plate, schematic diagram or elsewhere. However, the output of the usual pre-amplifier is 200 ohms. This can, of course, be verified as follows:

DETERMINING OUTPUT IMPEDANCE

Connect a bell-ringing or filament transformer to the 60-cycle line. Across the low-voltage side of the transformer connect a 100,000-ohm and a 100-ohm resistor in series. Across the 100-ohm resistor connect the input of the amplifier.

Across the amplifier output connect a 2-volt or 6-volt a-c. voltmeter. And across this in turn try various resistances, such as 200 ohms, 500 ohms, etc., and note the voltage reading for each. Now maximum power will be delivered when the output impedance is matched, and the power output is found by dividing the square of the voltage by the resistance. Thus, suppose 2 volts were delivered to a 200-ohm load. Then the power would be:

$$P = \frac{V^2}{R} = \frac{4}{200} = .02 \text{ or } 20 \text{ milliwatts.}$$

If 2.83 volts had been delivered to a 500-ohm load with the same amplifier input, then the power in this case would be:

$$P = \frac{2.83 \times 2.83}{500} = \frac{8}{500} = .016 \text{ watt.}$$

And if 1.26 volts had been delivered to a 100-ohm load, the power would be:

$$P = \frac{1.26 \times 1.26}{100} = .016 \text{ watt.}$$

We could therefore conclude that the amplifier was matched at 200 ohms since the power was about 1 db. less at 100 and 500 ohms. Great care must be taken in such measurements not to overload the amplifier, consequently the smallest possible input to give a readable output should be used.

DETERMINING GAIN

To estimate the gain of this amplifier—which was our original idea—we find that the amplification factor of the type 30 tube is about 9 and the plate impedance about 10,000 ohms. The voltage step-up of the average input transformer operating from a 200-ohm circuit is about 25. The voltage input to the first tube is amplified 9 times and will be divided between the output impedance of the tube and the primary impedance of the interstage transformer. However, it is usual practice to make interstage transformer impedance very high with respect to the tube impedance, so we can assume with negligible error that all of the voltage appears across the interstage transformer primary.

VOLTAGE STEP-UP

The voltage step-up of interstage transformers is usually between 1.5 to 1 and 2 to 1. Again this voltage is amplified by the second tube 9 times. The plate impedance of the last stage of the amplifier is usually matched. Therefore only one-half the voltage developed in the last tube will be applied to the primary of the output transformer. This will in turn be stepped down to 200 ohms. This represents an impedance stepdown of about 50 to 1 and a voltage stepdown of about 7 to 1. Therefore the gain of the amplifier will be about:

$$25 \times 9 \times 1.5 \times 9 \times 0.5 \times \frac{1}{7} = 216, \text{ or}$$

about 47 db.

Now we know that had no amplifier been present, one-half of the input voltage would have been developed across the 200-ohm load, whereas, due to the very high input impedance of the input transformer, nearly all of it appeared across the amplifier input. Therefore, we must subtract 6 db. from the value found above and the effective gain of the amplifier will then stand at about 41 db.

General Data . . .

Colonial Models 250, 279, 300 Universals

The same chassis is used in all three models listed above. There are, however, two different circuits, both of which are shown herewith. Receivers which are rubber-stamped "128 A" on the chassis just above condenser C11 which is near the front of the chassis, are wired as shown in Fig. 1.

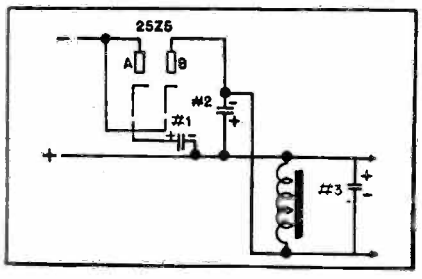


Fig. 3. Circuit of rectifier and filter when receiver is operated from direct current

Those stamped "128 B" are wired as shown in Fig. 2.

There are no great differences between the two circuits, so they may be described in a general way. The differences are principally in the wiring of the power unit.

The chassis is of the universal type, with series heater connections. The series heater resistor is an integral part of the line cord instead of being contained in the chassis, and thereby overheating of the cabinet is prevented.

Power Supply

Let us examine the power supply first. This is so arranged that when the receiver is operated from an a-c. line, the 25Z5 tube is used as a voltage-doubler. The circuit existing when the a-c., d-c. switch is in the d-c. position is shown in Fig. 3. Current flows from the positive side of the line, through the speaker field, developing a voltage drop across it, to plate B of the 25Z5, to its cathode, back to the negative side of the line.

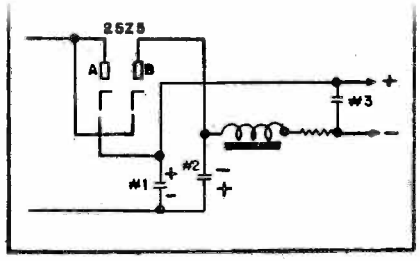


Fig. 4. Circuit of the rectifier and filter when receiver is operated from alternating current. This is a voltage-doubler circuit

The voltage developed across the speaker field is fed to the plates and screens of the tubes. The speaker field is shunted by condensers No. 2 and No. 3 in parallel, affording a large capacity reservoir. Plate A of the 25Z5 and condenser No. 1 do not function on d-c.

Voltage Doubling

The voltage-doubler circuit is shown in Fig. 4. This is the circuit when the switch is in the a-c. position. It works as follows: At some instant plate A of the 25Z5 is positive. Current will flow from it to its cathode through condenser No. 1 back to the negative side of the line. Condenser No. 1 is charged,

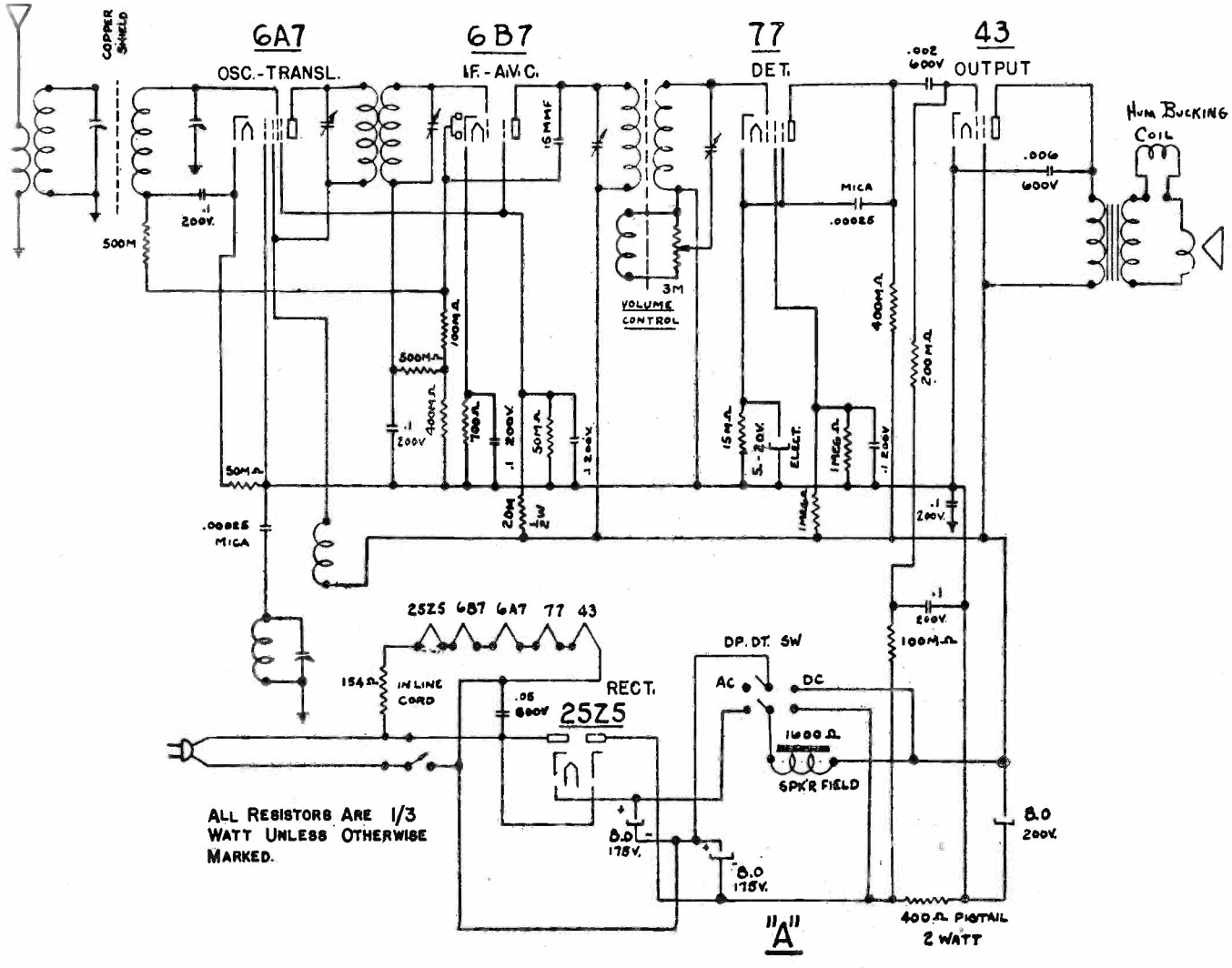


Fig. 1. Circuit diagram of the Colonial Universal chassis when stamped 128 "A"

COLONIAL 250, 279, 300 VOLTAGE DATA

Tubes	*Plate*	*Screen*	*Grid*	*Plate M.A.*	*Screen M.A.*
I-F., AVC	110	55	−7*	0.4	0.2
Detector	50	22	−1.5	0.1	0.04
Power	100	120	−10.*	26.0	5.00
Osc. Trans.	Ep=105 v. Eg#1=−5 v. Eg#2=105 v. Eg#3 & 5=55 v. Eg#4=*. Ip=2ma. Ig#2=1.3 ma. Ig#3 & 5=1.2 ma.				
Rectifier	Plate current=40 ma. per plate.				

Speaker field voltage = 70 volts.
* Indicates high series resistor.

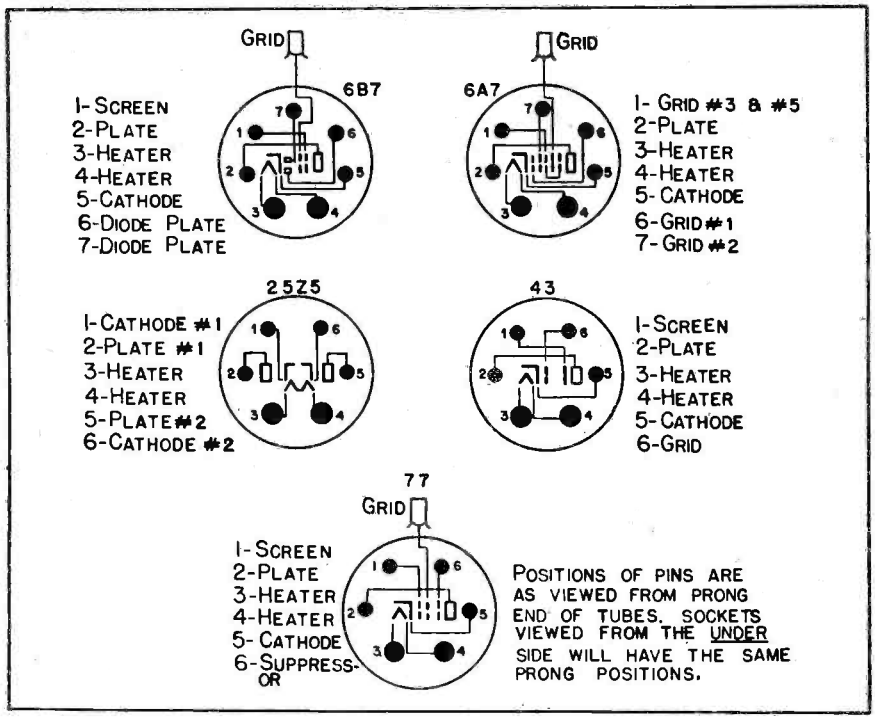


Fig. 6. Prong connections of the tubes used in the Colonial Models 250, 279 and 300 receivers. These connections are standard . . . keep them for reference

Voltage Data

All metal parts of the chassis (including the a-c., d-c. switch) are at high potential to ground. Do *not* attempt to attach a ground connection to the chassis, and do *not* touch the chassis while the line cord is plugged into an outlet.

The measurements given in the accompanying table were made with a 500-volt, 1,000 ohms per volt meter. Power supply 118 volts a-c. Measurements made with the set detuned and speaker field hot. Care should be used in taking readings with a set analyzer as the capacity of the cables may cause circuits to oscillate, giving rise to erratic readings. Usually, touching the finger to grid or plate is sufficient to stop oscillation.

Installing Philco Lazy X

It is often desirable to extend the length of the flat cable which connects the control cabinet with the speaker cabinet in the Lazy X models. An extension cable is available for this purpose in lengths of 25 feet. The extension cable can be obtained assembled with the plug on one end.

When using this assembly, the wires should be unsoldered from the plug at the end of the LZX cable and spliced to the ends of the corresponding wires at the end of the extension cable. The flat cable only without the plug is also available.

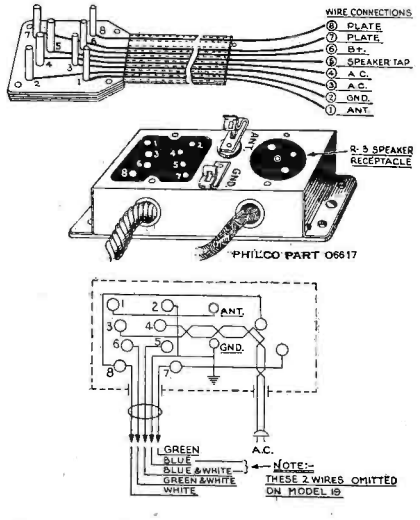
Extension Losses Eliminated

It is recommended that the total length of flat cable for any installation should be under 50 feet. There are certain losses introduced because of the close proximity of the aerial and ground wires in the cable. Up to 25 feet, the standard length supplied, this loss is not noticeable, but beyond this length the loss increases, and should be compensated for by increasing the length and the height of the outside antenna or by the installation of a Three-Purpose Antenna System such as made by Philco.

Another consideration when using more than 25 feet of cable is the excessive pick-up of man-made static originating in the house, which would call for the special antenna system mentioned.

There are two methods of connecting the Three-Purpose Antenna System to the LZX models, both of which will give equal performance. In the first method the transmission line from the Antenna Transformer is run direct to the radio cabinet on which the Set Transformer is mounted. Referring to the plug and cable illustration herewith, it will be noted that the ground and aerial wires through the flat cable are separated by a cord about the size of a wire. Lay the LZX cabinet on its side so that the chassis is in upright position on the floor. Looking from rear of chassis, first two wires from left of flat cable are antenna and ground connections, respectively. Slit the cable with a sharp knife so that enough of the "ANT" and "GND" lead is exposed to reach the Set Transformer. Cut first wire from left in cable and connect end coming from chassis to "ANT" terminal of Set Transformer. Second wire from left must not be cut, but should be bared and short lead spliced from bared section to "GND" terminal of Set Transformer. This connection should be soldered and taped. Connect red wire in transmission line to "RED" terminal on Antenna Transformer, and black wire to "BLK" terminal. The Set Transformer should then be mounted in position in receiver cabinet.

In the second method the transmission line from the Antenna Transformer runs to the speaker cabinet, and two of the wires through the flat cable are employed as a continuation of transmission line up to the radio cabinet, at which point the Set Transformer is mounted. In order to get a properly matched line through the flat cable and not lose all the advantage of the system up to this point, it is necessary to employ a different wire through the cable as the antenna. At present the antenna wire is separated from the ground wire by a tracer cord. When making the change the antenna wire should be adjacent to the ground wire through the cable. It is simply a case of interchanging the wires on the two sides of the cable to agree with the cable and plug drawings shown, where wires 1 and 2 become antenna and ground, and wires 7 and 8 become plate connections. The antenna wire is cut a few inches from the chassis for insertion of the Set Transformer just the same as the first case described above.



Showing alterations to be made for Lazy X cable extensions

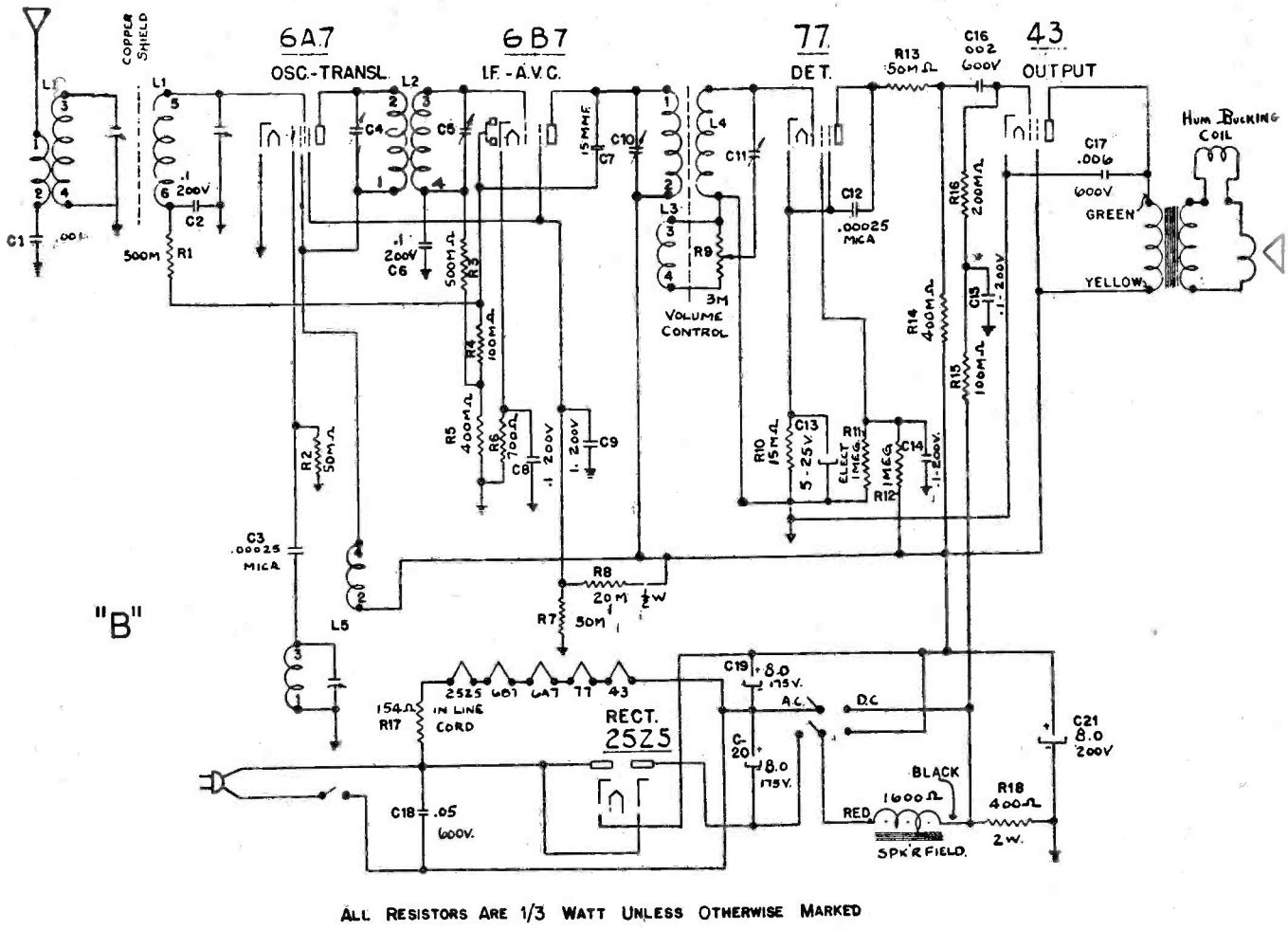


Fig. 2. Circuit diagram of the Colonial Universal chassis when stamped 128 "B"

then, to approximately the line voltage, with its polarity as indicated in the diagram. A half cycle later the other side of the line becomes positive. Current flows through condenser No. 2, charging it with polarity as shown, to plate B, to its cathode and back to the negative side of the line. The result is that condensers Nos. 1 and 2 are charged with their potentials in series so that the total voltage across them is approximately double the applied line voltage. This doubled voltage is filtered by the speaker field and condenser No. 3 and then fed to the plates and screens of the tubes.

The I-F. and AVC Circuit

The i-f. and AVC circuit is shown in Fig. 5. It is seen that the 6B7 tube is used for both of these functions. A portion of the i-f. signal voltage is applied from the pentode plate of the 6B7 through the 15-mmfd. condenser to the diode plates of the same tube. The diode current resulting flows through the 100,000-ohm and 400,000-ohm resistors, creating a voltage drop across them. Since the diode current flows from plate to cathode, the direction of the current through the resistors is from point A to point B, or, point A is positive with respect to point B. Since the cathode of the 6A7 (which functions as both mixer and oscillator) is connected to point A and the grid return is connected to point B, the mixer or translator grid of the 6A7 is biased negatively by the amount of the voltage drop across the 100,000-ohm and 400-000-ohm resistors. The amount of this drop is proportional to the strength of the i-f. signal. A portion of this drop (that across the 400,000-ohm resistor) is also applied to the grid of the 6B7. A strong signal increases the drop and thereby the negative grid bias on these tubes which in turn reduces their amplification. The amplification, then, varies inversely as the strength of the incoming signal so that the signal voltage at the i-f. output tends to remain constant. The residual (regular) bias for the 6A7 is furnished by the 50-ohm resistor in its cathode circuit. The 700-ohm resistor supplies residual bias for the 6B7.

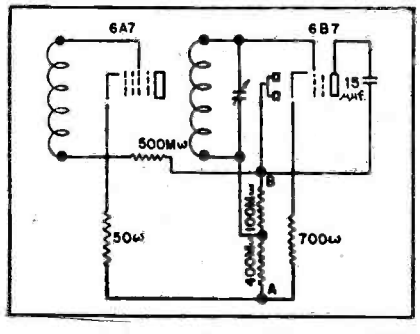


Fig. 5. Skeleton of the I-F. and AVC circuit, with 6A7 and 6B7 tubes

The AVC action thus brought about can be rendered inoperative, when peaking the i-f. transformers, by unsoldering one side of the 15-mmfd. coupling condenser. This condenser is mounted across the 6B7 socket and is marked C7 in the circuits of Figs. 1 and 2.

The four tuning-condenser adjustments for the i-f. transformers are accessible from the front of the chassis, two on the left side and two on the right. The two i-f. transformers are peaked at 175 kc.

Speaker Servicing

The speaker may be removed for replacement by taking off the 6B7 tube shield and removing the three speaker mounting screws. Be certain that the speaker leads color code, indicated in the diagram, is followed. Improper connection will cause excessive hum due to the hum-bucking coil's increasing hum instead of cancelling it out.

Speaker rattle may be due to the cone being off center. Loosen the center adjusting screw, insert four 1/8" wide strips of heavy writing paper between the pole piece and the inside of the voice coil, re-tighten the adjusting screw, and remove the paper spacing strips.

THE STORY OF RECEIVER DESIGN

Part V

THE audio amplifier is of considerable importance from the standpoint of fidelity, and under most circumstances requires careful design. Several types of distortion may be introduced and frequently prevail in the audio-frequency circuits. These types of distortion are as follows:

Types of Distortion

(1) Non-linear distortion, which sets up harmonics and sometimes produces new frequencies due to inter-modulation of some of the signal components. This particular form of distortion is due to a departure of the input-output characteristic from linearity—which is to say, generally, that the characteristic of the output does not conform with that of the input.

(2) Frequency distortion, which discriminates against or in favor of certain frequencies. Thus, a particular a-f. circuit may amplify to a greater degree frequencies around 1,000 cycles and amplify to a lesser degree frequencies around 100 cycles. This form of distortion is most commonly due to an improper choice of coupling and bypass elements.

(3) Overloading, which usually causes distortion through the introduction of harmonics. This is due to insufficient load capacity of the amplifier or some part of it—meaning that the equipment cannot handle the input voltage without being overloaded.

(4) Transients, which appear as "tweets," are caused by insufficiently damped resonant circuits in the amplifier.

While many of the older receivers and some of the modern midget sets employ only a single stage of audio amplification, two stages of audio are more common. Usually the first stage is resistance coupled to the detector and the second stage transformer coupled.

Load Requirements

To better understand the load capacity requirements, let us first design a simple two-stage audio amplifier. Suppose the total voltage available from the power supply is 300 volts, and it is desired to have a power output of 1.5 watts. This can, of course, be met by a single type '45 tube which until recently was the most popular tube for the power amplifier of high-fidelity receivers. We would then arrange to supply 250 volts to the plate of this '45 tube and about 50 volts to the grid. The output transformer would be chosen so that it would safely carry 35 milliamperes and would have an impedance ratio of 1700 ohms to, say, 15 ohms, if that were the voice-coil impedance of the dynamic speaker. Good design dictates that the power stage overload before the first stage of a-f. Therefore we must deliver a peak signal voltage *in excess of 50 volts* to the grid of the power tube; 80 peak volts should be adequate. With this arrangement there is no opportunity of the first a-f. tube overloading before the normal power output of the power tube is reached.

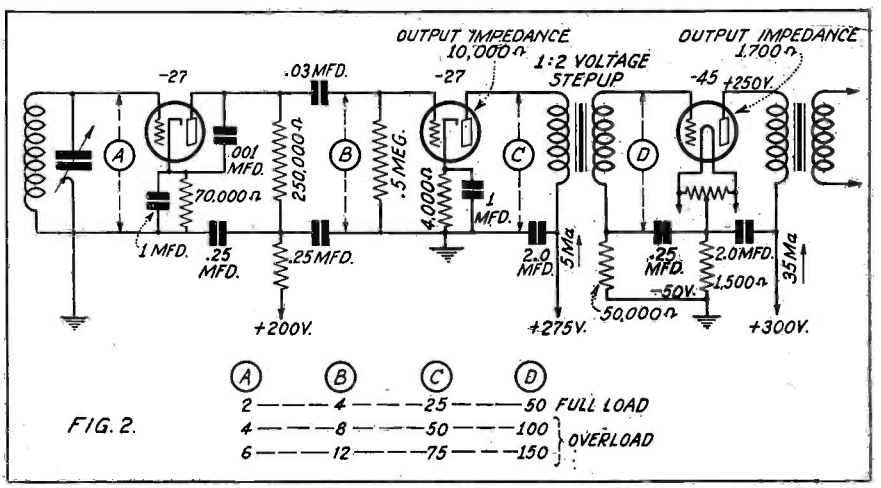


FIG. 2.

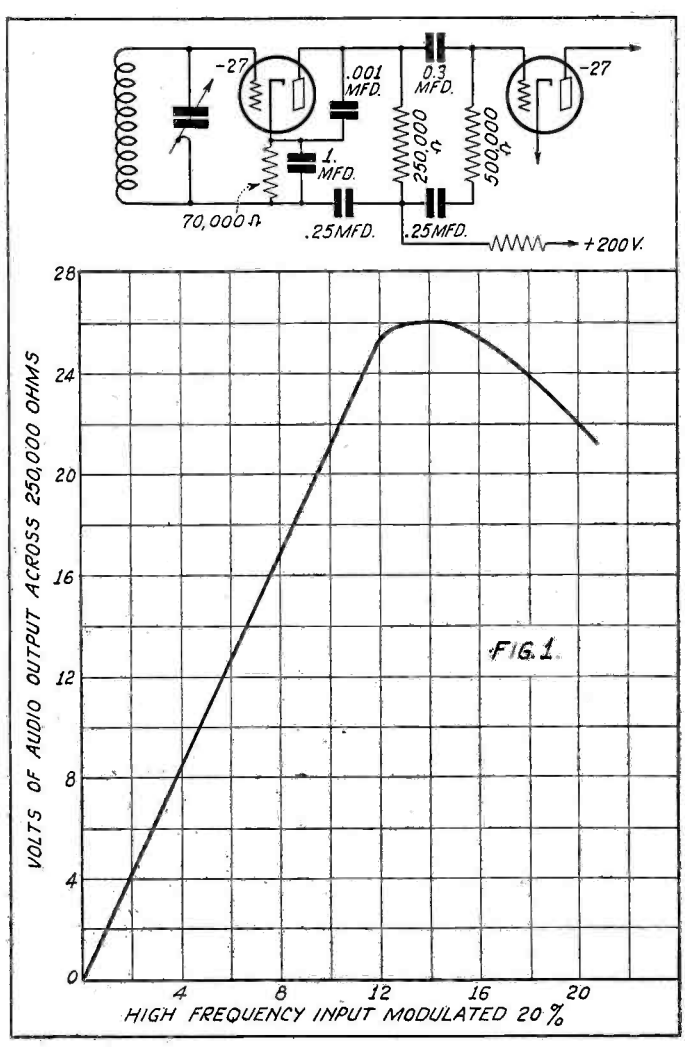
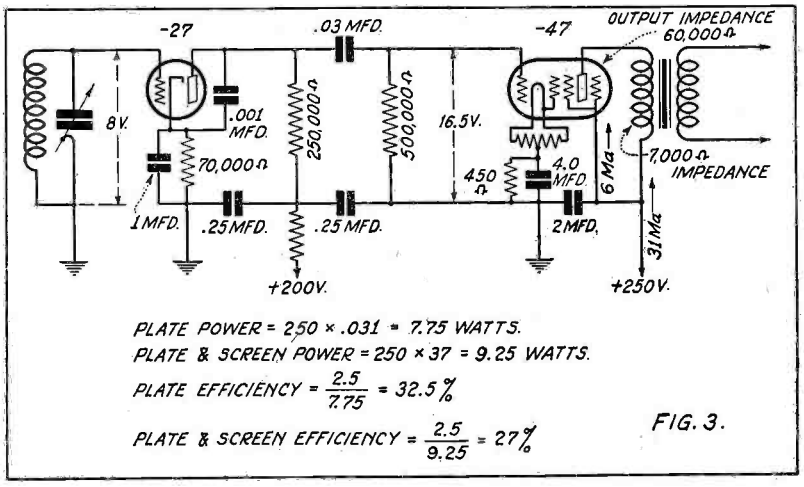


Fig. 1. (Left) The input-output characteristics of a type '27 tube used as a biased detector, with 20 per cent modulation of r-f. or i-f signal

Fig. 2. (Above) Circuit of amplifier designed to overload power tube before intermediate a-f. overload takes place. Table gives voltages at points A, B, C, and D

Voltage Step-up

For good quality a voltage step-up of something over 2 to 1 can be achieved in the interstage transformer. Therefore about 40 volts peak of signal must be delivered to the primary of the interstage transformer. A single '27 tube will be adequate to deliver this voltage without overload. This tube with 250 volts on the plate and 21 volts grid bias has an amplification factor of 9 and a plate impedance in the vicinity of 10,000 ohms. Since this tube is employed as a voltage amplifier, *its output impedance is not matched* by the interstage transformer, but instead the impedance of the primary of the transformer is made as high as possible consistent with good fidelity. Suppose the primary self inductance of the transformer is 80 henrys, a common value in high-fidelity



Circuit with pentode power tube which, because of the high amplification factor of the pentode, requires no intermediate audio stage and works direct from the detector

coils—then the impedance of the primary at 50 cycles is:

$Z = 2\pi FL = 6.28 \times 50 \times 80 =$ 25,000 ohms approximately. Therefore the voltage delivered by the '27 tube will divide between this impedance and the plate impedance of the tube. (See page 22, SERVICE, January, 1933.) Of course, the transformer is almost wholly an inductance and the plate impedance of the tube is a pure resistance, therefore treating the two as though both were resistance is not correct. However, for a quick check on the safe side this is justified. If we treat both as resistances the voltage developed across the primary of the transformer will be: $\frac{25{,}000}{25{,}000 + 10{,}000} = .7$ volt. That is, 70 per cent of the voltage delivered by the '27 tube will be applied to the primary. As a matter of actual fact, about 90 per cent of the delivered voltage will be applied to the transformer primary. While this matter is more of academic than practical interest it can be shown as follows: The total output impedance (i.e., tube and transformer in series) is:

$Z = \sqrt{(10{,}000)^2 + (25{,}000)^2} = \sqrt{725{,}000{,}000} = 27{,}000$ approximately. For simplicity suppose the developed voltage were 27 volts. Then one milliampere would flow. The voltage across the transformer primary would be 25 volts and: $\frac{25}{27} = .925$, or 92.5% if the voltage appears across the transformer. Thus we see that treating both as pure resistances simply gives us a greater factor of safety, which is desirable to allow for transformer losses, etc.

Thus, the voltage developed in the '27 tube must be: $\frac{40}{.7} = 57$ volts; say 60 volts. One-ninth of 60, or about 7 volts of audio must be applied to the grid of the tube. This is much below the bias (21 volts) and therefore satisfactory as the tube will not be overloaded.

CIRCUIT VOLTAGES

Fig. 1 shows the input-output characteristic of a '27 used as a biased detector when the high frequency (i.e., r-f. or i-f.) is modulated 20 per cent. Greater percentage modulation would of course produce greater outputs. Likewise a screen-grid tube would produce greater outputs for the same inputs. Fig. 2 shows the audio amplifier with sufficient voltages to produce overload in the output tube. We see from the table accompanying this diagram that 2 volts of carrier modulated 20 per cent will fully load the power amplifier tube without approaching overload in the detector or audio amplifier tubes. With 4 or 6 volts of carrier, the detector and amplifier tubes are still not overloaded, but the power tube is—the voltages in both cases greatly exceeding the power tube bias.

The self biases shown in Fig. 2 are arrived at by dividing the desired grid voltage by the plate current. The bypass condensers in the signal circuit must be small compared to the other circuit impedances. Thus, the 2-mfd. plate bypass condenser in the output circuit of the '45 will have an impedance of about 1600 ohms at 50 cycles and will therefore result in a loss of about 2 db. at this frequency. In general this is not serious.

PLATE EFFICIENCY

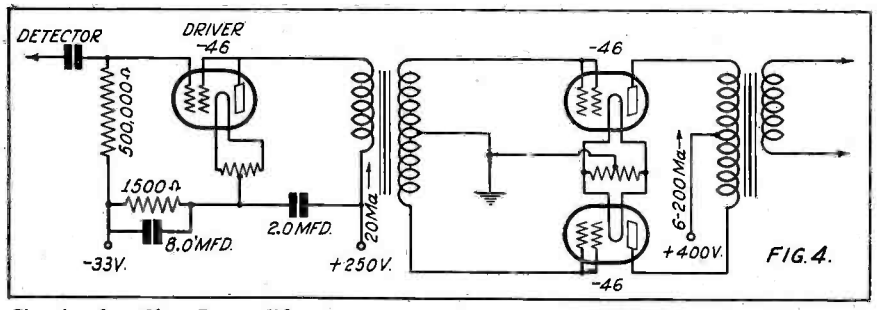
Now we notice that the plate efficiency of the '45 tube is only about 13 per cent. The plate efficiency is the ratio of the power delivered to the plate circuit of the tube (i.e., $300 \times .035 = 10.5$ watts) to the maximum audio power. This can be increased considerably and at the same time the first stage of a-f. may be omitted by the use of a power pentode in place of the '45. This increase is obtained at the expense of some non-linear distortion however. The '45 at full load has a harmonic output of 3 per cent or less, while a pentode may run 10 per cent harmonic or more. However, if this distortion does not exceed 7 per cent, it is not perceptible to the average person.

As we have said, a pentode may be operated directly from the detector—such as the detector shown in Fig. 1—and will deliver, in the case of the type '47, 2.5 watts with a plate efficiency of 32 per cent or plate and screen efficiency of 27 per cent. Other pentodes, such as the 59 and the 2A5, will deliver 3 watts with a correspondingly greater efficiency. The same power supply will also be sufficient for these tubes. The set input to supply 2.5 watts, i.e., to fully load the power stage, will be four times as great however, but to deliver 1.5 watts, only about twice as much input as for the '45, as of Fig. 2, would be required. This is shown in Fig. 3. Of course, if the first stage a-f. had been retained the amount of input for a given power output would be much less for the pentode as for the '45 tube.

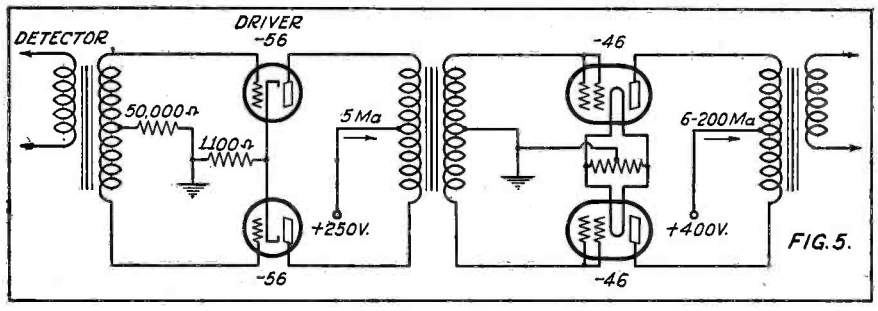
LOAD IMPEDANCES

While in the case of the '45 the output impedance of the tube was matched for maximum power output, in the case of the '47 a plate impedance of only 7,000 ohms is used to match a tube of 60,000 ohms impedance. In other words, the load impedance for a '45 tube is greater than the plate resistance of the tube and the load impedance for a pentode, such as the '47, is less than the plate impedance. With a lower load impedance for a pentode it is possible to obtain operation more nearly linear and therefore hold harmonic distortion within reasonable limits. At the same time it prevents the development of excessive voltages in the plate circuit.

It is essential that a load always be connected to a pentode when in use, otherwise very high voltages may develop in the plate circuit which might break down the output transformer. This is due to the high amplification factor of the tube, which is 150 for the '47 compared to only 3.5 for the '45. Suppose the load were disconnected and 16 volts signal applied to the grid of the '47. Then the voltage developed in the plate circuit would be $16 \times 150 = 2{,}400$ volts! As a rule, output transformers are insulated for 500 volts. It is obvious then, that without



Circuit of a Class B amplifier using one type 46 as a Class A driver and two type 46's in Class B connection, the two latter tubes operating at zero bias



Another Class B circuit, employing two 56's in Class A push-pull as drivers for the 46's. Typical voltage and current values are given

a load arcing might occur between windings or between primary and core. For this reason a resistance of about 15,000 ohms is often connected across the primary or secondary of the output transformer. Sometimes this is used in combination with a condenser for tone control or equalization.

Class B Amplification

About a year ago, Class B amplification (sometimes called push-push) was introduced and the type 46 tube was brought out for this purpose. This, as you know, is a two-grid tube and when used for Class B amplification the two grids are tied together. The tube can also be used for Class A amplification by tying one grid to the plate. One circuit for Class B amplification with type 46 tubes is shown in Fig. 4, and a more common one in Fig. 5.

The Class B amplifier may be defined as an amplifier in which the tubes are biased approximately to cutoff—that is, to the point where practically no plate current flows. When operated under such a condition of bias, a tube will amplify only that portion of the wave which tends to decrease the negative bias (i.e., to drive the grid more positive). Under such conditions, the plate current of the tube will consist of a series of pulses, each a somewhat distorted half-wave. These pulses will be separated by half-cycle intervals. When two such tubes are combined in the usual push-pull circuit arrangement, one will amplify one-half of the wave and the other tube the other half. Thus, each tube works half the time at high plate efficiency since appreciable direct current is drawn only when amplification occurs. The normal (Class A) amplifier has a constant plate current which is independent of the load. The Class B amplifier has a negligible plate current at no load or small loads and draws appreciable plate current only when signals are being amplified. In order to use a Class B amplifier to full advantage, the input signals at full load must drive the grid positive and thereby cause grid current to flow at the peaks of the input signal. If there is appreciable resistance in the grid circuit, this grid current will change the grid bias in the tube. This created bias will be in opposition to the signal wave and will therefore tend to reduce the amplification. Such a state of affairs will flatten the peaks of the signal wave and thus give rise to third and other odd harmonics which cannot be balanced out by the push-pull circuit arrangement.

It would appear that dry batteries might be used to supply grid bias to Class B amplifiers. However, due to grid current flow the batteries would eventually be damaged and become noisy. It is for this reason that the type 46 tube was designed to operate without bias when the two grids are tied together. What actually happens is that strapping the two grids together raises the amplification of the tube so high that very little space current flows at no bias.

Class B Transformers

The input and output transformers for Class B amplification must be designed specifically for this class of service. Thus, the input transformer steps down the voltage rather than stepping it up as it does in Class A work. The output transformer is in reality designed like two separate transformers and acts that way. The circuit of Fig. 4, while it has been used, was not particularly popular because the 46 driver, being of the filament type, introduced a-c. hum into the circuit which was amplified by both stages. This is the principal reason that 56 tubes were adopted for drivers. Either of the circuits of Figs. 4 and 5 will deliver a peak power of 20 watts with a plate dissipation of like amount, the operating plate efficiency at full load then being 50 per cent. Actually plate efficiencies as high as 70 per cent have been realized in this class of amplifier.

Considerable care must be exercised *to prevent short circuits in the output transformer or load* when the amplifier is operating. Otherwise all the power delivered will be dissipated in the tubes, since no power can be dissipated in a zero resistance load, and the tubes will burn up in short order. Of course, the same condition exists in connection with any power tubes, but the dissipation is usually much smaller. In any case, if the power is not dissipated in the loudspeaker, it will be dissipated in the tube or tubes in the form of heat.

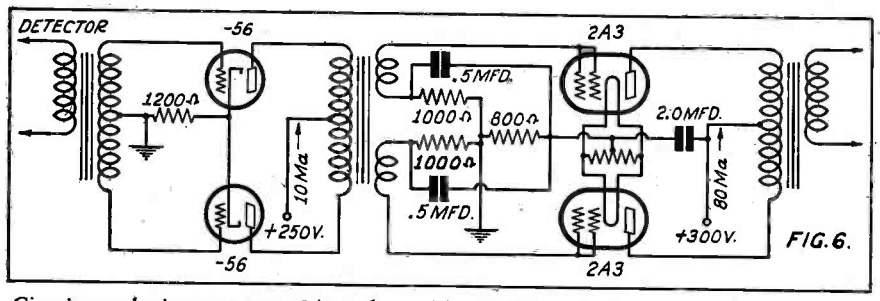
In most cases (special use of the type 53 tube being one exception) mercury-vapor rectifiers such as the 82 and 83, and low-resistance chokes, must be used in the power supply of Class B amplifiers to provide the necessary regulation; otherwise distortion of the output results and the fluctuating plate current of the last stage may couple through the power supply to the rest of the receiver and cause motorboating.

Semi-Class B Amplifier Tubes

Fig. 6 shows a common type of Class A push-pull audio amplifier circuit, but using most uncommon tubes—the new type 2A3—and intended to deliver 15 watts. Actually the tubes operate as Class A amplifiers (i.e., no grid current and no variation of plate current with signal) up to about 6 watts and beyond this as a sort of hybrid between Class A and Class B. At full load the plate efficiency of the last stage is about 65 per cent. Up to 6 watts the harmonic content is very low but at 15 watts it may rise to about 7 per cent, which is still not serious. The output impedance of the power stage is matched at the combined tube plate impedance of 5,000 ohms (2,500 ohms per tube). This type of amplifier is found only in modern receivers and represents the best design combining high fidelity with high efficiency and high power output. The push-pull connection balances out all second and other even order harmonics, the operation being very similar to that described for the circuit of Fig. 2. Because of the extremely low plate resistance of the type 2A3 tube (765 ohms) and correspondingly high mutual conductance (5,500 micromhos) it is necessary to obtain a pair of well-matched tubes for a push-pull amplifier if a balanced output is to be expected. It becomes readily apparent that a slight difference in plate resistance will mean quite a large difference in mutual conductance.

Class A Prime

A type of amplifier, sometimes called Class A prime, has been used in some receivers, usually with type '45 tubes in push-pull connection. It is a hybrid circuit partaking of the characteristics of both Class A and Class B. It differs in that the tubes are biased about half-way between the normal Class A bias and complete cutoff (Class B). The tubes draw no grid current. Self bias is not always employed but a separate and fairly



Circuit employing two type 2A3 tubes, with self bias, which operate as semi-Class B tubes at high power

constant voltage is used as C-bias. The plate current fluctuates somewhat as in Class B. Its principal advantage lies in high power output and high plate efficiency with fidelity between that of Class A and Class B in most cases. The new 2A3 tubes perform the same function with better efficiency and less distortion. In the circuit of Fig. 6 self-bias is used. With this arrangement the power output is 10 watts. With fixed bias the output is 15 watts.

G. S. GRANGER.

(To Be Continued)

•

Howard J-3 Super

The Model J-3 chassis is used in the "Compact." This receiver covers the usual broadcast frequencies and also the police bands. A glance at the diagram will show that the input is changed from the broadcast band to the police band by means of a switch which throws out one set of coils and throws in another set.

The first detector and i-f. tubes are the type 78, the second detector a type 77. These tubes, as well as the type 37 oscillator and the type 84 full-wave rectifier, have their heaters connected in parallel and connected to a common winding on the power transformer. This is made possible with the type 84 tube because the heater is separate from the cathode. A separate heater winding is used for the type 43 power pentode, as this tube has a 25-volt heater.

The i-f. in this receiver is peaked at 456 kc. The i-f. transformer in the output circuit of the i-f. tube appears to be a single coil in the diagram, but is in reality a closely coupled transformer with the secondary untuned.

Note that voltage readings are given on the diagram, the reading in each case being in a dotted line box. These are the voltages as measured from ground to the various points and should be taken with volume control full on and with a line voltage of 115.

The circuit shown applies only to those receivers with serial numbers from 225,525 to 225,028. In receivers having serial numbers above 226,028, the screen of the second detector tube is connected to the plate through a 500,000-ohm resistor, and the reading is 11 volts instead of 38 volts as in the diagram shown. Furthermore, this screen is bypassed directly to ground through an 0.1 mfd. condenser rather than the 4 mfd., 40-volt electrolytic condenser in the diagram. Also the lead from this point in the diagram to the connection between the 30,000-ohm resistor and the volume control is eliminated. In other words, the screen-grid lead is removed from the volume control.

•

Sparton Models 27, 27-A and 28

For operation on 25-cycle lines the following changes are made in the 60-cycle diagram of Models 27, 27-A and 28.

In the 25-cycle receivers the 4-mfd., 550-volt filter condenser (A-8123-1) is paralleled with another identical condenser.

The 5-mfd., 450-volt filter condenser (A-6611-A) connected from rectifier tube filaments to end of filter choke coil (A-8572) is removed. The 0.5-mfd., 200-volt condenser (A-8552) shunted across filter choke coil (A-8572) is replaced with a 2-mfd., 200-volt condenser (A-8895). Power transformer (B-4922) is replaced with *both* Power Transformers (B-4922-25) and Filament Transformer (A-8702).

•

Clarion Note

The Clarion Model 320 five-tube midget, Model 321 five-tube console and Model 300 fourteen-tube console, occasionally go dead for no apparent reason, the cause being the tube shield touching the control-grid cap of r-f. or i-f. tubes, although the later production of these sets and subsequent models were constructed with a piece of fish paper insulation included in the top of the tube shields.

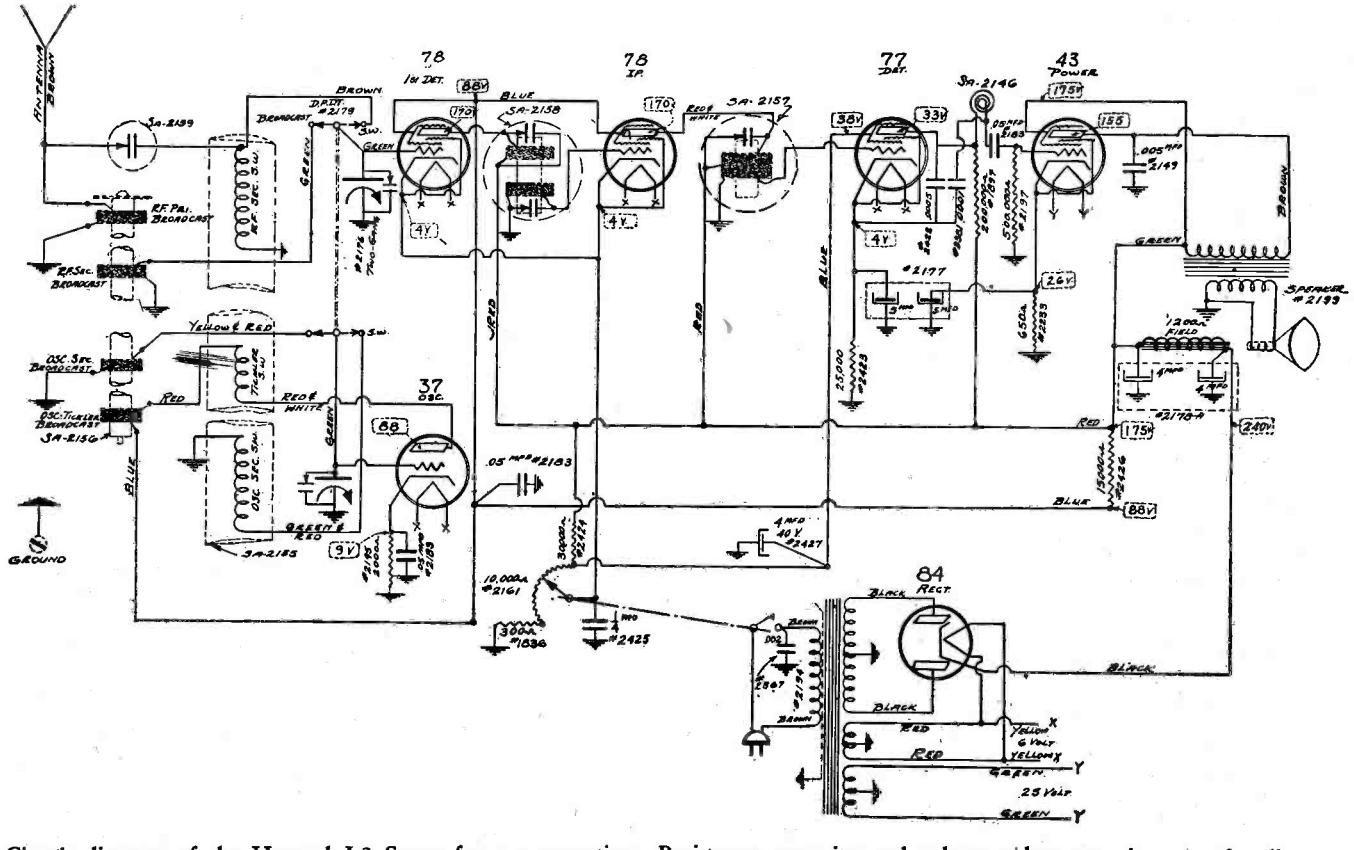
The first type 57 and 58 Arcturus tubes were shorter in length than later productions by perhaps a quarter of an inch, and these later, longer tubes permit this trouble to develop.

•

Socket Layout Diagrams

United Motors Service are to be congratulated on their clever schematic diagrams. Instead of drawing their tubes in symbolic form, they sketch the whole socket, showing the prong connections as well as the element connections to each prong.

This manner of sketching the tube and socket right in the diagram provides the maximum amount of convenience for the Service Man who can tell at a glance just what terminal is which without having to refer to a separate chart of tube connections.



Circuit diagram of the Howard J-3 Super for a-c. operation. Resistance, capacity and voltage values are given on the diagram

TABLE OF I-F PEAK FREQUENCIES

ALL-AMERICAN MOHAWK

Model	I-F. Peak
S-7	175
S-8	175
SW-8	485
S-10	175
S-50	175
S-63	175
SA-65	175
DC-65	175
B-80	175
S-80	175
SW-80	485
SA-90	175
SA-91	175
SA-110	175
SA-130	175
U-55	485

ALLIED RADIO

Model	I-F. Peak
Knight 118 AVC Super 1930	175
Knight 6 tube	175
Knight E-9830	177.5
Knight E-9831	177.5
Knight 12 tube Class B	177.5
Knight 7 tube	175
P	175

ATWATER KENT

Model	I-F. Peak
72 Chassis H-1, H-2	130
80, 80-F	130
83, 83-F	130
82-D	130
82, 82-F	130
82-Q	130
84-D	130
84, 84-F	130
84-Q	130
85, 85-F	130
85-Q	130
86, 86-F	130
87	130
87-D	130
89, 89-F, 89-P	130
90, 90-F	130
91-B, 91-C, 91	260
92	130
92-F	130
93	1,000
94, 94-F	130
96	130
96-F	130
99	130
99-F, 99-P	130
188, 188-F	130
228	130
228-F	130
228-D	130
228-Q	130
246	262.5
260, 260-F	130
469, 469-F	130
480	472.5
469-D	130
558-D	130
469-Q	130
558-Q	130
567, 567-F	130
558	130
612	130
627	130
812	130
155	262.5
636	262.5
756, 756-B	262.5

AUDIOLA RADIO

Model	I-F. Peak
1931 Super	175
7 Tube Super Pent. '31	177.5
8 Tube Super Pent. '31	177.5
9 Tube Super Pent. '31	177.5
9-T-45	177.5
10 Tube Super	177.5
23-S-12	177.5

BELMONT RADIO

Model	I-F. Peak
525	456
All others	175

BRUNSWICK RADIO

Model	I-F. Peak
3 NC 8	180
5 NC 8	180
3 NW 8	180
11, 12, 16, 33-AC	175
17, 24, 25	175

BULOVA WATCH

Model	I-F. Peak
M-701	175
G-781	175
C-751	175

COLONIAL RADIO

Model	I-F. Peak
44	175
47, 48	175
50	175
51	175
52	175
55	1,000
56	175
62	175
69	175
71	175
73	175
76	175
T-345	175
C-399	175
T-397	175
C-495	175
C-595	175
C-695	175
C-995	175

COLUMBIA PHONOGRAPH

Model	I-F. Peak
32, 34	175
C-80-A	175
C-80-B	175
C-800	175
C-90	175
120-B	175

CROSLEY RADIO

Model	I-F. Peak
96	181.5
120	175
122	175
123	175
124	175
124-1	175
125	175
126	175
126-1	175
127	175
127-1	175
128	175
129	181.5
131	175
129-1	181.5
132-1	181.5
133	181.5
134	181.5
134-1	181.5
135	181.5
136-1	181.5
137	181.5
141	181.5
146	181.5
146-1	181.5
148	456
150	181.5
155	456
156	456
157	181.5
158	181.5
160	181.5
163	456
154	456

DELCO APPLIANCE

Model	I-F. Peak
RB-1	175
RC-1	175

DEWALD RADIO

Model	I-F. Peak
AC-746-7M	175
BAH	175

ECHOPHONE RADIO

Model	I-F. Peak
S-5	175
5	175
14	175
10, 15, 20	175
16, 17, 18	175
12, 38	175
35, 36	175
50	175
60	175
70	175
80	175
90	175

ERLA

Model	I-F. Peak
81, 82 (245)	175
81-P, 82-P, 30	175
61, 62, 63	175

EMERSON RADIO

Model	I-F. Peak
JS	175
KS	175
AW-55	445
CS	175
M-AC-7	175
H-5	172.5
B-AC-10	175

FADA

Model	I-F. Peak
45, 45-Z (KU)	175
48, 49 (KW)	175
51 (KO)	175
53, 57 (KOC)	175
55 (RG)	175
66 (KY)	175
73, 85 (RE)	175
74, 76, 83, 88, 89 (RA)	175
78, 79 (RC)	175
101 (RK)	175
RN	470

FEDERATED PURCHASER

Model	I-F. Peak
31-40	175

FREED RADIO & TELEVISION

Model	I-F. Peak
51 DC	175
58 AC	175
72,74, MB-7	175

JESSE FRENCH & SONS

Model	I-F. Peak
U-1	175

GENERAL MOTORS

Model	I-F. Peak
216, 217, 219, 250 (S-1A, S-1B)	175
251 (S-2A, S-2B)	175
252 to 258 inclusive	175
211	175
220	175
281	535

A. H. GREBE

Model	I-F. Peak
HS-3	175
HS-4	175
HS-5	175
HS-6	175
HS-7	175
HS-8	175
HS-12	175

GRIGSBY GRUNOW

Model	I-F. Peak
20, 21, 22, 23	175
50, 52	175
60, 61, 62	175
160, 163	175
15, 15-B	175
25	175
25-B	175
35, 351, 353	175
55	175
120	175
150	175
200	175
210	175
220	175

GRIGSBY GRUNOW (Continued)

Model	I-F. Peak
10	1,000
290	175
300	175
310-A	175
310-B	175
320	175
330	175
340	175
360	175
370	456
390	175
400	456

GULBRANSEN

Model	I-F. Peak
13	175
23	175
20	175
10	175
92, 93	175
352	262
53	175
322	175
362	262

HAMMARLUND

Model	I-F. Peak
Comet Dec. '31	465
Comet July '32	465
Comet Pro	465
Comet All-Wave	465

H. H. HORN

Model	I-F. Peak
59, 69, 90	175
70, 71	175
101-B, 102	175
101, 110	175

HOWARD RADIO

Model	I-F. Peak
35, 40 (H)	175
45, 60 (AVH)	175
20, 25, 30, 32 (O)	175
420	175
M	175
400 Chassis K	175
5-3	456
EX	140
A (SW Converter)	680
35-A	175

INTERNATIONAL RADIO

Model	I-F. Peak
JS	175
KS	175
AW-55	445
CS	175

JACKSON BELL

Model	I-F. Peak
205	465
25	175
27	175
28	175
29	175
33	840

COLIN B. KENNEDY

Model	I-F. Peak
52	175
53-SW	1,000
54-SW	1,000
54	1,525
56	175
62	175
62-A	175
882-62D	175
563-A	175
64	175
164-B	175
882-64C	175
66, 66-A	175
266-B, 366-B	175

KOLSTER RADIO

Model	I-F. Peak
K-60, K-62, K-70, K-72	175
K-80, K-82	175
K-90, K-92	175
K-63, K-73, K-103	175
K-110, K-120, K-122	175
K-133, K-143	175
K-130, K-132	175
K-113, K-123	175
K-140, K-142	175
K-83, K-93, K-114	175

LANG RADIO

Model	I-F. Peak
SA-7	175
SA-8	175
MA-8	175
MD-8	175
MA-7	175
MD-7	175

C. R. LEUTZ

Model	I-F. Peak
C-10	47

MID-WEST RADIO

Model	I-F. Peak
Miraco Pentode 11-Tube Super	175

MONTGOMERY WARD

Model	I-F. Peak
62-11, 62-12, 62-14, 62-27, 62-19	175
62-20, 62-20X (62-25)	175
62-22, 62-30 (62-21)	262
13, 15, 16X, 16, 17, 18, 18X	262
1111 (62-1611)	175
811 (62-1711)	175
1238 (62-1838)	262
1355 (62-1955)	262
62-29 (11-12)	175
62-38, 62-40, 62-50	262
Auto Radio	262
17	175
62-1, 62-2	175
62-7, 62-8	175
62-9	175

NATIONAL CO.

Model	I-F. Peak
AGS	500

NORCO MFG. CO.

Model	I-F. Peak
4 Super	250

OZARKA

Model	I-F. Peak
93	175
93-A	175
93-B	175
94-AVC	175

PACKARD

Model	I-F. Peak
4 Tube Super 5	465

PATTERSON RADIO

Model	I-F. Peak
70-AW, 107-AW, 207-AW, 210-AW	262

PHILCO

Model	I-F. Peak
7	175
8, 12	175
5	460
4	1,000
15	175
35	260
43	450
51, 51-A	175
53	450
37	175
48	175
71	260
80	450
81	460
14, 91	260
70, 70-A	260
270, 270-A	260
89, 19	260
90, 90-A	175
90, 90-A (with 2-47's)	260
91 (121-221)	260
22-L	260
23-X	260
47DC (121-221)	260
111, 111-A	175
211, 211-A	175
112, 112-A	175
212, 212-A	175
470, 470-A (SW-IF)	1,000
(Broadcast IF)	260
490 (SW-IF)	1,000
(Broadcast IF)	175
116,116-A	175

PILOT RADIO

Model	I-F. Peak
39	115
41	115
S-148, S-164	175
C-162, C-165	175
SW Converter	550
1010	115
C-153, C-154	175
11	115
B-2	456
81	482
D-3	456

PLAZA MUSIC

Model	I-F. Peak
5-Tube Super	456
711 Super	175
6 Tube Long Wave	175
7 Tube Super	175

RADIO CHASSIS

Model	I-F. Peak
LSA 37	175
AC-36	175
QAC-36	175
LSA-36	175

RCA VICTOR

Model	I-F. Peak
R-4, R-6	175
R-7, R-9	175
R-7A	175
R-8, R-12	175
R-10	175
R-11	175
RE-18	175
RE-19	175
RE-20	175
R-21	175
RO-23 (SW IF)	1,075
(Broadcast IF)	175
RAE-26	175
R-28	175
M-30	175
P-31	175
M-34	175
R-37, R-38	175
RE-40	175
R-43	175
R-50, R-55	175
RAE-59	175
R-51	180
62	180
64	180
66	175
R-71, R-72	175
R-71-B	175
R-73, R-74, R-75, R-76	175
R-77	175
R-78	175
RAE-79	175
80	175
RE-81	175
82	175
RAE-84	175
R-90	175
SW Adaptor	1,000
SWA-2	1,075

REMLER CO. LTD.

Model	I-F. Peak
Best "115KC"	115
10	180
19	180
15	180
21	180
10-3	250
15-3	180
17	180
21-3	250
26	450

RADIOTROPE

Model	I-F. Peak
70-R	262
71-R, 72-R, 73-R	262

SCOTT LABS

Model	I-F. Peak
All-Wave Super	470

SEARS-ROEBUCK

Model	I-F. Peak
1320, 1322, 1324	175
1430	175

SEARS-ROEBUCK (Continued)

Model	I-F. Peak
1462	175
1480, 1482, 1484	175
1600	1,000
1580, 1582, 1584	175
1570, 1572, 1574	175
1590, 1592	175
1630	175
1640	175
1390, 1400, 1402, 1404, 1406	175

SENTINEL RADIO

Model	I-F. Peak
108	175
109	175
108-A, 110	175
114	175
261	175
513	175
550	175
560, 561	265
614	175
106-B	175

SILVER-MARSHALL

Model	I-F. Peak
36-A	175
Bearcat Midget	175
714	175
716, 683	175
724	175
726	175
727	465
728	175
738	1,000
739	650
773	175
A	175
F	175
B	175
C	175
D, E	175
G	175
J	175
R	175
V	175

SIMPLEX RADIO

Model	I-F. Peak
K	175
J	175
L	175
N	175
P	175
Q	175

SONORA

Model	I-F. Peak
70	262
71, 72, 73	262
84, 85	262
86, 87	262

SPARKS-WITHINGTON

Model	I-F. Peak
10	172.5
12	172.5
14	172.5
15	172.5
16, 16-AW	172.5
18	172.5
25, 26	172.5
26-AW	172.5
27	172.5
27-A	172.5
30	172.5
34	172.5
45	172.5
56	172.5

STEINITE RADIO

Model	I-F. Peak
203, 600, 605, 630, 635, 642, 643	175
700, 705, 706, 725, 642-B	175

STEWART-WARNER

Model	I-F. Peak
102-A, B & E	177.5
R-102-A, B & E	177.5
R-104-A, B & E	177.5
105 (SW IF)	1,525
(Broadcast IF)	177.5
1090 to 1099	177.5

STROMBERG-CARLSON

Model	I-F. Peak
19, 20	175
22, 22-A	175
25, 26	175
27	175
29	175
37	175
38, 39, 40	175
48, 49, 50, 51	175

TRANSFORMER CORP. OF AMERICA

Model	I-F. Peak
AC 80, 81, 90	175
90-A, 91	175
AC 84, 85	175
AC 94, 25-94	175
AC 100	175
120-139	175
AC 160, 25-160	175
200	600, 1,000, 1,500
220	175
240	490
260	175
280	175
300	175
320	175
340	175
420	175

TRAV-LER RADIO

Model	I-F. Peak
S-9	175
S-8	175

UNITED AMERICAN BOSCH

Model	I-F. Peak
10	175
20-J, 20-K, 20-L	175
31, 32	175
36, 37	175
40, 41	175
91, 92	175
100 Auto	175
108	175
236, 237	175
242, 243	175
250, 251	175
260, 261	517.5
305-A	456
312, 313	175

UNITED MOTORS SERVICE

Model	I-F. Peak
2035	262

U. S. RADIO & TELEVISION

Model	I-F. Peak
5-A	455
7	262
7-D	455
8	262
10	262
10-C	262
9, 19	262
12, 120	262
24	455
25	455
69	262
99	262
1006, 1007	262
3040, 3056	455
112-A	1,000

WARE

Model	I-F. Peak
SB-45	175
SBA	175
SBB	175
S-1	175
SBF	175

WELLS-GARDNER

Model	I-F. Peak
022	175
052	262
062	262
092	175
92, 93	175
502	175
572	175

WHOLESALE RADIO SERVICE

Model	I-F. Peak
10	175
20	175
L-1	175
L-20	262
80-M, 80-MA	175
Auto Radio	262

WILCOX-GAY

Model	I-F. Peak
2-S-5	175
2-T-5	175
2-VA-7	175
3-D-5	175

ZENITH RADIO

Model	I-F. Peak
91, 92	175
AH, CH, RH	175
BH	175
LH, WH, MH	175
103	175
210-5, 211-5, 270-5	125
210, 220	175
230, 240, 245	175
250, 260, 272 (SW-IF)	1,000
(Broadcast IF)	175
410, 411, 420	175
430, 440	175
500, 501, 503, 514, 515, 600	175
604, 606, 610, 616, 618	175
701	456

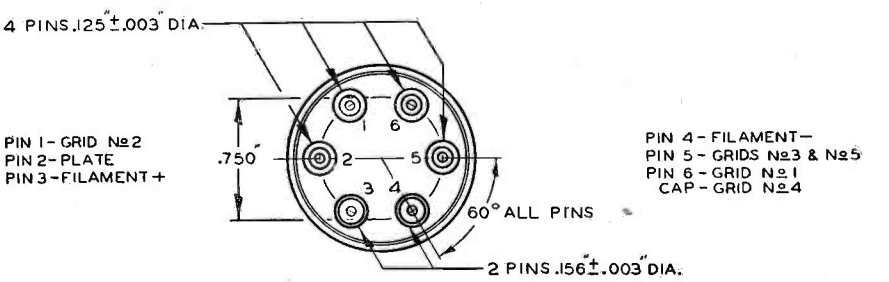
Type 1A6 Tube

RCA Radiotron and E. T. Cunningham have introduced the type 1A6 tube which is the battery version of the Pentagrid Converter tube for superheterodynes known as the 2A7 for standard a-c. receivers and as 6A7 for universal receivers and auto-radio sets.

The filament of the 1A6 draws 0.060 ampere at 2 volts. Since there is no cathode as in a heater-type tube, the base has only 6 pins rather than 7 as do the types 2A7 and 6A7 tubes. The base is the new small type.

As you will recall, this type of tube functions both as the oscillator (of the electron-coupled type) and as mixer or first detector. This latter function is in a sense a translation and for this reason the first detector or mixer is now being called the translator.

The pin connections for the 1A6 are shown in the accompanying sketch.



Bottom view of base for the type 1A6 tube, and pin connection designations. This is a small 6-pin base

Supreme Model 333 Analyzer

The Model 333 Analyzer is designed for complete point-to-point analysis, as will be noted from the accompanying schematic diagram, and is adaptable to the rapid changes in tube terminal arrangements. Beside these points, any circuit may be taken as the reference circuit for voltage or resistance measurements.

Many analyzers provide the possibility of only two reference circuits for connecting the self-contained 4.5-volt battery to only (1) a control grid and to (2) a normal grid circuit. The Model 333 enables battery connections to any one of seven possible grid circuits for tube tests with operative radios. At the same time, this arrangement enables complete resistance analysis of all of the circuits of any tube socket directly from the panel. Any one of the circuits may be taken as a reference point for resistance measurements, or the radio chassis or ground may be taken as the reference point.

Meter Ranges

A two-gang, four-position rotary switch is utilized for selectively connecting the meter for the following ranges:

6 d-c. milliampere ranges of 0/2.5, 0/10, 0/25, 0/100, 0/250, 0/1,000 ma.

6 a-c. voltage ranges of 0/2.5, 0/10, 0/25, 0/100, 0/250, 0/1,000 volts.

3 capacity ranges of 0/0.1, 0/1.0, 0/10.0 mfds.

6 d-c. voltage ranges of 0/2.5, 0/10, 0/25, 0/100, 0/250, 0/1,000 volts.

4 resistance ranges of 0/1,000, 0/10,000, 0/100,000, 0/1,000,000 ohms.

A new circuit is employed for compensating the effects of temperature and other variations of the full-wave rectifier unit and for utilizing a single d'Arsonval meter for a-c. and d-c. measurements on a single uniform scale without the confusion of offset scales or of scales with crowded divisions at the lower end. The meter circuit is so designed that R.M.S. values cannot be inadvertently read as average d-c. values or vice versa; a-c. potentials will not register on the meter when it is set for d-c. measurements, and d-c. potentials will not register on the meter when it is set for a-c. measurements. The a-c. functions of the tester are calibrated for 60-cycle power supply and the impedances worked out on this basis.

Uniform Reading System

The unique feature of this analyzer is the method employed for effecting a-c. potential and capacitive measurements on the uniformly-divided d'Arsonval scale of the meter. The varying characteristics of the crystalline rectifiers are such that it is usually necessary to have separately calibrated scales for a-c. measurements. The varying characteristics correspond to the "current density" characteristics, in which the internal resistance increases with decreasing current values, so that the total resistance of the metering circuit is not constant for all measurements on any one range, but increases if the meter current decreases. The markings of the a-c. scales of meters which utilize rectifiers are consequently "bunched" or crowded on the left side. Such readings are made to fall on the uniformly-divided scale of the Model 333 by employing a form of impedance circuit instead of the usual resistive circuit for a-c. measurements. For the 5-volt measuring range, a series capacitor (C5 in diagram), is utilized as a multiplier reactor instead of the usual procedure of using a multiplier resistor. The impedance of the 5-volt measuring circuit is, therefore, vectorially represented by a right-angled triangle in which the internal resistance of the rectifier combined with the internal resistance of the meter constitutes one leg of the triangle, the impedance of the capacitor constitutes the other leg of the triangle and the hypotenuse represents the resulting impedance. Since the variable resistance leg is very short in comparison to the capacitive leg, the current density variations which affect the resistance leg have a comparatively negligible effect upon the length of the hypotenuse, so that the variations in the resistance of the rectifier corresponding to the variations in the current density load are made to have a negligible effect upon the total impedance of the circuit. It is therefore possible to cause a-c. values to fall very close to a uniform scale distribution, the actual variations, it is said, being less than 5 per cent under the worst conditions encountered; namely, on the lowest measuring range of the meter.

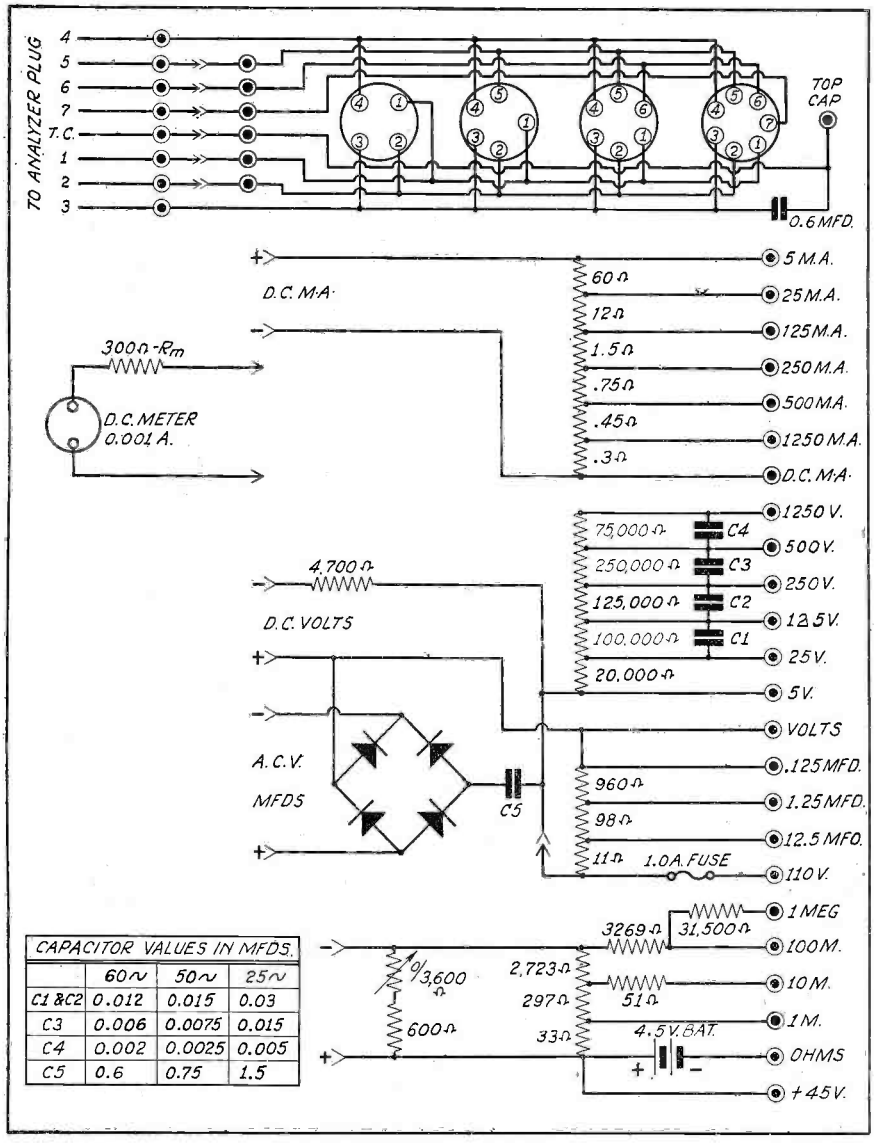
Jumper System

The method used for making the proper connections of the meter to the analyzer cable circuits and its tester is practically identical to the method employed in the Model 56 Analyzer—in other words, a form of jumper system.

The reference numbers on the leads of the analyzer plug in the diagram follow the standard RMA system for designating tube terminals. These numbers appear on the panel of the analyzer.

Philco Model 57 A-C. Midget

This is a four-tube superheterodyne receiver, combining standard broadcast and police reception, the same circuit being used for both bands. The switch (6) in the dia-



CAPACITOR VALUES IN MFDS.			
	60~	50~	25~
C1 & C2	0.012	0.015	0.03
C3	0.006	0.0075	0.015
C4	0.002	0.0025	0.005
C5	0.6	0.75	1.5

Circuit diagram and values of condensers and resistors for the new Supreme Model 333 Analyzer

gram is for the purpose of changing from broadcast to police reception. It merely throws a fixed condenser in shunt with a portion of the secondary of the antenna transformer when in the closed position.

It should be noted that the first type 77 tube is employed as combined mixer and oscillator. This tube feeds an i-f. transformer peaked at 460 kc. which is coupled directly to the second detector, another type 77 tube which has an exceedingly high gain in comparison to similar tubes. Note that this second detector, operating at i-f., is also regenerative, the feedback being through the adjustable condenser (19) coupled to a tickler coil which is a part of the secondary of the i-f. transformer. At the upper end of the secondary coil there is coupled an open-end coil. This functions partly as a grid condenser.

The output of the type 77 second detector tube is resistance coupled to a type 42 power pentode. This power tube receives its bias from the drop across resistor (32).

The resistor (22) in the plate circuit of the second detector tube functions as an i-f. choke. It has a value of 10,000 ohms as indicated in the table accompanying the diagram. This resistive choke is bypassed to ground by condenser (23)-A and the combination of the two keep i-f. out of the grid circuit of the power tube.

Capacity (A) in the antenna-cathode circuit is obtained by a pair of twisted wires.

Adjusting Condensers

The oscillator padding condensers (12) and (15), the i-f. transformer trimmer condenser (18) and the regeneration control condenser (19) may all be reached for adjustment through holes along the back of the chassis base. When viewing the back of the chassis the first condenser hole to the left is (12), the next is (15), the third is (18) and the last hole is (19). Trimmer condensers (4) and (14) are on the ganged tuning condenser assembly.

Test Data

All the readings given in the accompanying table were taken from the underside of the chassis, using test prods and leads with a suitable a-c. voltmeter for filament voltages, and a high-resistance, multi-range d-c. voltmeter for all other readings. The volume control should be set at maximum and station selector turned to low frequency end. Readings taken with a radio set tester with plug-in adapter will *not* be satisfactory.

Point-to-point resistance and capacity measurements—if made in preference to voltage measurements—should be carried out in the same manner, with ohmmeter, capacity meter and test prods. All values of resistance and capacity are included in the diagram for this specific purpose.

The power consumption of the Model 57 is 46 watts.

Receiver Adjustments

The i-f. (460 kc.) compensating condensers are adjusted first, after which the Antenna and High Frequency compensating condensers are adjusted at 1,400 kc.; then the Low Frequency at 600 kc. (The Antenna and High Frequency compensators can be reached with a screw driver through side of cabinet.)

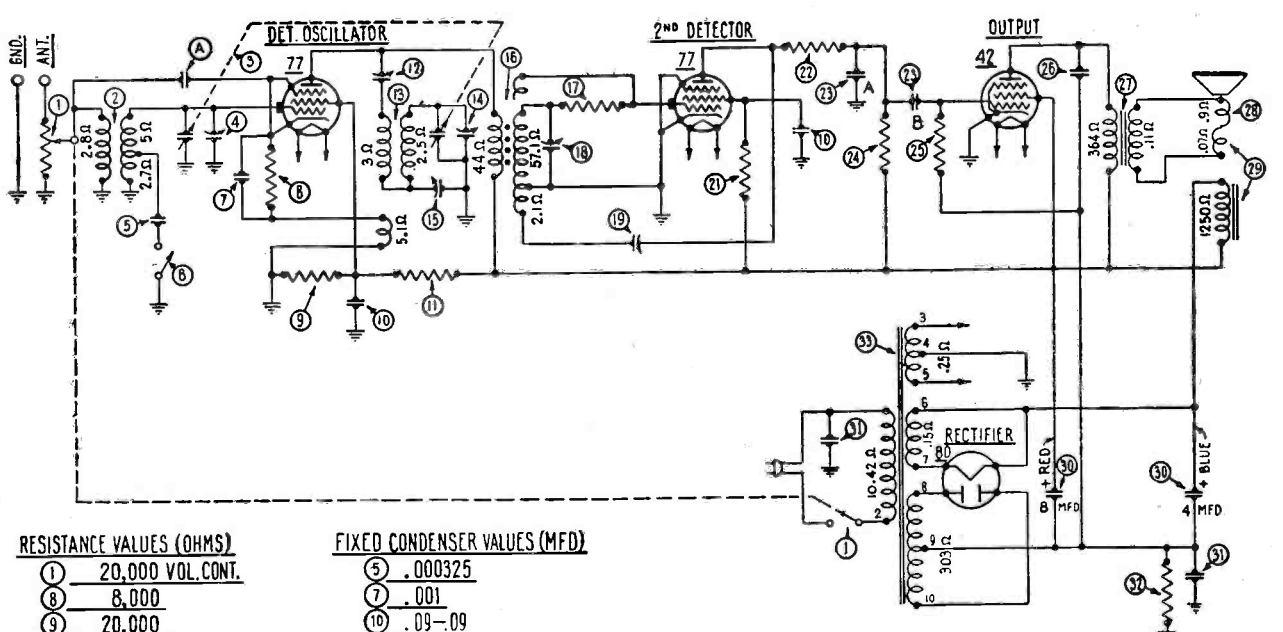
The Regeneration Control condenser is adjusted with a 1,300-kc. oscillator signal or station carrier. Turn the fibre screw at back of chassis (right end when facing back of set) in a clockwise direction, with screw driver, until the receiver goes into oscillation, giving a squeal when various carriers are passed with the station selector. Then turn the screw counter clockwise until the "swishing" sound just ceases. Continue to turn in the same direction about one-quarter of a revolution beyond this point. Then tune to different stations over the dial and if a squeal is present on any stations received, turn the screw farther in a counter-clockwise direction. Should the type 77 tube (2nd detector) under the metal shield ever be replaced, this adjustment should be repeated.

Following the regeneration adjustment, the i-f. compensating condensers should be finally re-trimmed, inasmuch as the two circuits are closely interrelated.

PHILCO 57 VOLTAGE DATA

Tube	*Fil.*	*Plate*	*Screen*	*Grid*	*Cathode*
Det.-Osc.	6.3	235	110	10.5	25
2nd. Det.	6.3	45	35	0.25	15
Power	6.3	235	250	0.25	15
Rect.	4.8	300			

Cathode volts measured from cathode to heater.



RESISTANCE VALUES (OHMS)

(1)	20,000 VOL. CONT.
(8)	8,000
(9)	20,000
(11)	25,000
(17)	4,000,000
(21)	1,000,000
(22)	10,000
(24)	240,000
(25)	490,000
(32)	325 (WIRE WOUND)

FIXED CONDENSER VALUES (MFD)

(5)	.000325
(7)	.001
(10)	.09–.09
(23)	A–.001–B–.015
(26)	.006
(31)	.015–.015

Schematic diagram of the Philco Model 57 A-C. Midget receiver. This job is similar to the former Model 80 except that the new type tubes are employed

Public Address . . .

Type 48 Tube as Triode

Although the type 48 tube was designed primarily for use as a power amplifier tetrode, certain advantages can be realized by operating it as a triode with the screen tied to the plate. While the power output, for a given plate voltage, is reduced from that obtainable with the tube operated as a tetrode, the total harmonic distortion is also considerably lower.

Low Harmonic Distortion

Two type 48 tubes operated as triodes in a push-pull output circuit with 105 volts on the plates are capable of approximately 2 watts output, having a total harmonic distortion of less than 2 per cent. The power output of two 48's under these conditions compares very favorably with that of two type 38, 41, 42 or 89 pentodes at the same plate voltage. The distortion from the 48's however, is only about 1/5 that of the pentodes. Two type 43's operated as pentodes in push-pull with 100 volts on the plates will give a power output somewhat higher than that of the 48's. However, as in the comparison with other pentodes, the distortion from the 43's will be much higher than that of the 48's.

Direct Current Use Only

The 48 operated as a triode, therefore, has interesting possibilities in connection with the design of amplifiers of moderate power-output and low distortion. The 48 is not suitable for use in small transformerless receivers using a single rectifier tube, since the plate current requirements are considerably in excess of the rating of the rectifier tubes used in such equipment. Furthermore, the heater of the 48 is not designed for a-c. operation—the cathode being so large that it has a control effect on the tube, thus introducing considerable hum.

(*Information courtesy of RCA Radiotron and E. T. Cunningham.*)

•

Measuring Transformer Ratios and Impedances

Fig. 1 shows a simple method of determining transformer ratios. T1 is a bell-ringing or filament transformer. R1 and R2 are variable resistors of known value, say 100,000 ohms and 1,000 ohms respectively. P1 is a wire-wound potentiometer of about 50,000 ohms. The procedure is as follows:

With P1 set at zero, adjust resistors R1 and R2 until a deflection past midscale is obtained on the a-c. voltmeter V, which may have a scale deflection of 150 volts or less. Then adjust P1 until zero reading is obtained on the meter. If the reading of the voltmeter increases as P1 is increased, then the secondary of the transformer under test (i-e., T2) should be reversed. When zero reading is obtained measure the voltages at points V1 and V2.

Now the voltage applied to the primary of T2 is: $V1 \times \frac{R2}{R1 + R2}$. The secondary

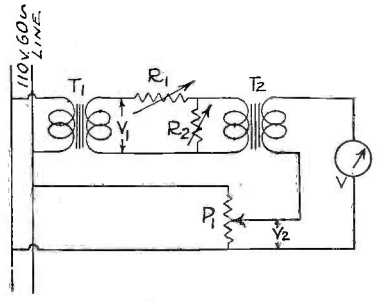


FIG. 1

Simple circuit for determining audio-frequency transformer ratios direct from a-c. line

voltage developed is V2. The ratio of the two gives the voltage ratio of the transformer T2.

Impedance

The impedance ratio is the square of the voltage ratio. To find the impedance from which the transformer will operate properly, we must know the inductance of one of the windings. Fig. 2 shows a simple method of finding the inductance. The primary of the transformer under test is connected through a resistance R (say 1,000 to 10,000 ohms) to a 110-volt, 60-cycle line. The secondary of the transformer is left open. A series of paper or mica condensers of known value are shunted across the primary and the value found for minimum voltage across R. This indicates resonance.

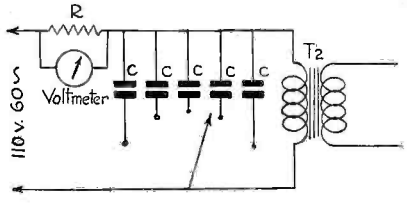


FIG. 2

With this circuit it is possible to find the inductance of a transformer winding. Again the 60-cycle, a-c. line is used

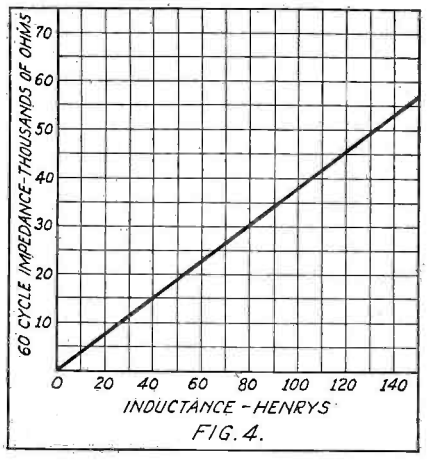


FIG. 4.

With the inductance of a transformer winding once known, the impedance at 60 cycles can be determined from this curve

The curves of Fig. 3 indicate the inductance corresponding to the various capacity settings or values. The impedance corresponding to each value of inductance is given in Fig. 4. Now the primary impedance of the transformer is usually 3 to 5 times the impedance from which it is intended to work. Thus, for a transformer to work out of 200 ohms, a primary impedance of 600 to 1,000 ohms, corresponding to an inductance of 2 or 3 henrys, is required. This in turn corresponds to a capacity of 2.3 to 3.5 mfd.

•

A.R.R.L. Midwest Convention

Hey all you brass pounders and boiled owls—the A.R.R.L. Midwest Division Convention and Third Annual Missouri Convention will be held in Saint Louis, September 2-3, 1933.

Information regarding the Convention may be obtained from Dr. Chas. L. Klenk, Manager, 420 Metropolitan Bldg., St. Louis, Mo.

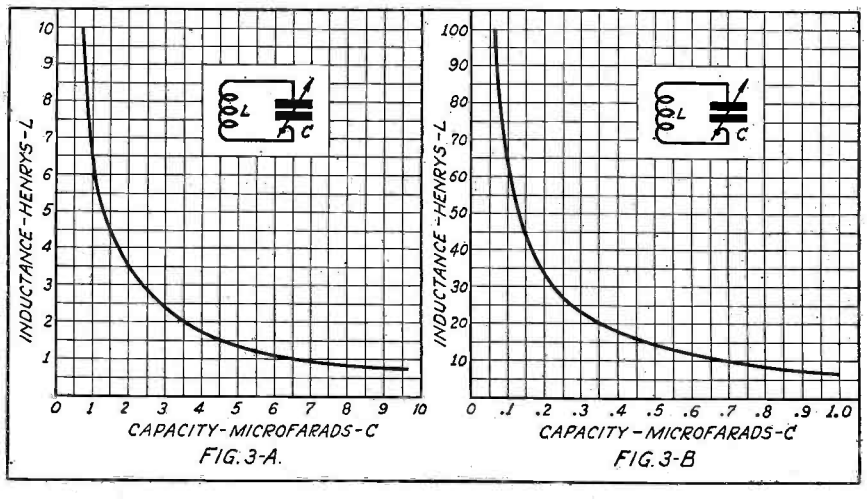
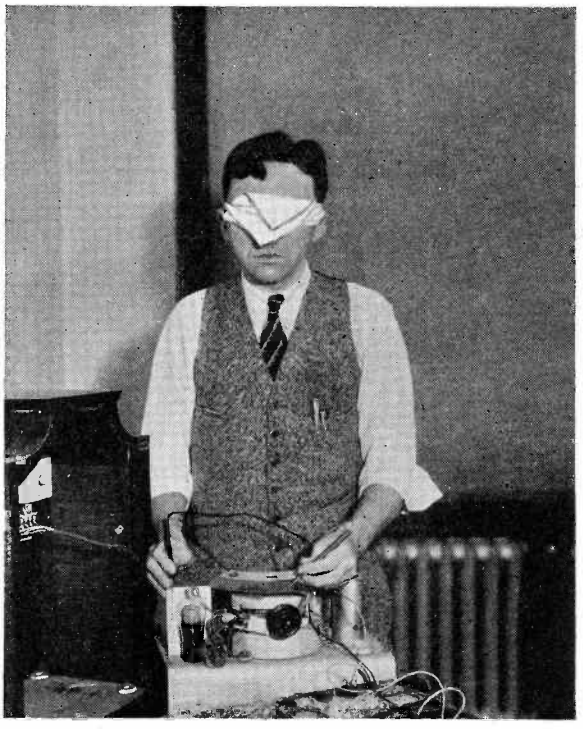


FIG. 3-A. FIG. 3-B

The two curves above give the inductance in henrys of transformer windings corresponding to the various capacity values as used in the circuit of Fig. 2

YOU Wouldn't Work BLINDFOLDED!



• You wouldn't think of working with a blindfold over your eyes. . . . Neither would you work in the dark. . . . You know it can't be done. . . . So why service receivers without the proper service information? . . . It's the same idea.

Service information and data has a definite function in the service field. It tells you what's what. You examine the schematic wiring diagram and you are immediately familiar with the receiver . . . you recognize peculiarities in the circuit arrangement . . . you know what to expect in the various circuits . . . you see the units which constitute the circuits . . . you examine the chassis layout and immediately know where to find the parts you seek.

With the proper service data, you know what to do. You don't have to guess at i-f peaks . . . and guess wrong. You don't have to suppose that certain trimmers have certain functions, that certain leads to the power transformer feed certain circuits. With the proper service data at hand, you instantaneously determine exact facts. You eliminate guesswork, supposition, unnecessary waste and loss of time.

RIDER'S MANUALS ARE SHOP EQUIPMENT

Service information is not just data . . . it is a vitally important part of your test equipment. Because of the tremendous amount of service information of the most complete and accurate order, Rider's Manuals have become standard shop equipment in service organizations. As a matter of fact, service organizations all over the country make it a requirement that the service men they employ have these Manuals in addition to the regular test equipment. It is a part of their test apparatus.

Famous and reliable instrument manufacturers, such as Weston, Hickok, Supreme and Readrite, recommend Rider's Manuals to their instrument owners. Famous tube manufacturers, such as E. T. Cunningham, National Union Radio Corp. and RCA Radiotron, offer Rider's Manuals in tube deals. With marvelous reputations to uphold, you can readily realize that these test instrument and tube manufacturers would recommend only the finest.

Receiver manufacturers recommend Rider's Manuals to the service industry because they know that these Manuals contain the most complete representation of their lines of receivers and because the information is most accurate.

Rider's Manuals Volumes I, II and III contain about 3,000 non-duplicated pages as the grand total . . . and this information covers every bit of service data which you need and can use. There is nothing finer!

SPECIAL ANNOUNCEMENT

Beginning with August 1st, we are inaugurating a free question and answer service for the owners of the PERPETUAL TROUBLE SHOOTER'S MANUALS. The following are the rules governing the service:

(1) Not more than five questions in any one mail.
(2) You must enclose a self-addressed and stamped envelope.
(3) Questions which require schematic diagrams cannot be answered free of charge.
(4) Questions which cover the design of equipment cannot be answered free of charge.
(5) This question and answer service applies only to service problems.

JUST OFF THE PRESS

Volume III . . . 1185 Pages!

Letter press printed from engravings
A revelation in clearness of printing
Startling in accuracy and detail

Volume III is the only manual that contains a Chronological Catalog of all receivers made and sold in the United States since 1923.

PRICE $7.50 POST PAID

See these Manuals at your dealer's—or send for descriptive literature.

JOHN F. RIDER

1440 BROADWAY NEW YORK, N. Y.

Auto-Radio . . .

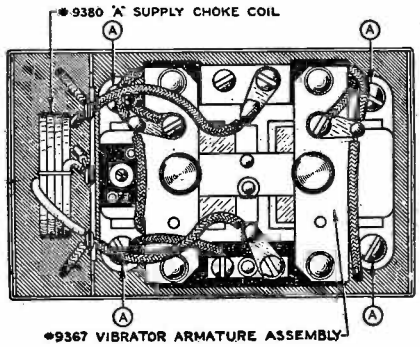
Majestic Models 116 and 116-A

The accompanying schematic diagram is that of the Majestic Model 116-A which is practically the same as the Model 116 which was brought out earlier in three different types. All four receivers employ an intermediate frequency of 175 kc. and have the same general circuit arrangement so that the servicing procedure is the same for each of the four types.

As seen from the accompanying diagram of the 116-A, a type G-57AS is employed as combination mixer and oscillator, two type G-58AS tubes as i-f. amplifiers, a type G-85A as second detector, automatic volume control and a-f., a type G-89 as power output pentode and a type G-6Y5 as rectifier. The G-6Y5 is a full-wave mercury-vapor rectifier and is used in conjunction with a vibrator-transformer for supplying the high voltage for the receiver. A special "Globar" resistor (R-14), is connected across the plates of the rectifier tube in place of the speaker gap and resistor which was used in all three types of the Model 116 receiver. This resistor has a value of 500,000 ohms at 750 volts d-c., and a value of 1,500 ohms at 2,000 volts d-c.

Types 1 and 2 of Model 116 use type G-75 for second detector, and type 6Z5 rectifier tubes. Type 3 uses the same tubes as are employed in the Model 116-A receiver. The other differences between the three types are slight changes in the values of a few of the resistors and condensers.

The three types of the Model 116 group are covered by the serial numbers 10,001 to 16,036. The Model 116-A group is covered by the serial numbers 16,037 and up.



The Duro-Mute Power Unit

The voltages given in the accompanying table are for the three types in the Model 116 group but will apply also to the Model 116-A. All measurements are made from designated points to ground with a 1,000-ohms-per-volt, 300-volt range, d-c. voltmeter, with the receiver connected to a storage battery delivering 6.0 volts at the battery terminals under load. The condenser gang should be fully meshed, and no signal applied to the input of the receiver. The tubes should have been previously tested to assure that they are in good condition.

The Duro-Mute Power Unit is housed in the large metal container located at the extreme right of the receiver. This unit should not be tampered with unless it becomes necessary to inspect or replace the vibrator armature assembly. In such a case, proceed as follows:

Unmount the receiver and take off top and bottom covers of the chassis container. Then unsolder the red, yellow, blue and black leads from the speaker output transformer. Follow by removing the flexible drive cable from the gang condenser drive pulley, being careful not to cause any sharp bends or kinks in the cable.

After removing the five screws from the ends of the receiver, lift the container and speaker from the chassis, being careful not to place undue strain on the antenna lead wire. Now unscrew the four screws which hold the cover of the Duro-Mute Power Unit in place. The cover is easily removed by rocking slightly and lifting upward.

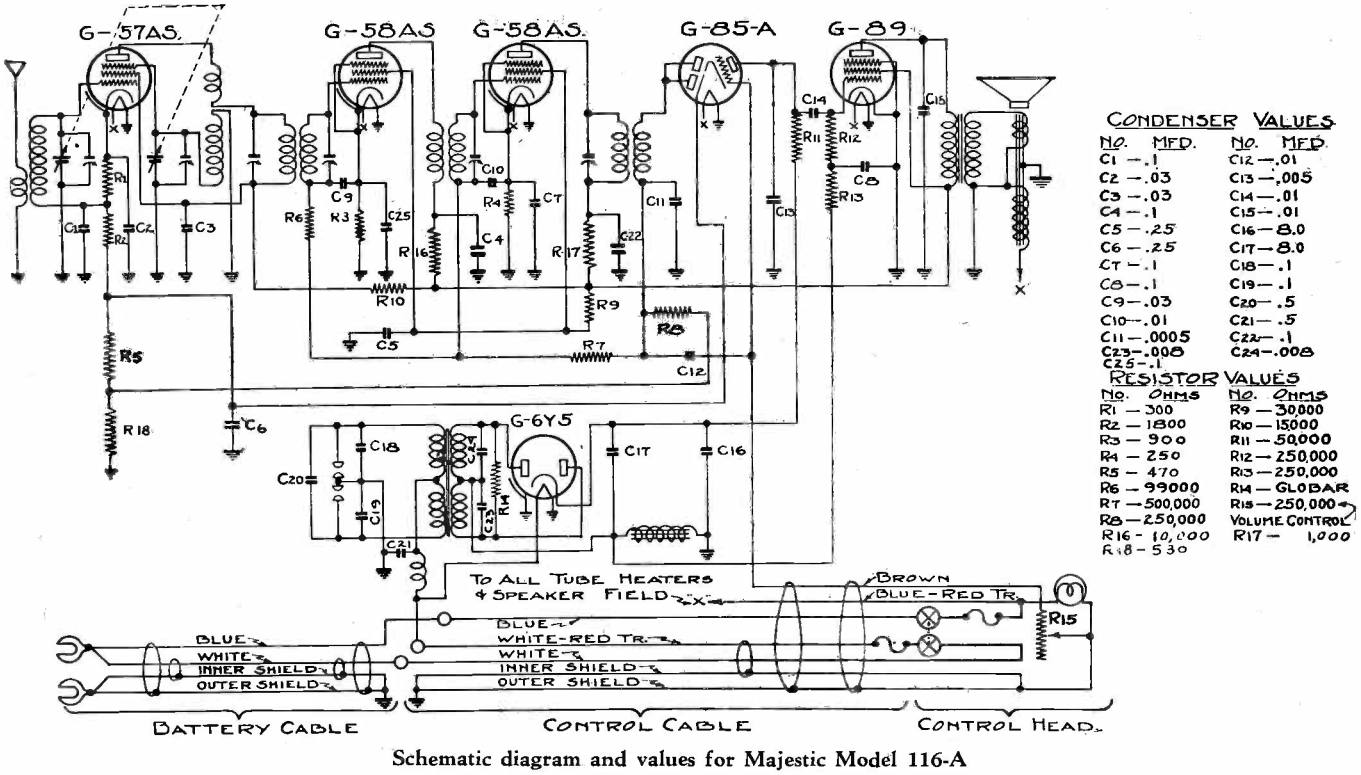
The entire vibrator armature assembly is now accessible for inspection or replacement.

If the vibrator armature assembly is known to be defective, remove it by disconnecting the necessary wires and unscrewing the four large screws marked "A" in the accompanying sketch. Replace with a new vibrator armature assembly (No. 9,367).

If there was a spacing washer under each of the screws at "A," they should *not* be used when the vibrator armature assembly is replaced with a new one.

MAJESTIC MODELS 116 AND 116-A VOLTAGE DATA

Tube	*Plate*	*Screen*	*Cathode*	*Suppressor*	*Grid*
Det.-Osc.	110	110	15.0	0.0	1.4
1st. I-F.	180	90	3.5	3.5	..
2nd I-F.	180	90	3.5	3.5	..
2nd Det.	135	..	2.25	..	..
Power	170	180	0.0	0.0	..
Rect.	..	..	180.	..	..

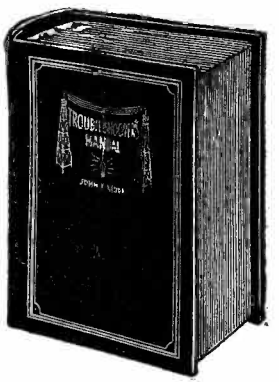


Schematic diagram and values for Majestic Model 116-A

YOUR BEST FRIENDS WILL TELL YOU!

If you have good friends in the service business, although they are competitors, they will tell you to use . . .

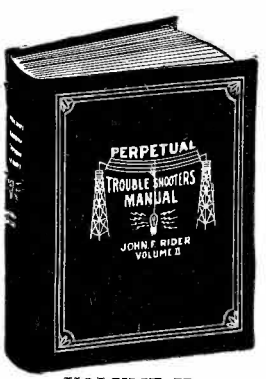
RIDER'S PERPETUAL TROUBLE SHOOTER'S MANUALS



VOLUME I

If your competitors are *not* your friends, then they will advise that you use other manuals. By doing so, they who employ Rider's Manuals gain a definite advantage over you—because they have the most complete file of service data, and are in a position to offer the most rapid and accurate service.

Volumes I and II total approximately 2000 pages. These two volumes cover receivers produced between 1919 and 1932—no duplication.



VOLUME II

MONEY BACK GUARANTEE

You guarantee satisfaction to *your* customers! *We* guarantee satisfaction to *you!* If after purchasing either Volume I or II, or both, you feel that you can do without these Manuals—or that they are not worth the money — send them back and we will refund the purchase price.

If your dealer does not carry Rider's Manuals in stock, do not accept substitutes. There are none "just as good."

SPECIAL NOTICE

For the present, the list prices of Rider's Perpetual Trouble Shooter's Manuals remain as heretofore. Volume I, price $5.00 postpaid; Volume II, price $5.00 postpaid. However, due to increasing production costs, it may be necessary in the near future to increase these prices. Take advantage of today's prices!

Send for descriptive literature

JOHN F. RIDER

1440 Broadway New York, N. Y.

Useful Tips *from other Service Men*

FREE!

"SYLVANIA NEWS" carries a full page of practical servicing facts every month. Mail coupon for complimentary subscription.

● Here's a way to keep up-to-date on the shortcuts other "live" service men are finding valuable in their business.

The monthly news and service bulletin, "Sylvania News," gives you this information, as well as all the latest news in the radio and tube industries. Simply mail the coupon and the makers of Sylvania Tubes will put you on the list for a free subscription! No obligations.

Send in your own servicing tips, too. For every one that's printed in "Sylvania News," you'll get a free Sylvania Tube (any type you select up to $3.00 in value!)

Don't miss this opportunity!

Sylvania

THE SET-TESTED RADIO TUBE

A Product of Hygrade Sylvania Corporation

MAIL COUPON TODAY!

HYGRADE SYLVANIA CORP.
Emporium, Pa. (B)

Dear Sirs:

Please put my name on the mailing list for your free radio bulletin, "Sylvania News."

Name .....

Address .....

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

ON THE JOB . . .

Directional Antenna For Broadcast Reception

At the present time, due to the low number of sun spots, radio reception from distant stations is very good at night. So good in fact that reception of local stations is sometimes absolutely spoiled by a distant station which shares the same channel. At the present time there are about 80 shared channels of the 96 available for broadcasting. As a result there are a great many complaints from receiver owners relative to interference which cannot be eliminated with the usual forms of directional aerials. Such types of interference can be eliminated, however, and the special antenna to be described has already proven its worth.

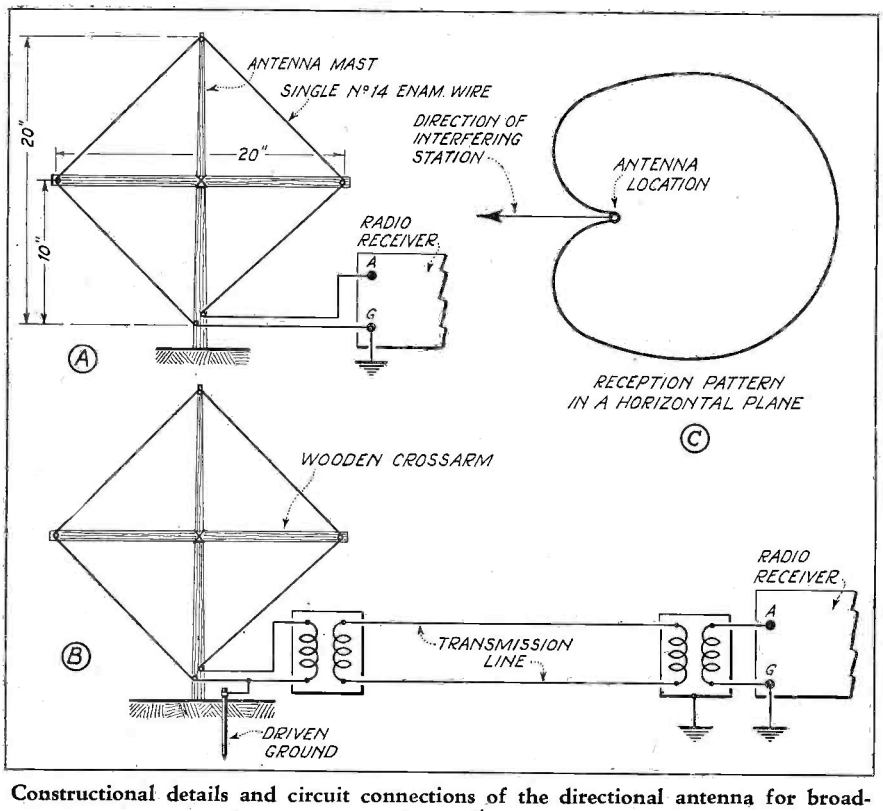
A highly directional receiving antenna for broadcast frequencies is either too large or too expensive for general use. However, high directivity is neither essential nor desirable for the type of interference mentioned above, since usually directivity is desired for only a few stations. As a matter of fact, the thing that is generally required is suppression of the ground wave or sky wave of one particular station.

Fortunately a reduction in signal strength of ten to twenty times in a single direction is not difficult to attain with fairly simple antennas. For example, a simple loop antenna has a figure 8 reception pattern, receiving best in its own plane. However, it is a very poor signal collector and it is not directional for sky waves unless special attention is given to its shape. As a result, the usual square or rectangular loop has lost most of its popularity.

A large single-turn loop of the shape shown in the accompanying illustration, with one side grounded, has a cardiod or heart-shaped pattern which is very effective in reducing the signal from one direction. Moreover, it is practically independent of the direction of the arrival of the wave; i.e., whether it is a ground wave or a sky wave. This type of antenna is very simple to construct. Typical dimensions are given in the illustration but these may be varied to suit the local conditions. The antenna supports consist of a horizontal pole as high as practical with a cross-arm equal in length to the height of the pole. The cross-arm should be lashed, not bolted, to the center of the pole so that it is free to swing and be rotated 90 degrees, that is, 45 degrees in either direction. A single No. 14 enameled copper wire is in the form of a diamond and is supported at the sides of the cross-arm and the top and bottom of the pole. One end of the diamond-shaped loop thus formed is grounded either to a driven ground at the foot of the antenna pole or at the radio receiver. The other terminal of the loop is connected directly to the antenna post of the radio receiver or to the antenna terminal of a shielded antenna system. Both methods are shown. Any suitable supports, such as pin-type insulators, may be used at the ends of the cross-arms and top and bottom of the pole for supporting the antenna wire.

When ready to use—which would be in the night-time, of course—the receiver is tuned to the channel on which interference is to be reduced and the cross-arm rotated until interference is a minimum. The cross-arm should then be anchored at this point. Wood should be used for both cross-arm and pole to prevent reducing the effective height of the antenna, which metal would reduce.

This system has certain limitations—such as small directional difference between the station to be received and the interfering station, and as a result is not a cure-all. However, under reasonable operating conditions, it will, when properly constructed, give a good account of itself. Its big advantage lies in its simplicity and in the fact that it will receive well from *all directions but one.* Keep it clear of trees and metal obstructions and solder all joints if good results are to be expected.



Constructional details and circuit connections of the directional antenna for broadcast reception

Tying Tube Sales With Service

The average radio set owner may not be a reasoning animal, but the message we broadcast to the set owners in our town by means of mimeographed sheets placed in every doorway evidently "got them" from the wholesale response we enjoyed. Here is the text:

GIVE YOUR RADIO A CHANCE

Seventy per cent of all radio troubles come from defective tubes. BUT . . . the other thirty per cent include most of the things that make tubes become weak, noisy, etc. If the circuits of the set do not supply the tubes with the proper operating voltages, the best tubes on earth will soon become duds.

SO . . . Don't blame the tubes *until you know!*

THEREFORE . . . FOR BEST POSSIBLE RADIO RECEPTION . . .

1—Let us show you what a difference proper installation of your set will make. If it is not properly installed, we will tell you so. If we make any changes you will be able to see that we have improved things.

2—Have your set inspected by us at least twice a year in order to catch little troubles before they become big ones.

3—Let us install a complete new set of perfect, first quality tubes with our *guarantee of one year of perfect service* which we make possible by inspecting both the set and the tubes at least twice during the year *without further charge.* Any tube found defective in that year due to any but unusual causes such as lightning, breakage, etc., will be replaced *free of charge.*

4—Get our FREE RADIO INSPECTION SERVICE COUPONS with every purchase of radio and electrical supplies from our shop.

5—We make our living by keeping radio owners satisfied. Remember, it isn't the make of set you own, or how new it is that satisfies . . . but *how it performs!* We will make your old set perform, and our reasonable charges will please almost as much as the radio reception you get. Call.....on .....for RADIO SERVICE.

J. H. Van Nice.

THE FORUM . . .

Protest

Editor, SERVICE:

I have just finished reading your article, "Organize for Profit," in the March issue of SERVICE.

You undoubtedly had good intentions in writing this article and it is a subject which should be brought forcibly to the attention of every Service Man in the country, but as you have presented it I believe it is a detriment rather than a help.

In the first place you say, "The first step is the formation of local associations." Why, may I ask, is it good for us to organize into local groups and not organize these local groups into one large national or international group? Furthermore, this method is very wasteful; of time, money, goodwill, and profitable returns. If we could all join some national or international organization, forming small local groups of members in our own localities, we can save time and money, have less ill feelings between members of the local group, and have greater and more permanent returns.

And why not? You are familiar with the men, ideals, and the achievements of the Institute of Radio Service Men. They are far ahead of you in ideas and ideals and over a year ahead in actual time. In the last year they have accomplished more for the good of the radio service profession than has been accomplished by all agencies in all the time since the profession became a fact.

You have a wonderful magazine for the service profession and I believe have done more for us than any other one individual, but we are all specialists, so why not recognize our fellow workers, give credit where credit is due, support our colleagues and expect support from them.

In other words, I am asking you to recognize the Institute of Radio Service Men and for the good of the whole industry—yourself included—put your magazine squarely behind them and help us push. We all need this help and I am sure that the hundreds of Service Men who now belong to the Institute of Radio Service Men and are enthusiastic about it and the hundreds more who will become the same way, will thank you and will give you credit for contributing one more worthwhile accomplishment to the profession.

As to the balance of your discussion, I believe that you have started with the part of the organization which is most likely to blow it up, and have overlooked the really important things which are essential for the permanent prosperity of the profession.

By way of illustration, I want to tell you a little of what the local chapter of the Institute of Radio Service Men has accomplished in the last year. This will be representative of what any properly organized local group can do if they follow the ideas and ideals of the Institute.

We have eighteen members and meet regularly on the second and fourth Tuesday night of each month (you are hereby invited to attend at any time). The first meeting each month is devoted to business, but the second meeting is an open meeting at which we have visitors—anyone who may be interested—and have a talk on general discussions on some subject of interest to the profession. We take turns giving these talks. We also discuss prices and compare prices and practices for different operations, but make no attempt to set prices on a job.

After we have attended several of these meetings and become acquainted with each other we cooperate better in every way and there is little price cutting among the members.

I think that organization in a big way, with the main idea to educate both the Service Man and his clientele, will do much to eliminate most of the evils of the profession.

G. R. MANN,
Champaign, Ill.

(Your last paragraph covers well just what we have outlined in "Organize for Profit." We are primarily interested in having such organization get well under way. When, as and if such local groups are formed they could well join the national organization of which you are an appendage, and thereby gain in strength.—THE EDITORS.)

•

National Organization

Editor, SERVICE:

Your work in promoting organization of the Radio Service Men of the nation is a humanitarian act to a struggling mass at this time.

The Radio Service Men of the nation, by not being organized, have allowed at least a million dollars to slip through their fingers into other channels when the recent Schmeling-Baer fight was not broadcast. We all know that a national organization would not have overlooked this or any other event that would have appealed to the listeners of the country.

Without any great display of imagination, one can see the possibilities of a great expansion of the public interest in radio, with a corresponding increase in repairs and sales through organization of a national scope.

Every other branch of the nation's business, from the farmer to the millionaire, is at this time organizing into cooperative groups for harmonious operation of their business. What is the one thing that is keeping one of the nation's most important industries from grasping the great opportunity that is offered in organization?

SERVICE has offered the opportunity for the expression of the Radio Service Men's views on the subject of organization. They have been in complete accord on the main subject although at variance with its application. Why not a call for state organization to be followed by a national convention?

PAT TRACY,
Cameron, Texas.

(We agree that sooner or later the Service Man will have to solidify his position. For the present, the RMA Campaign should assist him considerably and in the end may show him the way towards coordination of action. The Government may do this in any event by forcing some form of cooperative group to take shape.—THE EDITORS.)

•

Against Government Licensing

Editor, SERVICE:

We read regularly the page called "Forum." For some time past there has been quite an agitation for a Service Man's Organization and lately some even advocate Government licensing. Please accept the following as our protest against any such method.

Did you ever hear of the Government being asked to license watch repairmen, and do you believe that licensing and regulating watch repairmen would make them better mechanics or cause them to do any better jobs? Do you believe that it would regulate and eliminate the crook?

The licensing and regulation by a fixed set of rules as examination qualifications will not make an honest man out of a crook at any time. If we could see any logical reason in such regulation we would certainly be in favor of it. The biggest crook I know in this territory does the poorest jobs and charges the highest prices, yet he would be the most likely to pass a Government examination regardless of how technical—and I would like to ask if being examined, and licensed by the R.F.C., would make an honest man out of him?

FRANK MAUK,
Mauk's Radio Repair Shop,
Dubois, Pa.

(The idea is not to make an honest man out of the crook, but to eliminate him. We know of no scheme under the sun by which the crook can be made honest. But, there are means of keeping him out of or putting him out of a given profession. It is too early to say what influence the National Industrial Recovery Act may have on the Radio Service Industry. But, the Service Man may be regulated along with men of other professions, whether or not he may think it is good for him. He will at least have the opportunity of devising his own regulatory plans through key men. There is more clear thinking, spunk and determination behind the National Industrial Recovery Act than most people realize. That it has arisen since the discussions relating to Government control in this magazine is, of course, beside the point. It does not consider the matter of licensing but does *include the matter of regulation. Because of this, the Service Man will more than likely be freed of a great deal of cut-throat competition.*—THE EDITORS.)

HIGHLIGHTS . . .

THOSE WHO DIG . . .

By Henry Shafer

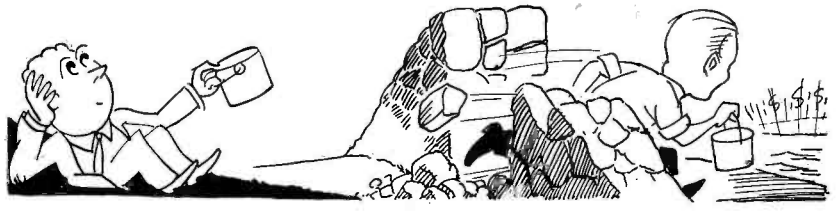
That there is a vast opportunity for the Independent Service Technician to work up a good, profitable, permanent business on a comparatively small investment, does not require clairvoyant powers to predict.

The 17,000,000 radios now owned individually by the general public in this country and the millions yet to be added for use in homes, autos, places of business, schools, clubs, etc., is bound to create a constantly increasing demand for the Independent Servicer.

In addition to ordinary servicing of radios now in use, there is a large percentage of sets which during the past few years have developed trouble and remained out of commission either because the Service Man was unable to obtain parts for sets that had become "orphaned" or because the owners were unable to have them rebuilt with the proper replacement parts at a price they could afford.

DEFERRED REBUILDING

This vast amount of deferred rebuilding work is the Service Man's present golden opportunity, especially in view of the fact that this country is rapidly awakening to the benefits of the "Roosevelt Dam" of billions of dollars, steming the tide that for several years threatened to inundate millions of mortgaged farmers and home owners who now will feel safe in digging into their socks and having necessary repairs made to their belongings.



The Service Man who "waiteth for the manna to fall with the morning dew" for each day's subsistence will, no doubt, be doomed to perish in the wilderness, but the ones who go forth to dig their way through the wall of Jericho and go after the service work in sight, are the ones who will get into the promised land where the rivers are flowing with milk and honey.

President Roosevelt is investing billions of dollars of the public's funds to start gainful pursuits on a gainful basis; however, he admonishes us that permanent progress can be established only be everyone's individual efforts.

Watchful waiting to see what the other fellow or the government will do for us will bring only more trouble. We must all be "go-getters".

The Service Man who prepares to give prompt remedies, the same as is necessary for any other successful craftsman, professional, or business person, is the one who is bound to win a permanent, profitable business. And this is the time to begin.

Let's go!

•

Merry Fourth

This is the one about the son of a Service Man who spent hours on the 4th of July trying to set off an electrolytic condenser in the back yard—believing it to be a giant firecracker.

Since we are writing this much before the Fourth, this may be termed a neat trick. It's all done with mirrors.

•

More Service Girls

Well, are *we* surprised! Mr. M. D. Jones, of Macon, Ga., says he has a Service Girl working for him. Her name is Miss Pat Jordan and she handles a soldering iron and an ohmmeter like an old timer. Mr. Jones says that the only difference between her work and that of a man's is that when she gets stuck on a set instead of cussing a blue streak, she just powders her nose again and goes at it. Hail, Pat!

And there's another "sweet service" out in Sunny California. According to Mr. Fearn, of Anaheim, (Sunny) California, who employs her, she is five feet two and still in her twenties—and Atwater Kent's are her favorites. Okay, Miss Five Feet Two; our favorites are peach and maple nut.

•

Pamphlet on Sound Systems

A very useful and interesting 32-page pamphlet on sound systems has just been published by Federated Purchaser, Inc., 25 Park Place, New York City. Anyone interested in the installation or care of public address systems may obtain a copy of this booklet gratis, upon request.

•

Arcturus Tube Chart

The Arcturus Radio Tube Co., Newark, N. J., have worked up a new bulletin containing the electrical and physical characteristics of Arcturus Tubes. A copy of this bulletin can be had if you will write to Arcturus on one of your letter heads.

•

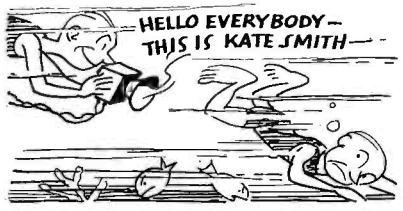
IRC Moves

The International Resistance Company have moved their furniture, grid leaks and engineers over to swell new quarters at 2100 Arch Street, Philadelphia. The general offices and the engineering department are now combined.

Put this new address in your note-book.

Beach Broadcasting

Something new under the sun, they call it. Audible Advertising, Inc., of New York, have erected along a mile and a quarter of the beach at Long Beach, L. I., what they say is the largest public-address system in the world.



From twelve especially built loudspeakers the latest in dance music, popular songs, beach exercises, swimming lessons, temperature and weather reports, etc.—and, of course, a bit of advertising wedged in here and there— will be wafted over the air to bathers and boardwalk strollers.

Audible Advertising boasts that listeners can't tune off and that Mr. Advertiser can actually stand on the boardwalk and count his circulation. This isn't quite true, for one could hold one's nose and take a dive into the brine and have a few moment's peace—until Audible Adevrtising started using submarine speakers.

•

Stolen

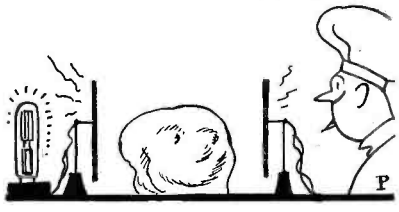
Mr. G. O. Zimmerman, Keedysville, Kentucky, reports that his Supreme AAA-1 Diagnometer was stolen from his car on the night of June 15th. The serial number of this Diagnometer is A-1253.

Should you happen to spot it, call a cop—and Mr. Zimmerman. Thanks.

•

Radio Bread

The latest is honest-to-goodness bread baked by radio. They use a short-wave transmitter which induces heat right in the dough, so that the bread is baked from the inside out, rather than from the outside in as it is usually baked. The result is that this radio bread has no crust and is perfectly dandy for making cream cheese and olive sandwiches (or maybe she likes pear and nut ones better). The point is that hotels and restaurants don't have to bother cutting off the crust when the bread is to be used for sandwiches—and there is no waste.



An interesting sidelight on this is that equipment very similar to the radio bread maker is also used for curing people of paresis! At this rate, it should also be good for chopping down trees for President Roosevelt . . . . or putting 'em up.

How Do *You* Do It?

How do you solve the many servicing problems with which you have to contend . . . what special kinks have you worked out which help you in servicing receivers . . . have you developed short-cut schemes for testing, or built test devices that do the work better and faster?

No matter what the scheme or the device, there are many, many Service Men who would like to know the how's and why's—just as you would like to know about the schemes and devices employed by others.

SERVICE WANTS TO KNOW!

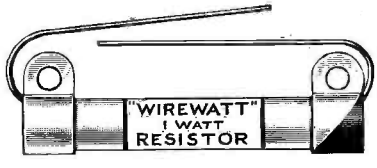
If you have clever ideas and clever devices, we want to know about 'em as much as do our readers. Regular space rates are paid for all material accepted for publication.

All you have to do is give us the outstanding points, and a rough pencil sketch of the device if it happens to be such—and we will do the rest.

Come on, now, and kick in. Write up those ideas now and send them in to the . . .

ON THE JOB DEPARTMENT

WHAT IS THE "WIREWATT"?



The WIREWATT Resistor is the unit that the service man has been waiting for. It is a radically different resistor, a real WIRE WOUND unit rated at one watt and small enough to be used in almost all radio circuits.

This resistor is the same size as a one watt carbon unit, but being wire-wound it has no voltage characteristics; and, because it is a quality unit, it is absolutely noiseless under all conditions.

Tests run by independent radio engineers show that a wire-wound unit is preferable, and that below 30,000 ohms, the inductive effect is negligible.

Write for Catalog Number Nine for complete information about Ohmite resistors, rheostats and test equipment.

OHMITE
MANUFACTURING COMPANY
637 N. Albany Avenue
Chicago, Ill.

The First of Its Kind!

A CHRONOLOGICAL SET CATALOG AND INDEX

of *all* American radio receivers manufactured and sold between 1923 and 1933.

More than 50,000 facts were collated under the personal supervision of the famous consulting radio engineer Ralph Langley in order to produce this 115-page volume. Each page is 8½ x 11 inches and printed letter press from plates.

Approximately *8000 different models* are catalogued showing the

—manufacturer's name
—model number and name of model
—year of production
—number of tubes
—number of controls
—type of circuit
—type of power supply
—number of stages.

For the receivers sold between 1931 and 1933, the above mentioned data is supplemented by a listing of the types of tubes used in the receivers.

This information has a multitude of uses and is the only one of its kind available in the world. This information should be of immense value to—

Radio Receiver Manufacturers—Parts Manufacturers—Tube Manufacturers—Radio Dealers—Radio Jobbers—Service Men—Statistical Organizations — Libraries — Technical Schools — Patent Attorneys — Instrument Manufacturers —etc.

LIST PRICE $2.00 POSTPAID
BOUND IN PAPER COVER

NOTE: *This catalog is given with Volume III of Rider's Perpetual Trouble Shooter's Manual. If you own this volume of Rider's Manual you already have this Set Catalog and Index.*

Published by

JOHN F. RIDER
1440 Broadway New York City

THE MANUFACTURERS . . .

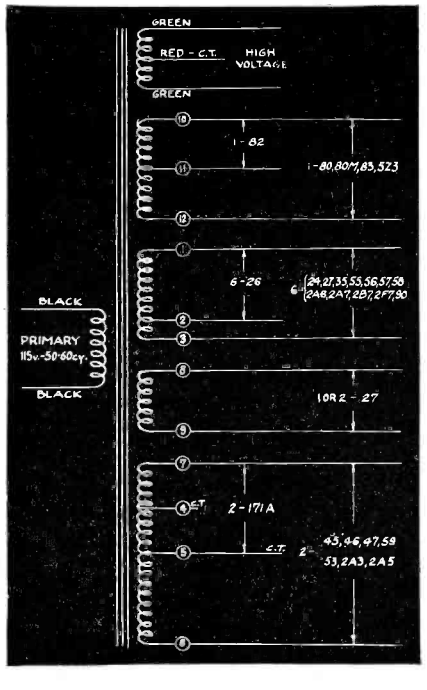
"General" Multi-tap Transformers

The General Transformer Corporation, 500 South Throop Street, Chicago, have come to the aid of the Service Man with a complete line of replacement power transformers quite out of the ordinary in design. They are called Multi-tap Universal Transformers and are universal electrically as well as physically. Their chief merit lies in the fact that their adaptability is not confined to one make set and therefore they may be stocked by the Service Man with a minimum capital investment.

The line consists of four models; one for 4 tubes, one for 5 and 6 tubes, one for 7 and 8 tubes and one for 9 and 10 tubes. All models are designed for various tube combinations as indicated in the accompanying diagram for the 9 and 10 tube type. These various combinations in the four models, it is said, may be used to deliver the required voltage and current values to the several leads in over *90 per cent of the sets in use,* as accurately as the original units, considering the fluctuations in lighting current in different localities.

The units are furnished with a "General" Universal adjustable mounting frame that permits a wide range of mounting without redrilling the mounting panel. The "General" Universal frames are of an enclosing shield type for use on sets built to pass Fire Underwriters' requirements.

These units may be used by the Service Man for permanent installations to replace defective transformers, or when the set owner insists on an exact duplicate, physically as well as electrically, the "General" Multi-tap Universal may be installed temporarily to give immediate renewal of original performance, until the Service Man can obtain an exact duplicate.



IRC Cable Type Suppressor

International Resistance Company, 2100 Arch Street, Philadelphia, Pa., has announced an improved cable type automobile suppressor designed to simplify difficult installations and at the same time provide a perfect contact. This is known as the "MCA" Improved Cable End Type Suppressor and is now included in IRC Handy Certified Suppressor Kits.

One end of the suppressor fits on the spark plug itself while the cable fastens on to the recessed screw in the other end for sure contact in the very center of the wire.

This new suppressor is especially adapted for Fords and other installations where it is impossible to use the ordinary type of cable unit.

The standard MCA Suppressor is rated at 15,000 ohms while those adapted for Ford use are 50,000 ohms.

•

Universal Hearing Aids

Universal Microphone Co., Inglewood, Cal., have brought out a group of hearing aid devices which will be marketed and serviced entirely through radio outlets and, because of no trial periods or exchange privileges, the list prices will be low.

There will be three models and, while primarily for office and home use, they will also be portable.

The large model will contain standard batteries. The medium size will need C battery replacement each 25 hours intermittent service, while battery change will be needed for the tiny size each 30 hours.

•

Fairbanks IRC Sales Manager

Effective July 1, Dan. J. Fairbanks became sales manager of the International Resistance Company. He succeeds Harry Kalker who, as mentioned in these columns, has affiliated himself with Sprague.

Mr. Fairbanks, who has been with International for some time, will be ably assisted by Harry A. Ehle, a brother of the late Francis R. Ehle, former president of the company.

•

Sprague Steps Out With Kalker

Harry Kalker, well-known to the radio trade as sales manager of the International Resistance Company for a number of years has been chosen to head the Sprague Sales Company of North Adams, Mass., which will market through the jobbing trade condensers made for replacement purposes by the Sprague Specialties Co. of that city.

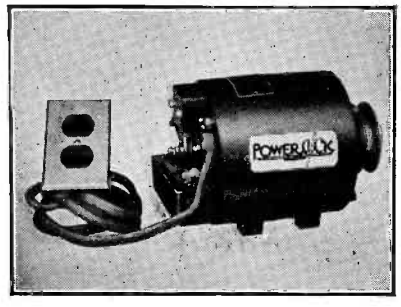
The new company will feature the Sprague "600"-Line of condensers. These are essentially the same units which the Sprague Specialties Company has been supplying to leading manufacturers for years, redesigned and styled for utmost facility in replacement work. The line will be complete in every respect, ranging from the Sprague Midgets to can and cardboard type dry electrolytics, automobile radio condensers and transmitting condensers.

Mr. Kalker will make his headquarters in North Adams.

•

Powerack Auto Generator

Powerack Television & Radio Corp., 112 West 18th Street, New York City, have placed on the market an electric generator for automobiles, known as the Powerack, which attaches directly to the fan belt in front of the car. This generator develops 110 volts alternating current so that it is possible to operate a standard receiver or universal



set. This obviates the necessity of placing a high drain on the car storage battery, all the power being obtained from the car engine.

The Powerack is supplied with a flexible cable and a standard double outlet which may be mounted on the instrument board in the car.

•

Philco Hardware Kit

Philco have brought out a Hardware Kit for convenient use in the service shop where it is necessary to have available at all times the most commonly used screws, nuts, washers, etc., for mounting various parts. The kit consists of 20 glass bottles, each containing a quantity of small hardware parts. The bottles are supplied in a heavy metal rack of two shelves so designed that the shelves can be fastened on the wall with five wood screws.

This Hardware Kit is known as Philco part 45-1009 and is subject to the regular parts discounts.

•

Radio Manufacturers Service

Philco Radio & Television Corp., Philadelphia, Pa., have instituted a national organization for Service Men called "Radio Manufacturers Service." Members are now being enrolled. If you haven't the dope, write to Philco, or go see your local Philco Distributor who will show you what's what.

Index of Monthly Literature

BROADCAST

Amplifiers, A-F.

Figuring A-F. Transformer Ratios
D. E. Noble, QST, pp 34, July, 1933

Reflex Circuits for Midgets (Circuits)
J. M. Stinchfield and O. H. Schade, Electronics, pp 153, June, 1933

Amplifiers, R-F.

Antenna Remedies (Improving Selectivity, etc.)
T. Parks, Radio World, pp 10, July 8, 1933

Automatic Regeneration (Circuit)
R. W. Tanner, Radio Engineering, pp 10, June, 1933

Reflex Circuits for Midgets (Circuits)
J. M. Stinchfield and O. H. Schade, Electronics, pp 153, June, 1933

General

Antenna Remedies (Improving Selectivity, etc.)
T. Parks, Radio World, pp 10, July 8, 1933

Reflex Circuits for Midgets (Circuits)
J. M. Stinchfield and O. H. Schade, Electronics, pp 153, June, 1933

Receivers

Modernizing the Majestic Model 15
M. Landau, Radio-Craft, pp 96, August, 1933

PUBLIC-ADDRESS

A 6-Volt A-C., D-C. Public-Address Amplifier (Construction)
L. Gancher, Radio-Craft, pp 88, August, 1933

Direct-Coupled A-F. Amplifier, Part I (Design and Construction)
L. B. Barcus, Radio-Craft, pp 80, August, 1933

Figuring A-F. Transformer Ratios
D. E. Noble, QST, pp 34, July, 1933

List of Non-Copyrighted Records for P-A. Performances
W. T. Golson, Radio Retailing, pp 37, July, 1933

Mobile Sound System (Construction)
C. E. Denton, Radio-Craft, pp 102, August, 1933

SHORT WAVE

Automatic Regeneration (Circuit)
R. W. Tanner, Radio Engineering, pp 10, June, 1933

"Eagle" (Gross Radio) S. W. Receiver (Circuit)
J. Gross, Short Wave Craft, pp 229, August, 1933

National Type SRR 5-Meter Super-Regenerator
Short Wave Craft, pp 151, July, 1933

Powertone A-C. Short Wave Receiver (Circuit)
Short Wave Craft, pp 162, July, 1933

Tuned and Untuned S. W. Aerials
Dr. W. Moller, Short Wave Craft, pp 210, August, 1933

TESTING SYSTEMS

All-Wave Modulated Oscillator (Circuit Details)
W. F. Peck, Radio World, pp 8, June 24, 1933

Figuring A-F. Transformer Ratios
D. E. Noble, QST, pp 34, July, 1933

Handy Tube Voltage Test Adapter
G. Johnson, Radio News, pp 109, August, 1933

Impedance-Measuring Device (Details)
A. W. Barber, Electronics, pp 194, July, 1933

Multi-Purpose Meters, Part II (Extending Ranges)
H. G. Cisin, Radio News, pp 88, August, 1933

Philco All-Purpose Set Tester (Circuit)
J. Kaufman, Radio News, pp 74, August, 1933

Point-to-Point Adapter
W. Brown, Radio Retailing, pp 37, July, 1933

Portable Service Kit (Construction)
L. E. Easley, Radio-Craft, pp 82, August, 1933

Resistance-Stabilized Oscillators (Theory and Circuits)
F. E. Terman, Electronics, pp 190, July, 1933

Superfine Superhet Alignment
P. E. Grivet, Radio Retailing, pp 35, July, 1933

Tube Tester (Construction)
M. Reiner, Radio-Craft, pp 86, August, 1933

TUBES

"Catkin" Metal Tube (English)
Electronics, pp 152, June, 1933
Also Radio Engineering, pp 11, June, 1933

Characteristics of Type 59
L. Martin, Short Wave Craft, pp 150, July, 1933

Characteristics of 12A5, 1-v, 53 and 25S
L. Martin, Radio-Craft, pp 78, August, 1933

High-Vacuum Rectifiers (Characteristics)
Radio-Craft, pp 104, August, 1933

Hum Generation in Vacuum Tubes (Heater Design)
J. J. Glauber and A. G. Campbell, Radio Engineering, pp 12, June, 1933

New-Tube Connection Chart
Radio Retailing, pp 38, July, 1933

Type 2B6 (Triple-Twin) Amplifier Tube
Radio Retailing, pp 33, July, 1933

MISCELLANEOUS

List of Non-Copyrighted Records for P-A. Performances
W. T. Golson, Radio Retailing, pp 37, July, 1933

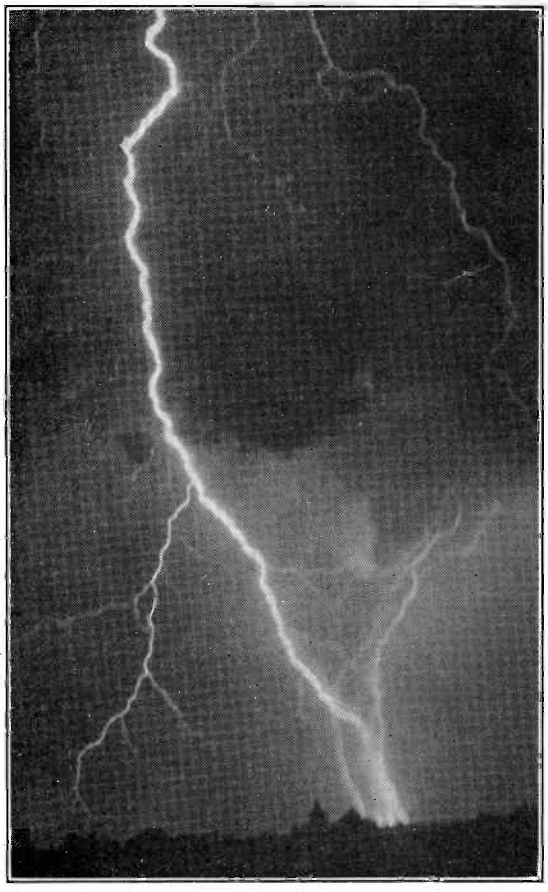
Modernizing the Majestic Model 15
M. Landau, Radio-Craft, pp 96, August, 1933

Resistance-Stabilized Oscillators (Theory and Circuits)
F. E. Terman, Electronics, pp 190, July, 1933

The "Iconoscope" (Cathode-Ray Scanner)
Electronics, pp 188, July, 1933

All articles listed on this page are cross-indexed for your convenience. Titles given are not necessarily the titles of the original articles, but in each case serve to determine the substance of the article. Listings marked with an asterisk (*) are abstracted in this issue. The material in each issue of SERVICE is alphabetically indexed on the Contents Page.

SERVICE
Hits The
SPOT



Group Subscriptions at Substantial Savings!

The Regular Subscription price for SERVICE is now $2.00 per year.

You, no doubt, know many other Service Men who would like to receive SERVICE every month. Probably several other Service Men in your acquaintance are already subscribers.

Here are two plans whereby you can save money for yourself and your friends:

- *1—Subscriptions (new or renewals) can be purchased in groups of ten or more for $1.00 per year each.*
- *2—Subscriptions (new or renewals) can be purchased in groups of five to ten for $1.50 per year each.*

If your subscription is about to expire, show SERVICE to five or ten of your friends. They, too, will want it. If they are already subscribers, they will want to renew or extend their subscriptions.

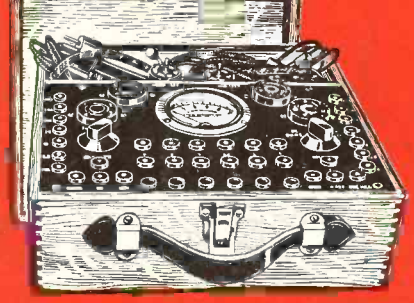
If you wish to *extend* your subscription at these savings, get five or ten others to subscribe at the same time.

Be sure to print clearly the name and address of all the subscribers, and send a check or money order covering the exact amount, noting in each case whether the subscription is a new one or a renewal.

John F. Rider Publications, Inc.

1440 Broadway **New York, N. Y.**

PRINTED BY
BLANCHARD PRESS
NEW YORK



FREE

The Supreme No. 333 Combination Set Analyzer and Point to Point Resistance Tester given with an initial order for 25 National Union tubes, an agreement to purchase 475 more National Union tubes during a two year period and a deposit of $20.00, refunded upon completion of purchasing agreement as a merchandise credit.

NOTE:—This is but one of numerous National Union offers. Ask your jobber's salesman or write direct to National Union for details on other premiums not shown.

Two Service Manuals are given without deposit with an initial order for 25 National Union tubes and an agreement to purchase 75 more National Union tubes during a one year period. The Third Volume is also given without deposit with an initial order for 25 National Union tubes and an agreement to buy 100 more National Union tubes during a one year period.

This Unameter Visual Tube Tester which tests 130 tube types with provisions for additional types is given with an initial order for 25 National Union tubes, an agreement to purchase 475 additional National tubes during a two year period and a deposit of $20.00, refunded upon completion of agreement as a merchandise credit.

NOTE:—The Free Offers shown on this announcement are but a few of those available. Ask your jobber's salesman or write National Union direct for details on others.

Through NATIONAL UNION *You Can Get This Equipment* FREE!

The only key we know to successful merchandising is, to help.

Helping the service man-dealer is the National Union policy which is bringing profit to many thousands of your fellow radio service workers. National Union help is given in many ways . . . by supplying tubes consistently superior in quality . . . by giving shop equipment, meters and manuals with the purchase of National Union tubes . . . by supplying up to the minute data sheets, such as Peak Frequency Charts, Voltage Divider Charts, Characteristic Charts, Tube Base Connection Finder and Tube Data Books . . . by constantly being alert to the needs of the service man-dealer as changes and advancements take place in the industry.

Can you as a progressive dealer afford to ignore the advantages of tying up with the National Union tube line? . . . Let National Union help *you* . . . write or send coupon for full details of National Union equipment offers.

NOTE: Write for special bulletin on new National Union increased profit plan.

NATIONAL UNION RADIO CORPORATION OF N. Y., 400 Madison Avenue, New York City

Send me complete details about your shop equipment offers!

NOTE
All offers are subject to withdrawal without notice.

Name.....

Address.....City.....State.....

NATIONAL UNION *Jobber Stocks Are Complete!*