

NATIONAL

RADIO

NEWS

FROM N.R.I. TRAINING HEADQUARTERS

Vol. 1—No. 9

WASHINGTON, D. C.

MAY, 1929



You're Out for Success — Which Example Will You Follow?

Radio Retailing

Mc Graw-Hill Publishing Company Inc.
TENTH AVENUE AT 36TH STREET
NEW YORK, N.Y.

March 26, 1929

Mr. J. E. Smith,
National Radio Institute,
16th and U Streets,
Washington, D. C.

Dear Mr. Smith:

My analysis of a number of factors which I think will have a decided influence on the radio business during the coming summer leads me unhesitatingly to express the opinion that there will be a greater volume of business done — all through the radio industry — in the hot weather months of 1929 than ever before.

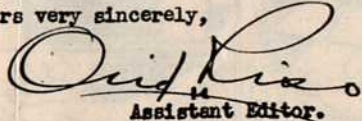
Chain programs are now being put on an all-year-round basis. Figures issued by the National Broadcasting Company show that sponsors of chain programs have practically doubled and that there is but a negligible falling off in summer broadcasting, especially as compared with previous years. Officials of the broadcasting chain systems estimate that \$25,000,000 will be spent in 1929 on chain programs alone. These facts indicate that both the quality and quantity of programs will show decided improvement this summer.

It will be remembered, also, that next summer will be the first in which the station reallocations ordered by the Federal Radio Commission last November will be in effect. The reallocations have had such a favorable effect on the broadcasting situation that they will undoubtedly prove a remarkable stimulus to summer sales.

Another favorable indicator is the radio survey among the farmers recently conducted by the Pennsylvania Department of Agriculture. This showed that 75 per cent of the farmers are using the weather and market reports which are broadcast daily. As farmers appreciate the business value of owning a radio set, hot weather will have no effect on radio sales in rural districts.

Do you not agree with me that these are excellent indications that the summer of 1929 will mark the beginning of the annihilation of the summer slump bugaboo?

Yours very sincerely,



Assistant Editor.

Ovid Riso

RR-8 PUBLISHED IN THE INTEREST OF RADIO AND ALLIED INDUSTRIES
MEMBER OF AUDIT BUREAU OF CIRCULATIONS AND ASSOCIATED BUSINESS PAPERS

May, 1929

NATIONAL RADIO NEWS

3

National Radio News

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NATIONAL RADIO INSTITUTE

Washington, D. C.

May, 1929

EDITOR'S NOTE.—Be sure and read the letter from Mr. Riso reprinted on the opposite page. As assistant Editor of a large Radio Magazine, Mr. Riso knows the Radio situation from all angles. He agrees with the views of leaders in all branches of Radio that the remaining months of 1929 will be the best yet for big profits in Radio Sales and Service.

Summer—Growing Months for Radio Profits



IF THERE is any one thing that the Radio industry is certain of today, it is this—that Radio has lost much of its seasonal character and now maintains an all-year-around balance of Radio profits.

We must admit that there was a time when Radio activity was limited principally to the Spring, Fall and Winter months, while the Summer was rather "slow going," but that is a thing of the past now.

No matter in what direction we look we see added evidence of uninterrupted Radio prosperity throughout the Summer months of 1929 and the years ahead. Why, even last Summer Radio practically banished the bad Summer business bugaboo by piling up an unprecedented volume of sales and service profits.

With that as a start, the new Radio designs, and the many improvements in A. C. operated sets indicate that the Summer ahead offers some of the very best opportunities for profitable Radio sales and service work.

There are any number of factors contributing to this era of Radio prosperity. One is the improved quality of broadcast programs evidenced by the new Star Radio Forum which is mentioned on page 4 of this issue of the News, and also the fact that \$23,000,000 will be spent this year on chain programs alone, is another sign that Radio activities will continue at a high level.

On the opposite page there is a letter from the Assistant Editor of Radio Retailing which is worth your careful reading and thought. Look it over—note the factors that make for Radio prosperity this Summer, and then add to them the many signs of such prosperity in your

local surroundings. Why, there is no question about it at all—Radio sales are going ahead at a high pitch, and the man who lays down on the job this summer certainly is going to lose out on some mighty good profits. On the other hand, the man who digs right in, takes every possible chance he can to increase his business and income will certainly put some nice, tidy rolls of currency in his pockets.

You can make your profits even larger by laying out a systematic plan to follow in building up a good business this summer, and following it out to the letter. Map out a schedule for the Summer—lay aside so much time for studying on the course, figure out how many prospects you are going to see, drum up some new ways of demonstrating and selling sets to campers, for special Summer outing groups, lawn parties, etc., think up as many different plans for cashing in big on your Summer business as you possibly can, read this issue of the News carefully and make use of some of the money-making ideas we are giving you in it, and then after you have organized your Summer campaign—follow it out carefully and thoroughly.

You'll have a better opportunity this Summer to cash in big on a summer business than you have ever had in any previous Summer, and I want every N. R. I. man to get his full share of these rich Radio sales and service profits.

One thing more—we know that you can do the best work and go farthest in Radio when you know that we are right here on the job working with you. We have a glimpse into the future—we know what Radio holds out for well-trained men in the years ahead, and we aren't losing a minute here—we are going to be on the job all Summer, working hard, giving you the very best possible training, and ready to give you many tips and pointers to help you increase your Radio business.

So let's keep in step, work together now and make the remaining months of 1929 the most profitable months ever for you.

J. E. SMITH.



Prominent United States senators who were the speakers in the first three programs of the National Radio Forum. Left to right: Senator Jones of Washington, Senator Smith of South Carolina, Senator Borah of Idaho who was the first Forum speaker, Senator Harrison of Mississippi and Senator McNary of Oregon.

National Radio Forum Major Broadcast Event

THE formation of a National Radio Forum by the Washington Evening Star in cooperation with the Columbia Broadcasting System is an event of great significance in Radio.

Nationally known speakers will discuss questions of great importance in these weekly broadcasts over a chain of 50 stations. This signifies a new day in the era of broadcasting. It fills a real demand for programs of the highest quality, and furnishes a constructive information service on the problems before the government to people in all sections of the country.

The first speaker of this new series of programs was Senator Borah of Idaho. Senators Jones and Harrison spoke on the following Saturday evening on "Farm Relief," and Senator Smith and Senator McNary spoke on the third Saturday evening on the same subject, and were followed by Congresswomen Ruth Bryan Owen of Florida and Ruth Hanna McCormick of Illinois. Many other notables are scheduled to speak over this Forum every Saturday evening at 10 p. m. They include Secretary of Treasury Mellon, Secretary of State Stimson, Senator Moses of New Hampshire, Congressmen Longworth of Ohio, and Gar-

Mr. Oliver Owen Kuhn, originator of the National Radio Forum, and managing Editor of the Washington Star



ner of Texas, and other members of the Cabinet, senators, and congressmen.

It is significant that a Washington newspaper should sponsor a program of such magnitude, reach out beyond its circulation and bring to the people in all corners of the land the best thought of government officials and other nationally prominent men and women.

And yet it is only natural that Washington, the Capital—where leading Radio activities and regulations converge, should also be the source of one of the most noteworthy of the chain broadcast programs.

It is developments of this character that reflect the growth of Radio and its strong grip on the American public.

This is just one of the many "signs of the times" that indicate that interest in Radio activities will continue at a higher level this Summer than ever before.



"I would not part with my course for \$100,000 and I tore up the Money-Back Agreement the first month I enrolled." Stanley E. Campbell, Rt. 1, Box 199, Petaluma, Calif.

"My employer wrote you requesting a catalogue and some information about your course, as I was considering taking some course in Radio. Although he is a graduate of another school, he recommended your school to me, because he said he thought you gave the most thorough training to be had in this line." Harry F. Nourse, c/o Mapleton Radio Shop, Mapleton, Iowa.

"I would not sell my knowledge gained from first 10 lessons for \$1000." Mr. J. Gates, P. O. Box 389, Salisbury, N. C.

"Out of about twenty applicants, Mr. Blackmore, Certified Master Radio-Trician of N. R. I. and myself secured positions with Kemper Radio Corp. I am now employed as service manager of the Oakland branch." Mr. Wade W. Wightman, 847 44th Street, Oakland, Calif.

"I have successfully serviced Radiolas, Crosleys, Majestics, Bremer Tully, Orphens, Fadas, and quite a few outlandish, nameless and terrible concoctions, including three sets that were declared by quite smart men as unfixable." Mr. Louis T. Thoma, 3125 Vine St., Cincinnati, Ohio.

"I can't express myself or my feelings in words just how much I value and treasure my association with the National Radio Institute." Cliff D. Johnson, Columbia, So. Dakota.

"The study of Radio is full of thrills and adventures. Each lesson is a book of adventures, leading into the great jungle 'Radio!' The N. R. I. Radio course is wonderful and interesting." Herbert G. Faris, 1953 Ahuula St., Honolulu, T. Hawaii.

"I am getting along fine with my set-building experiments on the apparatus you furnish with the course. I set Nashville, Tenn., most every night with the one tube circuit—that's 850 miles." E. M. Mickle, Belleville, Ont., Canada.

"I have been selling Philco Radios and have made about \$750.00 in 3 months." Mr. F. H. Williamson, 1880 Portsmouth Ave., Portland, Ores.

"Before enrolling I had worked at most everything but did not seem to be satisfied with anything very long. I am now employed by a large music store handling most of the leading Radios and electric Phonographs at a fine increase in salary. Words cannot express the benefit I have received from your course." J. R. Lewis, 1154 Corona St., Denver, Colo.

"Your Radio Job and Service Sheets are a great help to me." Homer F. Saville, 503 W. Main St., Blanchester, Ohio.

"I have made about \$275 in the last three weeks during my spare time. I surely got out of the rut when I took up N. R. I. course. It is worth twenty times what it cost me. I will always be a booster of N. R. I." H. G. Perkins, Box 661, Greenville, Penna.

"I made about \$65 or \$70 in the last ten days here—not so bad for a small town." Mr. J. W. McCool, Jr., 607 Grant St., Dennison, Ohio.

"I have averaged better than \$275 per month for the last eight months." M. Eckenbeck, Skamokawa, Wash.

"I have made \$436.00 since I took up the study of radio with you." Robert J. Clark, R. F. D. No. 1, Box 390, St. Calir Shores, Mich.

"I met an N. R. I. graduate the other day. He sure gave the N. R. I. and faculty a good send-off! He advised me as you have done, to stay with it EVERY DAY and not to play off as some do! He certainly is 'tickled to death' that he graduated from your, or rather, our school. He can't be more tickled than I am to know that I am receiving the VERY BEST there is!" W. A. Higgins, 11156 Burbank Blvd., North Hollywood, Calif.

"I've been so busy servicing sets around this district that I've not had an hour to call my own for the last two weeks, and I've another busy week ahead. You know I can only service in the evenings. Since I wrote you last I have made \$91.30, so that's not doing bad for a small village and farming district. I feel sometimes that I'd like the servicing to slacken up a bit so as to give me a chance at my lessons." John Johnston, Box 240, Richmond Hill, Ont., Canada.

"Your lessons are so interesting and very clear. I am Swiss French. When I wrote to you the first time, I could speak English, but not read or write very well. Now I can. If you know some people here that would like to join the N. R. I. and are still hesitating, I should be very pleased to prove to them that the course is worth a lot more than you ask." Mr. H. Giroud, Rua Jacequay, No. 45, Sao Paulo, Brazil.

"I received my Junior Radio-Trician card and it got me a job in a large radio factory." Hymen Kushner, 718 N. St. Louis St., Los Angeles, Calif.

"I have been so busy that I haven't had time to write you but I will say that the training the N. R. I. gives a man sure is good. At the present time I am making about \$30.00 per week in my spare time and I would not sell what the N. R. I. taught me for \$10,000. My servicing is increasing by leaps and bounds. And I thank you and Mr. Dowie for all you are doing for me." F. H. Williamson, 1880 Portsmouth Ave., Portland, Oregon.

"I've averaged about \$1.75 or more for every hour I've put in so far." Jos. H. Bingham, 7259B, 2068 Merd. Ave., Ogden, Utah.

Adjusting and Neutralizing Crosley Receivers

By N. R. I. Technical Staff.

All circuits involving the neutrodyne method of balancing of tuned Radio frequency sets must take into account the fact that there is a variation in the characteristics of vacuum tubes. In the Crosley Showbox, Jewelbox, and Bandbox models, the method of balancing is by means of small adjustable condensers.

It is generally known that the balancing of the set has much to do with the amplification gain. All Crosley Radio sets are balanced in the factory, using vacuum tubes which are carefully selected and frequently checked, having average standard characteristics. Every Radio-Trician knows that it is occasionally necessary to rebalance any receiving set using the neutrodyne circuit in case the particular tubes used in that set are somewhat off of the average standard. The Crosley Gembox does not have the small variable neutralizing condensers. It utilizes what is known as the grid-to-grid method of balancing. The balance of this set depends largely upon the critical angle of the Radio frequency coils or transformers. They are occasionally adjusted in the factory for average standard tubes just as are the other Crosley models, and as a general rule, these sets will function perfectly with the average tubes with which they are equipped in the field.

However, if any set tends to oscillate with the tubes with which it is equipped, or if the set seems to lack in sensitivity, the method of adjusting the set is extremely simple to adapt it to the tubes with which it is to be used. Simply remove the lid when the set is in operation; change the coil angle by slightly raising or lowering the top of the Radio frequency coil; replace the lid; turn the dial throughout its entire range. If it oscillates at any spot, remove the lid and again change the coil slightly in the opposite direction.

A sensitivity test may then be made by tuning to a weak signal and adjusting the coil or coils until the loudest signals may be had. With the lid again replaced, again test to see if there is any point on the dial where the set oscillates. In other words, get the maximum volume

without oscillation. The movement of the coil is only very slight, probably not a variation of over one-sixteenth to one-eighth of an inch.

The most critical coil in this balancing operation is the first coil in the front of the set. The second coil is far less critical and it is seldom necessary to touch the third coil. This balancing operation is required no more frequently than is required in any other condenser balanced neutrodyne circuit. Probably the majority of sets that you receive from the factory will require no balancing, but for those comparatively rare cases where rebalancing is necessary, the above is the method of doing it.

This method is far more simple than the method of balancing by means of the condensers. It requires no tools, simply a slight bending of the coil angle by means of the fingers.

The same method outlined above can be used in adjusting the coils in the Gemchest, except that it is unnecessary to remove and replace the lid. Of course, it is needless to tell you that this affects only the three Radio frequency tubes. Sometimes the same results can be obtained by shifting the tubes in the set from one socket to another.

Wherever a set is lacking in volume or sensitivity, or if an occasional set is found which oscillates, this simple method of adjusting as outlined will work very satisfactorily. The sensitivity can be increased a great deal and any objectionable oscillations completely eliminated.

OUR COVER

Did you study the story of two N. R. I. men on the cover of this issue of the News? One man studies consistently and works hard for Success—the other one loaf the summer away. And as sure as the sun rises, one man will stay in the rut and the other one will soon be trained to earn big money in a good Radio job. The story of these two men reminds us of Aesop's fable of the lazy grasshopper and the thrifty ant. It pays big to use the growing summer months to store up Radio knowledge and Radio profits for the times ahead. If you really want success you'll lose no time deciding which example you'll follow.

Succeeding In The Service And Repair Business

By EDGAR H. FELIX



RADIO reception effected its introduction to the public through novelty and, as an indirect consequence, the organization of Radio servicing has lagged behind the establishment of Radio manufacturing and distributing. The listener no longer tinkers with his Radio receiver; it serves him as an entertainment fixture. He expects Radio entertainment and does not consider it a magic mystery which may or may not work according to his whim. Concurrent with this change of attitude on the part of the listener, Radio has advanced from a device working on millionths of watts to a power device of no small magnitude. At the same time, the Radio receiver is in a steel metal chassis with wiring and parts, once exposed, now wholly or partly concealed. Individual circuits are identified in bundles of twisted cable by a color code and routine tests appear in manufacturers' service bulletins so that

the principal troubles may be identified. From a happy-go-lucky following of a blue print or circuit diagram, Radio repairing has risen to a skilled task, requiring specialized knowledge and study beyond the realm of the average consumer.

The servicing organization, contacting with the consumer, is neither well defined nor widespread. Most dealers have a technical man who has manifold duties, including passing on the purchases of new makes or types of sets which the dealer may wish to add to his line from time to time; the installation of newly sold receivers in homes and the answering of repair calls when such sets go wrong. Radio manufacturers issue bulletins to assist the service man in installing and maintaining receivers. But we are far from the day that the consumer buys Radio service as he buys automobile service, through well established and recognized channels. Rapid progress is being made in recognizing the necessity for organized service, but most of the service work done in the home is nevertheless being done by the independent service worker who establishes his clientele by personal contact with Radio set owners.

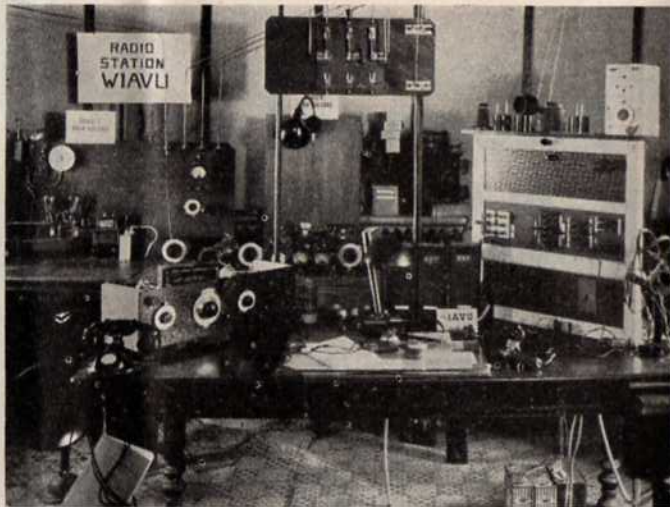
One of the reasons independent service men are so numerous is a heritage of the day when many receivers were built by specialists or custom set builders. These were independent workers, usually starting their business by building sets at night and selling them direct to consumers. It was natural that the work of keeping such sets in good order should fall to the men who built them. Being often men of considerable skill, they have

(Continued on page 19)

EDITOR'S NOTE:—The author of this article, Mr. Edgar H. Felix, is a well-known broadcasting consultant and authority on Radio allocation. He has served as a Radio Engineer for the Radio development section of the Signal Corps and later in the same military unit with Director E. R. Haas. At the present time he is Radio consultant to the National Electrical Manufacturing Association, contributing editor of Radio Broadcast and Aero Digest, as well as frequent contributor to Radio Retailing and Advertising and Selling. He is author of "Using Radio in Sales Promotion," which is accepted as the standard text book of the financial side of the broadcasting business. Mr. Felix has written this article especially for the News and we are confident that our readers will find it to be interesting, instructive and informative.

How I Built Station WIAVU

By
GRADUATE
HARRY O.
BARSCHDORFF



RADIO is one of the closest things to my life today. Radio, with all its possibilities, is intensely fascinating and it first interested me in 1923 when I was a sophomore in high school. I bought many Radio magazines and books but was not satisfied until I started my Radio course with the N. R. I. to master Radio theory and practice completely. I started while still in school and decided right then to make Radio my life profession.

After completing my N. R. I. lessons in receiving and transmitting apparatus I became intensely interested in constructing an amateur Radio station of my own. At that time I was doing quite a bit of service and repair work for several dealers so I took the profits from this work and built an amateur station in



my room at home. In February, 1928, I received my amateur license for operating and my station license.

Then I became interested in the technical end of short-wave transmitting apparatus. After carrying out some very interesting experiments I decided to do a little short-wave manufacturing work in building short-wave stations for others. This gave me a good income—I made around \$3 per hour on transmitters and \$2 per hour on receivers.

Then, in March, 1928, I became an Army amateur Radio station in the first corps area. I continued operating this station and manufacturing short-wave apparatus until June, 1928. By that time I found my present quarters a little crowded. I wanted to build a higher powered station so I could use a microphone. So in the summer of 1928 I put up a new building on Greylock Mountain—the highest point in Mass.—which was paid for entirely with the money I had made in the Radio business. I value the apparatus in this station at \$3000. All power lines, telephone, microphone and supply lines run under the ground. There is no steel conductor within 200 feet around the station. All wiring and lines to the station are lead cable. After much experimenting I have learned that the wood towers are more efficient than steel on short wave, so I am using them with my new station.

With WIAVU I have worked many stations in Hawaii, New Zealand, Australia, Juzio-Slavia and many other countries.

Radio has me in its grip. I'm going to keep up with new developments and do my best to carve out my little niche in the Radio Hall of Fame.

Editor's Note:—We are glad that Graduate Barschdorff has written this article for the National Radio News. It is a source of pride to the Institute that we can class among our students and graduates such men as Graduate Barschdorff. He has not reached the age of 21 yet, and the remarkable success he has had in Radio to date indicates that he has a most promising future. How many of you N. R. I. men have records such as his? Let us hear from you.

my room at home. In February, 1928, I received my amateur license for operating and my station license.

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Radio-Trician's Service Manual on Atwater Kent Receivers Models 40, 42 and 52

THE Atwater Kent Models 40, 42 and 52 are 6-tube single-dial A.C. receivers with a complete power unit (sealed in a single metal container) incorporated in the metal cabinet that houses the set. The power unit supplies complete filament, plate and grid voltages to the set from the 110-volt A. C. power line.

a coupling tube in order to eliminate the detuning effect of the different antenna sizes (which would otherwise disturb the synchronism of the three tuned circuits). There is a tuned detector and two stages of audio frequency amplification.

The volume control consists of a resistance connected across a section of the antenna coupling trans-

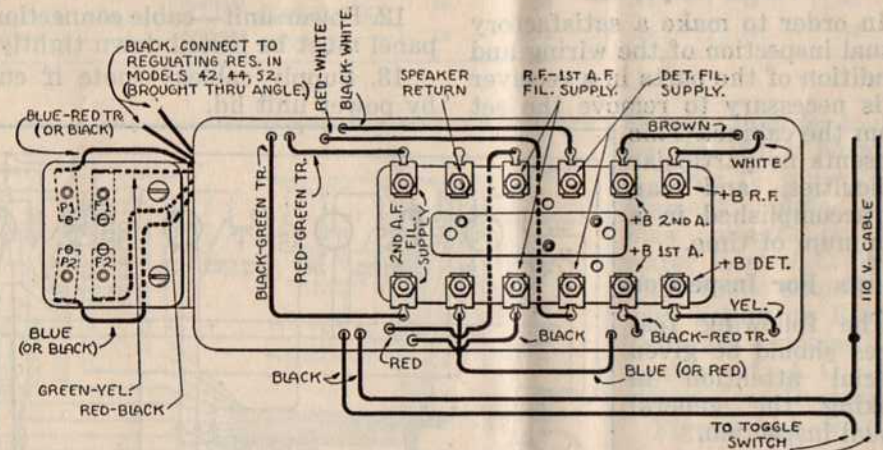


Fig. 1—View of Power Unit used in AK Models 40, 42, 44 and 52, showing connections from sealed container to panel assembly, rectifier socket and regulating resistance.

Models 42 and 52 are equipped with an automatic voltage regulator in series with one side of the A.C. line. This device is so designed that owing to the heating effect, a voltage above normal (110) will increase its resistance value, and a voltage below normal will decrease its resistance, so that the voltage across the primary of the transformer is maintained at a constant value.

The circuit of each receiver has three stages of radio frequency amplification, the first stage acting as

former. A slider on this resistance connects to the ground and the antenna is connected to one side of the resistance. By adjusting the slider, more or less of the antenna current may be shunted to the ground, thus decreasing or increasing the volume.

The schematic wiring diagram of Models 40, 42 and 52 is shown in Fig. 2. Model 52 does not have the shielded antenna lead. In that set, two 20-ft. leads are connected to the volume control, black for antenna and black-green tracer for

ground. The outside end of the antenna coupling transformer is connected to the grid contact of the first R.F. socket.

Servicing Receivers and A.C. Power Unit.

The main tests to be applied to a set when not operating properly may be classified as follows, applied in order named:

No. 1, Visual inspection. No. 2, Continuity test, with voltmeter. No. 3, Voltage test.

The conducting of these tests will now be outlined.

Visual Inspection

In order to make a satisfactory visual inspection of the wiring and condition of the parts in a receiver it is necessary to remove the set from the cabinet. This presents no particular difficulties, and can be accomplished in a minimum of time.

Points For Inspection

The following features should be given special attention in making the general visual inspection.

1. Soldered joints—examine for firmness. A poor physical joint means a poor electrical connection. Note especially ground lug connections.

2. Screws, bolts and nuts—must be all tight.

3. Insulation on wiring—must be perfect and not cut or frayed through where it passes metal edges of tubes, contacts, etc.

4. Tube socket fingers—should be clean and tight.

5. Switches—switch blades should be clean and make good contact.

6. Dials—should not scrape on panel.

7. Grid resistances—note if intact and tightly riveted on.

8. R.F. transformers—examine for loose or damaged coils, or bad connections at terminals.

9. Variable condensers—check for foreign particles between plates and note spacing between rotary and stationary plates.

10. Rheostats or volume control—must operate smoothly.

11. Power supply cable—note condition of insulation on lead and condition of terminals at power end.

12. Power unit—cable connection panel must be bolted down tightly.

13. Supply cables—note if cut by power unit lid.

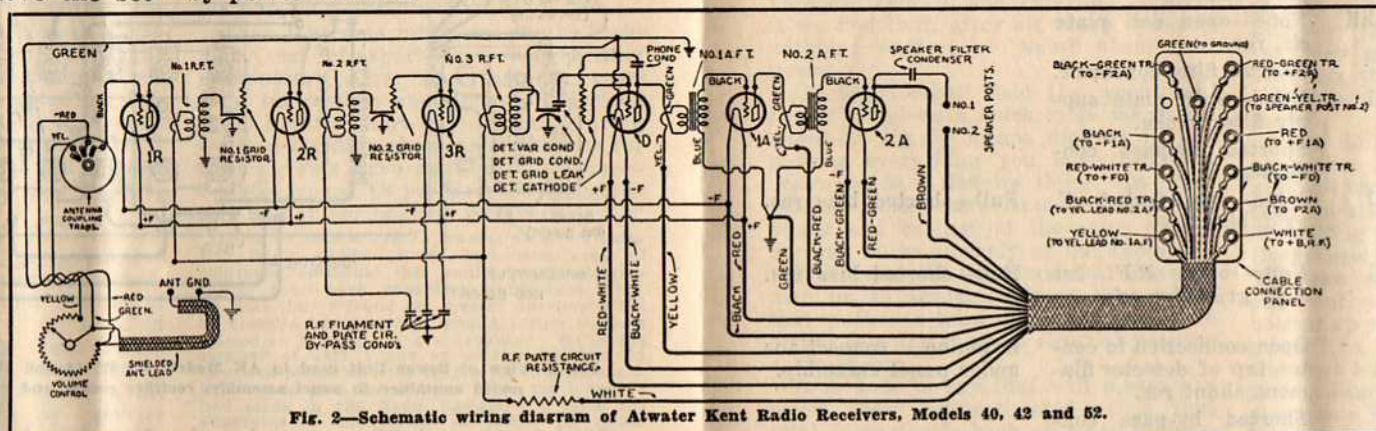


Fig. 2—Schematic wiring diagram of Atwater Kent Radio Receivers, Models 40, 42 and 52.

Continuity and Voltage Test

After the receiver has been thoroughly checked by visual inspection, the next step toward locating possible defects will be to apply the series of circuit continuity tests. These tests should be made with a low range D.C. voltmeter, zero to 50 volts, connected in series with a 45-volt B battery.

It will be necessary also to check the voltages supplied to the various circuits by the power unit.

TABLE I
VOLTAGE TEST CHART—ATWATER KENT A. C. SETS
(Measurements made while set is in operation)

Fil. Voltages (Use 0-5 AC meter)	Test Terminals (Colors of cable leads)	Model 36 Model 37 to Serial No. 1,265,000	Model 37 Serial No. 1,265,001 to 1,385,001 and up Approximate Voltage	Model 38	Models 40, 42, 44 and 52
Detector	Red-white tr. to black-white tr.	2.3	2.2	2.3	2.35
R.F. & 1st A.F.	Red to black	1.4	1.45	1.3	1.45
Power (2nd A.F.)	Red-green tr. to black-green tr.	4.8	4.7	4.8	4.8
Plate Voltages (Use high resistance DC meter)					
Detector	Red-white tr. to yellow	30	25	30	44
R. F.	Red to any R.F. tube "p" contact (thru eyelet)	135	165	170	180
1st A.F.	Red to black-red tr.	110	135	160	155
Power (2nd A.F.)	Red-green tr. to brown	120	145	175	180
Bias Voltages (Use high resistance DC meter)					
On Power tube	F to G (socket 2A, thru eyelets)	25	30	45	45
On R.F. and 1st tubes	F to G (socket 1A, thru eyelets)	12	12	13	13

of tubes in order to determine if it is normal.

Table I gives the filament, plate and bias voltages on Atwater Kent A.C. sets. This table should be very helpful to Radio-Tricians servicing all models of A.C. Atwater Kent Receivers.

Figure I shows the connections from the power unit used in models 40, 42, 44 and 52. This view shows

the approximate position of leads from the field container. In Models 40, 42 and 52, a hole is cut in the rectifier socket mounting angle and the two black leads are brought up through the hole and connect to the regulating resistance, which is mounted upright at the left hand end of the field container.

Table II gives the continuity test for power unit used in Models 40, 42, 44 and 52. For following test, remove table connection panel from unit.

A high resistance voltmeter should be used for testing B voltages, one having several ranges, such as 0 to 10, 0 to 100 and 0 to 200, any one of which can be used by changing connections on the meter.

For testing filament voltages on the tubes, a low range A.C. voltmeter is used having a scale reading of 0 to 5 volts.

A milliammeter can be used for checking the amount of plate current being drawn by one or a group

TABLE II

Test	Correct Reading	Wrong Reading Indicates	Remarks and Further Possibilities
Across 2nd A. F. filament Supply.	Full	None—open 2nd A.F. fil. winding and open 2nd A.F. filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across R. F. 1st A. F. Filament Supply.	Full	None—open R.F. 1st A.F. fil. winding and open R.F. 1st A.F. fil. shunt res.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
Across Detector Filament Supply.	Full	None—open det. fil. winding and open detector filament shunt resistance.	Nearly full—open filament winding. (Unsolder one fil. winding connection and test winding and fil. shunt resistance separately.)
From +B R.F. to +B 2nd A.F.	Partial	None—open speaker (output) choke.	Full—shorted speaker choke.
+B 1st A.F.	Small	None—open 1st A. F. plate cir. res.	
+B Detector.	Very Small	None—open det. plate cir. res.	
Ground.	None	Shorted filter condens'r.	
F1 (on Rectifier Tube Socket).	Partial	None—open plate supply filter choke.	
From Ground to +B Detector.	None	Shorted by-pass condenser.	
One Side of 2nd A. F. Filament Supply.	Partial	None—open 2nd A. F. grid bias res.	Full—shorted bias res.
One side of R.F.-1st A.F. Filament Supply.	Partial	None—open R.F. 1st A.F. grid bias res.	Full—shorted bias res.
One side of Detector Filament Supply.	Full	Open connection to center tap of detector filament shunt res.	Examine connections under panel assembly.
+B 1st A.F.	None	Shorted by-pass condenser.	
P1, P2 (on Rectifier Tube Socket)	Nearly Full	None—open high voltage sec. winding.	
Each Terminal of A.C. Plug.	None	Grounded primary of power transformer.	Inspect A.C. cable and switch leads for accidental grounds.
Other Tests			
Across terminals of A.C. Plug. (Toggle Switch "On".)	Full	Open primary of transformer or open cable or switch leads.	
F1 to F2 (on Rectifier Tube Socket).	Full	Open rectifier filament winding or connections.	
One side of 2nd A. F. Filament supply to speaker return terminal.	Full	Open connection to center tap of 2nd A. F. filament shunt resistance.	

Will Power Carries a Punch

By DIRECTOR E. R. HAAS



A GREAT deal is written and spoken about will power. Some try to leave the impression that it is a very mysterious, elusive force. Others wrap it up in all sorts of technical phrases and hint that it is a God-given power.

But when we strip all of these high sounding phrases from it and carefully analyze it we find that, after all, there is really nothing magical or weird about will power.

On the football field the word "will power" is given a much more masculine name—it simply means digging in and putting everything you have behind a desire to do a definite thing. In other words, a man can't have a strong will power and be lazy at the same time—nor can he be slovenly or indifferent.

Will power is the force that drives a man on to accomplishment—the power that pushes a man on from smaller to bigger jobs the same as electricity drives a street car.

It is safe to say that will power has never been underestimated—it is that vital force that's back of most successful men today. All about us we see its results—big jobs done by men who had the will power to win.

We see men handicapped by the lack of sight or hearing who hold some of the most responsible positions. For instance there is the late Charles P. Steinmetz, the hunchback, who dogged his way to the top in the electrical world and became the recognized electrical wizard of the day. It is needless to mention any number of such men whose chief asset was an undying, irresistible will power—the will to do, the will to win!

Wishing will never do the job that will power only can do! You must be up and doing. Carry out your plans—start

working on that job you have had in mind for sometime—finish up that lesson you've let slide for awhile.

If you'll notice—it's the fellow with the will power to improve himself by work and study that gets first consideration when the job higher up is to be filled. It's only natural that he should. Employers are looking for men who can do a job better than the average man and who has the will power to keep behind a plan or idea until he puts it across. Furthermore, that kind of fellow just naturally radiates enthusiasm and quickly develops into executive material—acquires the ability to direct the work of others.

It's true that every one does not have strong will power, and it's because of this very fact that the really good jobs that pay good money are hard to fill. They are the jobs waiting for men who will step in, and do the work expected of them.

This desirable quality of will power can't be acquired overnight. Don't say "I'll wait until I finish my training—then I'll start doing things right." Start developing that power in you right now! Every new lesson is a challenge to you. You can weaken, lay the lesson aside and loaf your time away or you can bolster up your courage, get the old "will power" to working and smash through the next lesson with the force of a battering ram. And if you'll do that to every new job you tackle you'll stand out head and shoulders above the crowd.

I say, make a clean-cut decision and put plenty of pep and energy—will power—behind your decision or plan and you'll develop a power that does not recognize the possibility of failure. You have will power—don't let it lie latent—use it.

Success or failure in business is caused more by mental attitude even than by mental capacities.—Walter Dill Scott.

Theodore Roosevelt once said, "If a man wants a thing bad enough to work hard enough, he is bound to get it."

"A man's accomplishment is not limited to the degree of his ability, but to the extent of his persistence, his perseverance. For, nine times out of ten, success is merely a matter of keeping at some one thing until you win success at it."

Lands Firestone Job

Dear Mr. Smith:

I have the pleasure of advising you that I have accepted a Radio job with the Firestone Tire and Rubber Company at Akron, Ohio, in their short-wave telegraph department—also in their Radio research department. This pays me \$200 per month to start with. As my plans were laid more than two years ago when I started your course, to try my best to get some place in the Radio game, I now see them materializing. This looks like my chance to "go from here" in the Radio game. I thank you for your part in my preparation. It is now possible that I may some day be able to visit you in Washington.

Tell "Chief" Dowie about this too—you both have certainly been a great help to me. Accept my regards and my thanks.

NORMAN R. HOOD,
1022 S. Ash Street,
Casper, Wyoming.

Congratulations, Graduate Hood—and good luck! You have made a splendid start. Come to see us the first chance you get.

EDITOR.

1929 REGULATIONS GOVERNING THE ISSUANCE OF RADIO OPERATOR'S LICENSES

1. Commercial extra first class.—To be eligible for examination, an applicant for this class of license must have held a commercial first-class license and must have been actually engaged as an operator at stations open to public correspondence for at least 18 months during the 2 years previous to his application. A speed in transmission and reception of at least 30 words per minute, in code groups, Continental Morse Code, and 25 words per minute, in plain language, American Morse Code, 5 characters to the word, must be attained. The questions in this examination will cover the same subjects required for a commercial second-class license but considerably wider in scope.

2. Commercial first class.—To be eligible for examination, an applicant for this class of license must have been actually engaged as an operator at stations open to public correspondence for at least 12 months. Applicants for this class of license must pass code tests in transmission and reception at a speed of at least 20 words per minute in Continental Morse Code, in code groups, and 25 words per minute in Continental Morse Code, in plain language (5 characters to the word). The practical and theoretical examination will cover the same subjects as required for the commercial second-class license.

3. Commercial second class.—Applicants for this class of license must pass code tests in transmission and reception at a speed of at least 16 words per minute in Continental Morse Code, in code groups, and 20 words per minute in Continental Morse Code, in plain language (5 characters to the word).

A Young Man and His Spare Moments

"I WISH I had time to study."

So often do we hear someone make this remark. Should you ask any person how much time he has at his disposal, nine chances in ten he will reply: "Not over a half hour or an hour a day."

An hour a day?—that's a world of time.

Do you know what can be done with a spare hour each day?

One can read 12,000 words within that time and give serious thought to each thought. That means that in one year's time one can read one hundred volumes of 200 pages each. Within three years, with one hour at one's disposal, he can master many a subject. In fact, one hour a day can bring one a college education.

Suppose one has but fifteen minutes a day for study. It is a rare individual who cannot find more time than this at his disposal, but we will figure on that basis.

Should he read deliberately for this length of time, within one year it will be an easy matter to cover five thousand pages, averaging 200 words to a page or twenty-five volumes of two hundred pages each.

If one-third of the fifteen minutes is devoted to reading passages over for the second or third time in order to get a clearer understanding of a statement, even within six months one can read eight and a half volumes of 200 pages each.

There is no one who cannot spare fifteen minutes a day for study or educational reading.

It pays to devote every spare moment one can to study, as the knowledge gained thereby enriches one's life just so much.

Many a person is bemoaning the fact that he cannot be this or that because he lacks the ability. If such a person would utilize his spare moments for self-improvement, he would find that he can qualify for the particular work which he has in mind and for which he feels that he is particularly fitted.

Clerk: Do you wish to try some of our mixed nuts?

Customer: No, but I'll try a pound of those Radio Nuts I've heard so much about.

CALL AGAIN

We are always glad to have N. R. I. students, and graduates, stop in and visit us while in Washington. The school is easily accessible from all parts of the city, and we are always on hand to meet you, become better acquainted with you, and show you over the big school that we have here to serve you.

Among those who have called here at the Institute in the past few weeks are the following:

August J. Rush, Stop 4, Western Ave., c/o A. Lister, Albany, N. Y.

Charles E. Talbot, 142 "A" St., N. E., Washington, D. C.

W. F. Hortman, 4133 New Hampshire Ave., N. W., Washington, D. C.

N. E. Padgett, 1030 17th St., N. W., Washington, D. C.

R. S. Johnson, 647 W. Princess St., York, Pa.

Ross Bratton, 425 W. South St., Salina, Kansas.

Julian T. Cervantes, 232 S. Seely Ave., Chicago, Ill.

Edward J. Day, Fort Monroe, Va.

J. H. Weber, 117 E. Main St., Shiremanstown, Pa.

Mrs. Henry J. DeWitt, wife of Student DeWitt, 3145 Scottwood Ave., Toledo, Ohio.

R. L. Howard, Tuskegee, Ala.

John Williams, New Freedom, Pa.

A. W. Hooper, Purcellville, Va.

R. Horton, 1206 Edison Ave., Baltimore, Md.

J. E. Stout, 531 N. Columbus St., Alexandria, Va.

W. E. Brown, Apt. 501, 1230 N. H. Ave., N. W., Washington, D. C.

Stanley Bizon, Chicopee, Mass.

A. J. Jobbagy, 1124 12th St., N. W., Washington, D. C.

Di Giovanni, c/o Munson Lines, Baltimore, Md.

RADIO MATHEMATICS

Radio Instructor: In radio measurements, a "micro" means one-millionth; a microampere is one-millionth of an ampere, and a microfarad is one-millionth of a farad. Now, can any student give me further examples?

Bright Student: Yes, sir; a micrometer is one-millionth of a meter and a microphone is one-millionth of a phone.

He: Why did you call a plumber instead of a service man to fix the radio?

She (indignantly): What does a service man know about grid leaks?

Submitted by Student E. E. Youngkin, Altoona, Penna.



1414 West 48th St.,
Norfolk, Va.

Dear "Chief" Dowie:

Just a few lines to say hello and to tell you that the N. R. I. course has been a God-send to me. I am busy all the time. My earnings are many, many times greater than I ever anticipated when I signed up for the course.

I am conducting my own business from my home—selling, installing, servicing and repairing sets. For the past few months I have averaged between \$500 and \$600 a month—very seldom dropping below \$100 in any one week.

So you see how really valuable N. R. I. training has been to me. It will mean even more to me in the future, for the surface of the Radio industry has only been scratched.

Your grateful student and graduate,

E. E. WINBORNE.

Graduate Winborne on the job. He is making good money today—and he'll be making still bigger profits in the months and years ahead—men who stick everlastingly by their course and master Radio thoroughly make big money in Radio. The more Radio knowledge you have—the bigger your earning power will be. Keep going!—Editor.



The Forward March of Radio

Five Radio telegram stations have recently been established in Brazil.

Regular Commercial Trans-Atlantic Radio Telephone communication between Buenos Aires and Europe was recently inaugurated. A wavelength of 34 meters is used.

Majestic is selling Radios by the train-load according to Student M. D. Edson, Harlowton, Montana. He writes that 24 cars of Majestic Radios passed through that town for Seattle recently and 8 cars for Butte, Montana.

After 3 years research work, a New York inventor has announced the perfection of a means of simultaneous broadcasting from 100 stations on the same wavelength. His system will soon be demonstrated before the Federal Radio Commission.

The Arceturus Tube Company plant at Newark, N. J., is now producing 17,500 Radio tubes daily. Orders on hand now will require several months' production before they can be filled. Operation will continue at full capacity right through the year. This is just one more indication that Radio activity will continue at a high pitch throughout the summer and fall months.

The New York Central has asked the Federal Radio Commission for two short-wave channels to be used in the operation of long freight trains. A transmitter and receiver will be installed on the caboose and in the locomotive. The conductor will sit quietly in the caboose and dispatch his orders to the engineer instead of the limited and uncertain means of delivering instructions by arm or flag signals.

Radio has been put to another practical use by an enterprising Akron Ohio Taxicab Company. The central office is equipped with a short-wave transmitter and each cab is equipped with a receiving set. A pair of headphones is strapped around the driver's head, and he takes orders throughout the day as to where to go to pick up his next passenger... The success of this practical installation will likely result in similar installations by other cab companies.

The Trans-Continental Air Transport and National Air-transport are working in cooperation with the Department of Commerce and will establish the world's most complete system of Air-way Radio control and beacon stations. Altogether 68 stations are planned along the route between New York and San Francisco. Planes flying this route will be equipped with a 100-watt voice transmitter, a radio beacon receiver, a microphone, a key for sending Code and two antennae—one for receiving and one for sending.

Leaders in the Radio industry predict that over 3,000,000 sets and 100,000,000 tubes will be sold in 1929.

A recent report issued by the Department of Commerce says there are more than 20,000,000 Radio sets in use in the world. Approximately half of these are in the United States.

Radio tube sales jumped from \$6,000,000 in 1922 to \$110,000,000 in 1928. New records are expected in 1929.

The Sonatron Company is one of many organizations sponsoring expensive broadcast programs. Their Sunday evening program over the Columbia net work costs around \$1,000,000 and is generally referred to as the Million Dollar Broadcast program.

The Federal Radio Commission recently granted 17 broadcast licenses for still or moving picture transmission. Also, 11 permits for construction of Television stations were granted. The onward march of Television means big things ahead for the trained man.

A new aircraft Radio receiving set, designed by the Signal Corps of the United States Army, is only 3 3/4 inches thick, 14 1/2 inches wide and 9-7/16 inches high. The cost of this receiver is around \$800 and the total outfit does not weigh over 12 pounds. This compact Aircraft receiver shows the remarkable progress being made in the field of Radio in Aviation.

A new centralized antenna system whereby a "jungle of wires" atop roofs is eliminated and a maximum of 80 receiving sets can be operated simultaneously from one antenna without interference has been developed by the Engineers of the Radio Corporation of America. A total of 160 sets can be accommodated by the use of 2 antenna wires.

We understand that one of the large air transport companies has placed orders for 25 big passenger planes to be equipped with separate Radio cabins. It is said that their operators must be thoroughly trained in Radio, and especially Aircraft Radio. This is right in line with recent predictions by authorities that the future progress of aviation is becoming more and more dependent upon Radio. Big men close to Radio predict that many of Radio's best jobs in the near future will be in the field of manufacturing, selling, installing, repairing and operation of Aircraft Radio transmitters, receivers and Radio beacons.

Applying Ohms Law to "B" Power Dividing Resistances

CHIEF INSTRUCTOR J. A. DOWIE



THE relation between volts (pressure potential or electromotive force) amperes (current) and ohms (resistance) from which any one of the values may be found when the other two are known, is called Ohms Law. The rules based on this law are very useful in Radio, therefore it is advisable for students to become familiar with their application to practical problems.

Fortunately, Ohms Law is very simple, and a common school arithmetic (ordinarily multiplication and division) is sufficient to work out problems which may arise under it. It may be stated forward or backward; and in its three formulas, will give the rules: (1) for determining the voltage "applied to" or "across" or "dropped in" a circuit when both the flow of current and the resistance in the circuit are known; (2) for determining the flow of current when both the voltage and the resistance are known, and (3) for determining the resistance when both the voltage and the current flow are known.

The voltage or potential, as it is sometimes called, existing in an electrical circuit is equal to the product of the current passing through the circuit by the resistance in the circuit. As the potential or pressure is expressed in "volts," the current in "amperes" and the resistance in "ohms," we may say that the voltage equals the product of the amperes multiplied by the ohms. This is written as our first formula.

$$E = I \times R \quad (1)$$

E in electrical engineering signifies voltage (electromotive force); I represents current (intensity), and R represents resistance.

The above formula (1) is useful when we wish to know the voltage and know the current and the resistance in the circuit. We may turn this formula backward in two ways. To determine the current when the applied voltage and the resistance are known, we use it in this form—

$$\text{Current} = \frac{\text{voltage}}{\text{resistance}} \quad \text{or}$$

$$\text{Amperes} = \frac{\text{volts}}{\text{ohms}}$$

Here is the second Ohms Law formula:

$$I = \frac{E}{R} \quad (2)$$

Or, supposing that we know both the voltage and the amperage, we can determine the resistance by dividing current into voltage:

$$\text{Ohms} = \frac{\text{volts}}{\text{amperes}}$$

This is the third formula:

$$R = \frac{E}{I} \quad (3)$$

In designing a voltage dividing resistor for any power unit, it is first necessary to know the exact voltages and the amount of current which will be required by a receiving set which is to be operated from the power unit. This is absolutely necessary; as any change in current will produce a different voltage drop, with the result that the tubes of the receiver will not be operated at their rated voltages.

The data supplied by the manufac-

turer indicates the plate current required by the various tubes of the set.

Figuring the Resistances

We are now in a position, after studying the previous paragraphs, to determine the current and voltage demand on the B power unit. Let us consider a 6-tube receiver using three 226 radio frequency tubes, a 227 detector tube, a 226 audio frequency tube, and a 171 power tube.

TABLE I

Type Tube	Plate Volts	Grid Volts	Plate Current m.a.
Power tube 171	180	-40	20
A. F. tube 226	90	-6	2.6
Detector tube 227	45	grid leak	2.5
3 R. F. tubes 226	90	-6	9.3

(Total) 34.4 milliamperes

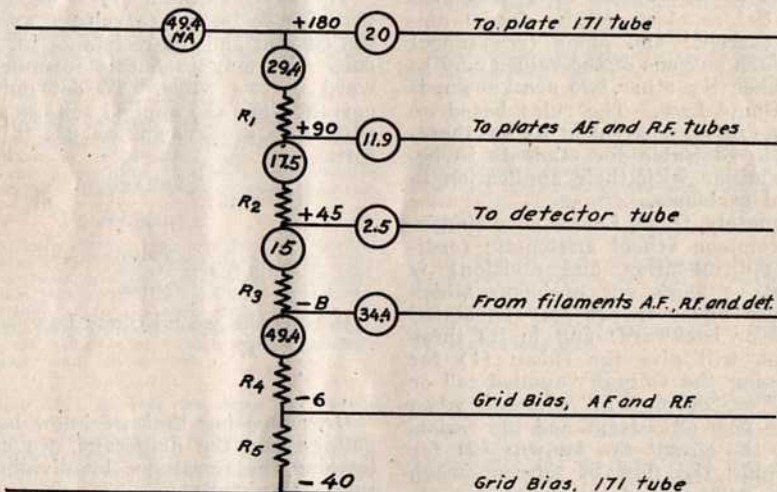


Fig. 1—Plate Voltage and Grid Bias Resistors connected across power output unit.

Thus a total of 34.4 milliamperes must be delivered by the power supply for the plate circuits of the tubes.

In calculating the values of resistances necessary for a B power unit, it is only necessary to keep clearly in mind just how the direct currents are to be distributed. Consider the voltages and currents as outlined in Table I. Let us picture just where these currents are going. Figure 1 pictures the distribution of currents from the B power unit to the set. At the 180-volt terminal point on the voltage divider, we are going to draw off 20 m.a. for the plate of the 171 power tube. Also, at the 90-volt terminal, we shall take off enough current for the plates of the R.F. and A.F. tubes.

Current coming from the power unit has two well-defined paths to follow. Twenty milliamperes will be delivered to the plate of the power tube, to be returned to -B; the rest of the current will flow through R1. At the 90-volt section, the plate current of the A.F. and R.F. tubes will be drawn. A total of 11.9 m.a., to be returned to -B; the rest of the current will flow through R2. At the 45-volt terminal, 2.5 m.a. will go to the detector tube and the rest will flow through R3.

In addition to the current required by the receiver some current greater than 34.4 m.a. must flow into the output resistor, since there must be some surplus current left to flow through R3 to establish a voltage across it. Taking a value

of 15 m.a. to flow through R3, will give a value of resistance for that section, which will not be too large and will be suitable for the circuit design.

We have established the amount of current to be drawn from the filter circuit which will be 34.4 m.a. for the set and 15 m.a. for the resistor, giving a total of 49.4 m.a.

Now that we have studied the distribution of current in a power unit, the voltages obtained are determined by the familiar Ohms Law, $E = I \times R$, where E is expressed as a function of the current, and the resistance. This gives us an accurate and working formula for calculating the resistance, R, required for the

(Continued on page 19)

Succeeding in the Service and Repair Business

(Continued from page 7)

been employed on a broader scale by the acquaintances of those who have bought custom sets, with the consequence that many an independent service business has been built up from small beginnings. At first, the worker confined himself to night work in Radio repair, earning his living during the day by some other trade or profession. Since the owners of receiving sets are more likely to be at home at night, this permits of building up a substantial volume of business, often enough to justify giving up regular employment during the day and concentrating thereafter on service work.

As I have indicated, most of the independent service men have learned their Radio repairing by practical experience. Experience depends on repetition and where the troubles encountered are not unusual, the school of hard knocks turns out useful service men. But, more often than not, such a service man will fail on a difficult or unusual case, or one involving a new technique introduced by advances in the Radio art. On the other hand, he who has a general grounding in Radio theory and has made a study of practical service methods through a reputable school is more fully prepared to meet the unusual and the unexpected. The addition of such elements as power packs, dynamic speakers, alternating current tubes, shielded catcombs, single dial control and power tubes make guesswork methods uncertain and unreliable.

There are a few outstanding instances of specialized service businesses in the United States which have grown to considerable proportions, employing as high as twenty to thirty men and meeting a good part of the service needs of large communities. These are, however, only the modest beginnings of what we may look forward to within the next few years. A new situation is gradually arising. Most of the receivers in service up to three or four years ago were in the hands of persons having a special aptitude for electricity and a familiarity with Radio, either through the construction of their own receivers or by technical study of the subject. With the coming of the modern manufactured receiver, operating directly from the light socket, however, millions of receivers have been put in daily use in the homes of persons totally unskilled in the Radio art. As these receivers become older,

they will naturally require repair service and the calls upon existing service organizations will multiply rapidly. A Radio receiver is remarkable in the small amount of service attention which it requires, but many consumers are farsighted enough, probably because of their automobile experience to realize that greater satisfaction will be gained if their sets are periodically examined by experienced service workers. All this business will grow with consequent opportunities for the man familiar with the theory and practice of Radio servicing.

The man who would enter the Radio industry via the service route, either as an employee of a dealer, jobber or manufacturer, or as an independent service man, should overlook no opportunity to become proficient in Radio theory and practice under circumstances which do not jeopardize his reputation as a reliable and efficient worker. It must be realized that to succeed in Radio service, as in anything else, the worker must be skillful, efficient, and must accomplish his task without any waste of time. This does not permit of protracted experiment in the set owner's home but requires rapid diagnosis and speedy repair. If the service man must fumble around and appear to waste considerable time, searching for the actual cause of the trouble, he is not likely to find his business growing by word of mouth recommendation, an essential to a business which shows constant gain.

Applying Ohms Law to "B" Power Dividing Resistances

(Continued from page 18)

power unit design. E is in volts, I is in amperes, and R is in ohms. A milliampere is one-thousandth of an ampere, or expressed in figures, is equal to .001 ampere. Thus, for the values of voltages and currents outlined above, the following resistance values are calculated:

Resistor	Voltage across R	Current through R m.a.	R (Ohms)
R1	90	29.4	3,061
R2	45	17.5	2,571
R3	45	15	3,000
R4	6	49.4	122
R5	34	49.4	690

The resistors R4 and R5 are for obtaining the "C" biasing voltages and the current passing through each of these resistors is equal to the total current delivered by the power unit, or 49.4 milliamperes, as no "O" current is drawn by the tubes. The easiest way of determining the resistance in the above table when we are dealing with milliamperes is to multiply the volts by 1000 and divide by the milliamperes. For example, 90 multiplied by 1000 is equal to 90,000; 90,000 divided by 29.4 is equal to 3,060.

In actual practice, it usually will be found impossible to buy resistors having the exact resistance values required. However, the resistance of each unit need not be exact and the standard resistors having the nearest value may be substituted.



Left: Herbert Hoover, Jr., son of President Hoover, who holds the position of Communication Specialist for the Western Air Express. Realizing the opportunities in the growing field of Radio in Aviation, young Hoover left his position as instructor at Harvard University recently to take up this new position. Rapid developments are being made in this new field with the installation of many beacon control stations and Radio equipment at airports and in the cabins of planes. This means new positions being opened up in this fascinating and profitable branch of Radio.

Something New in Radio for Hotels and Apartments

Many hotels and big apartments are installing a master receiver in the lobby and a loudspeaker in each room. Here are two pictures showing the system recently installed in Canterbury Court in Chicago. The office, reception room and 181 apartments are equipped with loudspeakers. The master set installed in the lobby plays five wave-lengths over 184 outlets. Any apartment may play any of the five stations at any time with-



out cross-talk. There is a local intensity control at each speaker, and the set is automatic. The volume of the master set is reduced late in the evening for 24-hour service. The system is so balanced that the intensity of sound remains the same whether they are all playing on one station or divided among all stations. Each radio frequency unit in master set is filtered for a particular wave-length which results in finest reproduction.

Upper picture shows Mrs. Carroll Pyne looking over the master set. Picture at left shows Mrs. Belle Barnett and Mrs. Pyne turning on the control which operates loud speaker in upper right-hand corner.

