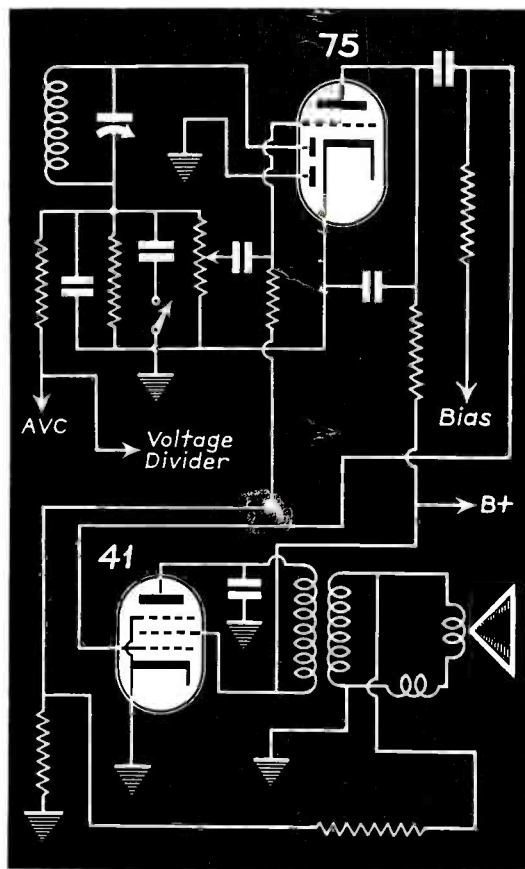


SERVICE

A Monthly Digest of

RADIO

and Allied Maintenance



PER COPY
25 CENTS

JULY
1938

Tone Control and Feedback
(See page 15)

For Longer Life and Better Performance

Insist on Mallory Replacement Vibrators!

Millions in Use

Trouble - Free Long Life

Lowest Cost per hour

Absolute Freedom from Broken Reeds

Priced as low as ordinary products

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No Lead Breakage or Corrosion

From every angle there is no greater assurance of complete satisfaction on any radio replacement part than the Mallory insignia. Yet they cost no more than ordinary products.

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SERVICE

A Monthly Digest of Radio and Allied Maintenance

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EDITORS

JULY, 1938

Ray D. Rettenmeyer

W. W. Waltz

VOL. 7, NO. 7

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* Indicates that a circuit accompanies the text.

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THE ANTENNA . . .

JOBS THAT SERVICE MEN DON'T WANT!

ANY FAIR-MINDED set manufacturer will agree that the Service Man is a highly essential part of the radio industry. The RMA has so indicated by its support of the Radio Servicemen of America; individual manufacturers admit it, tacitly at least, by the mere fact that they have no service organizations of their own in the field to take care of troubles which their sets are developing. Picture to yourselves the terrific service load the set manufacturer would have were it not for the presence in every community, large and small, of Service Men who are, in effect, shouldering the entire load of service requirements.

The trouble is, from the standpoint of the Service Men, that too much of this "service load" by far is concentrated in the repair of the so-called "price" sets—service jobs on which it is impossible for the Service Man to work at a profit. Yet, he must handle these jobs if he is to build up and retain good will in his community.

Let's examine a typical case: This Service Man will accept jobs of this kind, but he accepts them on the basis of doing them if, as, and when he has the time available—certainly this doesn't make any too great a hit with the customer, but it is about the only way to handle the problem without turning the job down completely. There is a fixed charge of \$2.50 for labor; then (and here's the rub) in order to keep the cost of the job down, replacement parts are billed at cost—40 percent off list! Where is the profit? That \$2.50 fixed charge doesn't result in any—for confirmation of this point see the article by Arthur E. Rhine in this issue—and there obviously isn't any profit on the parts.

It has been suggested, as a result of discussing this case that parts should always be billed at list, or very slightly under list prices. There is a firm foundation under this idea. In the first place, it enables the Service Man to eke out a little profit—not enough, to be sure, but perhaps enough to swing the job out of the "total loss" class. In the second place, the Service Man's estimate, and later his bill, will not be open to quite so much question if replacement parts make up the major part. That item of "labor" on a bill is one which a great many persons will argue about, whereas they can't successfully question the billing of parts.

Looking a little further for reasons, we find that these sets are so compact in construction that it is virtually impossible to do any work on them without tearing them down completely—time becomes an element of the greatest importance. The Service Man, knowing full well the actual cost of the set, hesitates to quote a repair charge in excess of ten or fifteen percent of the initial price, yet with the time element so great something must "give"—it is, unfortunately, the profit without which the Service Man can't stay in business. This, however, is not an argument against compactly-built sets; it is, rather, a demonstration of the fact that the all-important Service Man cannot make a living repairing sets that are manu-

factured with an eye on the group that buys on price alone. We are of the conviction that the general public—including these "price buyers"—is sufficiently dependent upon radio to buy sets at whatever price the manufacturer may choose to name; in other words, if the public can't get sets at ridiculously low prices it *will* pay more. Maybe there would be a decline in sales, temporarily, but in the long run everything would work out to the advantage of the industry. This fact has been pretty well established in the auto trade.

What it amounts to is this. If cheap sets must be made, make them cheap enough so the users will junk them at the first sign of trouble; but don't expect the Service Men to continue losing money on the repair of such receivers. There isn't a Service Man in the business who wouldn't welcome the complete and total breakdown of these sets once their life expectancy has been reached. They—the Service Men—must refuse, sooner or later, to handle on a repair basis the sets which are sold below a certain price level.

. . .

CODE OF ETHICS

THE RSA is to be congratulated on the recently adopted Code of Ethics to which its members are to be pledged; the application of this Code in the daily work of RSA men can reflect greatly to their advantage, both individually and collectively.

Adherence to this Code, in spirit as well as in fact, should become a "must" for every radio Service Man.

. . .

THE TRADE SHOW

DRAW YOUR OWN conclusions as to the significance: Attendance figures at the Chicago show were far in excess of even the most optimistic estimates. Technical lectures were literally jammed, and interest in new components and test equipment was at fever heat. If that isn't indicative of an undercurrent of anticipation of better business, we don't know what is!

And, if you want confirmation, look at the newspaper reports of business in general—things are brightening up, no doubt about it.

Better get ready now to take advantage of the upswing when it hits your locality—if it hasn't already done so.

New test equipment—increased stocks of replacement parts and tubes—a new coat of paint in and around the shop—new window displays—all of these will help, not only by indicating to your customers, especially your *prospective* customers, that you are all set for a big increase in business, but also that you have had enough foresight to prepare adequately for this business increase.

Announcing the RIDER Chanalyst



JOHN F. RIDER
in whose Successful
Servicing Labora-
tories this revolu-
tionary instrument
was developed.

The Greatest Advance Ever Made in the History of Servicing Instruments

Because the Rider Chanalyst is of *fundamental* design, its value to servicemen as a testing instrument is inestimable! Its uses innumerable!

It makes possible, for the first time, receiver testing under ideal conditions! The Rider Chanalyst enables you to localize troubles in a particular stage or part of a receiver or amplifier with greater speed and efficiency than ever before, *no matter how complicated the circuit* and regardless of the number or types of tubes . . . this it does *without* the use of adaptors or plugs!

The Rider Chanalyst can be used to test *all* types of receivers, public address systems, school sound equipment, and all other similar equipment! With the Chanalyst, any serviceman can apply a standard, systematic, time-saving routine of servicing to his work.

The Rider Chanalyst will detect! It will tell! It will show! Its applications are so numerous that it is impossible to list them all here. At the right are listed a few of the major tests which you can conduct with the Chanalyst while the receiver is in operation.

At your jobbers, on or about August 1st.

SERVICE INSTRUMENTS, Inc.
404 Fourth Ave., New York City

A Few of the Major Tests You Can Conduct with the Rider Chanalyst While the Receiver is in Operation

1. Trace passage of signal through receiver from antenna to speaker in r-f, i-f or a-f stages, enabling you to establish where it exists, dies, becomes weakened—where it becomes distorted and where it takes on hum—without interfering with the operation of the receiver.

Check gain or loss or noise in r-f, i-f or a-f stages. Possible to break into any part of the signal circuits of the receiver under test in order to examine the character of the signal during operation.

2. Check actual operating voltages at any point in the receiver without loading the circuit.

Because of the unique and original design of the voltmeter in the Rider Chanalyst you can measure operating voltage at tube elements or in high resistance circuits without changing the constants of the circuit and while the signal is passing through the receiver.

3. Accurately check actual control voltages developed by the signal and present at the tube elements—without interfering with the normal operation of the receiver.

Because of special design the voltmeter in the Rider Chanalyst is capable of measuring the actual avc or other control voltage directly at the control grid of a detector, amplifier or oscillator tube during actual operation—that is, with the signal present in the tube circuit.

The avc channel characteristics can be established with the greatest of ease—afc control voltages can likewise be measured whenever present—despite high resistance or balanced networks.

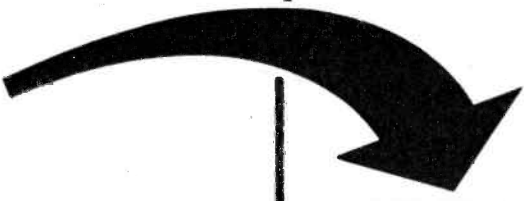
4. Check frequency output of the oscillator section in a superheterodyne.

Constant check of the performance of the oscillator in a superheterodyne with frequency calibrations up to 15 megacycles and check of operation of the oscillator section of the receiver—up to 70 megacycles.

5. Instantly check wattage consumption of the receiver during actual operation.

6. Quickly locates troubles in intermittent receivers.

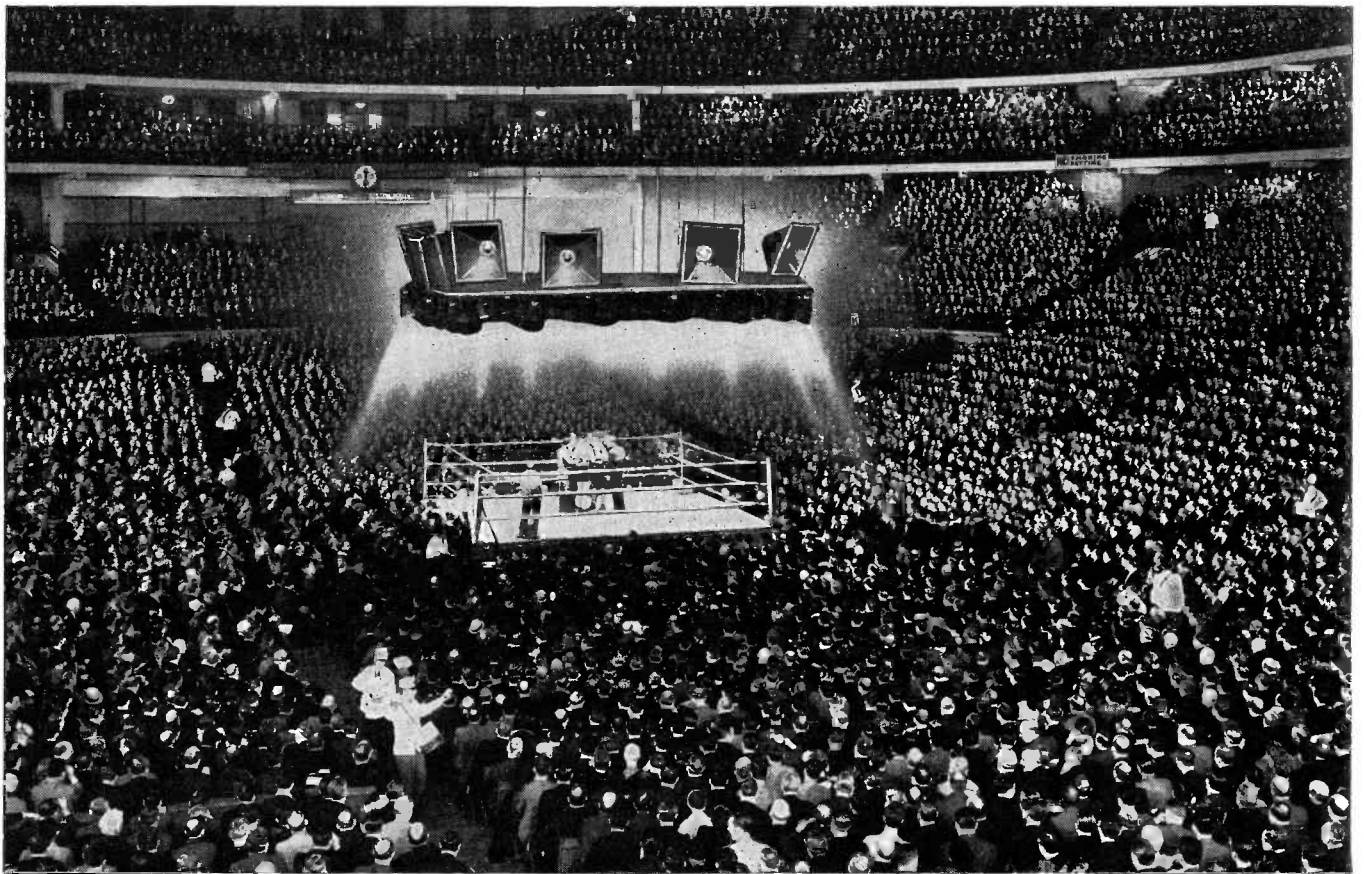
The test channels available in the Rider Chanalyst provide a means of separating a complete receiver into five basic sections. Each of these sections has its own indicator. When an intermittent condition develops, the indicators show the presence or absence of the signal in the various sections—the change in voltage consumption and operating voltage—if any. By interpreting the indications — you can localize the fault as being in a certain part.



**SEND TODAY FOR FREE
BOOKLET ON THE RIDER CHANALYST
WHAT IT IS—WHAT IT DOES
—HOW IT WORKS!**

SERVICE INSTRUMENTS, INC.
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Please send descriptive booklet No. 4
on The Rider Chanalyst.

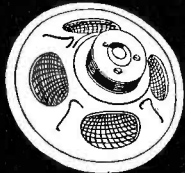
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Address.....



UTAH WINS!

At any event where speakers play an important part you will usually find Utah Speakers selected for their unexcelled performance and dependable, trouble-free operation. The Utah trademark affixed to a radio speaker has been the symbol of dependability for sixteen years.

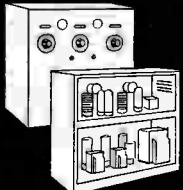
There are Utah Speakers for every purpose—home radio—auto radio—inter-communication systems—P. A. systems. They have earned an enviable customer preference. Like all other Utah products, Utah Speakers are precision engineered and time tested to meet the gruelling performance requirements of today—INSIST on the Utah trademark on the speakers YOU buy—Ask your parts jobber.



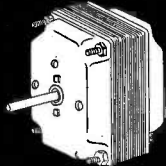
SPEAKERS



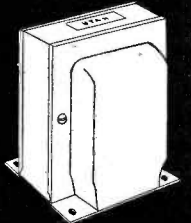
VIBRATORS



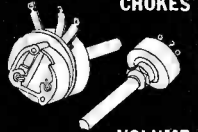
AMATEUR TRANSMITTER KITS



MIDGET MOTORS



TRANSFORMERS AND CHOKES



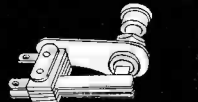
VOLUME AND TONE CONTROLS



PLUGS AND JACKS



VITREOUS RESISTORS



SWITCHES

UTAH RADIO PRODUCTS CO.
CHICAGO, U. S. A. CABLE: UTARADIO, CHICAGO

DEPENDABLE SINCE 1922

SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR JULY, 1938

MAKING A PROFIT IN THE RADIO-REPAIR BUSINESS

Part II—The Actual Cost of Doing Business

THE MAJORITY of radio service engineers wonder why really sizable profits have not accrued to them as a result of the long hours put in, numerous jobs completed and prompt, efficient service rendered, in spite of real and expressed customer satisfaction.

The answer was supplied in the June issue of SERVICE. We might well have titled that article "The Cause" and this one "The Cure." No reader could fully appreciate the importance of this current article unless he has read, digested and perhaps re-read the June article. I urge you to obtain a copy if you would proudly proclaim yourself "businessman" rather than merely "radio serviceman." You are no businessman unless you have the fundamental knowledge necessary for profitable conduct of a business, be that business what it may.

It is comparatively easy to preach. No man can be forced to act upon the advice of another, but judging from the numerous letters and personal comments prompted by the first portion of this article, many service engineers have done some deep and heavy thinking with the result that "many lights suddenly dawned" for them. For example: a serviceman who is well known in his section and who is an efficient repairman, and who had been charging seventy-five cents an hour for his time, told the author personally that after listening to the recent lecture (which included the subject matter of the June SERVICE article) he immediately changed his hourly rate to \$3.00 an hour, that he had lost no business thereby, and has had money in his pocket for the first time.

No one will ever place a higher value on your services than you do. If you charge \$1.75 per hour (though it would be impossible to do so in 99 out of 100 cases without loss to the serviceman)—

By ARTHUR E. RHINE

and you can not charge less, no one will volunteer to pay you more. You have placed a definite value on your commodity—hours available for sale. No man should consider his own worth to be less than that of any other who pursues the same profession, unless he be afflicted with an inferiority complex. If you can repair radio receivers as well as anyone you know of, your time is definitely and absolutely of equal value. You must convince yourself as to the fundamental truth of such reasoning if you expect my writings to help you put money in a savings bank. Therefore we must work together, you and I. You must have an inflated idea of your time value rather than a deflated idea as is all too general among the greater number of radio servicemen. What can you expect other than deflated pocket-books? You must not be inclined to "pooh-pooh" what you read. Accept my words and figures at their face value and the results will be gratifying (to use a mild word).

In short, be a money-maker. Consider your "fixing" ability merely as the medium by which you make money, but do something about it now!! Stop your pernicious habit of "fixing radios" for prices which you guess will be sufficient to make a bare living for you. From now on you can determine exactly what your clear and net profit will be for any given repair job, and you will know what you must charge in addition to your cost in order to secure the necessary minimum profit that insures more than "just a living" for you.

I am going to use reasonably low figures so as to impress you with the fact that no attempt is being made to exaggerate the ultimate hourly-cost figure.

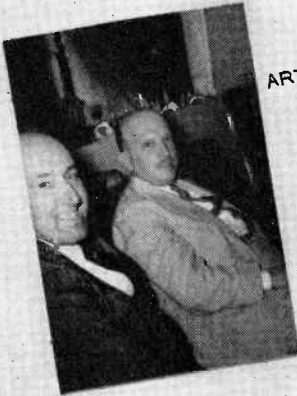
Let's start with a typical and reasonable setup:

The proprietor draws a salary of	\$30 weekly
He pays a helper or shop assistant	15 weekly

His total payroll is..... \$45 weekly

We will use a 60-hour week as a basis of calculations; therefore, it is no trick to determine that you pay out 75 cents for salaries for every hour that you have available for sale. If—for the purpose of making this demonstration—we wanted to make costs as high as possible, we could use a 40- or 50-hour week. If a 50-hour week, you would pay out 90 cents per hour; if a 40-hour week, you would pay out \$1.12½ cents for each saleable hour. Therefore, the 75-cent example may be considered as fair. The proprietor's 60 hours are the only hours available for sale in this example because the \$15 assistant (or office tender) is part of the overhead. His time is a "necessary evil" and is never sold. If such an assistant were a serviceman whose duties were to repair and service radios and he worked 60 hours a week there would be 60 additional hours available for sale whether the salary were low or high. Such salary would, however, increase the "labor cost" in the accompanying chart. Your cost per hour for time would be slightly affected. If you add a serviceman to the staff at a \$30 salary, your payroll would be \$75 a week and you would have 120 hours available for sale, bringing your labor cost up to \$1.25 per hour on a 60-hour week, if you sold but 60 of the 120 hours available. If, however, you did the impossible by selling 120 hours service actually charged for,

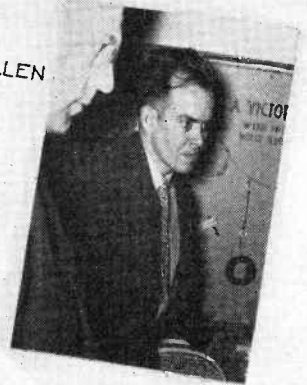
(Continued on page 8)



(R) ARTHUR BERARD
Ward-
Leonard



(L) LEON ADELMAN
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(R) CHARLIE GOLEMPAUL
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(C) HARRY KALKER - Sprague



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Amperite



(L) J.J. MCCARTHY
Triumph



(R) J.L. ROBINSON
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RALPH HILL
Ohmite



ED DE NIKE
Nat'l Union



PAUL TARTAK
Oxford-Tartak



RAY R. SIMPSON GEO. H. KOCH
Simpson Elec.



(L) DAN FAIRBANKS
I.R.C.
(R) PERRY SAFTLER



BILL OSLER
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LOUIS FISHOFF
Paris, France



H.M. PAULEY
Pauley-James



(R) P. NEWTON COOK
Mallory

COST SHEET					
ITEMS	TITLES	JANUARY ACTUAL COST	FEBRUARY ACTUAL COST	MARCH ACTUAL COST	APRIL ACTUAL COST
1	Labor	\$ 195 00			
2	Idle time rate (40%)	78 00			
3	Rent	25 00			
4	Electricity	4 00			
5	Telephone	6 50			
6	Heat	- -			
7	Car Storage	6 00			
8	Gasoline	16 50			
9	Tires	2 00			
10	Car Repairs	1 50			
11	License Plates	1 25			
12	Advertising	3 00			
13	Books	1 65			
14	Tools	1 00			
15	Workmen's Comp. Ins.	7 00			
16	Other Taxes				
17	Depreciation of Test Equipmt	8 00			
18	Car Depreciation	10 00			
19	Social Security & Ins., 1% helper salary		65		
20	Uncollectable Accounts	3 45			
*					
TOTAL MONTH'S EXPENSES		\$ 175 50			

* OPTIONAL ITEMS
 "FLOOR SPACE OCCUPIED" "INVENTORY LOSSES" "INTEREST ON INVESTMENT"
 "DEPRECIATION OF FIXTURES", "DUES" ETC.

the labor cost would come down to exactly 62½ cents per hour.

"Lost" or "idle" time will be the most important factor in your computations. Surveys of all types of service and maintenance businesses reveal that the idle time factor ranges from 40 percent minimum to over 60 percent. A fair average for the sake of the example to follow would, therefore, be the minimum—or 40 percent. This now represents the number of unsold hours. If you have 60 hours available for sale—you work a 10-hour day (average.) By keeping track of the actual number of hours sold each day, week and month, you can know exactly whether 40 percent, 50 percent, 60 percent or any other percent remain unsold. Lucky indeed is the man who succeeds in selling 60 percent of his saleable time all year 'round.

Although it is not necessary in computing your costs to know the actual percentage of idle time, it will be easy for you to determine in a few seconds. Your monthly total of working hours is 260 (4 1/3 times 60) and you find that you have sold 156 of them (60 percent of available saleable hours.) By dividing the number sold by the number available for sale you will find the percentage figure of hours sold. (156 ÷ 260 = .60, or 60 percent.)

The result is 60 percent of your time sold; obviously, 40 percent remains unsold from the total of 100 percent available. If you make note of this percentage figure on each month's cost sheet, you will have the advantage of

knowing what progress you have made in selling more available time and thereby reducing your costs. It will also act as an incentive to devise means for selling more time.

I am now going to set up a typical cost chart or sheet. It makes no difference whether you are operating down on Main Street or from a room at home—you must adopt this setup method of operating your radio-service business or it will be impossible for you to profit from that business in the future any more than you have done in the past.

If \$195 is labor cost and \$78 is idle time (40 percent), the total \$117 (60 percent of labor cost) will be the cost to you for the time or hours sold. Obviously, if your total expense is \$175 (see total of "Actual Cost" column) and \$117 represents the cost to you of time actually sold, your rate of overhead will be an amount greatly in excess of 100 percent. In other words, if your expenses were exactly \$117 instead of \$175 it would cost you \$117 to sell time already costing you another \$117. The rate in such an instance would be 100 percent, and we would use that 100 percent in computing the hourly operating cost. However, we find that we have expenses amounting to \$175 which is greatly in excess of our cost of time sold. In order to find the rate we have, divide \$175 by \$117 and the result is 150 percent. That means that our expenses chargeable to time we have sold are 150 percent greater than the cost of the time in salaries.

The total cost of all time sold is

the total of \$175.00
and 117.00
or \$292.00

Divide this by the actual number of hours sold during the month (which in this case is 156) and you find your actual operating cost per hour to be exactly \$1.87½. Some may consider the following as an easier way to compute this cost. Add your salary of \$30 and the office tender's salary of \$15; a total of \$45 was paid out for a 60-hour week. You have paid 75 cents an hour whether you sold the hours or not. By using what is known as an empirical figure (in this case an arbitrary one of 150 percent since the ratio will in all cases prove to be about that exactly) the use of 150 percent as such will result in determining 150 percent of your 75-cent salary payment. It is \$1.12½ which represents the hourly expense in addition to the 75-cent salary. Add both together and thus obtain your operating cost per hour. (\$1.12½ plus 75 cents equals \$1.87½.)

RENT

I believe \$25.00 a fair figure to use as an example. Many of us pay a great deal more. Those who operate from their homes must charge a portion of their rent, light, heat, etc., to this item in proportion to the space occupied. If a three-room apartment costs \$36.00, 1/3 or \$12.00 will be the amount chargeable to "rent"; ¼ if a four-room apartment, etc.

ELECTRICITY

Since over half of your electric bill at home represents current consumed in the space occupied as a shop, 50 percent must be charged to the business.

TELEPHONE

I believe the average phone bill is higher than the \$6.50 used as our example—my own ran as high as \$49.00 for a single month until I had a second phone installed. Believe it or not, it reduced my telephone bills to around \$30.00 a month. With the second phone, calls outside my area are not additional toll calls as previously. These bills, however, are unusually high and would not be a fair example.

HEAT

If cost of heat in a private home amounted to \$360.00 a year, the average monthly consumption would be \$30.00. If one room out of four is used for radio work ¼ of the bill is added to cost sheet.

CAR STORAGE

Maybe some of you can get car storage for as little as \$6.00. I cannot.

SPAIN



INSURGENTS *and* LOYALISTS BOTH USE COMMUNICATIONS RECEIVERS EQUIPPED WITH **RAYTHEON Tubes!**

TORN by civil strife, Spain is a proving ground for the finest of modern armament and equipment. In this bitter, desperate struggle both factions rely on RAYTHEON tubes to maintain communications between front lines and headquarters.

When you replace a tube in a radio set, the fate of thousands of lives does not hang in the balance. The set doesn't have to operate perfectly, instantly, and over a long period of time! But if your time is worth money, and your customer's satisfaction is important, your Jobber can supply you with the identical tubes that both armies in Spain have found to be the most dependable! And they cost no more!

RAYTHEON

CHICAGO • NEW YORK • ATLANTA • NEWTON, MASS. • SAN FRANCISCO

"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"

JULY, 1938 •

SAY YOU SAW IT IN SERVICE

GASOLINE

Gas figure is based on 1000 miles per month—12,000 miles per year is a very low figure. At 12 miles per gallon or 1,000 gallons per year the cost at 18c is \$180.00 for year's supply, \$15.00 a month. Of course the figure is solely for the purpose of this example. You will supply the figure easily after you know how much your gas cost during the month just past.

TIRES

Who doesn't spent at least \$24.00 per year for tires?

CAR REPAIRS

\$20.00 repair job, plus twelve \$1.50 greasing jobs amounts to over \$3.00 a month. We cut it in half now because we skip many a 1,000-mile greasing job and maybe that big repair only cost \$10 instead of \$20.

ADVERTISING

\$2.00 for throwaways; \$1.00 postage; \$1.50 stationery—a total of \$4.50 is a low figure. Let's cut it down further to \$3.00.

BOOKS

Rider \$10; SERVICE \$2; other publications \$3; service books, etc., \$5—total \$20—average per month \$1.65.

TEST EQUIPMENT

Test equipment may be said to last an average of 3½ years only. For the sake of low figures, let us make it last for 5 full years. \$480.00 worth of equipment will depreciate at the rate of \$96.00 a year and at the end of 5 years can be considered worthless; \$96.00 per year is \$8 per month.

CAR DEPRECIATION

If we pay only \$300.00 for a so-called "load"—after 2 years we can trade it in for \$60.00 tops—it has depreciated a total of \$240.00 in those 2 years—an average of \$120.00 a year, or \$10.00 a month.

At the above depreciation rates, these items alone will represent an expense of 11½ cents per hour over your time cost of 75 an hour. Without regard to other expense items, your cost is up to 86½ cents already. (Divide number of productive hours sold—156—into \$18.00 and you will get a cost of 11½ cents an hour for depreciation.)

SOCIAL SECURITY

One percent of salary of \$65 a month helper.

UNCOLLECTABLE ACCOUNTS

Uncollectable accounts are placed at the arbitrary figure of \$41.40 a year or \$3.45 a month only to make the total expense add up to an even \$175.50. It will help us to do some simple dividing. The monthly and yearly uncollectable figures are not, however, unreasonable. More than "just likely" we all can show more than \$3.45 in uncollectable monthly balances.

We have established the indisputable fact that a \$45.00 weekly payroll; plus expenses as registered in this example, combine to encumber (if that may be considered an appropriate word)—to encumber the business with an actual cost per hour of \$1.87½. Authorities say that the least amount which can be added to this cost to insure safety of profitable operations is, 20 percent—so—remember—that is not tops—it is "bottoms." When you add 20 percent to your cost of anything in order to get a profit, you actually make a profit (on the sale) of 16 2/3 percent only—or 1/6. However, if you add this minimum of 20 percent to your \$1.87½ cost you will charge your customers \$2.25 per hour until the following month's computations warrant revision of the figure to a greater or lesser amount. If your costs do not rise above \$1.87 and you continue to charge \$2.25 you are assured of 16 2/3 percent profit.

For the benefit of those who want some figures, I will show what to add to your costs in order to obtain specific profits. You already know that in order to obtain 16 2/3 percent profit from an hour's time sold that you must add 20 percent to your cost, so we'll put it down in this way:

cated corporation which requires the combined business abilities of many men. The big thing in managing a business profitably is the extraction of profits therefrom. It is not the manufacturing, selling or repairing of the particular article of merchandise that produces profits. Give me any ordinary business to manage and I will not have to know anything about how the product is made or how to make it myself, yet I will make profits for it. I will want to know every detail as to costs, from the costs of raw materials and labor, down to the operating and selling costs. I don't even have to compute those things myself. I would have an accountant certify as to the correctness of the costs and consider my job to be that of fixing the selling prices, minimum and maximum discounts, to insure a certain minimum percentage of profits, reducing here and there the selling costs if too high—and that is all there would be to it. We service fellows go about our daily tasks enthusiastically because we love the work; we become depressed when we realize we cannot place our hands on a few hundred extra dollars if we want them, and it is entirely our own fault. The brains of the radio engineering world have tried and still

PROFIT DESIRED	ADD TO YOUR COST
16 2/3 %	20 % or 1/5
20 %	25 % or 1/4
25 %	33 1/3 % or 1/3
30 %	43 % or 3/7
33 1/3 %	50 % or 1/2
35 %	54 % or 7/13
40 %	66 2/3 % or 2/3

If anyone is satisfied to take a 16 2/3 percent profit by adding 20 percent to a cost of \$1.87½ he shall have to charge \$2.25. It is foolish to establish a rate which may necessarily have to be jacked up and down all of the time. Such decisions are up to the individual, but, if your cost rises above the \$1.87 figure, you shall have to be forced to recognize facts and act accordingly.

I am in the radio service business—have had 18 years of it. Like all the rest of us, I have had my ups and downs. I did not have to wait until this business came along in order to find out how to obtain profits in business. After years of practice, it seemed but a matter of common sense that one should know these things before attempting to manage any business. When you have done so as long as I have you will feel as I do. I think that I could manage any business other than some great compli-

are trying to influence us—have actually implored us to be first and essentially business men not repairmen. Let's go to town—the competitor will soon envy you, and if he too does not reform his methods, you will soon have that field to yourselves. I could continue and probably prove to you that this is so.

I think that all should have a fairly clear picture of the proper method of conducting a radio repair service business. You should realize that it is the height of folly to run a business which requires all of the endless details encountered for the mere purpose of squeezing out a salary for yourself. If you charge your customers your exact cost only (which was \$1.87 in our example) it is true that you cover your salary among other items—but—have you stopped to consider what would happen if for some reason (such as a

(Continued on page 38)

General Data . . .

Airline 62-302, 62-312, 62-442, 62-452

Tuning: Manual

Ranges: 528-1730 kc; 5750-18300 kc

Tubes:
 1st Det: 6A8G
 Osc: 6C5G
 1st I-f: 6U7G
 2nd I-f: 6U7G
 A-v-c: }
 2nd Det: } 6V7G
 1st A-f: }
 2nd A-f: 25A6G

Pwr Amp: 6N7G (push-pull)
 Rect: None; 32 volts applied directly to screens and plates

Power Supply: 32 volts dc; 1.45 amps
 I-f: 456 kc

Speaker: Electrodynamic
 Field Res: 94.2 ohms.

GENERAL NOTES

As will be seen in Fig. 1, the chassis base is connected to one side of the 32-volt supply line. Since either side of a 32-volt line may be grounded, both antenna and ground terminals are isolated from chassis by a 0.02 mfd condenser. To avoid danger of damage to the radio and accidental short circuit, contact between the chassis and external ground must be avoided. In any service work, therefore, keep the chassis on a

wood or other insulating surface. The person working on the set should also avoid contact with ground.

ALIGNMENT

Volume control should be at maximum during alignment. Connect chassis to ground post of signal generator with a short heavy lead.

Connect high side of signal generator to first detector grid cap through a 0.1 mfd dummy; set range switch on receiver to B; set generator to 456 kc. Receiver tuning condenser should be full open. Adjust i-f trimmers (C14, C15, C18, C19, C23) for maximum output.

Connect generator to antenna lead through a 200 mmf dummy; range switch remains at B; set generator to 1730 kc. Adjust Oscillator Range B (C8) for maximum output.

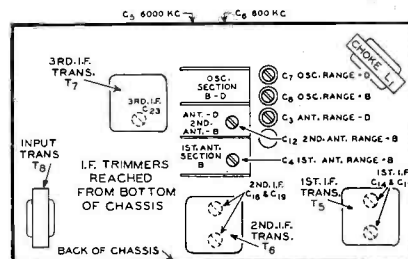
Receiver still on Range B, dummy antenna and generator connection remaining the same, set generator to 1500 kc and tune receiver to maximum signal. Set dial indicator to 1500 kc. Adjust C4 and C12 for maximum output.

With all connections and range switch remaining set, tune generator to 600 kc. Tune receiver to signal, and while rocking tuning condenser, adjust C6 for maximum output.

Set range switch to D. Use 400 ohm dummy antenna in all following adjustments. Generator remains connected to antenna lead. Set generator to 18300 kc, turn tuning condenser full open. Adjust oscillator Range D (C7) to maximum output.

Reset generator to 15000 kc and tune receiver for maximum signal. Adjust C3 for maximum output while rocking tuning condenser.

Reset generator to 6000 kc and tune receiver to signal. Adjust C5 for maxi-



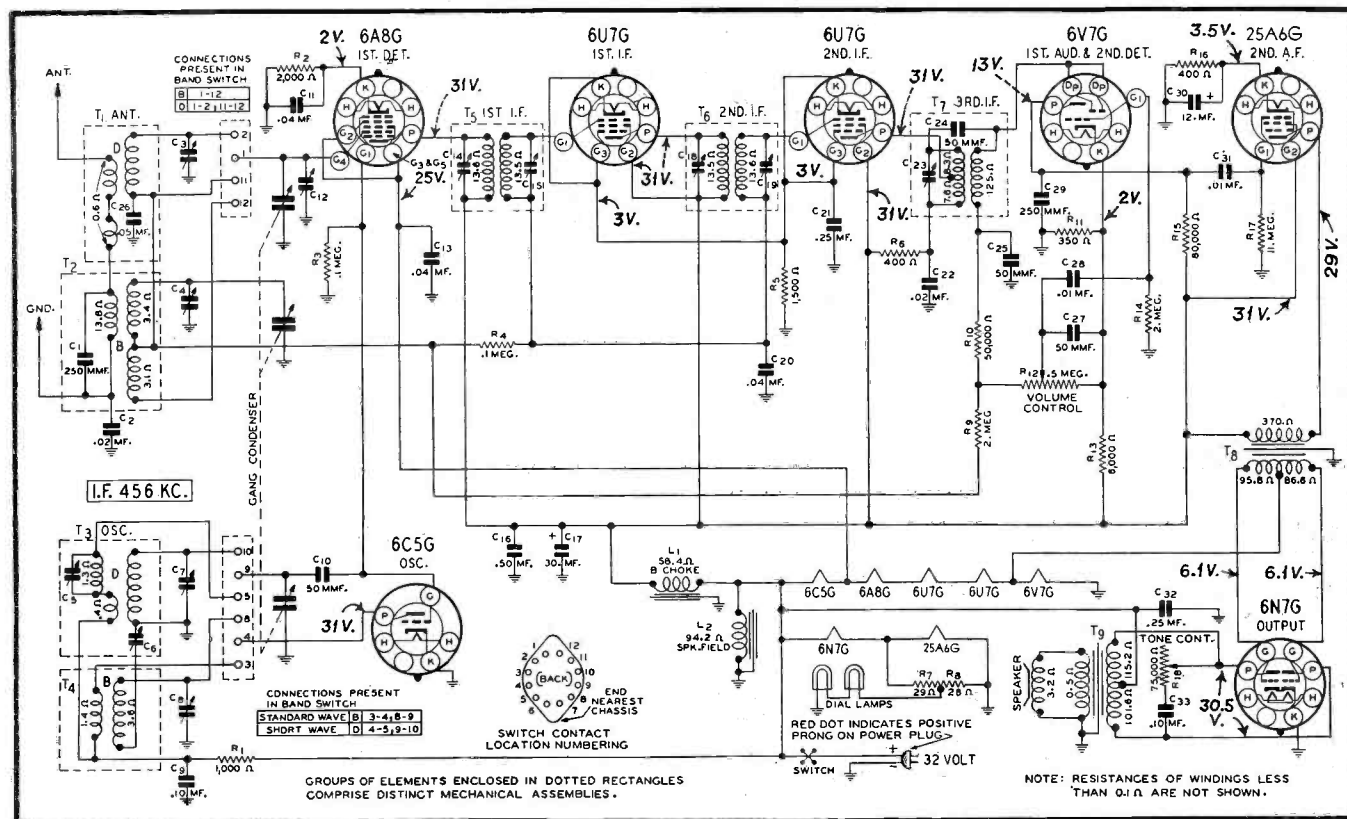
Trimmer location, Airline 62-302, etc.

imum output while rocking tuning condenser.

ELIMINATING IGNITION AND GENERATOR NOISE

After the radio is in working order, the following procedure must be followed in practically all cases to eliminate ignition and generator noise caused by the charging plant. If the charging plant causes no noise, then, of course, these steps do not have to be taken.

One spark plug suppressor must be



Circuit schematic, Airline 62-302, etc.

placed on each spark plug of the engine. One suppressor, for example, would be required on a one-cylinder engine and four must be used on a four-cylinder engine. To connect the spark plug suppressor, remove the wire from the top of the plug, put the suppressor on and attach the wire to the other end of the suppressor.

A generator condenser must be used. This consists of two 0.5 mf sections in one unit. The two sections have one side grounded to the metal case of the condenser. Mount the condenser on the frame of the charging plant. This will ground it. Then connect the two leads to the charging switch, one on each side of the line.

In some large installations, where the charging unit is on only two or three times a week, the above steps do not have to be taken as interference is caused only when the generating plant is in operation.

Noisy operation may be due to a faulty antenna system. The action of the automatic volume control, due to the low pickup, causes the radio to operate at its maximum sensitivity, thereby increasing noisy reception due both to external pickup and internal conditions.

The radio may be partially detuned, causing it to operate at maximum sensitivity. The signal should be very carefully tuned in until it is clearest and strongest.

If the reception is noisy only when the generating plant is in operation, then the noise is due to the latter and several things can be done. There may be loose parts in the generator plant rubbing together. Tighten all parts and be sure that all parts of the engine are well grounded. Dirty spark plugs may cause noise. Clean and re-space the plugs or try out a new set. In some instances it may be necessary to filter the power-supply line to the radio.

If any motor driven devices, such as

pumps, are operated from the 32-volt line, the motor may cause noisy reception in the radio. This can be corrected in most cases by connecting one of the dual 0.5 mf condensers mentioned above across the line at the motor. The common connection to the two condensers which is grounded to the can is grounded externally by mounting the unit on the motor frame.

DIAL LAMPS

For the dial lamps, No. 51 bayonet pin base lamps must be used. These lamps are part of one section of the tube heater circuit (see Fig. 2) and any other lamps having a different current drain would upset the voltage system of this section.

Belmont Automatic Tuner

Chassis: Model 583, series A
 Tuning: Manual and automatic
 Ranges: 535-1720 kc; 5.45-18.3 mc
 Tubes:

- 1st Det: 6A8G
- Os: 6A8G
- I-f: 6K7
- A-v-c: 6Q7G
- 2nd Det: 6Q7G
- 1st A-f: 6Q7G
- Power Amp: 6K6G
- Rect: 5Y3G

Power Supply: 110-130-230 volts, 40-60 cycles, a-c. Taps provided on transformer for adjustment to line voltage

I-f: 465 kc
 Speaker: Electrodynamic
 Field Res: 1550 ohms
 Phono Connection: See schematic circuit diagram

SETTING UP AUTOMATIC TUNER

There are six levers on the dial by means of which six stations may be selected (See "B," Fig. 2).

Make a list of local stations you tune in regularly; any number up to and including 6.

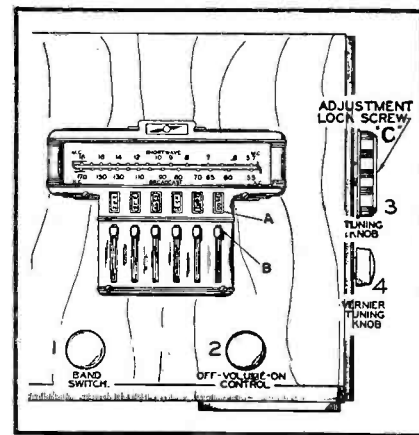


Fig. 2. Front view of automatic tuner controls.

Punch out from the set of station call letter tabs supplied, the call letters of the stations you have selected.

Above each automatic tuner lever an opening in the escutcheon is provided for inserting the call letter tabs (See "A," Fig. 2). Any order of grouping can be used, either by arranging the call letters alphabetically or grouping them to correspond with the calibration on the dial scale, namely, starting with the lowest frequency station on the right and so on up in frequency to the highest frequency station on the left.

Insert the call letter tabs in the rectangular openings in the escutcheon above each of the automatic tuner levers. One of the small celluloid tabs supplied should be snapped into place over each of the station call letter tabs.

Press down any one of the automatic tuner levers. Hold it down, and by means of the tuning knob No. 3, tune in very carefully the station you have selected for this lever. Turn the tuning knob very slowly back and forth until the signal is clearest. The station will then be accurately tuned in.

Release the lever and press down another automatic tuner lever. Hold it down and carefully tune-in the station indicated on the station call letter tab above this lever.

Follow this procedure until you have selected all of your favorite stations. Hold tuning knob securely with left hand to prevent it from turning and with a coin (half dollar) tighten the special locking screw ("C") in the center of the tuning knob (See Fig. 1).

This screw will lock in place all the stations you have selected on the automatic tuner levers. (Note: Locking screw "C" is loose when radio is shipped from factory.)

If you should desire to change any station you selected to another, hold the tuning knob No. 3 securely and with a

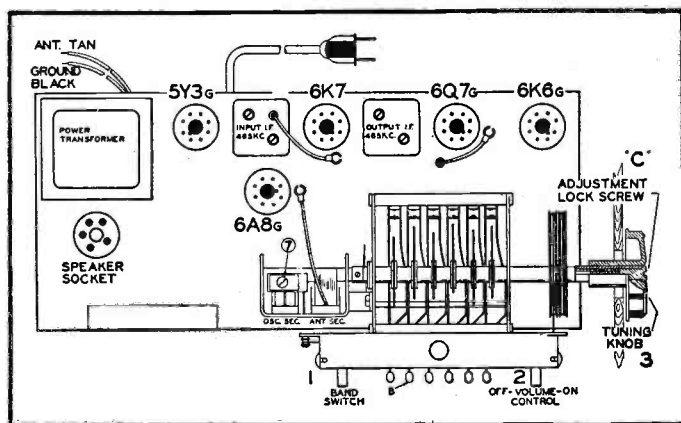


Fig. 1. Chassis layout, showing part of the manual and automatic tuning mechanisms.

Meissner Announces

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You can buy any Meissner product with full assurance there is no finer quality available anywhere at any price.

Meissner has, in its huge factory, the laboratory, engineering and production facilities for the finest electronic equipment.

From the smallest radio part to the big 14-tube kit, you have the greatest dollar-for-dollar buy in the industry.

The name "MEISSNER" has represented precision engineering, fine workmanship and honest merchandise for two decades.

FREE!

Meissner 1938 catalog. 44 pages—everything you need. Complete Kits, P. A. Tuner, All-Wave Tuning Units, Coil Assemblies, Adapter Kits, Push-Button Tuners, Remote Controls, Interference Filters, Signal Shifter, Coils, Filters, Transformers, Chokes, Exact Duplicate Replacement Units, Dials, Condensers, Switches, Chasses, Cabinets, Panels, etc., etc. Get this big FREE BOOK now while the supply lasts. . . .

See your PARTS JOBBER—or write direct to Meissner Manufacturing Co., Mt. Carmel, Illinois.



"A FAMOUS NAME FOR TWO DECADES"

GENERAL DATA—continued

coin loosen the locking screw "C" one or two turns; select the new station as explained. Be sure to tighten the locking screws, otherwise the stations you have selected will not stay adjusted to the levers.

The automatic dial is now set up for quick tuning.

SERVICE NOTES

Voltages taken from different points of circuit to chassis are measured with volume control full on, all tubes in their sockets and speaker connected, with a volt meter having a resistance of 1000-ohms-per-volt. These voltages are clearly indicated on the circuit diagram.

All voltages are to be measured with 115 volts on the primary of the power transformer.

Resistances of coils and transformer windings are indicated in ohms on schematic circuit diagram.

To check for open bypass condensers, shunt each condenser with another condenser of the same capacity and voltage rating, which is known to be good, until the defective unit is located.

Excessive hum, stuttering, low volume and a reduction in all d-c voltages is usually caused by a shorted electrolytic condenser, open bypass condensers frequently cause oscillation and distorted tone.

ALIGNING INSTRUCTIONS

No aligning adjustments should be attempted without first thoroughly checking over all other possible causes of trouble, such as poor installations, open or grounded antenna systems, low line voltages, defective tubes, condensers and resistors. In order to properly align this chassis, an oscillator (generator) is absolutely necessary. No aligning adjustments should be attempted with the chassis in the cabinet.

To remove the chassis from the cabinet, remove the four bolts which are used to fasten the chassis to the cabinet bottom; remove the special locking screw in the center of the tuning knob on the side of the cabinet; pull the knobs off their shafts and pull off the six button lever keys on front of dial.

Use as a resonance indicator an output meter connected across the primary of the speaker input transformer, or by means of an adapter between the plate and screen terminals of the type 6K6G output tube. Maximum deflection of the meter indicates resonance. Use only enough signal to get a readily readable output. A low range output meter or the low scale of a multi-range meter should be used.

The following dummy antennas are

used in aligning and are referred to in the following alignment instructions as "Dummy 1," "Dummy 2," and "Dummy 3."

Dummy 1: (I-F)—Consists of a 0.1 mfd condenser connected in series with the external oscillator.

Dummy 2: (Broadcast)—Consists of a 200 mmfd condenser and a 20-ohm resistor connected in series with each other and in series with the external oscillator.

Dummy 3: (Short Wave)—Consists of a 0.01 mfd. condenser and a 400 ohm resistor connected in series with each other and in series with the external oscillator.

ALIGNING I-F TRANSFORMERS

Part No. 108-112B output i-f transformer.

Part No. 108-111B input i-f transformer.

These i-f transformers have two ad-

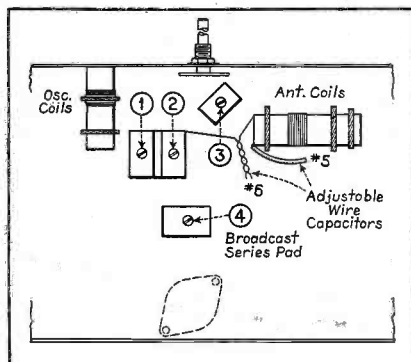


Fig. 4. Bottom view of chassis, Belmont 583. Adjustment numbers referred to in text will be found on this drawing.

justments, both of which are accessible from the top of chassis (see top view).

1. With volume control full on (the extreme right of its rotation), the band changing switch in the broadcast position (extreme left of its rotation), and with variable condenser in its minimum capacity position, plates entirely out of mesh, make the following adjustments:

(a) Connect external oscillator set at 465 kilocycles, in series with "Dummy 1," to the control grid cap of the type 6K7 tube, and adjust the output i-f transformer (No. 108-112B) to resonance.

(b) With "Dummy 1" still connected, move oscillator output clip from grid of 6K7 to grid cap of 6A8G and adjust input i-f transformer (No. 108-111B) to resonance.

SHORT-WAVE BAND

1. With band changing switch in the

short-wave position, extreme right of its rotation, and with external oscillator set at 16 megacycles and connected in series with "Dummy 3" to the antenna and ground leads, make the following adjustments:

(a) Move dial pointer to 16 megacycles and adjust short-wave oscillator trimmer to resonance. This adjustment is the trimmer mounted on the top of rear section of the variable gang condenser (see Fig. 1, top view, adjustment No. 7).

(b) Adjust short-wave antenna trimmer (adjustment No. 3) to resonance.

BROADCAST BAND

1. With band changing switch in the broadcast position, extreme left of its rotation, and with gang condenser in its minimum capacity position, plates entirely out of mesh and with external oscillator connected in series with "Dummy 2" to antenna and ground leads make following adjustments:

(a) Set external oscillator to 1720 kc and adjust broadcast oscillator trimmer to resonance (adjustment No. 1).

(b) Re-set external oscillator to 1400 kc, rotate variable gang condenser and pick up signal. Adjust broadcast antenna trimmer (adjustment No. 2) to resonance.

(c) Re-set external oscillator to 600 kc, and adjust broadcast series pad (adjustment No. 4) to resonance by rotating condenser to approximately 600 kc, rocking it slowly to and fro until by adjusting series pad maximum output is attained. This adjustment is located on the bottom of the chassis directly under the variable gang condenser.

(d) Repeat adjustments "a" and "c" until sensitivity is at its maximum.

(e) Set external oscillator to 2100 kc (image of 1170 kc) and tune in the signal at 1170 kc on the dial. Adjust the wire capacitor (adjustment No. 6) by twisting the two wires until a minimum output is obtained on output meter.

(f) Set external oscillator to 2630 kc (image of 1700 kc) and tune in the signal at 1700 kc on the dial. Adjust the wire capacitor (adjustment No. 5) by moving the wire either toward or away from the coil winding un-

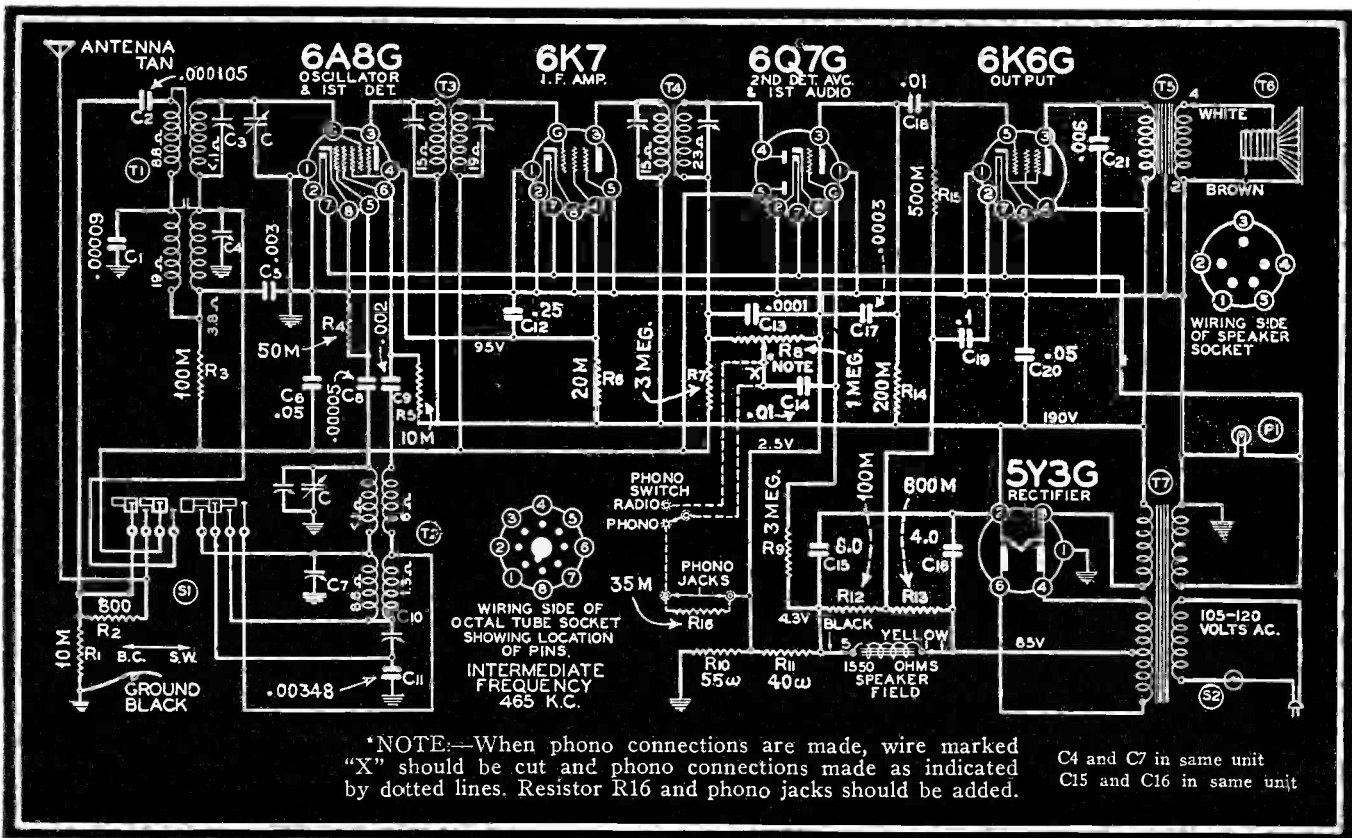


Fig. 3. Schematic diagram, Belmont 583.

til a minimum output is obtained on output meter.

- (g) Repeat adjustments (e) and (f) until the sensitivity is at a minimum.
- (h) Recheck the broadcast antenna trimmer (adjustment No. 2).
- (i) Recheck the short-wave antenna trimmer (adjustment No. 3).

Check for shorted condenser in 6K7 i-f plate return filter.

Willard Moody

Philco 602-C

Set dead: Shorted trimmer on oscillator tuning condenser. Quite frequent in this model.

Willard Moody

Pilot X201

Tubes light only momentarily, when set is shaken: Traced to an undersized heater prong on 25Z5 tubes. Very unusual condition, but it could happen again. The undersized prong would make contact only when the tube was moved, as in shaking the set.

Willard Moody

G. E. E-51

Loud hum peaked at 1,200 kc on dial: Condenser TC26 on G. E. circuit diagram (0.01 mfd connected between diode plate and B minus) should be shunted by another condenser of 0.1 mfd capacity.

Set dead: Look for plate prong of output tube shorting to chassis.

Willard Moody

G. E. E-129

Record changer skips records: Stretch spring on tone arm slightly so that ratchet action is improved. Adjust set screw on record lift lever.

Willard Moody

G. E. E-71

Power transformer starts to burn up:

TONE CONTROL AND FEEDBACK CIRCUIT

(See front Cover)

The circuit shown on the front cover is that of the audio system of the General Electric Models G-50 and G-55. The circuit of the two models is the same, the difference being in the style of cabinet.

Examination of the diagram indicates a quite conventional arrangement of the audio system. The a-f signal is taken from the diode-load resistor through a condenser thence to the grid of the 75 tube. Notice that there are two resistors between the 75 grid and ground.

To the top of the lower of these two resistors is connected another resistor which, in turn, connects to the "hot" or ungrounded side of the output transformer secondary. The other side of this secondary is grounded. Obviously, there will be a voltage developed in this network and, since this network includes

a portion of the grid return circuit of the 75 tube, the voltage is effectively in series with this part of the circuit—a condition for inverse feedback. The introduction of inverse feedback at this point flattens out the response of the entire audio system and adds the other well-know effects—reduction of speaker resonance by reason of lowering the impedance, etc.

The tone control function of the circuit obtains by shunting high frequencies through the condenser which, when the switch in the upper left of the diagram is closed, shunts the receiver volume control. The usual diode-load bypass condenser is of such value as not to bypass too many of the high frequencies; adding the additional capacity reduces the highs materially. This is in accordance with conventional practice.

Test Equipment . . .

A NEW SERVICING TECHNIQUE

By JOHN F. RIDER

WHAT WOULD you say to a man who told you that if he were given a defective receiver to service, he could place a single test prod upon the control grid of an r-f or i-f tube and without interfering with the operation of that receiver, check the character of that signal and simultaneously place another test prod upon the same point, so that both probes were there, and tell you the actual negative a-v-c voltage being applied to that control grid within a few percent of the true value? This also without interfering with the operation of the receiver or being concerned with the high resistance of the a-v-c network. Or if it so suited your fancy, check the extent of bypassing and the efficiency of filter circuits in the various channels of the receiver, regardless of circuit arrangement, by noting the amount of signal voltage existing at the various points of the filter system.

You would probably think for a few moments and after deliberating upon what experience you have had in servicing, realize that such has not been possible heretofore, hence should not be possible now—and tell the man that he was crazy.

Well, all of that can be done and much more. The man is not crazy. He is speaking actual facts . . . and they can be attributed to a simple comment made by a man who has very little technical knowledge of radio. All he knows about a radio receiver is to leave it alone and how to tune it. The man's profession is accounting. It is only incidental that he happens to be the writer's lifelong friend. For sake of identification, we'll call him F. One sentence spoken by him without any knowledge of its significance, resulted in several years of laboratory effort and the Chanalyst was born.

F and his wife were visiting our home. The women were discussing the usual feminine topics. We were discussing business practices in the servicing industry and F, being an accountant was of able aid in connection with some material being written. Casually without realizing what was to come, we happened to inject the thought that the increased complexities of radio receiver schematics were fast becoming a major problem, as a matter of fact as great a problem as the business side. We hap-

pened to state that what the service industry needed was a basis of analysis or diagnosis which would be standard and applicable to all types of receivers irrespective of circuit design. Thereupon F asked why such a system could not be established.

The answer was simple, namely that circuits and operating conditions differed widely, and that no one knew what circuit arrangements would appear in future receivers. Then came the 'piece de resistance'—the statement that started it all. Said F, "Why not find a common denominator. . . . Why not find something that is common to all receivers old and new and will likewise be common to all future receivers, and use that as a basis of test? . . . If you find a primary item, which perhaps can be supplemented with one or more secondary items, you can possibly establish a standard system of trouble localization which would be applicable to all radio receivers."

Our friend's statement was logical and sound. We explored the subject further. Having completed the discussion of the business angle, we listed items common to old and new receivers and likely to be found in future receivers. . . . In this he acted like a stenographer, listing the items as we called them off. We listed problems Service Men had in the past and still have. We named

major parts of receivers, common to all. We jotted down operating characteristics . . . the basis of operation . . . everything we could think of. Naturally we could list but few items concerning future receivers, but whatever we could think of was listed.

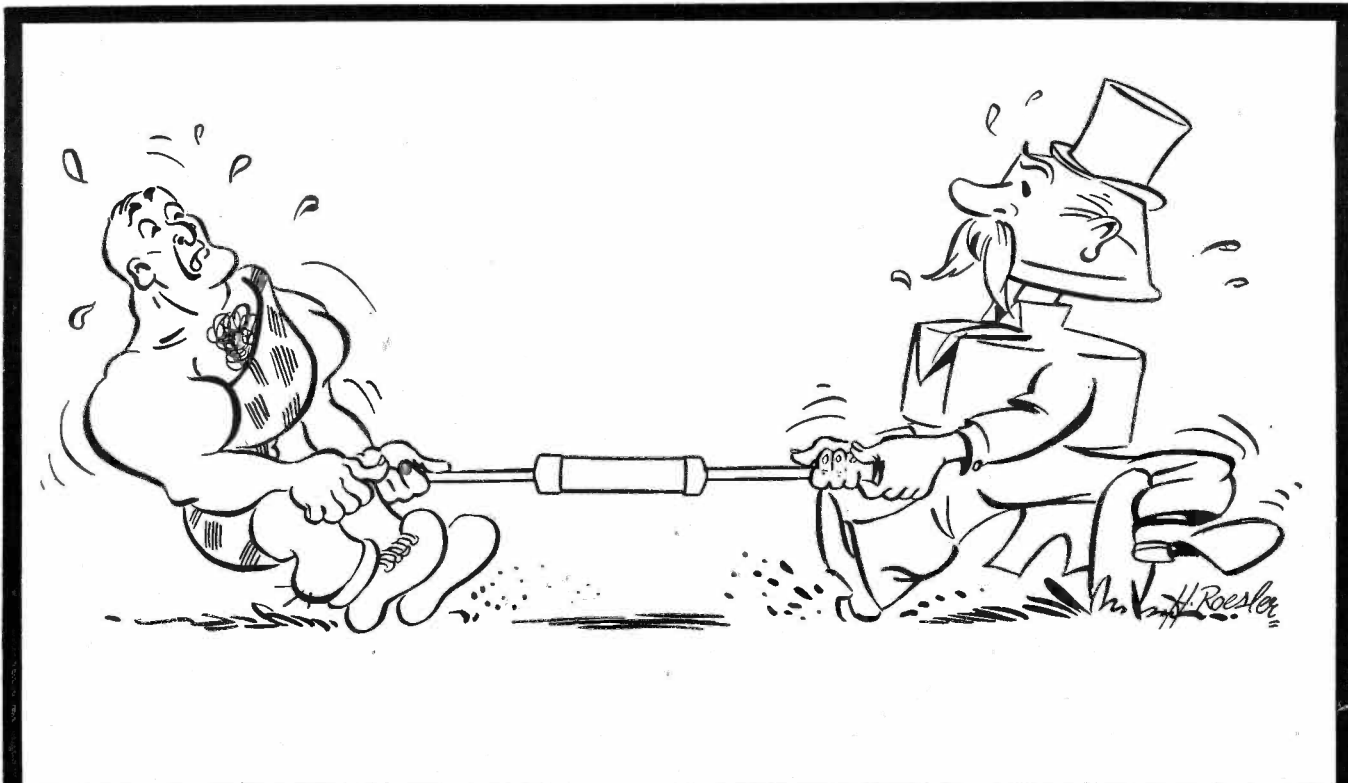
Then came a brain throb . . . it was astoundingly simple. It was basic—fundamental! It is found in all receivers, old and new, and will be found in all future receivers as long as receivers are made . . . it was the signal itself . . . the signal was the common denominator.

After all is said and done, a defective set does something to the signal fed into the receiver. The absence of the signal is the customer's complaint. Perhaps it is distortion, perhaps hum, maybe loss of receiver sensitivity, perhaps lack of control—whatever it is, something happens to the signal. It is the signal which the Service Man must restore, no matter what method of attack he uses, no matter what repair he makes. With the signal as the basis, circuit complications meant nothing; no matter what the circuit design, no matter what the brain child of the circuit design engineer; one thing appeared in the receiver when normal and one thing suffered when the receiver was operating in a defective manner—and that was the signal. As long as radio depended upon the transmission of a signal, the signal would be present in the receiver and could be used as the basis of a standardized method of servicing upon all radio receivers.

From that point on it became a laboratory job. We were not very much concerned with the secondary item, now that we had found the primary one. Since we were operating upon the signal, it was essential that the receiver under test be worked upon with the



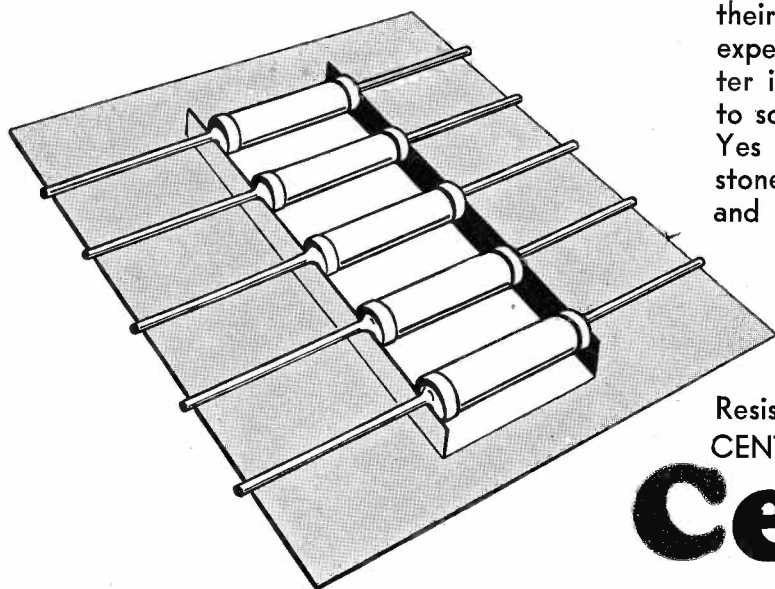
Fig. 1. The Chanalyst.



The New End Lead (*Center Lead*) CENTRALAB Resistor is



Now available . . . five to a card in one-half and one watt ratings . . . 100 ohms to 5 megohms.



★TUG-PROOF—a mighty important reason for changing to CENTRALAB's new Center Lead Resistors. For these new Fixed Resistors have their ends so firmly attached that you will never experience any trouble with loose ends no matter into what "tight hole" you may be forced to solder.

Yes . . . the same strong ceramic—hard as stone—and as impervious to moisture, vibration and shock as the previous types. End leads brought out through bakelite insulation. Baptized with fire at 2,500 degrees . . . they are still the best Resistor bet of all. For original equipment or replacements . . . select Centralab's new Center Lead

Resistors.

CENTRALAB, Division of Globe Union, MILWAUKEE

Centralab

RESISTORS

voltages applied. A theoretical analysis showed that given the proper equipment or the means of tracing the passage of the signal through all of the signal carrying circuits of the receiver, without influencing the operation of the receiver, we could solve innumerable service problems existent in the past. Furthermore it would provide a means not only of localizing the trouble to a certain major portion of the receiver, but supplementary tests could even identify the part that was defective.

Further analysis showed the superiority of voltage measurement as the secondary item over all others, because it too could be applied simultaneously with the signal test, providing this voltage test accomplished two things. First, that the measurement would not influence the operation of the receiver and, second, that it be all embracing in scope. By this we mean the ability to check with equal facility all operating voltages and those control voltages developed by the signal. If we could do this without interfering with the operation of the receiver, the problem was solved.

Weeks were spent in such theoretical analyses. We assumed the ability to trace the signal through the receiver without interfering with the operation of the receiver and the ability to establish all of the d-c voltages present in the receiver under like conditions.

Further elaboration of the idea clearly indicated that the system could be used to solve one of the most harassing problems besetting the service industry. . . . If the signal passage could be traced, then it would be possible to solve the intermittent problem.

We were still theorizing, but each step seemed logical. We then examined receiver schematics. What effect would circuit complications have upon the system? Would each part to be checked be accessible? Would the various signal paths be available? We consulted various engineering periodicals to establish the trend in receiver design. What would happen if the new ideas now in the process of development were incorporated into receivers? We spoke to development engineers concerning design trends. . . . All of our questions were answered in the affirmative. . . . In order to enable proper and economical maintenance of receivers sold, the parts in the unit would have to be accessible. If they were accessible, the various signal paths would be available for test. So far so good. When the problem was viewed from the angle of servicing capabilities of the servicing industry personnel with respect to the change in the design of radio receivers,

it was evident that a new form of approach of trouble localization or diagnosis would be helpful, an approach that was consistent with modern receiver design. Although receiver design has advanced by leaps and bounds during the past five years, the mode of attack in analyzing troubles in receivers has not kept pace.

With all of the theorizing completed, practical work started. This practical work meant not only the design of equipment to do what we established was required, but the actual application of the units to everyday servicing. Three requisites had to be fulfilled, namely, universal application, positive identification and fast operation. It is our opinion that these three requisites are fulfilled by the principles employed in the Chanalyst and those Service Men and service managers witnessed demonstrations of the device, concur in this opinion.

THE CHANALYST

Naturally you ask, "What is the Chanalyst?" Basically, the Chanalyst is a device whereby it is possible to trace or monitor by means of channels provided for that purpose, the passage of a signal through all of the signal circuits of the receiver. In the case of a superheterodyne receiver, this means that we can trace the passage of the r-f signal from the antenna to the point where it is converted into an i-f signal. Then we can trace the i-f signal through the complete i-f amplifier until it is converted into an a-f signal. Then we can follow the passage of the a-f signal through the audio amplifier up to the speaker voice coil. Further, since the superheterodyne receiver also contains an oscillator, a channel is provided in the instrument for monitoring the signal generated by this tube. Each of these channels terminates at an indicator. These indicators are cathode-ray tuning eyes. The r-f, i-f and oscillator circuits are resonated to the frequency of the signal present in the portion of the receiver being tested. For example if the r-f signal fed into the receiver is of 600 kc and the receiver i-f is 260 kc, the r-f pickup channel is resonated to 600 kc and will indicate the presence or absence of a signal in any portion of the receiver circuits which carry the 600-kc signal currents, without interfering with the operation of the receiver circuit.

Since the i-f is 260 kc, the oscillator pickup circuit is resonated to 260 kc more than the input 600 kc signal or to 860 kc, and when the pickup probe is connected to the oscillator circuit, the corresponding indicator will show the presence or absence of the oscillator sig-

nal in all parts of the receiver which carry the oscillator currents.

The i-f channel then is resonated to the aforementioned 260 kc and the corresponding indicator will show the presence, absence or level, if desired, of this i-f signal in any portion of the entire i-f channel of the receiver. For simplicity of design, the r-f and i-f channels feed the same indicator and each is selected at will. It was deemed unnecessary to supply a separate indicator for the r-f and i-f channels because sufficiently rapid localization of trouble can be accomplished by selecting either the r-f or the i-f channel by means of the switch and moving the probe to the corresponding portion of the receiver.

Furthermore, the presence of the separate a-f channel, provides a means of immediate localization if the r-f, oscillator and a-f channels are used simultaneously. For that matter, the i-f, oscillator and a-f channels can be used simultaneously. The a-f channel, as can be seen in Fig. 2, is separate and is operative over a frequency range of 50 to 50,000 cycles.

The Chanalyst also includes a wattage indicator connected to an electric eye. This indicator like the other circuits is calibrated and provides a continuous check upon the wattage consumption of the receiver during test. It is so arranged that the a-c receiver being tested is plugged into the power circuit through the wattage indicator channel. The wattage indication supplemented by the application of the electronic voltmeter V_M to show the maximum plate voltage, as for example that applied to the plate of the output tube, instantly provides a definite indication of the condition of the power supply. The presence of an abnormal load upon the power supply due to some type of short either in the power supply or external to the power supply will be indicated by high wattage consumption and lowered plate voltage. By the same token a subnormal load can be interpreted to show a different condition in the power supply or main voltage feed. These explanations are of necessity brief in this installment, but will be elaborated upon in the next issue.

The electronic voltmeter indicated as V_M in Fig. 2, is indeed unique in that its design is different from that of any existing type of d-c voltmeter. It indicates voltages which are either positive or negative with respect to ground and the pointer swings in one direction from the center zero for positive voltages and in the other direction from the center zero for negative voltages. It operates over four voltage ranges. The

TEST EQUIPMENT—continued

lowest range is from -5 to $+5$ volts. The next is from -25 to $+25$ volts, the third range from -100 to $+100$ volts and the highest is from -500 to $+500$ volts. The input resistance is approximately 10 megohms over all ranges, which means that on the 5-volt range, the resistance of the meter is 2,000,000 ohms per volt.

As a result of the design of the instrument, the voltmeter probe can be connected to any point in the receiver where a difference of d-c potential exists with respect to ground. The instrument will indicate not only the voltage, within a few percent of the absolute value at the point, but also the polarity, without requiring any switching of leads. Furthermore the high input resistance of the meter permits of its application to a-f-c, a-v-c, control-grid, plate, screen and cathode circuits without materially influencing the operation of the receiver. For example this voltmeter can be connected to the control grid of an a-v-c controlled tube, and the variation in control voltage plotted as the signal input to the receiver is changed. Likewise the meter can be connected to an a-f-c circuit and the control-voltage characteristic plotted as it swings from $+$ to $-$, when the receiver tuning is varied from the frequency of the input signal.

Referring again to the r-f, i-f and a-f channels, each of these channels is calibrated so that an idea of the signal voltage present at the point being checked can be established. When desired, gain measurements can be made within reasonable tolerance limits. For Service Man requirements where it is desired to check the presence or the absence of the signal, the variation of the shadow on the eye for any one setting of the gain control in that channel is sufficient to show a step-up or a step-down in the corresponding channel of the receiver as the probe is moved from point to point.

The r-f channel is operative over a band of 600 to 1700 kc and the indication on the eye is dependent upon the carrier and not the modulation component; hence it will give identical indications irrespective of the degree of modulation. The same is true of the i-f channel, which is operative in two bands over a frequency range of 95 to 630 kc, thus covering all of the intermediate frequencies being used in commercial receivers. If checking of the r-f channel is required between 600 kc and 500 kc, the i-f band, which embraces these frequencies is used.

The oscillator channel is operative in three bands over a range of approxi-

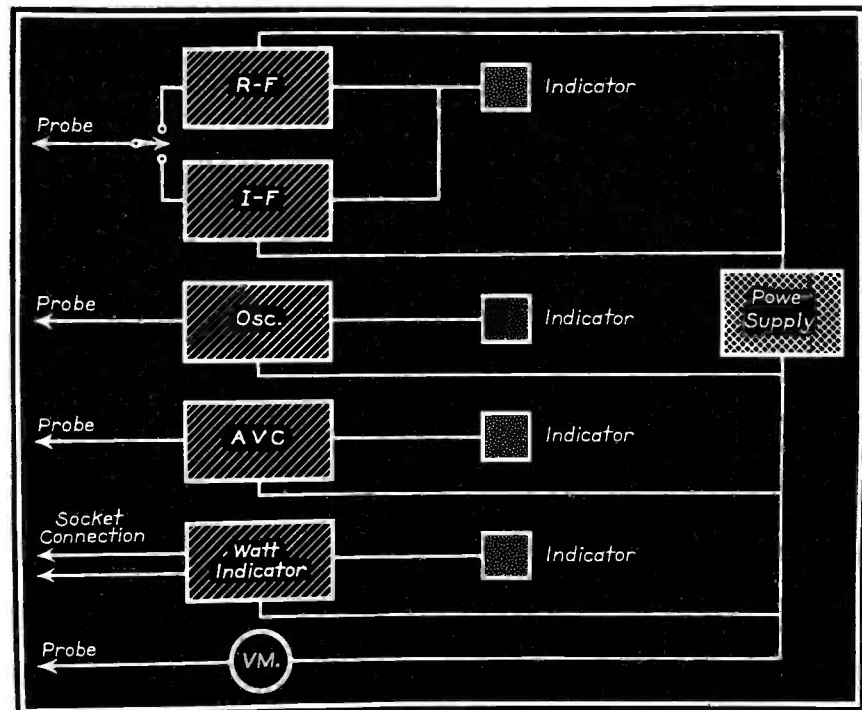


Fig. 2. Block schematic showing the elements of the Chanalyst.

mately 650 kc to 15,000 kc or 15 megacycles. Further checking of the operation of an oscillator can be made with the electronic voltmeter up to at least 70 megacycles by measuring the bias voltage developed across the grid leak of the oscillator. Incidentally, to make this test, the voltmeter prod is connected to the control grid of the oscillator, a very simple operation. Thus it is possible to follow the action of an oscillator in a receiver to check if it cuts out at any point over its entire frequency band. Of course the i-f and r-f channels can be used to check oscillator circuits operated at frequencies below 650 kc.

The fact that these r-f, i-f and oscillator channels can be connected to the corresponding portions in a receiver is made possible by the use of a very low coupling capacity between the point being checked and the proper channel in the Chanalyst. This coupling capacity is less than 1 mmf. Pickup of the signal present in the receiver is through the contact on the prod, because the remainder of the cable is shielded. The effect of this low coupling capacity will be discussed in full detail in the next installment, but let it be said at this time, that it in no way interferes with the proper operation of the receiver when the systematic routine we shall outline later is used. The same applies to the oscillator channel, which also is coupled to the oscillator being tested through a 1 mmf capacitance.

In addition to the visual indicators provided for the r-f, i-f and a-f chan-

nels, there also are means of connecting a headset to the output of these channels so as to be able to listen to the signal being checked. In other words if a modulated signal is fed into the antenna circuit, it can be aurally checked at any point in the r-f, i-f or a-f system. This provides a means of locating noisy stages, noisy windings and hum pickup.

Speaking about hum, the a-f channel which is operative over a range of 0.1 volt to 1000 volts can be used to establish the hum in any portion of the receiver where its presence may be suspected and to ascertain its level.

As to the principle of operation of the Chanalyst, it can be said that the r-f, i-f and oscillator channels are resonated vacuum-tube voltmeters. The a-f channel likewise is the equivalent of a vacuum-tube voltmeter, but it is not resonated. The electronic voltmeter is a d-c vacuum-tube voltmeter. For localization of a receiver defect as being in any one channel of the receiver, all that is needed is a test signal generator without special qualifications. Although Fig. 2 illustrates five separate channels, all need not be used at one time; they are provided to take care of intermittent problems.

John Rider is too well known to require any suggestion that the concluding portion of his article be watched for with interest. In it is promised the complete details of the operation of this new and amazing test instrument development.—EDITOR.

(To be continued)

Auto-Radio . . .

Silvertone 6100

Tuning:	Manual, with provision for push-button automatic motor tuning accessory
Range:	540-1,520 kc
Tubes:	
R-f:	6U7G
1st Det:	6A8G
Osc:	
I-f:	6B8G
A-v-c:	
2nd Det:	
A-t-c:	6U7G
1st A-f:	
Pwr Amp:	6V6G
Rect:	OZ4G or 6X5G
Power Supply:	6-volt storage battery; 7 amperes
I-f:	262 kc
Speaker:	Electrodynamic
Field Res:	4 ohms, approximately

GENERAL INFORMATION

The 6U7G atc-af tube functions as an automatic variable tone control. At low signal levels, when practically no a-v-c

voltage is being developed, the biases and phase relations with respect to the 6U7G tube are such that the tube acts as a shunt capacity across the input of the 6V6G tube, tending to suppress the high-frequency response. This is advantageous on weak signals since it eliminates much of the "shush" and background noise that accompany weak stations. When a stronger station is tuned in, the increased a-v-c voltage decreases the capacity shunting action of the 6U7G allowing more high frequencies to get through. With a station strong enough to insure reception free of background noise, the biases applied to the 6U7G are such that no tone control effect takes place and full high-frequency audio response is secured. In other words, the weaker the station, the more the "highs" are cut off, eliminating noises and improving reception.

ANTENNA MATCHING

Two separate adjustments are provided for matching the receiver to the particular car antenna. One adjustment consists of two taps on the antenna coil. The second adjustment is a trimmer, C1, on the variable condenser. It is accessible

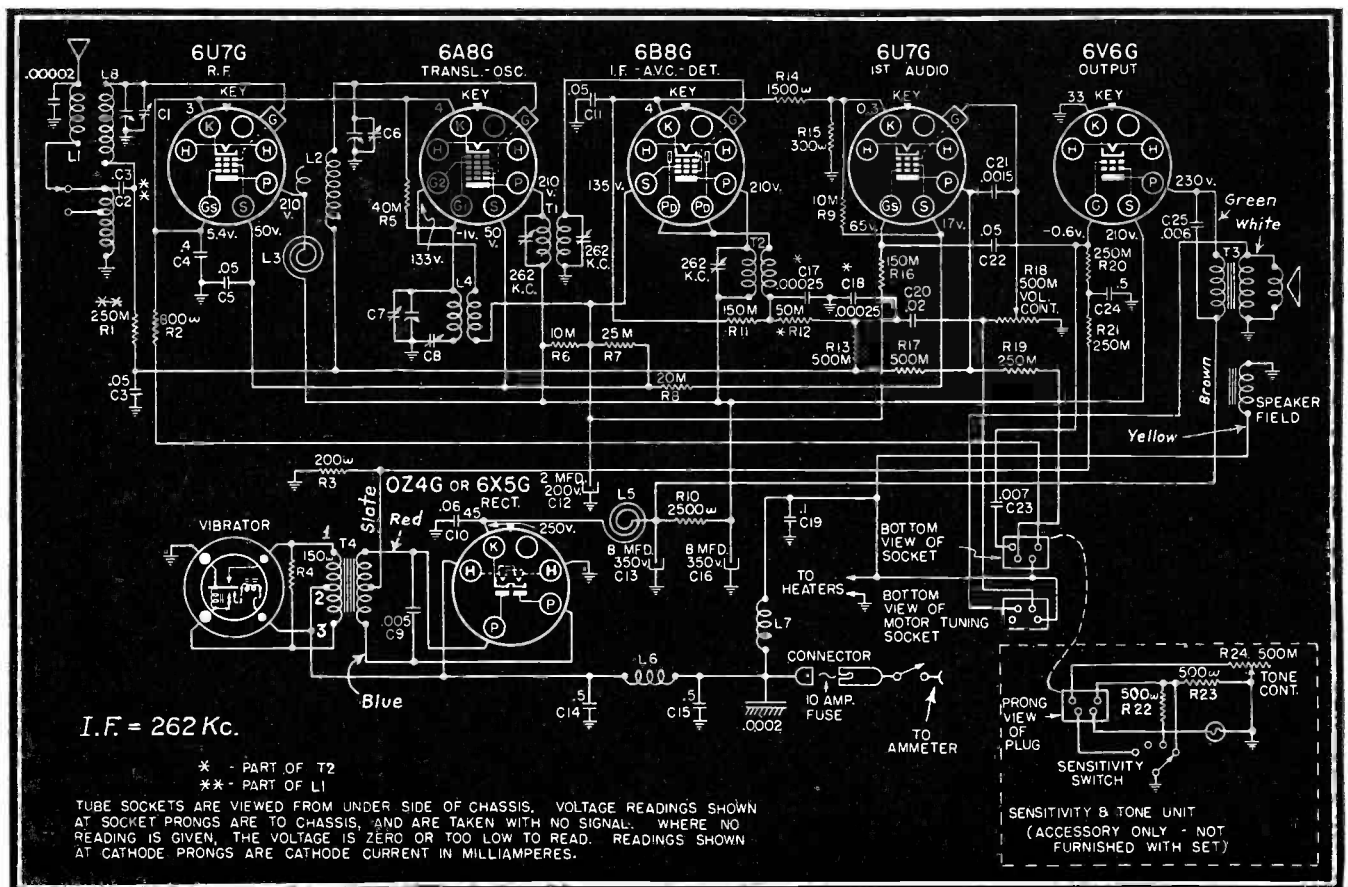
through a hole in the bottom cover of the receiver case. These adjustments are to be made as follows:

The adjustment of the tapped antenna coil should be made before installing the receiver on the car. Removal of the bottom cover of the receiver will reveal a terminal board mounted in the antenna coil shield can. The variable condenser plates must be closed for it to be seen. This terminal board has four jack holes, only two of which are used. These two are marked with the numerals "1," "2." The sets are shipped with the plug in hole No. 2. This adjustment is correct if:

- (1) The car has a fabric top and a factory built-in aerial.
- (2) The car has an insulated steel top that is connected at the factory for use as an aerial.
- (3) The car has running boards that are designed to be insulated for use as aerials. (1937 Buicks and 1937 and 1938 Oldsmobiles are examples.)
- (4) If under-car aerial is used.
- (5) Some part of the car is insulated and used as the aerial. For example, insulated trunks, rear-deck covers, etc.
- (6) If a horizontal rod type of aerial running along the roof of the car is used.

The plug position should be changed to hole No. 1 if a whip type aerial, or

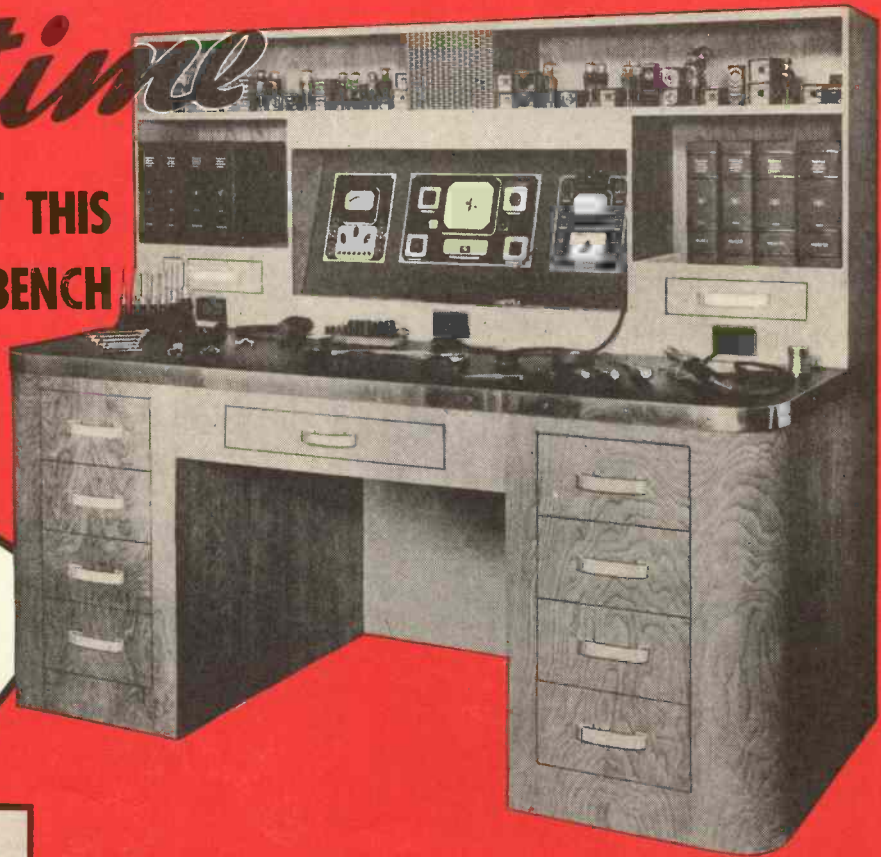
(Continued on page 22)



Circuit diagram, Silvertone 6100.

Still time

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1st PRIZE

This complete servicemen's test bench, including a high-sensitivity Analyzer, Socket Selector Set, Tube Checker, All-wave A.A.C. Oscillator, set of 8 Service Manuals, service tools and replacement tubes.

THE INSTRUMENTS
which make
any Service Bench
Complete



WESTON Model 776
all wave, hand-calibrated Oscillator



WESTON Model 772
Super Sensitive
Analyzer



WESTON Model 773
Tube Checker
(available in counter
and portable types)

... and 24 other awards in WESTON'S "50th Anniversary" Contest!

Get your entry blank today! Write 100 to 250 words telling "How Modern Test Equipment Helped Me Solve A Difficult Servicing Problem." Send in your entry before September 1st, and, if your answer is judged the most practical and most interesting, the completely equipped service bench shown above will be shipped to you FREE! And there are 24 other awards... all WESTON test equipment... being offered in this contest by WESTON in celebrating its 50th Anniversary of instrument leadership.

The contest is open to all individuals actively engaged in radio servicing, except WESTON employees or representatives. The contest rules, the complete list of prizes, and complete instructions are included on the entry blank. Be sure you enter today.

*Get entry blanks from your jobber,
or return the coupon today.*

WESTON

Radio Instruments

Weston Electrical Instrument Corporation
604 Frelinghuysen Avenue, Newark, N. J.

Send entry blank for WESTON'S "50th Anniversary" Contest

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NOW! You Too... Can afford to Own a Mobile Sound System



Model M-618

COMPLETE SYSTEM \$89.70

with Amplifier M-618, Turntable and Pickup with both 6 v. DC power pack and 110 v. AC power pack, two Model 3812 speakers, 15' cables and plugs, 1 Model 1240H velotron microphone with 25' of cable and plug; less tubes, less horns.
NET PRICE \$89.70

This remarkable new addition to Webster-Chicago's line makes it possible for dealers who have long wanted to get into the sound business to own a system that will take care of all kinds of rental requirements.

Handling up to 3,000 people outdoors and double this number indoors, it will handle all moderate size gatherings. Remember, this system includes phonograph turntable and motor, microphone, power packs and speakers.

Don't delay. . . . See Your Jobber or Write to Webster-Chicago for more information.

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WEBSTER-CHICAGO

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 Complete Catalog

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Manufactured under license arrangements with Electrical Research Products, Inc., subsidiary of Western Electric Co., Inc., and American Telephone and Telegraph Co.

NEW WEBSTER- CHICAGO 18 Watt Mobile Sound System

6 v. DC—110 v. AC
Operation

- Amplifier is 4-stage, 6 tubes, 18 watts output, with Multi-Stage De-generation Phase Inversion
- One Microphone, one Phonograph and one Tone Control
- Phonograph Turntable Is Built in as Integral Part of Amplifier
- P.M. Speakers
- Economical Power Requirements

This new Webster-Chicago system, Model M-618, combines all the advantages previously associated with the larger installations. This unit is built with the latest sound features, is thoroughly flexible, can be used both indoors and outdoors and on sound trucks. Ideal for rentals.

All component parts used are selected with Webster-Chicago's usual care, and this unit carries Webster-Chicago's standard guarantee.

AUTO-RADIO—continued

any other aerial of less than 125 mmf capacity is used.

THE ANTENNA TRIMMER ADJUSTMENT

With the set tuned to a weak station at about 1,500 kilocycles, turn the adjusting screw (accessible through the hole in the bottom cover) to the point affording maximum volume. A weak station must be used to prevent the a-v-c action of the receiver from interfering with accurate peaking. If a peak cannot be reached with the trimmer, the capacity of the car's antenna may be such that the other antenna tap adjustment should be used.

IGNITION NOISE INTERFERENCE WITH ROOF ANTENNA

If ignition interference is experienced in a car having a roof antenna, remove the antenna plug from its socket in the receiver case and check for ignition noise. If the noise is eliminated, it is likely that the interference is being picked up by the antenna leadin. It is very important that the shielded loom, furnished, be pushed as far as possible up the corner post. In some cars it may be necessary to remove a tack or clip that holds the leadin wire to the corner post and prevents the shielded loom from being pushed far enough up the post. The shielded loom must go up at least far enough so that the remainder of the downlead is completely enclosed by the metal corner post. Sometimes as little as 1/2 inch of unshielded leadin will produce severe spark noise. It is also important that the pigtail on the shielded loom be well grounded.

PROVISION FOR ACCESSORY COMBINED SENSITIVITY AND TONE CONTROL UNIT AND ACCESSORY AUTOMATIC PUSH BUTTON MOTOR TUNER

The two snap-in buttons on the right side of the case cover sockets for connecting these accessory units. The socket nearest the front of the case is for the combined Tone Control and Sensitivity unit. The socket nearest the back of the case is for the Automatic Push Button Motor Tuner.

AUXILIARY SPEAKERS

Three types of auxiliary speakers have been made available. The receiver has provision for the connection of these speakers and no alteration in the receiver is necessary.

NOISE CONDITION REMEDIES

Any ignition noise that may remain will always seem worse when no station is tuned in. This is so because under this condition the Automatic Volume Control feature increases the receiver sensitivity to maximum. It may be found

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It's as important to you as your job or your business! JOIN NOW and get in on all its benefits.

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Gentlemen:

I hereby make application for membership in the Radio Servicemen of America.

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All Metal RESIST-O-CABINET

GET ONE FREE!

A sturdy, good-looking 28-gauge ALL METAL chest of drawers, large enough to contain a complete stock of resistors and other small parts—and it costs you not one cent extra! All you pay for are the 59 popular range IRC Resistors it contains (List value \$15.16). The Resist-O-Cabinet is included with your purchase. Chest is 11" long by 5½" deep and 5½" high. Four large, all-metal drawers have metal partitions providing 28 compartments. The bottom is flanged so that they stack nicely one on top of the other.

ATTENUATOR (Commutator Type)
A new and radically different design with a noise level lower than can be accurately measured. This extremely low noise level is maintained in actual service. Step potentiometer and ladder types available.

L-PAD and T-PAD ATTENUATORS
Adaptations of famous IRC Type CS Dual and Triple Controls with the Silent Spiral Connector and 5-Finger Silent Element Connector. Special curves make them unexcelled for inexpensive sound equipment.

POWER WIRE NON-INDUCTIVE WOUND RESISTORS
Standard IRC Cement Coated 50, 100 and 200 Watt Resistors now available non-inductively wound by the Ayrton-Perry method. Also a new 10 watt 50 ohm Parasitic Suppressor for audio driver or power amplifier tubes.

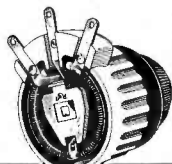
HIGH FREQUENCY RESISTORS
Power type metallized resistors with a flat frequency characteristic for use at ultra high frequencies. Just the thing as terminating resistors for obtaining maximum gain in a given direction with a Rhombic Antenna. The closest approach to a pure resistance available commercially.

UNIVERSAL BLEEDER RESISTORS
Type M-1034, 25,000 ohms. Universal as bleeder and bias resistor for any power supply in receiver or transmitter up to 500 volts. Taps for biasing one, two or three tubes.

25 WATT All Metal RHEOSTATS
More Watts Per Dollar!

Through utilization of the efficient heat dissipating qualities of aluminum, IRC has engineered a 25 watt ALL METAL Rheostat (Type PR-25) no larger in size than conventional types, yet with approximately one half the temperature rise at full load. Actual temperature rise, for full rotation, is only 140° C. measured at the hottest spot. In addition, due to highly efficient heat conduction, the full 25 watts may be applied across ¼ of the winding area with only 160° C. rise at the hottest spot.

Made in a complete line from 0.5 ohm to 5,000 ohms at standard list prices. Write for Catalog No. 128-S for complete details on new products.



INTERNATIONAL RESISTANCE CO.
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AUTO-RADIO—continued

that as soon as any station strong enough to be worth listening to is tuned in, the noise will disappear. It is advisable to check ignition noise in a location that is free from electrical disturbances such as are caused by power lines, street car lines, and electrical equipment. This is necessary to prevent mistaking electrical noises from outside sources for noises caused by the car's electrical system. Always be sure the hood is tightened down when checking for ignition noise. If objectionable ignition noise exists, proceed as follows:

When checking for the possible sources of ignition interference the following procedure is desirable:

(a) Disconnect the aerial plug from the receiver. If any ignition interference is still present follow the instructions below.

(b) If no ignition interference is heard with the aerial plug disconnected as described in paragraph (a), re-insert the aerial plug and disconnect the leadin at the point where it comes out of the shielded aerial cable. If interference is now noticed, make sure that the shielded aerial cable is thoroughly grounded to the car frame.

(c) If no interference is noted when the aerial leadin is disconnected as described in paragraph (b), it indicates that the interference is being picked up in the aerial.

Any defect in the ignition system of the car will aggravate the ignition noise picked up by the receiver. Be sure that the spark plugs are clean and have the proper spacing; that the distributor points are correctly spaced; that the distributor rotor is not worn too much; that the high tension ignition wires are not leaky.

Spark plug suppressors may be necessary.

Be sure that the high tension leads are pushed all the way down in their sockets in the distributor cap. If they are not pushed all the way down, a small spark may occur which creates noise in the radio and shortens the life of the distributor cap.

It is often helpful to ground any metal tubes, rods, or cables that pass from the engine side of the dash through the dash. This should be done by soldering short pieces of copper braid from these metal tubes to the engine side of the dash. The copper braid may be soldered to the dash or may be fastened by means of self-threading screws.

In some cars the ignition coil or leads come very close to the motor side of the toe board. This is true of the Chevrolet

(Continued on page 30)

Boost PROFITS with this new WARD AERIAL



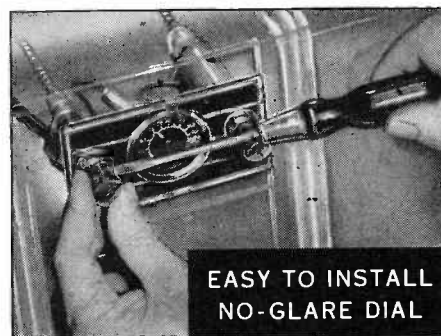
Here's the aerial you've wanted! Ward's new Model CO, a 2-section, telescopic, hinge type model sells at only \$1.95, complete, with 40' approved low loss shielded lead cable. Made of Admiralty metal. Easy-tilt mounting bracket. Easily installed.

Write for free catalog of WARD'S complete line.

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TWO NEW **SUPREME** *Speed* INSTRUMENTS MOUNTED IN ONE COMPACT UNIT!

FEATURES OF MODEL 592 PUSH-BUTTON SET TESTER

- 1 47 Ranges and Functions
- 2 Complete self-contained—No A. C. supply needed!
- 3 Panel area only slightly more than 1/3 square foot.
- 4 Sensitive 40 microampere meter (25,000 ohms per volt)
- 5 Both 1000 ohms and 25,000 ohms per volt in SAME UNIT!
- 6 Resistance ranges to 50 megs. ALL with internal batteries!
- 7 Only TWO PIN JACKS used for ALL functions!
- 8 All ranges and functions controlled from only TWO rows of push buttons. 14 buttons control 47 variations.

MODEL 592 is an exclusive, new push-button switching circuit giving direct current range from 1 microampere to 14 amperes; 0/70 microamperes/0.7 mil./7.0 mils./35 mils./140 mils./350 mils./1.4 ampere/14 amperes.

Two D. C. voltage functions from 0.1 volt to 1400 volts in 7 ranges each! 0/3.5/7/35/140/350/700/1400 D. C. volts at 1000 ohms per volt; 0/3.5/7/35/140/350/700/1400 D. C. volts at 25,000 ohms per volt.

The Model 592 gives you from one-quarter ohm to 50 megohms—in 6 ranges. 0/500/5M/50M/500M/5 meg./50 meg. using completely internal batteries—no A. C. supply required! "Ohms short" push-button on panel allows "Zero Adjust" procedure without shorting leads together.

The 592 offers 7 A. C. voltage ranges in all—0/3.5/7/35/140/350/700/1400. Push a button and a condenser is internally connected in series with all seven A. C. voltage ranges for use as an output meter.

Finally, 5 decibel ranges—10/+6, 0/+16, +10/+26, +20/+36, +30/+46 to check the power output of any P. A. amplifier.



1000 OHMS AND 25,000 OHMS per VOLT!

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Sound Service . . .

BETTER SOUND FROM EXISTING SYSTEMS

By MAURICE APSTEIN

EVEN WITH the outdoor p-a season well under way, there is no reason for the Service Man who specializes in this field of work to sit back and consider his further efforts as so much wasted time. As long as the summer lasts, every p-a user is a potential source of additional business. Granted, the man with a brand-new high-fidelity installation will need little or nothing in the way of equipment, but his less fortunate brother—the man who feels that a new system will have to wait for another year or so—is decidedly in need of some expert advice and assistance in gaining the utmost from the equipment which he already has.

Every owner of a p-a system—no matter how outmoded the equipment—has been sold on the idea of sound otherwise he would not have bought it in the first place. He is therefore one of the best prospects in the world for modernization of equipment. First of all, he has operated his present system steadily for several years and is no longer the novice he was when he bought it. He has come to learn by experience what his sound equipment needs are, and has by the same token found out the shortcomings of his present equipment. He will be quick to state what improvements in operating convenience should be made and although technically he may not know how to make them, fundamentally he will have the right idea. Properly handled, he is a willing customer to whom the idea of completely modernizing his installation for high-fidelity reproduction can be readily sold. It becomes the p-a man's job to show him the great strides p-a has made since he bought his present outfit, and prove to him that he can improve his business by improving his sound.

Modern sound systems differ from those of a few years back in only three basic characteristics. These are:

1. Higher overall fidelity.
2. Lower noise level.
3. Greater operating convenience.

Under higher overall fidelity, come a host of related improvements such as wider frequency range, increased power range, lower distortion, etc., all of which apply to input sources, amplifiers and speakers alike. Lower noise level includes both hum level and general noise

inherent in the equipment itself, as well as the reduction of unwanted external pickup such as crowd noise by the proper control of the directional properties of microphones. Greater operating convenience entails a greater flexibility in the installation of the equipment so that it may be used to best advantage. An outstanding example of this type of advance is the availability of electronic mixing at low cost, affording a degree of input control and flexibility heretofore reserved only for the higher priced installations.

By examining an existing installation for its shortcomings in the light of the above necessary characteristics, the p-a man can by a few well-thought-out changes in equipment seemingly work miracles in improving performance.

Perhaps no single unit in a sound system has undergone as much improvement as the speaker, especially in the last few years. We have for a long time had amplifiers of flat response and low distortion, and microphones of good quality, but the most expensive of our speakers of, say 5 years ago, do not compare in frequency range, power handling capacity, and flexibility, with the modern high-fidelity reproducer, especially the larger permanent-magnet types. Before the advent of the high-flux magnet alloys, p-m speakers were used only when it was absolutely necessary for economy in field consumption or simplicity of installation, and such economies were effected only at the expense of much wasted audio power due to their inherently low efficiency. Even now, many use them exclusively for portable use simply because no field wiring nor field exciter are necessary. However, from the modernization standpoint, there are numerous other advantages to be gained from their use in existing installations.

Having no field coils, and completely enclosed cones, both voice coil and field structure are more nearly weatherproof than their predecessors, making them ideal for outdoor use and doing away with watertight enclosures and weatherproof high-voltage wiring. Voice-coil leads may be run from old to new speaker locations with ordinary moulded rubber lamp cord, and old field wiring may be disregarded entirely.

Many of the older model a-c dynamics

used dry-disc rectifiers for field supply and the rectifier units having seen several thousand hours of service, are beginning to cause trouble due to hum and insufficient field current. By replacing these speakers with the p-m types, a marked improvement in frequency response, power-handling capacity, and efficiency, with a corresponding decrease in hum level will be accomplished. Thus by simply replacing the speaker equipment, the entire installation can be brought closer to modern requirements in all three of the basic characteristics listed above.

Another line of approach when modernization of an existing system is contemplated, is that of reducing the noise level. Many of the older installations still have old microphones or at best, out-dated pre-amplifiers with relatively high hum level. By replacing the old mikes with more modern types, such as crystal, dynamic or velocity, and installing a humless pre-amplifier, preferably with separate power supply mounted several feet away to minimize induction hum, hum level and noise will both be reduced and quality of reproduction will be improved. If possible, the pre-amplifier should include an electronic mixer which introduces no insertion loss, and usually a slight gain. Very often the inclusion of these two units in a system results in the sale of several additional microphones, making the conversion extremely worth while from the profit standpoint, at the same time expanding the flexibility of the system to the point where it is several times more useful to the owner than previously.

In choosing microphones for modern p-a systems, the installer will do well to keep in mind exactly the type of pickup required from the particular microphone in use. It has been the writer's experience that in installations using several mikes, optimum results will almost always be achieved by utilizing different types for different uses in the same installation, and choosing exactly the best type of response and directional property for the particular purpose required. In outdoor installations, for example, the back of the mike faces the crowd. The use of a bi-directional velocity, or non-directional crystal mike for solo work may result in a high degree of crowd noise being picked up and rebroadcast through the speakers, resulting in a background "hash" which is very unpleasant. A diaphragm type crystal, a dynamic, or a uni-directional sound-cell or velocity mike, should produce better results under these conditions. On the other hand, where several instruments in an orchestra are to be picked up with one microphone, a non-directional unit placed in the center of the instrument


SOUND SERVICE—continued

group, will give smoother pickup than several highly directional mikes.

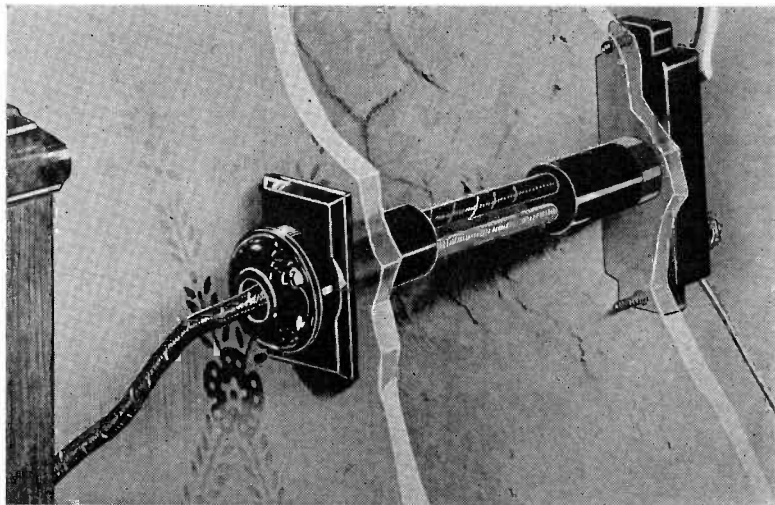
Selecting microphones for operation with a mixer is a problem in itself. Due to the high sensitivity of the modern low-level units, unless great care is taken to insure that the pickup field of one microphone does not overlap that of its neighbor, mixing will be almost impossible and a balanced pickup will be practically impossible to obtain. The writer recalls a perfect example of this type of problem, where a twenty-piece orchestra was to be picked up by seven microphones plus a solo mike, all working into an eight-channel mixer. The original installation used eight sound-cell non-directional mikes, placed at various points around the circular bandstand. Except for the solo control, varying the different channel controls made practically no difference in the pickup balance. In addition, the pickup from a noisy crowd made a wide volume range practically impossible of attainment. During solos, the soft orchestral accompaniment actually disappeared into the hash of crowd noise! After much "cut and try," the solo mike was changed to a highly-directional low-sensitivity type. This allowed operating the solo channel at much higher volume than before, with less crowd noise from that particular channel, and in addition enabled the mike to be brought right out to the edge of the platform without feedback from overhead speakers. The original solo mike and the seven orchestra mikes were then mounted in small parabolic reflectors, so distributed that each reflector covered a group of related instruments in the orchestra and at the same time shielded the microphone from the crowd. The difference in overall performance was remarkable. An entirely unlooked for result was a seemingly tremendous improvement in frequency response due to the fact that the bass instruments could be brought up to a relatively higher level than the rest of the orchestra by increasing the gain of their mixer channels, but without getting unwanted increased pickup from the more easily reproduced middle register brasses. Similarly, the string instruments could be distinctly heard, whereas before they had been completely lost. It is quite probable that the reflector idea was not absolutely necessary. Probably highly-directional microphones or some of the variable pickup microphones could have been made to do the work just as well. In the above instance, however, it was felt that there was no sense in discarding eight perfectly good high-fidelity mi-

(Continued on page 31)

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ASSOCIATION NEWS . . .

RSA

New National Officers of RSA Are Elected

At the annual meeting of the Board of Directors held in Chicago, June 8, 1938, the following officers were elected to serve until June, 1938:

T. P. Robinson, Dallas, Texas—President.
A. J. Theriault, Cleveland, Ohio—Vice-President.

Donald H. Stover, Freeport, Ill.—Secretary.

Lee Taylor, Chicago, Illinois—Treasurer.

T. P. Robinson was unanimously re-elected in recognition of his outstanding work in advancing the affairs of RSA in the past year.

A. J. Theriault brings to his position a wealth of experience gained in executive positions in other association work.

Don Stover is known as "ye Ed" of The Radio Serviceman.

Lee Taylor, the oldest man in point of service, was unanimously re-elected to the position of treasurer.

Six New Chapters Complete Affiliation

New chapters that have recently completed affiliation with the RSA are Alton, Illinois; Quincy, Illinois; Fremont, Ohio; Steubenville, Ohio; Ogden, Utah; and Long Island, New York. In addition to the above chapters, Danville, Illinois; Cincinnati, Ohio; Indianapolis, Indiana; and Tulsa, Oklahoma, are all definitely considering affiliation with RSA. We're growing and growing!

Highlights of First RSA Convention

After three days of activity, the Board of Directors of the RSA completed the tremendous task of revising the bylaws, establishing the Code of Ethics, electing new officers, and choosing an emblem and slogan for the RSA, as well as other business of the organization. The Board included in the revision of the bylaws all changes and suggestions of Chapters and individual members which were felt to be of permanent and practical value to the organization.

After months of effort on the part of many members, an official emblem was chosen by the Board. These emblems will be available to members as soon as the necessary art work can be completed.

A Code of Ethics embracing the highest ideals of the radio service profession was adopted. Servicemen are urged to read carefully, for the Code of Ethics is our pledge to the public and the industry.

A slogan, "Reliable Service Assured," was tentatively accepted by the Board. However, a contest will be held in which any member may submit his idea for a slogan to the national office. The winner of the contest will be decided by the Board of Directors at its 1939 meeting, and as a reward, will receive a life membership in the national organization, renewable each year.

After long deliberation, the Board of Directors fixed the amount of the national dues at three dollars a year effective January 1, 1939, in order that members can continue to receive all of the many benefits enjoyed in the past as well as a host of new ones to be added in the near future, and in order that the RSA might continue to be self-sustaining and entirely free from

any subsidy or domination. An admission fee of one dollar for 1939, was also agreed upon.

Technical meetings were very well attended. Outstanding among the speakers on the program were M. P. Wilder of the National Union Corporation, who spoke on "Television"; Henry Hutchins of the Western Advertising Agency, who spoke on "Get on the Profit Side of Radio"; and Walter Jones of Hygrade Sylvania, who spoke on "Tubes and the Courtesies They Expect." All of the speakers combined to furnish a very valuable and instructive series of technical sessions to the servicemen attending.

The annual meeting of members of the RSA was held at ten o'clock on Thursday morning, June 9, at which time the entire acts of all of the officers, the Board of Directors, and the Executive Secretary, were reviewed, and many helpful suggestions were received from the floor. These annual membership meetings present a chance for members to personally interview any of the officers or Board members of the organization.

Abilene, Texas

We decided to put on the dog and have a banquet! It was held in the Gold Room of the Hilton Hotel in Abilene. J. H. French was Master of Ceremonies, and, being gifted with a good line of gab, he kept things going lively. After a business session, W. C. Cosby set up a projector and screen and displayed curves on the screen that no oscillograph could come up to. This was followed by J. D. King, who plays a wicked piano. Everyone had a grand time, and we are looking forward to our next.

We are planning some group advertising to let the public know that we are all working together and not trying to cut each other's throats. We are going to stress each member's name and not so much the firm for which he works.

Alton, Illinois

At our May Meeting, we were advised that all arrangements for our affiliation with RSA were completed and our application for a charter would soon be before the Board of Directors.

Our regular meeting on June 7 was held at the shop of Robert Clayton, and was very well attended. Each member was presented with his Certificate and Card of Identification of RSA. Next, there was some discussion as to just what is meant by the term, "Service." It seems there are as many definitions of this term as there are servicemen. After the business meeting closed, we had the pleasure of inspecting Mr. Clayton's new shop. It is very neat and orderly and is arranged to very good advantage.

Our meetings are held the first and third Tuesday of each month.

Boston

Boston Chapter, after a heated run-off election, elected A. G. W. Saunders as Director of District Twenty. However, owing to the death of Mr. Saunders' father and his absence in Europe, Ingvar Paulsen, the alternate director is serving in his stead.

New Bedford

A special meeting of the New Bedford Chapter RSA was called for the purpose of changing the by-laws to include an office of an assistant treasurer. Preston Gifford was elected to that office.

At a regular meeting held June 15 plans were made for an outing and clambake to be held July 10 at Long Pond, Lakeville.

Fred Waring and Preston Gifford were received into the Chapter as Honorary Members. Their applications were forwarded to the national office for approval.

New Hampshire

On the 7th of June our Chapter met at Nashua, N. H. for the first meeting of the month.

At the previous meeting we decided that the meetings were getting too dry so a motion was made and carried that the first meeting of each month have some sort of entertainment for the members. In accordance with this resolution we found a man who had a portable movie outfit and he put on an excellent show for us. After the movies we had sandwiches and cold drinks. The idea seemed to have gone over from the looks on the various members' faces as they left for home. We also had several would-be members at the meeting.

New York

At the May 9th lecture, Charles H. Yocum gave a talk on the new Weston AC Oscillator. Using prepared schematics, he pointed out the possibility of making accurate tests with such an oscillator.

A. E. Rhine read a paper entitled, "Making a Profit in Radio Servicing." He explained that unless a sufficient charge is made for service work done, the more work a serviceman does the more are his chances of losing, instead of earning a profit. He substantiated his views with figures indicating costs of radio servicing. (Mr. Rhine's talk is the basis of a series of articles written by him and appearing in the June, July and August issues of SERVICE—Editor.)

Peoria and Freeport, Illinois

Final details for a picnic to be held on July 17th at Starved Rock Park, Illinois, have been completed by John Stoll of Peoria and W. F. Meyer of Freeport. A fine turnout is assured. Members of Chapters within driving distance of Starved Rock Park, as well as members at large of RSA, are cordially invited to attend the picnic, but bring your own eats and your wife or sweetheart to serve it!

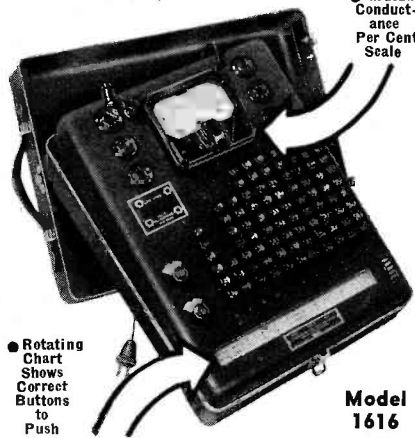
Bulletin, Peoria: A 7 pound 10 ounce boy was born June 11 to Mr. and Mrs. Fred E. Degenford. Jimmie is the name. Congratulations and best wishes.

Westchester

On May 11, Milton J. Shapiro of the Radiart Corporation spoke on "Impedance Matching of Auto Radio Aerials," and also the subject of "Automatic Voltage Regulators."

Our May 25th meeting had as guest speaker, Marshall Wilder, research engineer for National Union Radio Corporation who spoke on "Television."

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AUTO-RADIO—continued

1934 and 1935 Standard Models. As a result, interference is picked up by the occupants' body and transferred to the aerial if the car has a roof aerial. Trouble of this sort can often be detected through the fact that the noise increases if the person sitting alongside of the driver reaches his hand up to the roof of the car. It can be remedied by tacking a metal plate or screen to the motor side of the toe board or by placing the screen between the floor matting and the toe board. Then connect a piece of wire from this screen to an adjacent metal part of the car or else pass one of the screws that hold the toe board down, through the screen so that it makes an electrical connection to the car frame or body.

Very often interference may be fed into a roof aerial through the dome-light wiring. This can be determined by disconnecting the dome-light lead from the ammeter or lighting switch. If improvement results connect a condenser, of the same type as was used on the ammeter, to the dome-light lead as near as possible to the point where the lead enters the corner post. Cut the insulation from the lead at this point and solder it to one wire of the condenser. Tape the splice. Ground the other wire of the condenser to the nearest point where a good connection to the car can be obtained.

In extreme cases, it may be necessary to run a piece of heavy copper braid from the muffler to the car frame; from the transmission case to the car frame; from the torque tube to the car frame. In all cases, paint and dirt must be scraped away so that a bright metal contact is secured. The easiest way to make such bonds is to drill a small hole and use a nut and bolt to fasten the copper braid to the car member.

All of the electrical connections in the car must be tight. Be sure that the lamp bulbs fit tightly in their sockets and that they make good contact.

Tire static may occur on dry days when driving over dry roads. It can be told apart from ignition noise through the fact that it will continue even if the ignition is turned off and the car allowed to coast. Usually it will disappear if the brakes are put on or if the car is steered around a turn thereby putting pressure on the wheel bearings. Tire static collectors have been developed to eliminate such noise. They can be used in all recent General Motors cars and in any other make car that does not pack the hub cap with grease for lubricating the front wheel bearings.

Connect an output meter across the loudspeaker voice coil. Have receiver

in its case (covers may be removed) during alignment.

Connect signal generator to 6A8G grid cap through a 0.1 mfd dummy condenser; set generator to 262 kc; turn receiver variable condenser fully closed. Adjust trimmers (in order given) T2 and T1.

Reset generator to 1,520 kc and reconnect, through a 0.0002 mfd dummy, to antenna connector. Set receiver variable condenser plates full open. Adjust oscillator trimmer C7.

Reset generator to 1,400 kc and tune receiver to same frequency; dummy an-

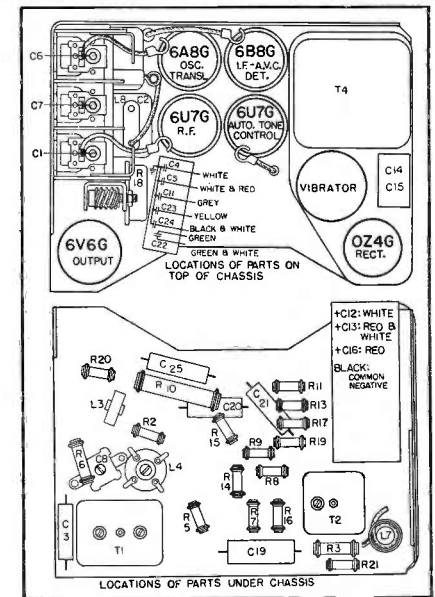


Fig. 2. Top and bottom chassis views, Silver-tone 6100.

tenna as above. Adjust antenna and translator trimmers, C1 and C6.

Set generator to 600 kc and tune receiver to same frequency. Dummy antenna remains as above. Rock variable condenser about 600 kc point while adjusting padding condenser C8.

Repeat these adjustments, in the order given, for greater accuracy.

Clinton 52

Hum: Caused by pickup by the grid lead to the 6C6 detector. The detector uses a 3-ohm (measured value!) grid leak so that it is necessary to re-route the grid lead directly to the top of the tuning condenser. Shielded wire is used to eliminate the hum pickup.

Willard Moody

Stromberg-Carlson 130H

Doesn't light; doesn't oscillate; no grid current in 6A8: First trouble may be due to defective switch. The others may be traceable to open coil or broken lead at oscillator grid coil.

Willard Moody

crophones, if they could be adapted to the service required without much expense.

Up to this point no mention has been made of the amplifier part of the system. This is because it is difficult to say without treating each case separately, just what should be done to improve an old amplifier. Improvements in amplifiers in the last few years, with few major exceptions, have been toward reducing the cost per undistorted watt rather than improving performance in general. In other words, a well-designed 4-year old class-A amplifier may still be a good amplifier; the chief difference between it and its modern successor being that it probably cost three or four times as much. Its chief drawback will probably be found to be insufficient gain, or possibly, too high a hum level. Pre-amplifiers, electronic mixers, and more efficient humless speakers can be made to at least partially correct these deficiencies as noted above.

There is however one notable advance which has taken place in recent amplifier design which should not be overlooked by the p-a man. This is the use in modern amplifiers of negative feedback, also called reverse, inverse, or degenerative feedback, or simply degeneration. Many old amplifiers can be converted to feedback amplifiers by a few simple wiring changes. The result will be an improvement in response, harmonic content, and noise level, at the sacrifice in some gain which can be taken up by the aforementioned pre-amplifier and electronic mixer. The various ways in which feedback can be introduced have been taken up in so many contemporary publications that it is felt unnecessary to go into detail here. However, one very important result of the introduction of feedback is its effect on load impedance. While this has been touched upon from time to time, it has never been brought home to the p-a installer just how he can put this aspect of feedback to use in the field.

Briefly, an output stage operating with negative feedback, is very insensitive to changes in speaker load impedance. Thus it becomes much less important to have a correct impedance match between the speaker lines and the output of the amplifier than if feedback were not present. Moreover, switching speakers on and off, and consequently varying the load into which the amplifier is working, has practically a negligible effect on either power output, frequency response or distortion. This characteristic goes a long way toward

(Continued on page 38)

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HIGHLIGHTS . . .

SOLAR CATALOG

A new catalog, Number 9-S, has been released by Solar Mfg. Corp., 599 Broadway, New York City. The catalog printed in five colors, lists complete information on the Solar condenser line; this includes wet and dry electrolytics, trimmers, paper, and mica. The catalog also describes the new type CC analyzer.

NATIONAL RADIO PARTS DISTRIBUTORS ASSOCIATION

The National Radio Parts Distributors Association held an annual meeting on Friday, June 10 at the Stevens Hotel in Chicago. Practically every distributor that attended the National Parts Show attended this meeting and there was a great deal of enthusiasm shown on the part of the distributors for the organization, both in the matter of ideas and opinions expressed and the financial backing contributed. On Saturday, June 11, the officers and the directors had another meeting to discuss certain matters of policy and then adjourned.

The officers for the season 1938-1939 are as follows: Pres., Leslie C. Rucker, Washington, D. C.; Vice Pres., Emmet Tydings, Pittsburgh, Pa.; Sec., George D. Barby, Reading, Pa.; Treas., Blakely E. Cross, Gloversville, N. Y.; Directors: Arthur C. Stallman, Ithaca, N. Y.; William A. Shuler, New Orleans, La.; Walter Hollenbeck, Altoona, Pa.; Joseph A. DeMambro, Boston, Mass.; Ralph C. James, Sr., Seattle, Wash.

1937 RCA SERVICE NOTES

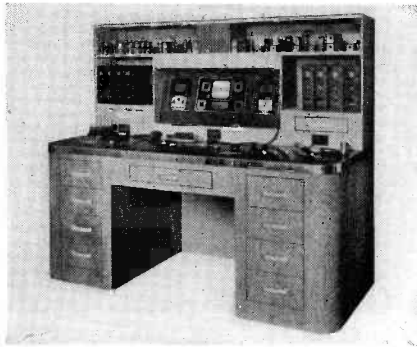
A handsome bound volume giving service notes, chassis-layout diagrams, illustrations and complete technical data for each of 85 RCA Victor instruments in the 1937 series has been made available to servicemen and dealers, it is announced by Edward C. Cahill, RCA Victor Service Manager.

Entitled "RCA Victor Service Notes for 1937," the 384-page book presents complete information on all RCA Victor home receivers, battery-operated models, phonograph-radio combinations, auto radios, record players, phonographs, amateur receivers, test equipment and antennas. In addition, technical data and diagrams are included for the RCA Victor Electric Tuning mechanism and Armchair Control.

The volume is completely indexed and includes descriptions and illustrations of principal items of test equipment. A special section is devoted to receiver alignment with oscillograph and associated equipment, while another section gives service hints and ideas, all completely indexed separately. Characteristics of each type and style Radiotron Tube are shown on a large chart.

Printed in clear easy-to-read type, with the pages numbered especially for easy reference, the volume is bound in durable hard back cloth covers with gold lettering. The book is the eighth edition to be issued by RCA Victor. Earlier editions cover all RCA Victor instruments back to 1923.

A handsome new catalogue featuring all RCA parts, test equipment and antennas has been prepared by the RCA Parts Division for distribution to dealers and service engineers through its parts distributors. The catalogue lists and illustrates more than 100 items in its 16 pages.



TWENTY-FIVE PRIZES OFFERED IN WESTON CONTEST

Twenty-five prizes are being offered to radio service men by the Weston Electrical Instrument Corporation, Newark, N. J., in a special "50th Anniversary Contest," announced at the Radio Trade Show in Chicago.

First prize is a complete service man's test bench, including a high-sensitivity analyzer, socket selector set, tube checker, full-wave a-c oscillator, set of Rider's Manuals, set of service tools and replacement tubes. This complete test bench was exhibited at the Weston booth at the Radio Show. Second prize is a combination high-sensitivity analyzer and tube checker unit. Other prizes include analyzers, tube checkers, oscillators and various servicing accessories.

The awards are to be made for the most practical and interesting answer to the question: "How modern test equipment helped me to solve a difficult servicing problem." Literary ability or general testimonial "puffs" will not be a factor in the judging—the decisions will be based on the usefulness and interest of an actual incident or "true story" based on everyday servicing experience.

The contest is open to all individuals actually engaged in servicing work, except those connected with the Weston company or its representatives. Answers should be submitted on the special entry blank, available from radio jobbers, Weston representatives or direct from Radio Contest Headquarters Weston Electrical Instrument Corporation, Newark, N. J. The contest closes September 1 and awards will be announced on October 1. The judges, to be selected from outstanding men in the radio field, will be announced at a later date.

RADIART UNIPAK

A novel display wrapper, which encloses without concealing, six individual cartons, has been made available by the Radiart Corp., Shaw Avenue and East 133 Street, Cleveland, Ohio. The Unipak is so designed as to stress the points claimed most superior in the Radiart vibrators.

TRIPLETT BULLETIN

A bulletin describing and illustrating the complete line of servicing and test instruments manufactured by The Triplet Electrical Instrument Co., has been issued by that company. Copies may be obtained by writing to Triplet at Bluffton, Ohio.

RADIO PARTS TRADE SHOW SETS NEW HIGH MARK

Industry cooperation scored another victory at the National Radio Parts Trade Show, at the Stevens Hotel, Chicago, June 8-11, and when the curtain was run down Saturday night (June 11) every previous record had been broken by a wide margin.

Opening attendance was higher and the increasing ratio was maintained to the end. So great was the press of visitors on Friday night that the closing of the show, after a quick vote of the directors, was extended.

Eighteen foreign countries, besides Mexico and the provinces of Canada were represented.

The 1939 National Radio Parts Trade Show will be held at the approximate time of this year's exposition, S. N. Shure, President announced.

The show corporation voted by acclamation to place the direction of the show in the hands of the present directors. They were re-elected Thursday morning.

These directors, besides Mr. Shure, of Shure Brothers, Chicago, are: A. A. Bernard, Ward-Leonard Electric Co., Mt. Vernon, N. Y.; Arthur Moss, Solar Manufacturing Corporation, New York City; and H. E. Osmun, Centralab, Milwaukee, Wis. Kenneth A. Hathaway, Chicago, will continue as managing director.

OHMITE STOCK CATALOG

An enlarged catalog of stock Ohmite rheostats and resistance units for the industrial, radio and electronic fields has just been issued by the Ohmite Manufacturing Company. The catalog lists and describes the extensive line of Ohmite vitreous enameled close control rheostats, resistors, tap-switches, chokes, non-inductive resistors, line cord resistors, radio-frequency chokes, transmitting band change switches and tap-switches, precision resistors, etc. Extensive tables list ohms, current and voltage for the different units.

There are seven sizes of rheostats in wattages from 25 to 1000 in scores of different resistance values listed, as well as many sizes of fixed and adjustable resistors. The catalog also lists rheostat accessories such as dials and special knobs.

The tables of ratings and large number of values make selections an easy matter. Copies of Catalog No. 17 can be obtained from the Ohmite Manufacturing Company, 4835 W. Flournoy Street, Chicago, Illinois.

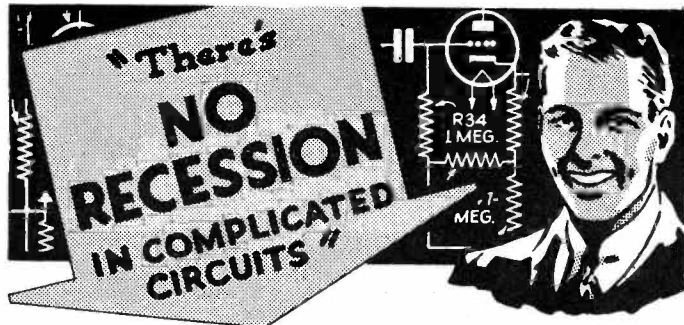
MUELLER SALES AGENTS

Mueller Electric Co., 1583 East 31st Street, Cleveland, Ohio, has announced the following appointments: Fred Somers, of Kansas City, will be the representative in Missouri, Iowa, Nebraska, and Kansas. Walter W. Boyd, of Chicago, will be the representative for Illinois, and eastern and southern Wisconsin.

PREMAX REPRESENTATIVES

William Gold, 72 Park Place, New York, has been appointed Premax representative in the Metropolitan New York and eastern territory. Al Bruning, 208 N. Wells Street, Chicago, is the new man in the Chicago district.

(Continued on page 37)



RIDER BOOKS

ALIGNING PHILCO RECEIVERS—New! Authentic instructions for aligning ANY of the 8,000,000 Philcos. Over 160 pp. Only \$1.00

CATHODE-RAY TUBE AT WORK—Complete, practical, written for servicemen. Information on Oscillograph, etc. \$2.50 335 pp 450 ill.

SERVICING RECEIVERS BY MEANS OF RESISTANCE MEASUREMENT Easy servicing with an \$1.00 ohmmeter. 203 pp., 93 ill.

SERVICING SUPERHETS Revised edition just published shows how to make superheterodyne repairs quickly. 288 pp., \$1.00

JOHN F. RIDER
Publisher
404-4th Ave.
New York City

Business may be tough—but not as tough as the complicated circuits in modern receivers. Right now, with conditions as they are, you can't afford to lose a job or a customer. Rider Manuals give you the circuit data you need for the most complicated of today's sets. Be sure you have all 8 volumes—you need them now more than ever before.

RIDER MANUAL VOLUME VIII

gives you the servicing data you need—simplified and standardized.

Included with Volume VIII is a special EXTRA section entitled, "How It Works." Covering operations peculiar to the

more complicated 1938 receivers. This is in addition to the complete information on the sets of over 100 manufacturers—1650 pages of indispensable facts—and the price is the same as last year.

YOU NEED ALL 8
Rider
MANUALS

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 shortcut 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 . . .

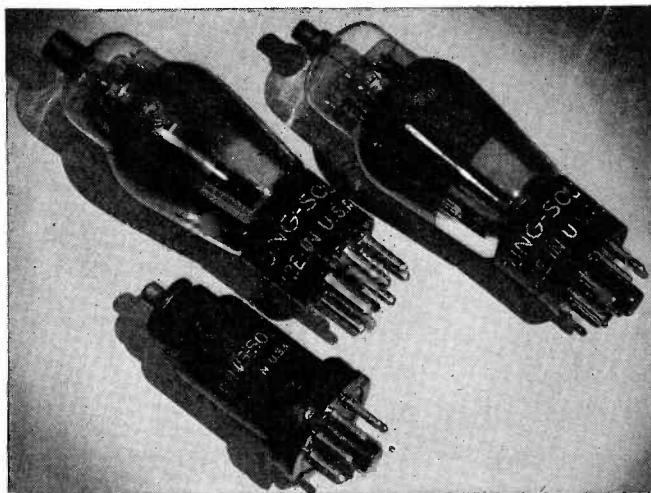
ON THE JOB DEPARTMENT

IF YOU CAN ANSWER "YES" TO THESE QUESTIONS

1. Have you an established radio service business?
2. Is your location free from interference with already established Tung-Sol agents?
3. Have you the necessary technical knowledge and equipment to service radio?
4. Is three months' supply a sufficient tube stock?
5. Will you agree to make a monthly stock report on standard forms provided by the wholesaler?
6. Will you regularly use display and advertising material furnished by us?
7. Will you maintain Tung-Sol established retail prices?
8. Have you sufficient capital to meet your obligations promptly when due?

If you can answer "Yes" to these questions, Tung-Sol has a Consignment Plan that will show you better and quicker tube profit than you ever thought possible.

Look the questions over—and if your answers are "Yes" — WRITE TODAY for name of your nearest wholesaler. DEPT. D



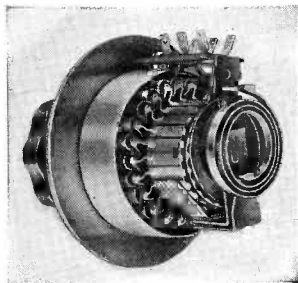
SALES OFFICES

Atlanta • Boston
Chicago • Dallas
Denver • Detroit
Kansas City • Los Angeles
Angeles • New York

TUNG-SOL
Flow Radio Tubes

TUNG-SOL LAMP WORKS, INC.
Radio Tube Division
General Office: Newark, N. J.

THE MANUFACTURERS . . .



IRC ATTENUATOR

The new IRC 20-step Attenuator just announced by the International Resistance Company, 401 North Broad St., Philadelphia, utilizes a molded motor commutator with conducting segments of polished, hard-drawn copper molded in phenolic. By combining the obvious advantages of this radically new design with a multi-finger beryllium copper contact and a flat, spiral spring connector, IRC claims that the new Attenuator (Type A-21) will maintain its initial low noise level of -150 db in service.

Each finger of the multi-finger copper contact operates independently, insuring smooth, noise-free contact. The design is such as to do away with the necessity for frequent cleaning and oiling.

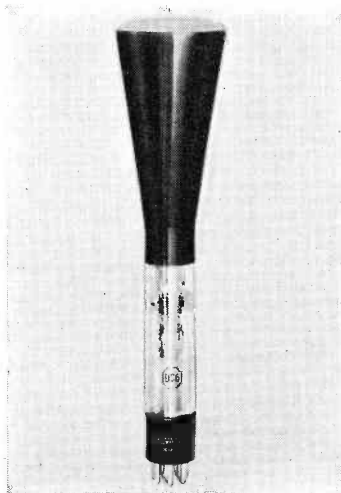
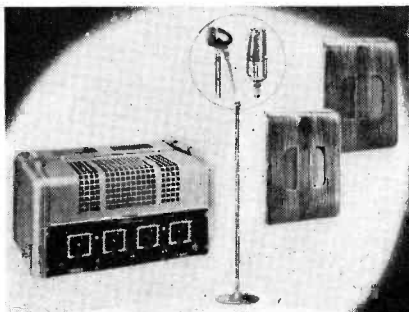
The "Silent Spiral" Clock Spring connector is a logical adaptation of the same principle pioneered by IRC more than two years ago in connection with its well-known Type CS Volume Controls. This important feature definitely eliminates one series pressure contact. Thus it contributes materially to maintaining an extremely low noise level throughout the life of the attenuator.—SERVICE

WEBSTER-CHICAGO 35-WATT SYSTEM

This new system features high-speed expander, multi-stage degeneration and dual tone compensation. It carries the Underwriters Laboratories' approval. The system was designed particularly for critical installations having a seating capacity from 7,000 to 9,000 people. Remote control and a smooth acting high-speed volume expander, combined with especially low distortion and inherent noise level, permits reproduction of the highest order.

The complete system includes amplifier, two permanent magnet speakers and either velocity or dynamic type microphone.

Full details are available from the manufacturer, The Webster Company, 5622 Bloomingdale Avenue, Chicago, Illinois.—SERVICE

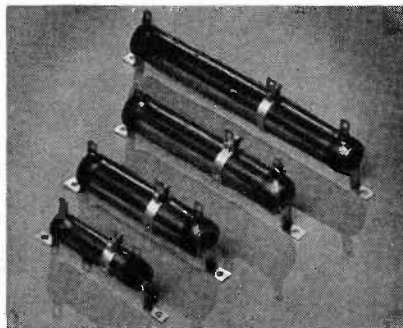


SYLVANIA ANNOUNCES C-R TUBE

Hygrade Sylvania Corporation has announced the production of a three-inch, high-vacuum cathode-ray tube, the type 906. This new Sylvania tube is designed for use in television receivers and similar applications. Type 906 will be found useful where a compact, high-brilliance tube is required.

According to the manufacturer, the 906 is the forerunner of a group of such tubes to be announced from time to time.

Full details of the tube may be obtained from the Hygrade Sylvania Corp., Emporium, Pa.—SERVICE



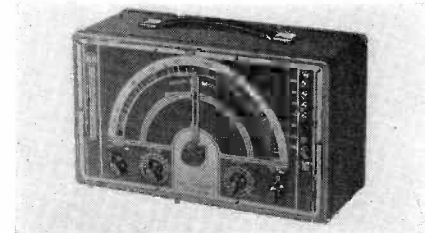
UTAH ANNOUNCES RESISTOR LINE

Utah Radio Products Company of Chicago has announced new additions to their Vitreous Enamelled Resistor line. These new additions include adjustable types in sizes from 10 to 200 watts dissipation.

The new Utah resistors have a double coat of vitreous enamel to insure complete protection. A special vitreous enamel protects and anchors the resistance wire in the exposed section. The standard resistance tolerance on the new resistors is plus or minus five percent.—SERVICE

SHURE PICKUP

A crystal pickup, model 94A, said to give full range frequency response, has been announced by Shure Brothers, 225 West Huron Street, Chicago, Ill. The pickup is compact in size and has rubber cushioned pivot bearing assembly.—SERVICE



RCA LISTS NEW PARTS AND INSTRUMENTS

Recently announced by RCA Manufacturing Co., Inc., Camden, N. J., are parts for the modernization of phonographs—a record changer, and a motor board for the user who wishes manual change of records. Both units are equipped with crystal pickup.

Shown in the illustration, top, are the type 154 Beat-Frequency Oscillator, and, bottom, a Cathode-Ray Oscillograph incorporating RCA's new two-inch tube.

In addition, there is the first noise-reducing antenna system to carry the RCA Victor name.

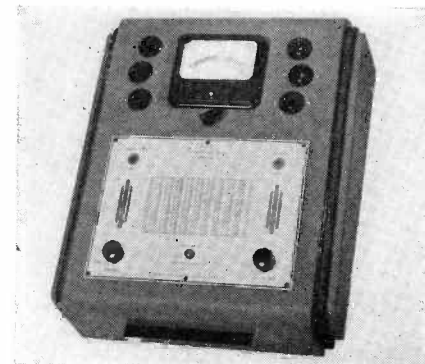
Complete information on all of these units may be obtained from the manufacturer.—SERVICE



DAYCO TUBE CHECKER

The series 401 tube checker, manufactured by Dayco Radio Corp., 201 Hickory Street, Dayton, Ohio, is said to have several unique features. A series of bakelite cards, 160 of them, each drilled differently, takes care of all present tube types; each card is marked with the identifying number of the tube it is designed to fit. The card functions in the checker in such a manner as to provide a complete test of the tube simply by turn of a knob and the pressing of a button. The checker makes it impossible to show a bad reading on a good tube and should, for this reason, favorably impress the customers of the service shop.

Further details are available from the manufacturer.—SERVICE



STAKE YOUR

Reputation on



Now! Better than ever! Each Meissner ELECTRONIC vibrator is aged and life-tested twice—to give you even greater dependability and operating efficiency than ever before. You can stake your reputation that—like all Meissner products—each Meissner ELECTRONIC vibrator is built of the finest materials and with the greatest possible care in the design and workmanship. Make your next vibrator replacement a Meissner! Your parts jobber sells them.

MEISSNER
MFG. CO.
Mt. Carmel,
Ill.

Meissner

"A FAMOUS NAME FOR TWO DECADES"

for P-A Jobs

Handles 25 watts continuously, safely, regardless of setting.



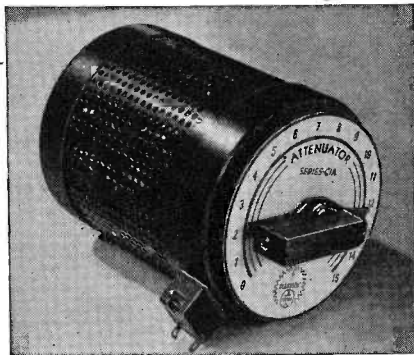
Linear up to 45 db in steps of 3 db. Infinite attenuation at end position.



Compensated ladder-type network. Constant input and output impedances.



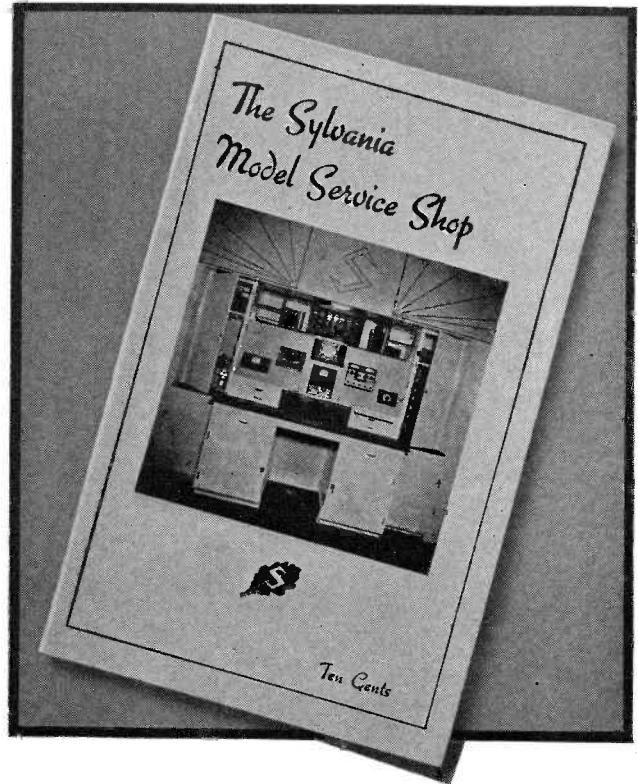
4 1/4" long by 3 1/4" dia. Single-hole mounting. Power switch for speaker field, optional.



● For better acoustics—especially in big installations running up into real money—you'll need this CLAROSTAT Constant-Impedance Attenuator to control individual loud-speaker volume *without distortion*. ● Write for technical data on this and other P-A controls.

CLAROSTAT Manufacturing Co. Inc.
285-287 NORTH SIXTH STREET
BROOKLYN, NEW YORK, U.S.A.
OFFICES IN PRINCIPAL CITIES

MODERNIZE
YOUR SERVICE SHOP



—This book shows you how!

A serviceman's biggest asset in business is a completely modern, completely efficient service shop.

Let this book help you modernize. It contains full working plans and specifications for the construction of today's model service shop—identical to the one we displayed at the National Trade Show in Chicago.

Following these plans, you can build the complete shop at very moderate cost. But even if you wish only to modify your present set-up, this book will be helpful. It contains many valuable tips—ideas and suggestions you can really use in modernizing your shop. Send the coupon and 10c for this book today. You'll be glad you did. Hygrade Sylvania Corp., Emporium, Pa.

Also makers of famous Hygrade Lamp Bulbs.

SYLVANIA
Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP. S-78

Emporium, Pa.

Here is 10c. Please send me the Sylvania Model Service Shop book right away.

Name

Address

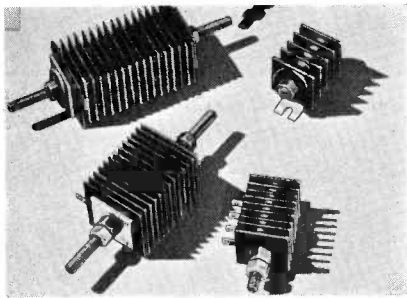
City..... State.....

Amateur

Serviceman

Dealer

Experimenter



MALLORY DRY DISC RECTIFIERS

P. R. Mallory and Company, Inc., Indianapolis, Ind., announces a complete line of dry disc rectifiers for servicemen, amateurs and experimenters. Types are available for outputs from one to twenty volts, and one-half to twenty amperes. Higher outputs may be obtained by simple series or parallel connection.

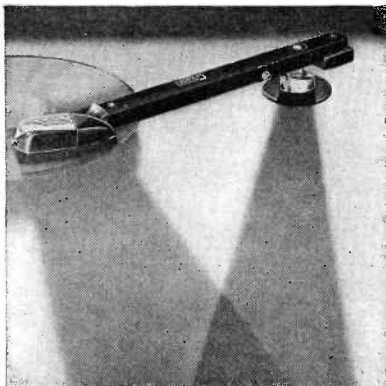
The rectifiers, designed to be operated from a simple step-down transformer, are suitable for use in constructing low voltage, high current power supplies for battery charging, speaker field excitation, the operation of toy trains, vacuum tube filaments, motion picture exciter lamps, automobile radio demonstrators, telegraph and telephone systems, relays, time clocks and hundreds of other applications.

Mallory Rectifiers are of magnesium-copper sulphide construction, this type of rectifying junction being especially adapted to heavy duty applications. Individual rectifier units capable of handling several thousand amperes have been constructed.

A new catalog, R-610, is available on request.—SERVICE

AUDAK ANNOUNCES NEW PICKUP

The Audak Company, 500 Fifth Avenue, New York, N. Y., announces a modified version of their Microdyne unit to be known as the Compensated Microdyne. According to this manufacturer, the new pickup has a response which is flat from 500 to 8000 cycles, while below 500 cycles the characteristic exhibits a gradual rise to a maximum of about 12 db at 50 cycles. This type of response, which is said to take care of the loss introduced in recording, is obtained through the combination of magnetic and crystal properties.—SERVICE



ARCTURUS MIDGET TUBE TYPES ANNOUNCED

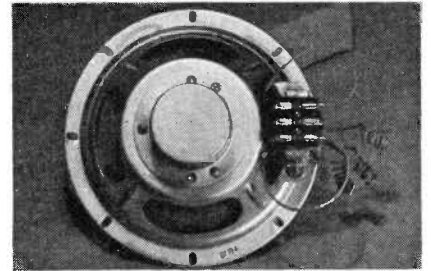
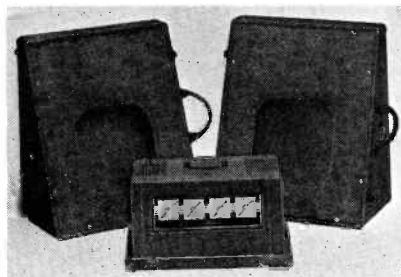
As a logical advance in the art of small tube manufacture which began with the introduction of its Coronet tubes several years ago, the Arcturus Radio Tube Company, Newark, New Jersey, has introduced a new line of midget glass tubes. The following seven Arcturus types are now available in the midget line, with others already in course of development: 6A8GT; 6K7GT; 6Q7GT; 6J7GT; 25A6GT; 25L6GT and 25Z6GT.

These new midgets are specifically designed for the currently popular small sets and may be used with uniformly fine results wherever space is at a premium. Exceptionally rugged and sturdy, they are said to make possible new standards of performance and durability in a confined space. Electrical characteristics are identical with those of the same type numbers in "G" or metal tubes.—SERVICE

OPERADIO 30-WATT PORTABLE SOUND UNIT

A 30-watt Portable Sound Unit with Remote Mixtroller, which gives all the advantages of the Remote Controller, but in addition mixes two microphones; it features: bass and treble tone compensators to bring out true tonal qualities of voices and music at various output levels; new bullet-type crystal microphone—other types available. Two Operadio extra-heavy-duty permanent magnetic dynamic speakers are set in infinite baffle twin speaker enclosures. Controls are fully protected, recessed and illuminated.

Specifications and further details may be had by writing Operadio Manufacturing Company, St. Charles, Illinois.—SERVICE



5 SPEAKERS MAKE SERVICE INVENTORY

The Accurate Electric Company of Chicago, in announcing their new line of permanent-magnetic speakers, is inaugurating a 5-speaker inventory for the serviceman. "Any radio set known today can be serviced from this 5-speaker nest," says Leon Levinthal, President of Accurate Electric Co.

The line features "Plug-Jack" universal transformers which improve the appearance and operating efficiency of the speakers and prevent "solder-sag" of connector board. These transformers are universal matching impedance or line types. This line is jobbered by radio parts distributors exclusively.—SERVICE

AMERICAN MICROPHONE UNIDIRECTIONAL MODELS

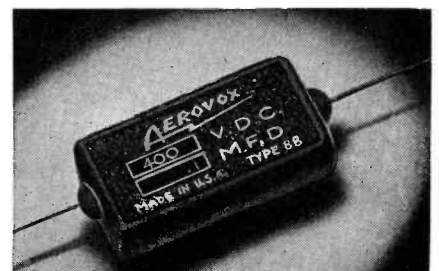
The models D9 and D9T of the American Microphone Co., Inc., Los Angeles, Cal., are said to possess unique characteristics by reason of the use of two microphones whose characteristics so complement each other as to result in unidirectional properties. Full details of this interesting device may be obtained from the manufacturer.—SERVICE

PAPER CONDENSERS MOLDED IN LIVE RUBBER

Paper condensers molded in live rubber jackets are now offered by Aerovox Corp., 70 Washington St., Brooklyn, N. Y., in meeting electrical characteristics demanded for r-f functions.

In the manufacture of these new rubber-molded units no moisture is released by the vulcanizing process which is accomplished at a temperature below the vacuum-impregnation cycle of the section. The insulation resistance and voltage breakdown characteristics of these live-rubber encased condensers are said to be excellent.

The new units are available in capacities up to 0.25 mfd in 200-volt, 0.1 in 400-volt, 0.05 in 600-volt, and 0.01 in 1000-volt.—SERVICE





For the Aid of the SERVICEMAN

The NEW Thordarson Guide No. 342-C Is Ready

Adding an Extra Speaker
 An Improved Condenser Analyzer
 Efficient Filtering
 A High Fidelity Amplifier
 A Vacuum Tube Voltmeter
 Profit or Loss
 Socket Tops and Bottoms
 A Low Cost 'Scope
 Using an Oscilloscope
 Logical Testing
 A Two Tone Audio Oscillator
 Watch Your Inventory
 A 32 Volt DC Power Supply
 Meters: How to Use Them
 Hi Fidelity Beam Power Amplifier
 Minimum Test Equipment
 R. M. A. Color Codes (Transformers)

Look at the list of features on the left. Translate them into terms of increased profits which such information will help you make. Then there can be no doubt of your desire for a copy of this guide.

The articles were written by Thordarson's own engineers and service experts. This assures the reader that he will have up-to-date and reliable information.

Notice that these articles point the way to improving existing equipment as well as offering better service. They are designed to help you *make more money*. Included is a simple bookkeeping method to help you know how and where you make your profits.

You can't afford to be without this guide! Get it at once!

Only 15c postpaid direct from the factory, or from your distributor less regular discount.



THORDARSON ELECTRIC MFG. CO.

500 W. HURON ST., CHICAGO, ILL.

Demand 'Power by Thordarson'

HIGHLIGHTS—continued

MEISSNER BUYS ELECTRONIC LABORATORIES VIBRATOR DIVISION

Negotiations have been completed for the purchase of the Vibrator Division of Electronic Laboratories, Indianapolis, Indiana, by the Meissner Manufacturing Company of Mt. Carmel, Illinois. The purchase was announced today by Mr. G. V. Rockey, Vice President of Meissner.

The Vibrator Division of Electronic Laboratories was the largest exclusive manufacturer of vibrators, and has a long and successful career in the radio industry. Several outstanding vibrator improvements have been developed by Electronic's vibrator engineers and their products have been highly regarded among the engineering fraternity.

The vibrator equipment of Electronic Laboratories together with many of their Vibrator Division personnel are now being moved to the Meissner factories at Mt. Carmel, Illinois, where the new Meissner-Electronic Vibrator will be manufactured under supervision of the Meissner Laboratories.

NU DISPLAY

A new set of display material consisting of an easel back window-counter display card and a window streamer was released this month to National Union distributors for distribution to NU service dealers throughout the country.

The new display is brilliantly printed in three colors and gold—sells radio service through the idea "Don't Monkey With

Your Radio—Call Us For Radio Service." The window-counter card features a large size head of a monkey and should attract much attention when displayed in shop windows.

J. J. Mc Bride, District Manager of National Union Radio Corporation with headquarters in Chicago, Illinois, announces the appointment of Fred Gusler, sound and radio tube expert, as his assistant.

Mr. Gusler brings to his new post a wealth of experience in radio and public address work, having sold RCA products in the Mid-West for many years.

UNIVERSAL CATALOGS

Two catalogs, one on microphones and the other on recording equipment, have been released by Universal Microphone Co., Ltd., Inglewood, Cal. Copies may be obtained by writing to the company.

SHALLCROSS BULLETIN

Bulletin number 140, describing a number of the instruments manufactured as well as the standard sizes of wire wound resistors, may be obtained from Shallcross Mfg. Co., Collingdale, Pa.

SERVICE SHOP

A booklet entitled "The Sylvania Model Service Shop" has been published by the Hygrade Sylvania Corp., Emporium, Pa. Complete working drawing, specifications, etc., for an up-to-date shop and store are included in the booklet which is obtainable from Sylvania at a nominal charge.

A.C. and D.C. VOLT-OHM-MILLIAMMETER
POCKET SIZE only \$12.00



Size: 3 1/16" x 5 7/8" x 2 1/2"

MODEL 736

Accuracy Guaranteed 2% D.C. - 5% A.C.

Uses TRIPLETT Precision INSTRUMENT

- Molded Case
- Jacks for All Ranges
- All Accessories Included
- For All A.C. - D.C. Voltages, Direct Current and Resistance Analyses.

Other Readrite-Ranger Testers Available at Money-Saving Prices . . . Write for Catalog

READRITE METER WORKS
 717 College Ave., Bluffton, Ohio
 Please send me more information on
 Model 736 Send Catalog
 Name
 Address
 City State

SOUND SERVICE—continued

solving one of the most vexing field problems the p-a man has ever had. By introducing feedback into an existing amplifier, additional speakers may be added without worrying about whether the speaker line impedance match has been disturbed. Moreover, speakers may be switched on or off at will without noticeable change in volume of the remaining speakers on the line, providing the percentage of feedback is fairly high (about 20 per cent), even though the load impedance may vary more than 100 per cent above or below the normal value required for a proper match. It is easy to see therefore that the introduction of feedback into an existing amplifier can not only improve its overall fidelity, but can also be made to increase its flexibility and operating convenience to a great degree.

The above information has been presented as a series of generalizations for the experienced sound man which should point the way toward desirable modifications in existing sound installations. By using these suggestions as a guide the experienced p-a installer should be able to turn such modification work into very profitable business.

MAKING A PROFIT

(Continued from page 10)

couple of dead months in the late summer when our business is normally poor)—if for some reason—you experienced several weeks of poor business or no business at all? If you were to sell no time during such a period, where do you suppose your own salary is coming from? You cannot extract the salary of 50 cents an hour from any \$1.87 hours sold if none of those hours

are sold! You will have to be satisfied to go without salary during those poor weeks. If you fail to provide for a reasonable profit for the hours sold during the good season and thereby build up a reserve for such emergencies, there is no power on this earth which will deposit a surplus in your bank account with the possible exception of rich uncles. In adding 20 percent to your cost and selling your hours for \$2.25 you are making a profit of 37½ cents for every hour sold. If 156 hours were sold, you would have a reserve of \$58.50 at the end of that month. All things being equal, you would have a \$702.00 reserve at the end of the year. Personally, I do not believe \$58.50 a sufficient factor of safety to provide for unforeseen emergencies in addition to providing a nest egg or dividend with which to take vacations, buy better clothing or obtain more enjoyment generally out of life, besides furnishing sufficient funds for a permanent savings account. A charge of \$2.50 per hour would furnish \$39.00 more each month or \$468 more for the year. Instead of reserving \$58.50 for the given month, you would park \$97.50 away; instead of \$702.00 you would have — if untouched — \$1,170 salted away. If you have any ideas about getting rich too fast at this rate, you and I have different opinions as to what constitutes wealth. Don't get the notion that any serviceman who builds a reserve of over \$1,000 in a single year must be robbing some customers or is making too much money! Are you afraid to take stock of your own value? If I believed for a moment that my time was worth \$20.00 an hour I should not hesitate a single moment in announcing that fact to anyone who should seek to employ my services. If you want \$2.50 an hour, \$3.00 or even more for your time and services, the only one who can prevent you from stating the

fact is yourself. If you want \$3.00 an hour—go out and get it! Most of you would not try because you believe that would be impossible, or that it could not be done. To those who feel that way about it I can say—only—you will never sell your services for any amount over that which you yourself value that service to be. No one will voluntarily offer you more.

MORE MONEY IS TO BE MADE WITH A PENCIL THAN WITH A SOLDERING IRON

Let your common-sense gray matter take the upper hand and prove its superiority over your "kilocycle brains." Only your own power of will can accomplish that. Direct your kilocycle brains in the proper methods for repairing those things for which your common-sense gray matter has already insured a profit. When you estimate a job, don't be merely sure you are charging for all the hours you believe will be required for the work; be doubly sure. When contractors estimate on large projects they always add from 10 to 25 percent to the final figures depending on the type and character of the project. This covers "error," "unforeseen occurrences" (such as costly strikes or acts of God, etc.). In a smaller way you should do the same. You must cover your time to be consumed in returning the receiver; including all the time away from the shop for that purpose. One hour usually covers the average re-installation. If a three-hour job is anticipated in the lab, you have a total of four hours. Since you desire to add enough to insure against loss on this job which you have accepted in order to make a profit, and since it is up to you and you alone to insure that profit you must add a fifth hour to the estimate since it is not customary or good practice to charge less than an hour's time for any part of an hour's work. After listing the parts at full list prices, including the tubes, you will then add 5 times \$2.25 or preferably \$2.50—your time or labor charge. At \$2.25, it would be \$11.25; at \$2.50 it would be \$12.50. When you are ready to present the estimate to your customer you must steel yourself to an unalterable decision that you positively will not accept any lesser amount than that which you have determined is the amount you are going to get. There is no reason why you should not or could not conduct your business in exactly that way. Pass up unprofitable jobs. Why should you undertake to do that which is sure to mean a loss. Forget those jobs. I have them just the same as you do. You have some more important things to accomplish instead of repairing the neighbors' radios without profit.



Part of the New York delegation to the Chicago Trade Show. Picture taken at Harmon during a stop of the Radio Trades Special.



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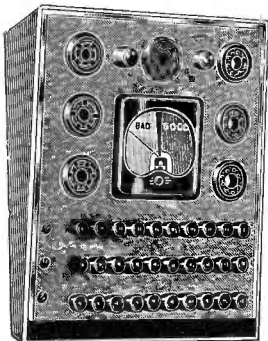
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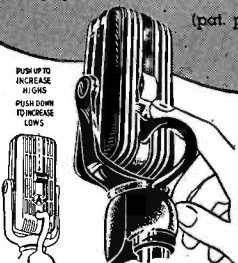
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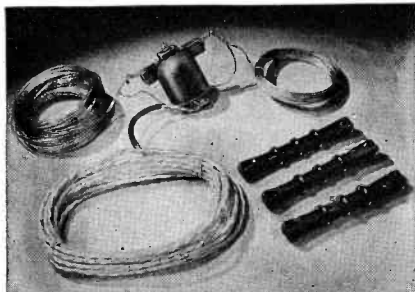
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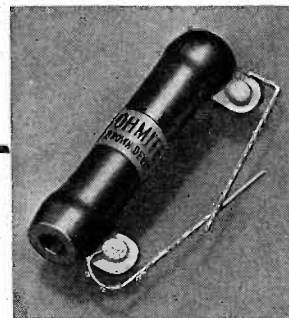
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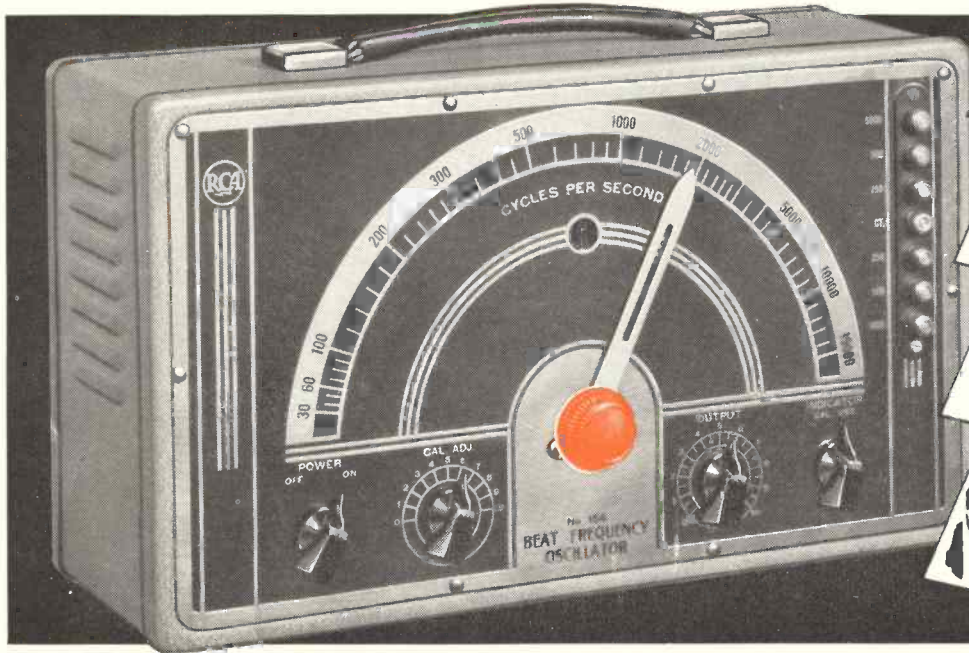
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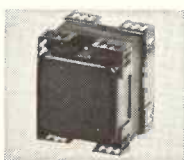
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