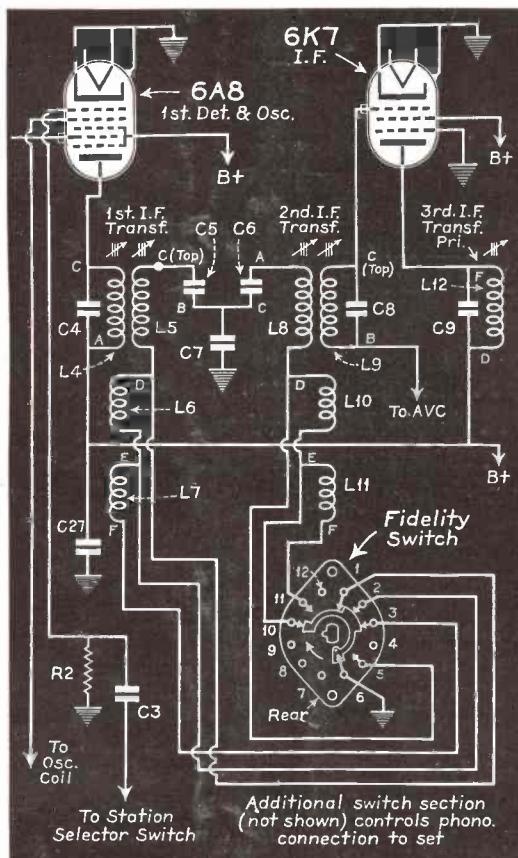


SERVICE

A Monthly Digest of

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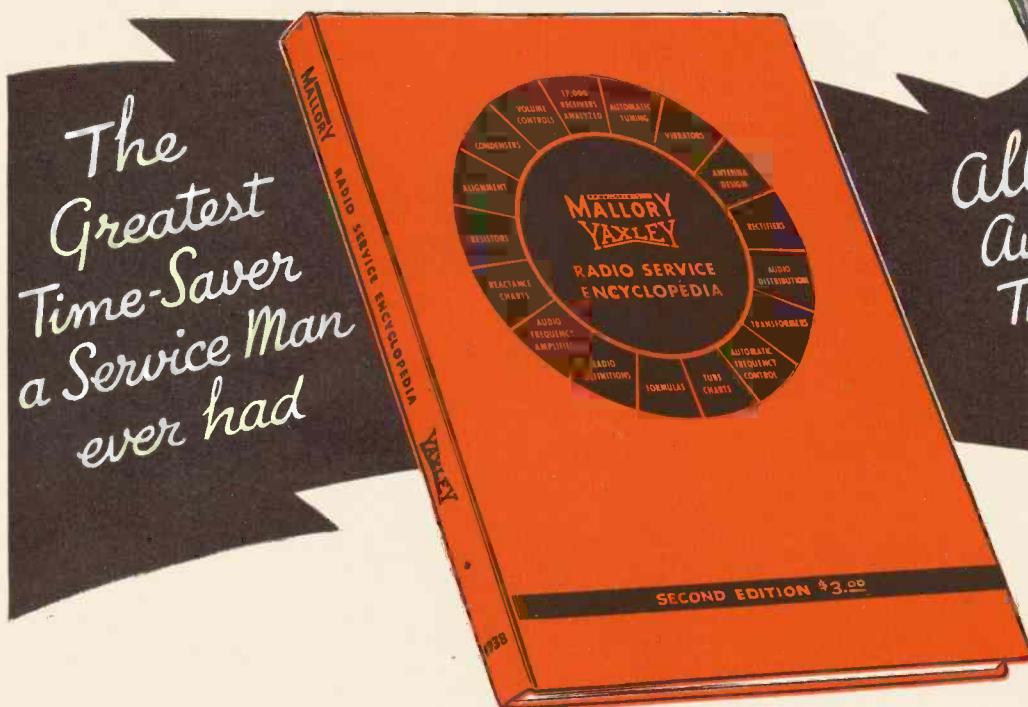
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Input I-F
(See page 11)

APRIL
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EDITORS

APRIL, 1938

Ray D. Rettenmeyer

W. W. Waltz

VOL. 7, NO. 4

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* Indicates that a circuit accompanies the text.

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THE ANTENNA . . .

DON'T DELAY!

DESPITE THE seeming return of winter weather, as we go to press, the fact remains that spring is here and warmer weather can be expected momentarily. The point is that very little time remains in which you can legitimately approach the users of public-address equipment on the subject of pre-season cleanup. Fortunately, such jobs will not, in general, take much time to do; but any further delay in making your contacts is liable to result in your losing this business.

We have pointed out before the many places that use sound equipment. If you are not already personally acquainted with the owners and operators of these places, lose no time in getting to know them. It's probably too late to use the casual approach—by which you fall into the habit of dropping in occasionally to talk over this and that, and make your lead into the discussion of sound equipment as gradual as you, and your prospective customer, may wish. The only thing remaining at this time is a direct appeal to the user's pocketbook. Point out the advantages to accrue from a thorough going-over of the equipment—such a cleanup is almost certain to reveal one or more points of potential trouble. Very often the equipment was permitted to "just get by" during the closing weeks of the previous season, and it takes the knowledge and experience of a trained sound man to find these weak points and correct them.

Of course, it never does any harm to suggest real improvements in the equipment. Many installations are equipped with amplifiers that can't shove enough power into the speakers (you'll find more than one case where additional speakers have been hooked into the circuits entirely without regard to the power-supplying capabilities of the amplifier) and situations like these call for some sales effort on your part. The obvious line of approach is in a definite demonstration of the effect of overloading the power amplifier in trying to handle all of the speakers which may be connected to it.

If you can sell the job on increased amplifier capacity, the next point to consider is that of increasing the amplifier power sufficiently to handle *future* speaker additions; don't overlook this. You may no sooner get the new amplifier in until someone wants another speaker hooked up, and if you have shaded too closely on amplifier power, the job might just as well be torn out.

In discussing new amplifiers, you must have a clear mental picture of the probable requirements; for instance, that vacant space over in the corner of the amusement park may conceivably become the site of a new conces-

sion, so don't overlook the fact that the p-a system will have to cover that part of the grounds if and when it is put to use.

New speakers may be in order—your survey of the job will indicate that. Be sure to point out the greatly increased fidelity of the newer speakers, particularly so with respect to old ones that have been kicked around for years and which, perhaps, are being used with torn or bent cones, little or no baffle, etc.

These are only a few of the things to consider in your work on sound systems. As we pointed out last month, the alert sound man will find many opportunities to improve things once he has lined up the job. That is first and foremost. Now is the time to do it!

• • •

AUTO-RADIO

ACCORDING TO all reports, the nation-wide campaign to dispose of used-car stocks was highly successful. Whether or not it was for the auto-radio industry, we don't know yet.

There is this angle to consider, in addition to those which we discussed on this page last month: quite a few owners of these used cars are still in the throes of "first love," so to speak. To many, the cars are their first in years; the novelty of again having a car is still present. But once the user has become adjusted to owning a car, the next thought is for some "gadgets" to hang on it.

You should, by this time, have a list of new used-car buyers; preferably, such a list should include the patrons of at least several car dealers. Get to work on the list as soon as you can. With summer scheduled for an early appearance, you'll want to begin talking to the car owners about the advantages of auto radio—especially for those long, hot summer trips.

And, don't neglect your tie-up with the car dealers. It's being rumored that new cars are beginning to move from the dealers' stocks. Here, then, is another prolific source of auto-radio business for you.

• • •

COMING EVENTS

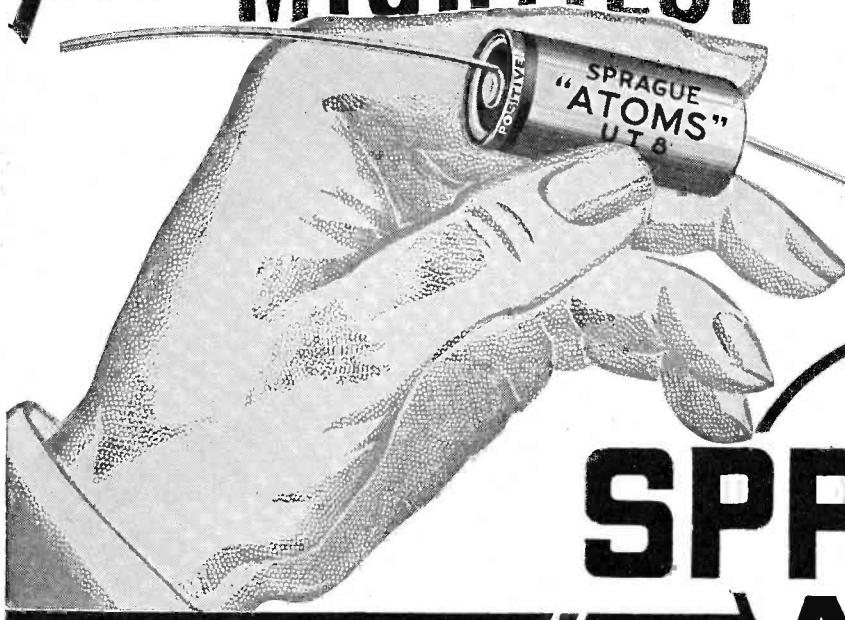
THE TRADE SHOW in Chicago has been mentioned several times lately. This is just a reminder to those of you who hope to attend.

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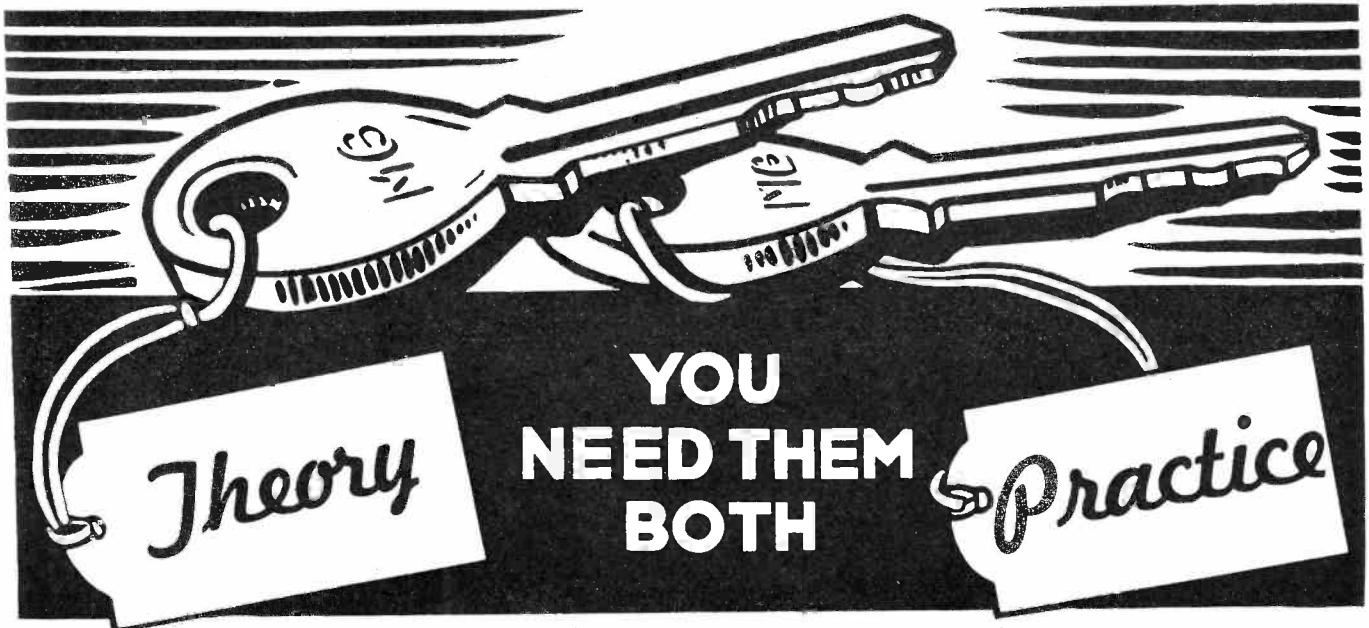
Cat. No.	Cap. Mfd.	Working Voltage	List Price	Metal Tube Diameter	Tube Length
TA-10	10	25	\$0.40	9/16"	1-5/8"
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UT-81	8	150	0.45	5/8"	1-5/8"
UT-121	12	150	0.50	5/8"	1-5/8"
UT-161	16	150	0.55	11/16"	1-5/8"
UT-201	20	150	0.60	3/4"	1-5/8"
UT-401	40	150	0.65	7/8"	1-5/8"
UT-42	4	250	0.45	9/16"	1-5/8"
UT-82	8	250	0.50	5/8"	1-5/8"
UT-122	12	250	0.65	11/16"	1-5/8"
UT-162	16	250	0.75	3/4"	1-5/8"
UT-43	4	350	0.50	5/8"	1-5/8"
UT-83	8	350	0.55	11/16"	1-5/8"
UT-123	12	350	0.70	3/4"	1-5/8"
UT-4	4	450	0.55	5/8"	1-5/8"
UT-8	8	450	0.60	3/4"	1-5/8"
UT-12	12	450	0.75	7/8"	1-5/8"
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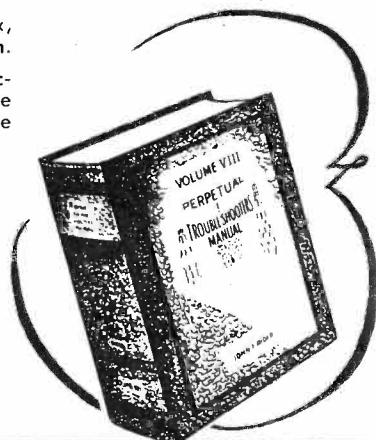
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SERVICE

A Monthly Digest of Radio and Allied Maintenance

FOR APRIL, 1938

TEST IT THOROUGHLY!

By W. ROBERT SCHOPPE

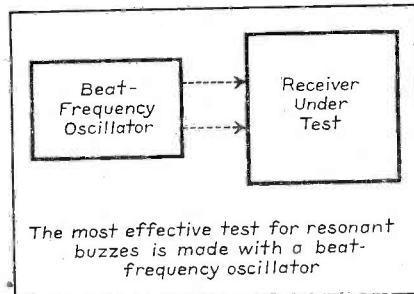
THE AVERAGE OWNER of a radio set is primarily interested in it as an entertainment device and its technical features are generally of secondary importance. What he wants is performance. His set must operate every time the power switch is turned on, and that holds true whether the set is a brand new one or one which has just been serviced. As a matter of fact, the customer is probably more critical of a serviced receiver than he is of a new one because his original intention in having had the set serviced was to avoid buying a new one. Whenever a receiver fails to perform, be it new or old, the customer's immediate reaction is to call a Service Man to "come up here right away and find out what ails this set." Frequently on such calls, service must be rendered without fee, and

The receiver is thoroughly checked—



the only return from the transaction is "experience."

Every Service Man has probably encountered this problem and wondered what to do about it. The writer feels



that many of these unnecessary service calls which must be done free, or at such a ridiculous price that they do not even pay for the time consumed, are caused by Service Men themselves and therefore can be eliminated by them. The purpose of this article is to analyze the causes of unnecessary service calls and give suggestions to eliminate them.

In analyzing our problem we will consider new and repaired sets separately. On new sets we find five causes of trouble:

(1) Sets are delivered to customers in original and unopened cartons. This seems to be a harmless practice, but close study will show that in spite of the precautions which all reputable manufacturers take, there is always a small percentage of sets which become inoperative in transit; consequently, if sets are delivered unopened, there is always

the possibility that the customer will get a defective set.

(2) Salesman "oversell" the set in order to make a sale, then, when the set does not perform as promised a service call results.

(3) Receivers develop trouble after installation, due to parts failure. This is usually covered by factory warranty.

(4) Sets are improperly installed.

(5) Customers are not instructed fully in the proper operation of the set.

Now we will consider those "repaired" sets which Service Men have delivered to their customers as "guaranteed OK" sets. Customer complaints relating to these sets will usually be one or more of the following:

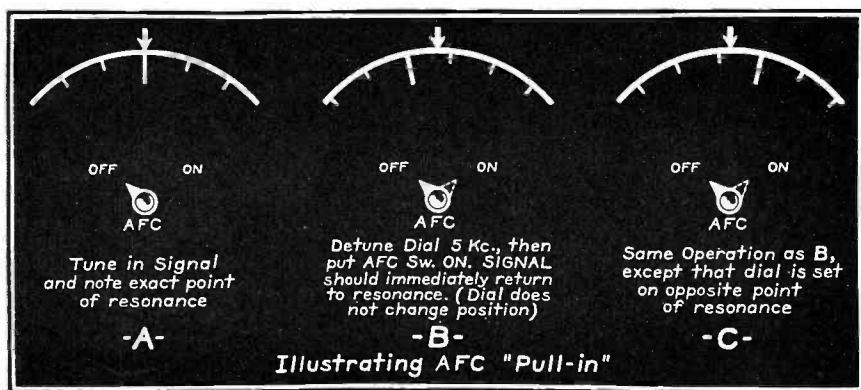
(1) The original trouble has not been corrected.

(2) A new trouble has developed.

—after careful unpacking.



(Photos by R. S. Palmer, Philadelphia, Pa.)



(3) The customer claims that the set doesn't work like it did before you took it away to fix it. (Recognize that one?)

In any event, whatever the nature of the complaint, we will frequently find the Service Man to be at fault because, either through carelessness or ignorance, he has:

(1) Made an incomplete test of the performance of the set.

(2) Made a poor installation.

(3) Failed to instruct customer in correct operation of set.

What is our next step? Well, if we study carefully the problems we have just outlined, one obvious conclusion will present itself. That conclusion is: "As long as the customer is the judge and jury, and the performance of the radio will make or break your business, then, for your own benefit and protection you should do everything in your power to make sure that *every set you deliver will perform the way it is supposed to!* The only way you can possibly do that is to *thoroughly test every set before it leaves your store or shop and then install it properly and show your customer how to use it!*"

To quote a recent editorial in *SERVICE*—"you should make a 'trial run' on every set, just as an auto mechanic makes a 'trial run' on a car." If you do this regularly, you will locate troubles before the customer does and your "free-calls" (which do not pay a profit) will be reduced to a minimum.

THE NECESSITY FOR TEST METHOD

From the foregoing it is evident that a need exists for some method of testing which will enable a radio dealer or Service Man to determine whether or not a set is in suitable condition for delivery to a customer. The tests should be comprehensive enough to really show how the set is performing, but they must also be simple enough to be performed by a person of ordinary skill and without the necessity for a complex test setup.

TWO TEST METHODS

In setting up any series of receiver tests we have a choice of two methods. We can either measure the actual performance with test instruments or, we can put the set into normal operation and then, as various stations are tuned in and the controls manipulated, make a series of expert observations and interpret these observations to indicate how the set is performing or what it can do under certain circumstances. Our interpretation will be influenced to a great extent by our past experience. For want of a better name we can call this method "air-testing."

OUTLINE OF TESTS

The extent to which any set should be tested depends upon the type circuit used in the set and the special features it incorporates. The first step in the test procedure should obviously be the determination of these characteristics.

The second step will be the selection of the tests to be made and the third step will of course be the performance of the tests. The following paragraphs show the tests arranged in two distinct groups and classified as "regular" and "special." The "regular" tests are those which apply to all sets regardless of circuit or types. The "special" tests are those which apply to sets with "feature circuits" such as avc, afc, etc. Although the tests are listed in a definite order, it is not necessary to make them in that order.

REGULAR TESTS

- (1) Sensitivity.
- (2) Selectivity.
- (3) Fidelity.
- (4) Distortion.
- (5) Power output.
- (6) Hum.



Something wrong?

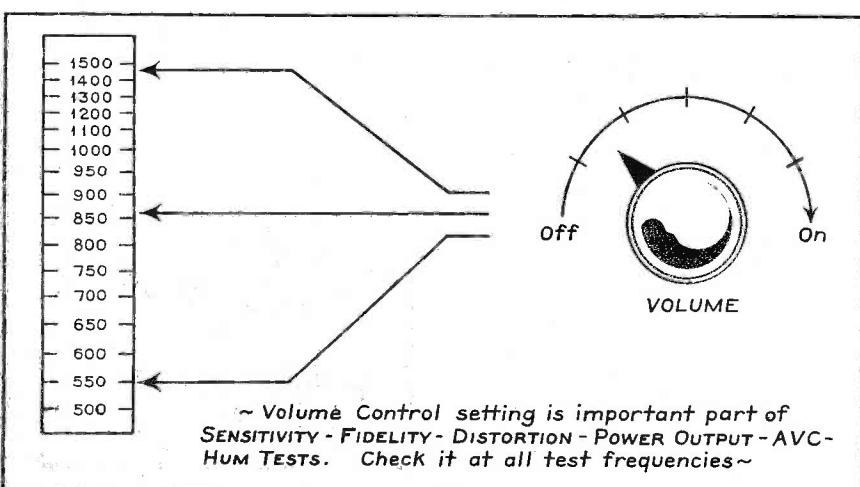
- (7) Parasitic oscillation.
- (8) Loose connections.
- (9) Volume-control operation.
- (10) Microphonics.
- (11) Resonant vibrations (buzzes).
- (12) Dial calibration.
- (13) Mechanical inspection.

SPECIAL TESTS

- (1) A-v-c action.
- (2) A-f-c action.
- (3) Tone-control operation.
- (4) Circuit stability.
- (5) Operation of resonance indicator.
- (6) Vibrator noises.
- (7) Fidelity-control operation.
- (8) Operation of Accessories. (This refers to special dials, phone attachments, extra speakers, push-button devices, remote controls, recorders, etc.)

MAKING THE TESTS

Before any actual testing is done, the set should be prepared by loosening or removing all shipping bolts, putting on



all knobs and setting up the receiver exactly as it will be used by the customer. The set should then be plugged in and allowed to heat for at least 15 minutes. Then, and then only, are you ready to start testing. Be sure that your antenna and ground system is in good order.

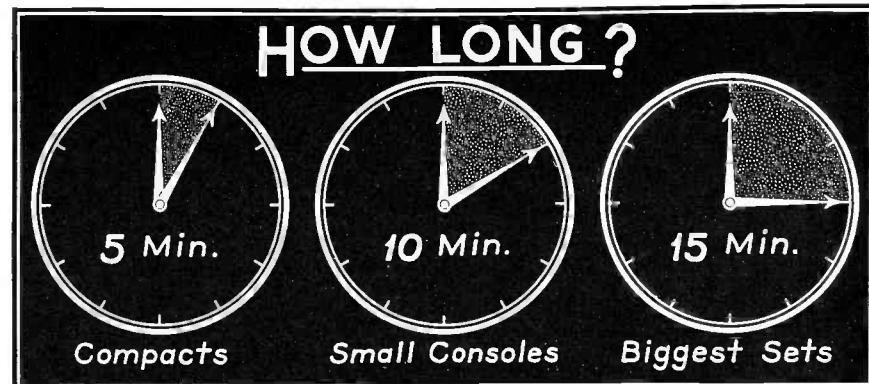
Sensitivity Test. Tune in a local station near the high-frequency end of the broadcast band. Adjust the volume control to give any desired output volume. For best results choose a setting which will give what is about average room volume or slightly less. Observe the position of the volume control which produces this volume. Notice how this setting compares with sets of similar type which you have previously tested. Now tune in several other stations and repeat the above. By observing the set-



Fix it before you leave.

tings of the volume control at each test frequency you can determine the *relative* sensitivity at each frequency. This method is not reliable for checking short-wave band sensitivity. The only reliable test is with a calibrated signal generator.

Selectivity Test. The frequency assignments of broadcasting stations place them 10 kc apart; also, high-power stations located closely together are assigned widely separated frequencies. The purpose of this is to minimize interference between stations. The average good receiver should have sufficient selectivity to differentiate between stations in adjacent channels. (Except in extreme cases which are peculiar to certain localities and which are familiar to Service Men in those localities.) The test for selectivity is quite simple. Tune in local stations on as many places on the dial as desired. At each test frequency notice over how wide an area (in kilocycles) the station can be heard. If it exceeds 10 kc notice to what ex-



tent it interferes with the station in the adjacent channel and whether or not that amount of interference can be tolerated.

Selectivity tests with service-type signal generators are not recommended unless an oscilloscope is available as an indicating device.

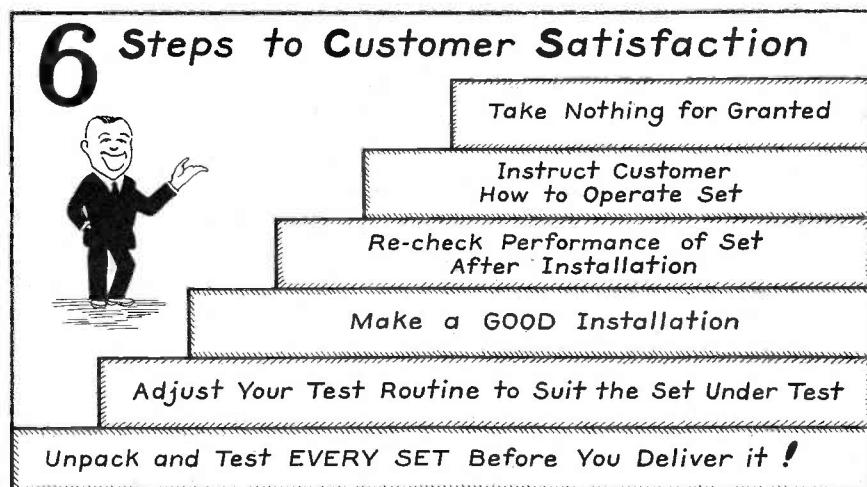
Fidelity Test. The purpose of this test is to determine the amount of realism present in the reproduced signal. The test consists not only of listening to the set, but listening intelligently. Try to determine the extent to which high- and low-frequency notes are present. Listen for distinctness on the sibilant sounds such as s, z, sh, f, etc. As an extreme test try to pick out instruments in an orchestra. *Note:* Some people like their music brilliant, with plenty of high notes, while others want boom-boom bass. Govern your judgment accordingly.

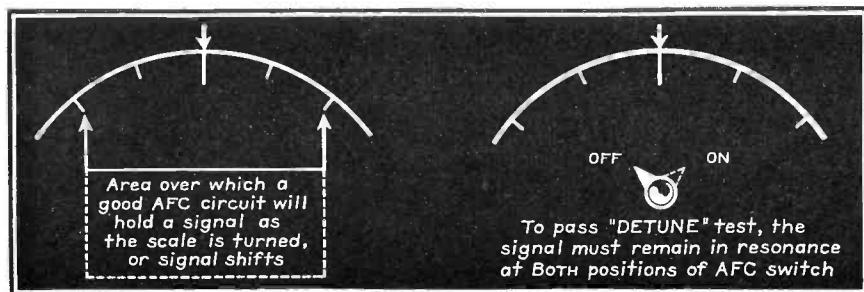
Distortion Test. Although distortion is related to fidelity it is treated separately because of some special considerations. When making the fidelity test previously described, the volume control was set at a point to produce room-level volume. In making the distortion test it is necessary to listen at several volume levels. It is also necessary to regulate intensity of the input signal to check for distortion caused by poor a-v-c action. Proceed as follows: Using regular antenna, tune in a local station of known good quality. Listen to the

reproduced signal at all volume-control settings from minimum to maximum. (Overload, with its attendant distortion, might occur at maximum volume.) If the signals do not become distorted at any setting below the overload point the set is OK. If the signals do become distorted at *low* volume and clear up at higher volume it indicates that the a-v-c circuits are not functioning normally. As a further check on this, detune the signal to slightly off-resonance. If the signal is undistorted at off-resonance and distorted at resonance, look for a-v-c trouble. A-v-c distortion can also be checked by removing the antenna and substituting a shorter antenna or piece of wire to reduce pickup. If the signals are OK at resonance with a short antenna and distorted when a strong signal from a large antenna is applied it is sure proof of a-v-c trouble.

Power Output Test. Check the power output by turning the volume up to a high level and listening to the reproduced signals. Compare the reproduction to that with which you are familiar on other sets having similar output circuits. Notice how far the volume control can be advanced before distortion occurs.

Hum Test. Have set in quiet room and remove antenna. With ear about two feet from speaker listen for hum at all settings of volume and tone control. Your experience will have to guide





you in the amount of hum which will be acceptable. The principal point to remember is that the room in which your customer will use the set might be quieter than your test room. Check for modulation hum by tuning in local stations known to have this characteristic.

Parasitic Oscillation Test. Turn dial slowly from one end of band to other. Set should be stable at all points on dial and on every band. Repeat test with antenna removed.

Loose Connection Test. With antenna removed and volume control set at maximum, strike chassis with rubber mallet and listen for clicking sounds which indicate loose connections. Repeat test by attaching antenna and tuning in signals. If the set is a small one and you have a shaker table available, use it. Make test on all bands.

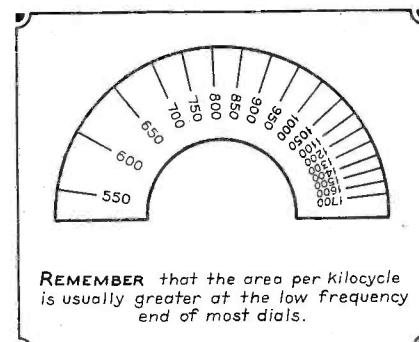
Microphonic Test. Tune in strong local station near center of scale. With volume control set at about half volume, or some setting which will produce volume level slightly higher than average, listen for the sustained howl which characterizes a microphonic set. This condition can be aggravated for test purpose by tapping the volume control, wave switch, or tuning control knobs.

Resonant Vibration (Buzz) Test. Tune in a station and set volume control to any desired level. Listen for buzzes or rattles. Try all settings of tone control. Programs with men's voices are particularly good for test purposes. If a beat-frequency oscillator is available, apply signal to set and vary frequency through entire range. If any resonant buzzes are present this method will reveal them.

Volume-Control Operation. Volume controls should be checked for three characteristics, attenuation, quiet operation, positive action. Either a music signal or a signal generator can be used. Attenuation is checked by observing the extent to which the volume changes as the volume control is rotated from minimum to maximum. Quiet operation can be checked simultaneously with attenuation. Positive action can be checked by tuning in a strong signal, then turning the volume control to minimum position. At this setting no signals should

be heard in the speaker. Place ear close to speaker to check this.

Dial Calibration. Put the set into operation and tune in as many stations as possible. Observe the point on the dial at which each station is received. If the set is to be delivered to a critical customer who wants every station "on the nose" you might have to repad the set. However, if your customer is the average type, if the stations can be received within a few kc of the mark on the dial the set can be considered OK. If the signals track to within about 5 kc at the low end of the broadcast band and about 10 kc at the high-frequency end there is no necessity for repadding. On sets having dials without accurate



PROFIT OR LOSS

By LELAND S. HICKS*

THIS MATTER of making a living in the business of radio servicing is not merely a matter of advertising. Advertising is but one of the many factors that make up a successful business. Admittedly it is an important factor in its many forms and one that must be taken seriously. Newspapers, telephones, direct mail and a house-to-house canvas all have their place and are useful. One service organization may secure phenomenal results from one method, another shop in another part of the same town may get best results from yet another medium. The most successful use every possible idea to bring work into the shop and find that variety is really the spice of life.

Once the work comes into the shop the real test of a business begins. The advertising has been successful, it is now up to the technician and the business man (often one and the same person) to produce that most essential ingredient in the transaction—a profit.

Obviously the first step is up to the technician. Too much cannot be said regarding the proper tools and the knowledge necessary to get the best possible use from them. Word-of-mouth advertising can make or break a service organization, especially in medium- or small-sized towns where many Service Men operate. The shop that does good work, that can be depended upon, and that dramatizes its equipment and ability in the right way, will automatically get this word-of-mouth advertising, especially if its prices are right. It is up to the technician to put out work of a quality that will merit this most sought after advertising medium, and it is up to the business man to see that the prices are right.

After the technician the business man must come to the front. The receiver has been brought into the shop and a good repair made. Now how much shall he charge for the job? This is the crux of the whole question. The price charged will determine whether or not a profit will be made on the transaction and, after all, profit must be made or the business will soon be bankrupt. Now enters a word abhorrent to too many service organizations—bookkeeping.

Too many Service Men, in their keen fight with competition, think they can be satisfied with the exact cost of ma-

terials, plus actual time spent, plus a small amount added for profit. They entirely overlook that big word “overhead” which so often upsets their hope for a profit and which must always be considered. The computation of this overhead is one of the urgent reasons for a bookkeeping system, even an incomplete one.

SYSTEMS

The most elementary bookkeeping system should give the following information to the business man:

1. The correct amount to charge for each repair made.
2. The daily, weekly, monthly and yearly results of all transactions in terms of total profit or loss.

Fig. 1. A "different" tag for receivers to be repaired. Give the customer the claim check, file the cost card, fill in the top section for the customer and mark "Paid." Notice the personalized guarantee—it's a good idea.

THE RADIO SHOP 1102 N. LOVE STREET QUINCY, FLA.		JOB NO. DATE
NAME _____ ADDRESS _____ RECEIVER TYPE _____ SERIAL _____		
CUSTOMERS COMPLAINT _____ _____		
QUOTED _____ REPAIRS MADE _____	DATE DEL _____ _____	_____
MATERIALS USED _____ _____		
TOTAL \$ _____ _____		
GUARANTEE THE REPAIRS COVERED BY THIS TAG ARE GUARANTEED AGAINST DEFECTIVE WORKMANSHIP AND MATERIAL FOR A PERIOD OF 60 DAYS. THIS IS A PERSONAL GUARANTEE FROM THE REPAIRMAN WHO DID THE WORK AND IS FURTHER BACKED UP BY THE RADIO SHOP		
SIGNED _____		
COST DATA NAME _____ ADDRESS _____ RECEIVER TYPE _____ SERIAL _____ CUSTOMERS COMPLAINT _____ _____		JOB NO. DATE
QUOTED _____ REPAIRS MADE _____	DATE DEL _____ _____	_____
LABOR COST—(HRS. @ \$ _____ PER HR.) OVERHEAD TO BE CHARGED (14 1/2%) SHOP COST _____ MATERIALS USED _____		TOTAL _____
TOTAL COST CUSTOMER CHARGED _____		_____
CUSTOMERS CLAIM CHECK RECEIVER TYPE _____ SERIAL NO. _____ TEL: 8762		JOB NO. DATE
THE RADIO SHOP 1102 N. LOVE ST. QUINCY, FLA.		JOHN BOE MGR.
NOT RESPONSIBLE FOR LOSS BY FIRE OR THEFT		

3. The actual worth of a business as of any given date.

Each of these items can be broken down into its various components, the degree of breakdown depending upon the size of the business and the completeness of the bookkeeping or accounting system employed. Only the first one will be considered at present, since it is fundamental and must be right if a business is to have need of the other information.

Included in the first item, the correct charge to be made for the work, are the items of materials used, the labor involved, and the proportion of shop overhead which the job should bear.

The first two parts are easy. Materials should always be billed at list prices since the service shop earns any mark up they may secure by stocking the needed parts and by buying in quantity and selling one unit at a time. A legitimate shop will charge legitimate prices. The second item, direct labor, is easily computed for any workman by dividing his salary per week or month by the total number of working hours in the week or month. For example: an owner allows himself \$30 per week salary. Working 8 hours per day for 6 days will give him 48 possible working hours per week. Dividing the \$30 by 48 hours gives 62½ cents per hour for labor cost. This rate times the number of hours spent on the job plus 20 percent, a fair margin of profit, should be the labor charge. The percentage markup on labor is an individual matter with the shop manager, but should be a fair figure if a profit is expected on the final transaction.

OVERHEAD

The third item, a fair share of “shop overhead,” is more difficult to compute, but it *must* be added in. There are expenses such as rent, heat, light, telephone, car expense, tools and equipment, etc., which are incurred each month and which must be paid for by the customer if the shop is to show a final profit; even idle time must be considered. Most service shops employing more than one man besides the owner usually have an accounting system which will show what proportion of the direct cost must be added to care for this item. As an empirical figure, for those smaller shops which do not have

*Thordarson Electric Mfg. Co.

EXPENSE SHEET AND "OVERHEAD RATE."

EXPENSE ITEM	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	YEARLY TOTAL
1 TOTAL LABOR EXPENSE	\$120.00												
2 LESS TIME ON JOB TICKETS	80.00												
3 LOST TIME EXPENSE	40.00												
4 RENT	25.00												
5 HEAT	3.00												
6 ELECTRICITY	8.00												
7 TELEPHONE	4.00												
8 ADVERTISING	15.00												
9 CAR EXPENSE (@5¢ PER. MI.)	15.00												
10 DEPRECIATION (TEST EQUIP.)	5.00												
11 TAXES (TOTAL ÷ 12MO.)	2.00												
12 MISCELLANEOUS (SMALL TOOLS, BOOKS, MAG. ETC.)	1.50												
13 TOTAL OVERHEAD	\$18.50												
14 OVERHEAD RATE (NO. 13 ÷ NO. 2)	148%												

Fig. 2. Suggested form for recording monthly shop expenses and computing overhead rate.

such a system, labor cost plus 150 percent will be found about right. In other words, for each hour of labor cost at 62½ cents per hour a cost of $(150\% \times .625) + .625$, or .936 + .625, or \$1.56 should be added to care for overhead. This may sound like a high figure but the experience of many successful service organizations has shown it to be high enough yet not too high for a shop which does not have accurate information available. Any service organization, even the small one-man shop, should have some form of accounting system. Of course, it would be foolish to spend too much time keeping books and not enough in getting business and making repairs. The small shop should have a small system and the larger business a correspondingly larger and more accurate one.

KEEPING THE RECORDS

Returning to the item of overhead, it is obvious that data cannot be accumulated overnight, but must be built up over a period of time. A record should be kept of all expenditures for rent, heat, light, telephone, car expense, lost time, etc. Data for one month will help, records covering three months are better, but information gathered over a period of years is the best and will give the most accurate information. The above mentioned items of "indirect expense" are not all that should be included in this classification. They are the only items that will be mentioned here since this short article is not a text on accounting principles, but is an attempt at selling the Service Man on the need of keeping records and a simple explanation of the benefits he will gain from so doing. The form shown in Fig. 1 is suggested for accumulating this data.

It shows expenses and the resulting overhead rate for any month and by showing the different months side by side it indicates trends. For example, the item of idle time will tend to vary from month to month. As it rises the shop will put forth more effort at getting in work or more time may be spent selling and installing sound systems, etc. Again, advertising may vary from month to month, even when definite amounts are set aside in the budget. The use of a form such as shown also makes it easy to total the "overhead rates" to date and average them. Other simple forms will come to the mind of the shop owner as he becomes "record conscious" and can be incorporated into the bookkeeping system.

Lost time has been mentioned several times, and rightly so—it is important. It has been shown that the labor rate per hour is computed by dividing total

wages per week or month by the total available working hours in the week or month. No man can work every hour of an eight-hour day on work that can be charged to the customer. Some time must be spent cleaning up the shop, some time goes into study, and some time into selling the customer tubes, parts, repairs, merchandise, etc. This time cannot be charged to any particular job, yet it is an expense that must be borne by the shop and must be computed when figuring net profits. Adding it into the indirect expense or shop overhead is the only way out. The time actually spent in making repairs should be accurately recorded and totaled each day or week. All other time, based on the same cost rate, should be added into that week or month's summary of overhead expense, and thus considered in setting up an overhead expense rate.

This actual rate is determined by dividing the total of the overhead expense for the given period by the total direct labor recorded for that same period. Using the total chargeable labor as a basis requires the accuracy mentioned before. Once this rate has been established it may be used instead of the arbitrary 150 percent mentioned earlier. It can be clearly seen that the more records available and the longer they are kept, the more accurate this "overhead expense rate" becomes. In fact, a year's record will show monthly and seasonal variations that will be important to the alert Service Man.

The total of these three items—materials cost, labor cost, and overhead expense, plus a reasonable mark-up for profit, gives the answer to the first question—How much shall we charge? If all these costs have been accurately recorded and a fair mark-up added, the answer to the second question will be "A net profit," and the balance sheet each month will show a steady growth of "Cash on hand and in the bank."

SOURCES OF HUM IN TUBES

THERE ARE numerous ways in which 60- or 120-cycle hum can get into the circuits of a receiver or amplifier; some of these are quite evident—as, for instance, the 120-cycle hum due to insufficient filtering or the B supply—while others may be obscure. Among these latter, hum caused by heater-cathode leakage, emission from heater to other tube elements, and capacity coupling between heater leads (within the stem press of glass-type tubes, for instance), are possible sources, although this brief listing does not cover more than the most commonly experienced.

Hum caused by heater-cathode leak-

age has three possible remedies: (1) reduce the impedance in the cathode circuit of the tube by using large bypass condensers across the cathode resistor; (2) obtain bias for the tube from some source that is not common to heater and cathode; (3) bias the heater either positive or negative with respect to the cathode. This latter method is one that is little appreciated; in general, a bias of 10 volts will be sufficient—whether positive or negative can only be determined by trial.

Emission directly from heater to other elements of the tube causes hum

(Continued on page 31)

General Data . . .

RCA Victor HF-1

Cabinet: Console.

Tuning: Push button.
Range: 540-1550 kc.

Tubes:

1st Det: } 6A8.

Osc:

1-1:

A-V-C:

2nd det: }

1st A-F:]
B: 1615

Driver: 6J5.
Ph. Inv.: 6J5

Pwr Amp 1

Rect: 5T4.
Power Supply: 105-125 volts, 50-60

cycles, or

I-f: 455 kc.

Speaker: Electrodynamic.
Fig. 11. P. 1800 shows.

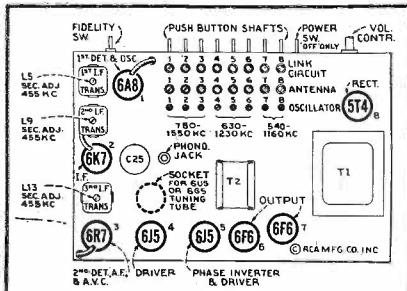
Field Res: 1800 ohms.
 V-c Imp: 2.25 ohms at 400 cycles.
 Model HF1 is designed especially for
 critical music lovers in metropolitan
 areas where a number of strong broad-

INPUT I-E. RCA VICTOR HF-1

(See front cover)

At first glance, the input i-f transformer of the RCA Victor Model HF-1 appears to be a capacity-coupled band-pass network. However, calculations based on the circuit constants indicate that a band of only some 3700 cycles would be passed by such a circuit if the primary intention of the designers had been to make this a band-pass circuit. As a matter of fact, the system is essentially a link circuit so arranged that a maximum transfer of signal is obtained. With the impedance relations so obtained, the two i-f transformers are connected together without any appreciable effect upon the bandwidth of the transformers themselves. As will be noticed, the bandwidth passed by the i-f system of the receiver is governed by the supplementary coupling coils which are located at the "low" ends of the transformer windings and which are cut in or out of the circuit by the fidelity-control switch.

It should be noted particularly, in connection with the service data on the HF-1 which are given below, that the manufacturer plainly states that this receiver is of the local-station type only; that is, its sensitivity is such as to preclude its successful use in localities other than those quite near to a number of high-quality broadcast stations. Attempts to realize high-fidelity reception in remote areas are liable to be disappointing.

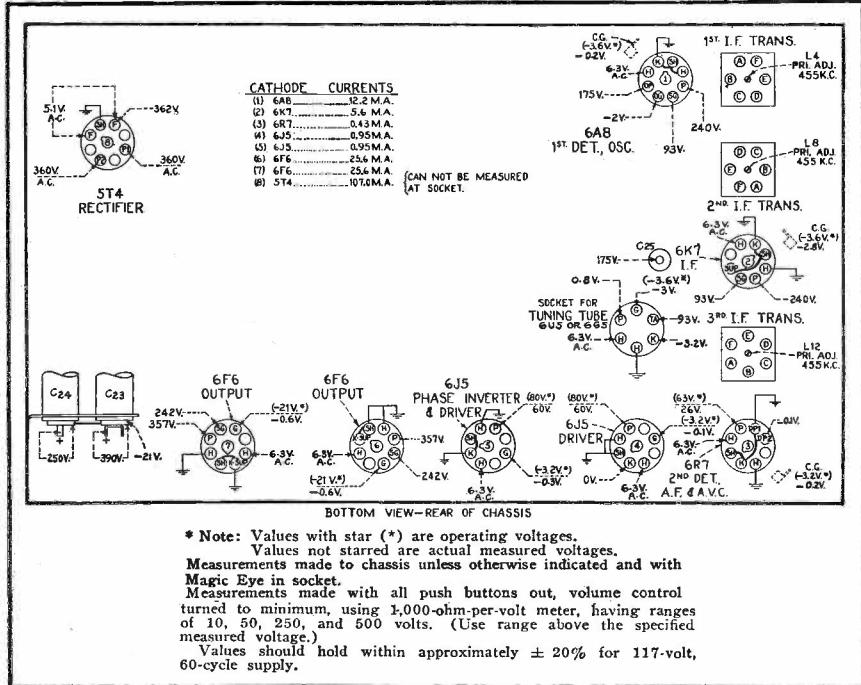


Top view of chassis, RCA Victor HF-1.

cast stations, with high-quality programs, are available. It has comparatively low sensitivity, and is not intended for use beyond a distance of 100 miles from a strong first-class station. (Any high-fidelity receiver is subject to cross-talk and other types of interference when used for reception of weak distant stations.)

Model HF1 has electric tuning for eight stations in the standard broadcast range, thus ensuring correct tuning at all times. It has a six-position selectivity-fidelity-phonograph switch, which permits selection of sharp, medium, and broad tuning (corresponding to narrow, medium, and full-range audio response). In the full-range position, the reproduction is faithful from 50 to 7,000 cycles. The purpose of the six positions on this switch is explained in a table on page 3.

The No. 6 position (knob turned full clockwise) on the fidelity switch provides minimum selectivity and maxi-



Socket-terminal voltages, RCA Victor HF-I.

GENERAL DATA—continued

Purpose and Function of the Six Positions on Fidelity Switch		
No. 1	Phone operation, with minimum high-frequency response.	Connects phone to high side of volume control. Connects C12 (.01 mfd) from plate of 1st-a-f. tube to chassis. Disconnects radio by short-circuiting diode lead R4.
No. 2	Phone operation, with maximum high-frequency response.	Same as position No. 1 except that C12 is disconnected.
No. 3	Radio operation, with maximum selectivity and minimum high-frequency response and minimum fidelity.	Short-circuits phonograph. Connects diode lead to high side of volume control. Connects C12 (.01 mfd) from plate of 1st-a-f. tube to chassis. Grounds low end of L5 and L8.
No. 4	Radio operation, with maximum selectivity.	Same as position No. 3 except that C12 is disconnected, resulting in more highs than position 3.
No. 5	Radio operation, with medium selectivity and medium fidelity.	Same as position 4 except that ground is moved from L5 and L8 to low end of L6 and L10.
No. 6 (clockwise)	Radio operation, with minimum selectivity and full-range fidelity.	Same as position 5 except that ground is moved from L6 and L10 to low end of L7 and L11.

or alignment tool (such as RCA Stock No. 31031) for all adjustments. Leave the fidelity switch in position 3 or 4 while making adjustments for electric tuning.

3. Remove the antenna lead-in from the "A" terminal and wrap it once around the green lead to the top cap of the 6A8 tube. (This provides capacity coupling between the antenna and the 6A8 grid.)

4. Push in button No. 1 and turn oscillator core No. 1 to bring in the first station on the list. Adjust the core carefully for peak output as indicated by the Magic Eye. Adjust link trimmer No. 1 for maximum output.

5. Remove the antenna lead-in from the 6A8 grid lead and connect the lead-in to the "A" terminal. Adjust antenna trimmer No. 1 and link trimmer No. 1 for peak output as indicated by the Magic Eye.

(Clockwise rotation of cores and trimmers tunes the circuits to lower frequencies, and counter-clockwise adjust-

ment tunes the circuits to higher frequencies.)

6. Push in button No. 2. Adjust oscillator core No. 2, antenna trimmer No. 2, and link trimmer No. 2 for the second station in the same manner.

7. Follow the same procedure for the remaining stations.

8. After tuning in eight stations as specified above, leave the antenna lead-in connected to the "A" terminal, and carefully readjust each of the oscillator cores for peak output on the respective stations.

9. After the set is installed and connected to the customer's antenna, make a final readjustment of the antenna and link trimmers.

10. The Magic Eye should be removed from the chassis after completion of the electric-tuning adjustments.

SERVICE DATA

Loudspeaker: Centering of the loudspeaker is made in the usual manner with three narrow celluloid or paper

feelers after first removing the front dust cover. This may be removed by softening its cement with a light application of acetone, using care not to allow the acetone to flow into the air gap. A dust cover should be cemented in place with ambroid upon completion of adjustment.

Precautionary Lead Dress and Replacement of Parts: 1. The green lead from the antenna coil to the switch, and the green lead from the link coil to the switch, should be dressed away from the oscillator coils, and free of other leads, chassis, and parts.

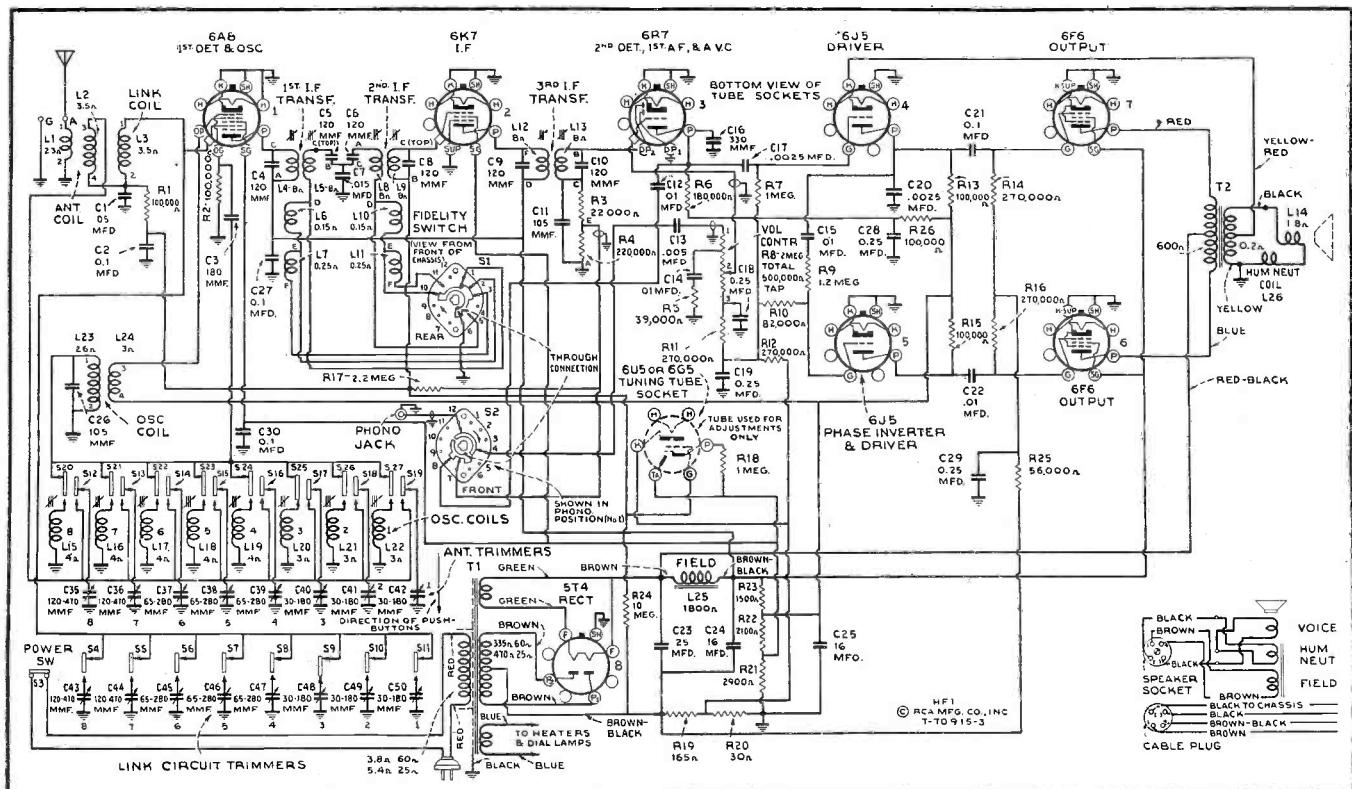
2. When replacing a dual trimmer, it must be installed so that the top plate (to which the adjustment screws make contact) is the ground side. This is particularly important on C39-C40, and C47-C48, because the sections of these trimmers are of different capacity range and must be correctly oriented in the receiver. Grounding the top plate takes care of this.

3. Maintain color coding on output transformer (T2) as shown in the schematic diagram. This is necessary in order to obtain correct inverse-feedback action.

I-F ALIGNMENT PROCEDURE

Cathode-ray Alignment is the recommended method for Model HF1. Connections for the oscilloscope are shown in the chassis drawing.

Output Meter Alignment: If an out-



Schematic diagram, RCA Victor HF-1

When Scientific Research and *Life Itself* Depend on Radio Tubes—

the Bowdoin-Kent-Harvard
Arctic Expedition
used **RAYTHEONS!**

Up in the cold, bleak Arctic—radio communication is all-important—the life-line to any scientific expedition.

Radio tubes *must* work efficiently—*must* be of sturdy construction to withstand the rigors of cold climate, the vibrations of the ship, the jarring of dog sleds.

The custom-built radio receivers used in the recent Bowdoin-Kent-Harvard University Expedition to the Arctic were completely equipped with Raytheon tubes—another reassuring tribute to Raytheon engineering, quality and dependability.

Radio servicemen and dealers save on unprofitable call backs and build good-will by using these same Raytheons.

Use Raytheons for your replacements and enjoy greater permanent tube profits.

RAYTHEON

CHICAGO • ATLANTA • NEW YORK • NEWTON, MASS. • SAN FRANCISCO
"WORLD'S LARGEST EXCLUSIVE RADIO TUBE MANUFACTURERS"



GENERAL DATA—continued

put meter is used, connect it across the voice coil, and turn the receiver volume control to maximum.

Test-oscillator: For all alignment operations connect the low side of the test-oscillator to the receiver chassis, and keep the output as low as possible to avoid a-v-c action.

Push in button 8, and adjust the No. 8 trimmers and core to a quiet point near 600 kc. Leave the button pushed in for the following operations:

Connect the high side of the generator to 6K7 i-f grid through a 0.001 mfd dummy; set generator to 455 kc with a 20-kc sweep. Adjust L12 and L13 (third i-f transformer) for maximum peak and symmetry.

Connect generator to 6A8 grid through the 0.001 mfd dummy; generator remains at 455 kc with the 20-kc sweep. Turn fidelity switch to position 4 from left. Turn L4 and L5 (first i-f transformer) out as far as possible. Peak L8 and L9 (second i-f transformer) and then L5 and L4. Readjust L8 and L9 slightly if necessary.

Turn fidelity switch to position 5. Response should exhibit a slight dip in the top of the curve. With the fidelity switch in position 6, the curve should show materially wider and with a somewhat greater dip in the top.

Airline 62-292, 62-294, 62-373, 62-374

Tuning: Manual.

Range: 528-1730 kc; 5750-18,300 kc.

Tubes:

1st Det: } 1C7C

Osc: }

I-f: ID5G.
A u.s. }

A-V-C
2nd Det: { 1

1st A-f: 1E5G.

Driver: 1H4G

Pwr Amp: 1H4G (2).
Pact: Vibrator

Rect. Vibrator.
Power Supply: 6 volts

I-f: 456 kc.

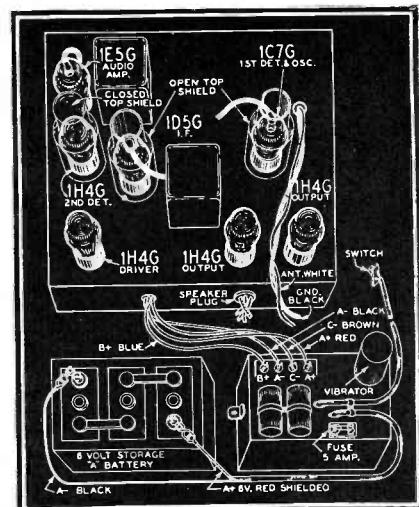
Speaker: P-m dynamic.

This radio is designed to operate from a 6-volt storage battery and uses a synchronous vibrator and a transformer to provide the required high voltage. The tubes used are of the 2-volt type.

Two bands are covered with a tuning range on each band as shown in the specifications above.

Referring to the schematic circuit diagram, Fig. 1, T1 and T2 are the antenna coil assemblies and T3 and T4 are the oscillator coil assemblies. The standard-wave and short-wave coils are indicated by the letters B and D respectively.

The band switch completes connec-

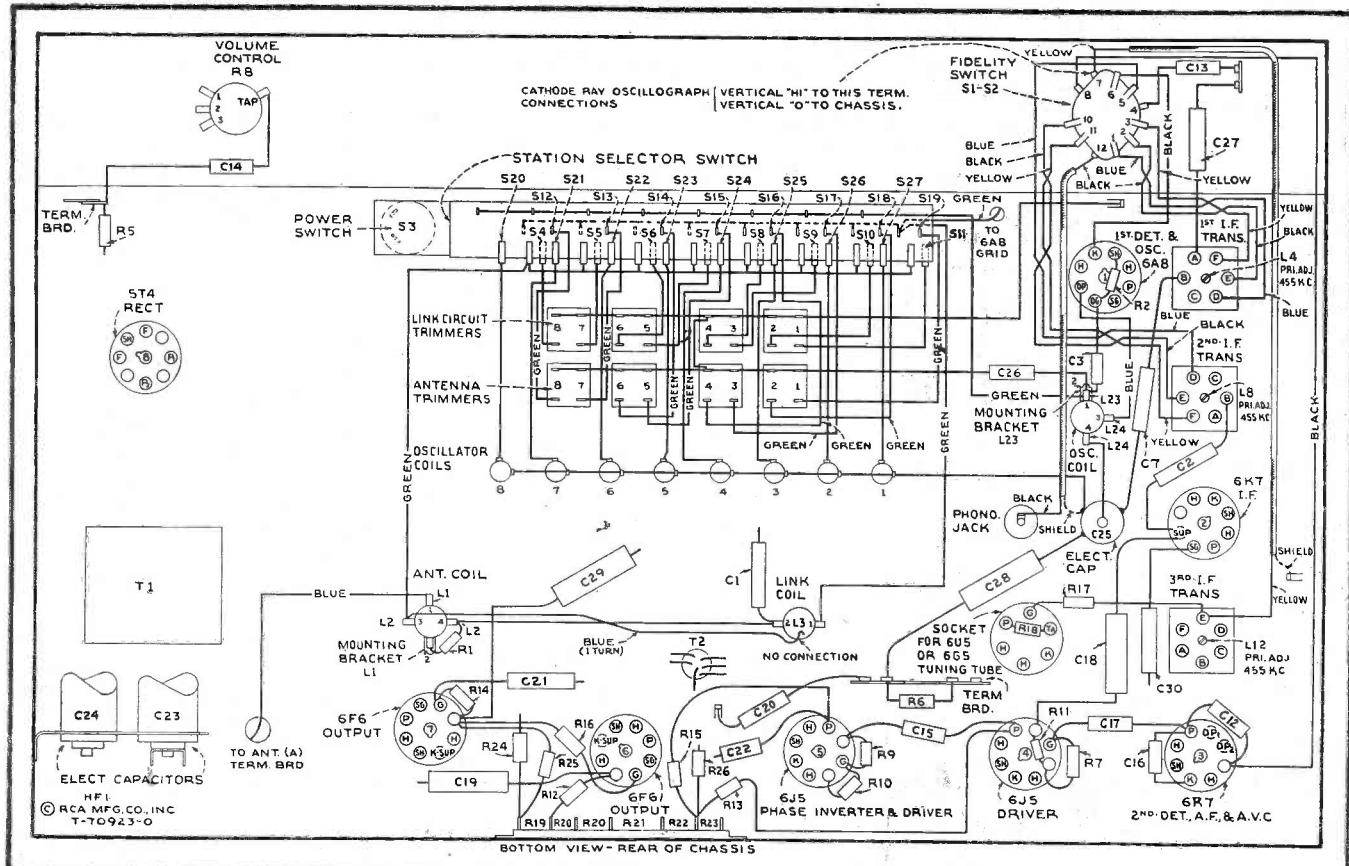


**Battery connections and tube locations,
Airline 62-292, etc.**

tions to the coils in use. When it is in the range B position, a double tuned antenna r-f stage is used while for the D range, a single-tuned secondary is used.

A type 1C7G pentagrid converter tube functions as the oscillator and first detector.

The oscillator potential on the oscillator control grid of this tube modu-



Underside of chassis, RCA Victor HF-1.

GENERAL DATA—continued

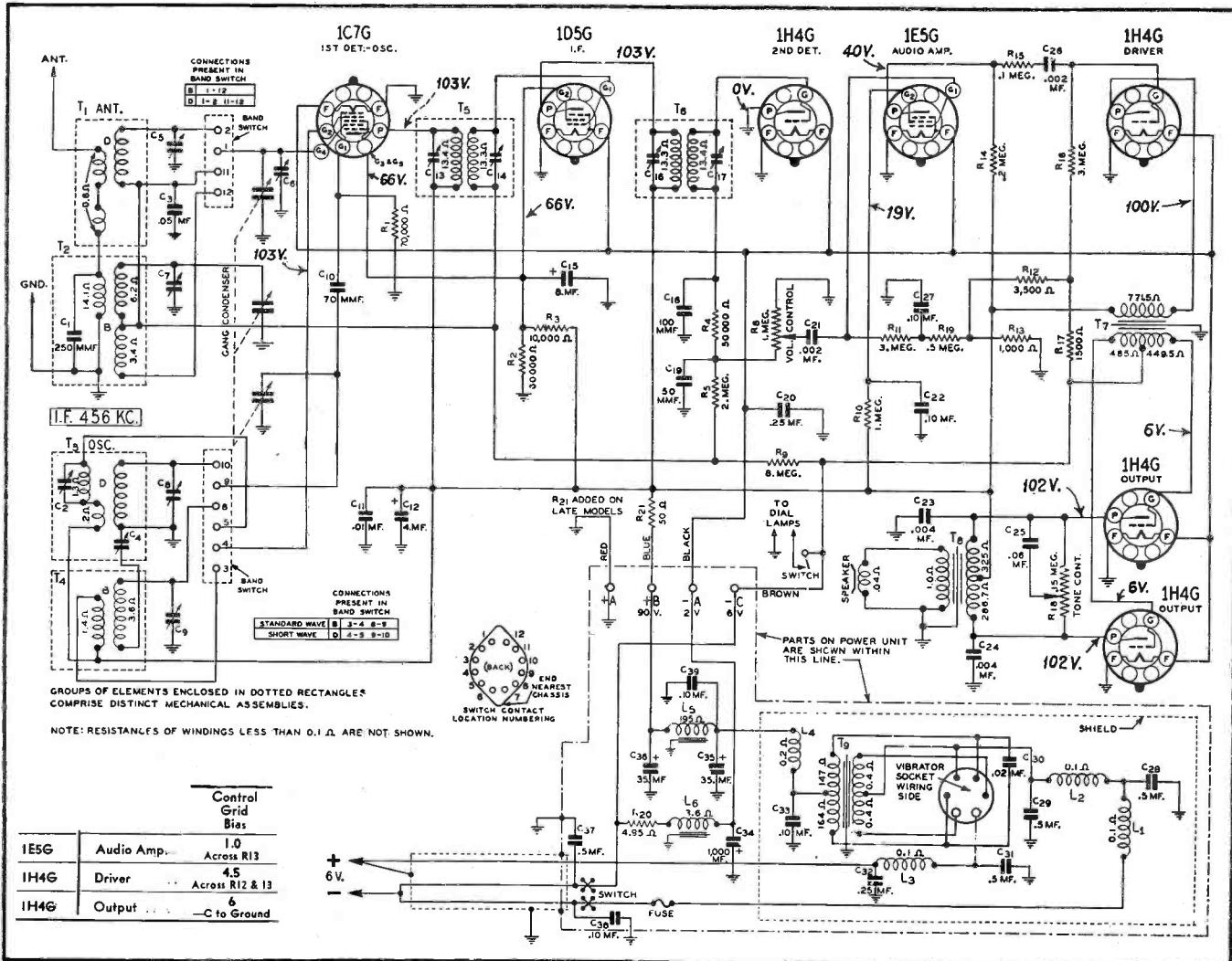


Fig. 1. Schematic diagram, Airline 62-292, 62-294, 62-373, 62-374.

lates the electron stream from the cathode in such a manner as to impress on it the oscillator frequency which is always 456 kc above the frequency to which the r-f amplifier is tuned.

One stage of i-f amplification is employed using a 1D5G tube. The primaries and secondaries of the first and second i-f transformers are tuned by small trimmer condensers.

A 1H4G tube functions as a diode second detector. A-v-c voltage is applied to the control-grid circuits of the first detector and i-f tubes.

A 1E5G tube functions as the first audio amplifier while a 1H4G tube is used in the driver stage.

The output stage employs two 1H4G tubes in a stage of Class "B" amplification.

A synchronous type vibrator is used in the power unit. This vibrator interrupts the current through the primary of the power transformer and also rectifies the current in the secondary circuit.

ALIGNMENT

The volume control should be at

APRIL, 1938 •

maximum during all adjustments. Connect receiver chassis to ground post of signal generator with a short heavy lead. Allow both generator and receiver to warm up for at least fifteen minutes.

I-f: Set band switch to range B; connect signal generator through a 0.1 mfd dummy antenna to grid cap of 1C7G first detector; set generator to 456 kc. Adjust trimmers C13, C14, C16, and C17 (i-f transformer) for maximum output.

Range D (5750-18,300 kc): Band switch at range D; signal generator connected to antenna lead through a 400-ohm dummy antenna; set range switch to D; set generator to 18,300 kc; turn variable condenser to full open. Adjust C8 for maximum output.

Range B (528-1730 kc): Band switch at range B; signal generator connected to antenna lead through a 200 mmf dummy antenna; generator set to 1730 kc; variable condenser plates turned to full open; adjust trimmer C9 for maximum output.

Reset generator to 1500 kc, dummy antenna and connection to set remaining as above; turn variable condenser to point of maximum output, set indicator to 1500 kc. Adjust trimmers C7 and C6 for maximum output.

Reset generator to 600 kc, dummy antenna and connection to set remain-

ing as above; turn variable condenser to point of maximum output. Rock condenser while adjusting C4 for maximum output.

Range D (5750-18,300 kc): Connect generator to antenna lead through a 400-ohm dummy antenna; set range switch to D; set generator to 18,300 kc; turn variable condenser to full open. Adjust C8 for maximum output.

With dummy antenna and connection to set remaining as above, set generator to 15,000 kc; turn variable condenser to point of maximum output; rock condenser while adjusting C5 for maximum output.

Dummy antenna and connection to set as above; adjust generator to 6000 kc; turn condenser to point of maximum output; rock condenser while adjusting C2 for maximum output.

NOTES

Attenuate signal from generator to prevent leveling-off action of the avc.

After each range is aligned, repeat procedure as a final check.

After alignment of range D has been

GENERAL DATA—continued

completed, do not make any adjustments of range B trimmers; if this is done, it will be necessary to realign range D.

In sets using the finger-tip tuning dial, remove retaining ring which holds dial scale in position. Readjust condenser to point of maximum output; hold station-selector ring and turn dial scale until pointer is at 1500 kc mark. Replace retaining ring.

Be careful to avoid adjusting at the image frequency when aligning short-wave band. When, for example, aligning at 15,000 kc, the image will be found at 14,088 kc—i.e., 15,000 minus twice the intermediate frequency.

Emerson BA-199, BA-201

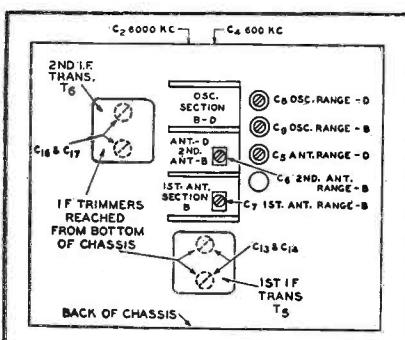
Chassis: BA
Cabinet: Table
Tuning: Manual
Range: 540-1725 kc

Range: 540-1725 kc
 Tubes:
 R-f: 6D6
 Det: 6C6
 Power Amp: 25L
 Rect: 2Z5Z
 Ballast: L 55BG

Ballast: L55BG
Power Supply: 105-125 volts a-c or d-c.
Speaker: Electrodynamic
Field Res.: 450 ohms

VOLTAGE ANALYSIS

Readings should be taken with a 1000-



Trimmer location, Airline 62-292, etc.

ohm-per-volt meter. Voltages listed below are from point indicated to ground (chassis) with volume control turned on full and no signal. The line voltage for these readings was 117.5 volts, 60 cycles, a-c.

<i>Tube</i>	<i>Plate</i>	<i>Screen</i>	<i>Cathode</i>	<i>Fil.</i>
6D6	100	100	2.3	6.3
6C6	30	15	2.1	6.3
25L6G	93	100	6	25.0

Voltage across speaker field, 26 volts.
25Z5 cathode to ground, 126 volts.

ALIGNMENT PROCEDURE

An oscillator with a frequency of 1400 kc is required. Use as weak a test signal as possible. An output meter should be used across the voice coil or output

transformer for observing maximum response.

Rotate variable condenser to the maximum capacity position and set the pointer at the next calibration mark beyond 55. Then rotate the variable condenser until the pointer is at 140 and feed 1400 kc to the antenna through a 0.0001 mf mica condenser and adjust both trimmer condensers on the variable condenser for maximum response.

Silvertone 4668

Tuning: Manual.

Range: 540-1730 kc; 5.7-18.3 mc.

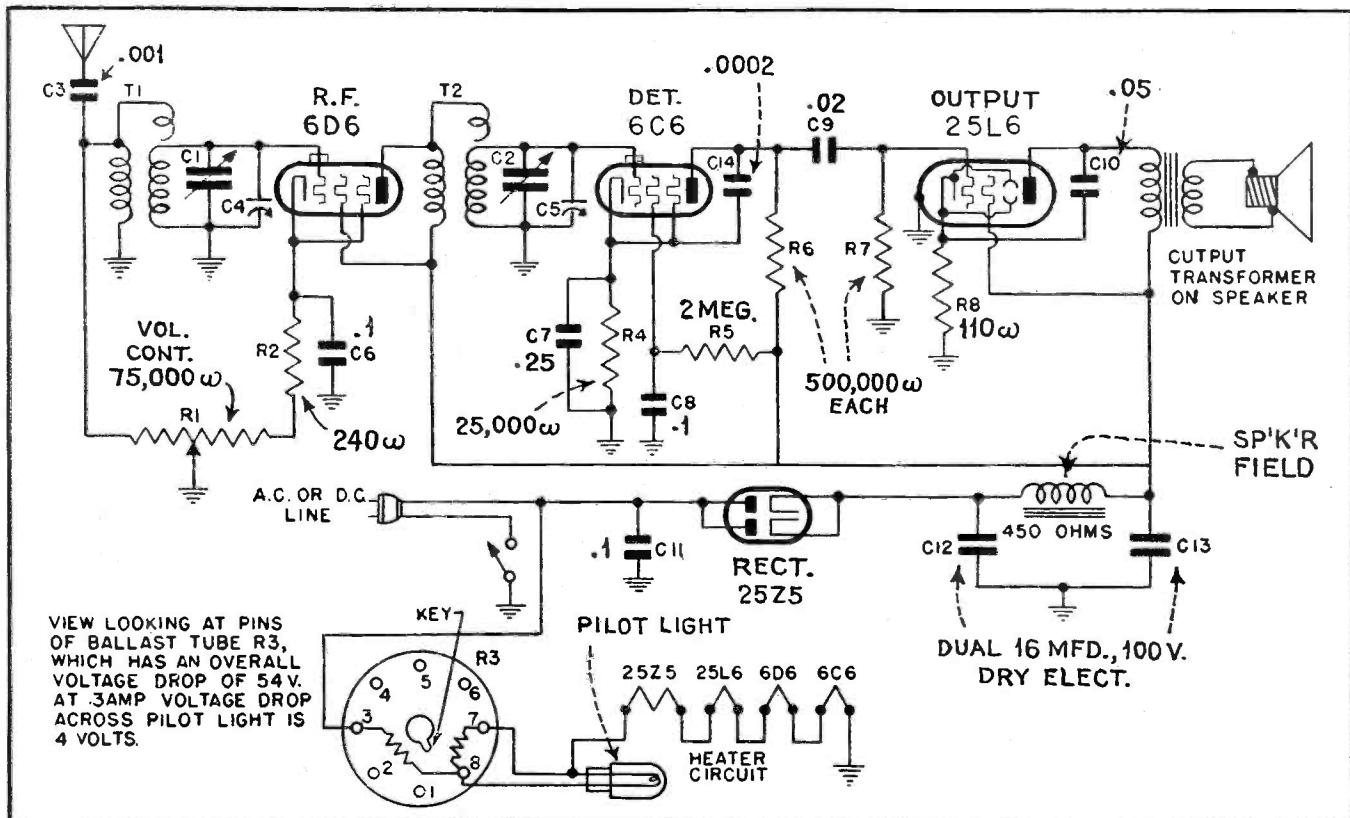
Tubes:
 1st Det: } 6A7.
 Osc: }
 I-f: 6D6.
 A-v-c: } 76.
 2nd Det: }
 1st A-f: 76.
 Bass Amp: 41

Pwr Amp: 41.
Rect: 80.
Power Supply: 105-125 volts, 60-cycle
a-c.

I-f: 456 kc.
Speaker: Electrodynamic.
Field Res: 1050 ohms.
Phono: Crystal pickup.

ALIGNMENT PROCEDURE

Always keep the output from the signal generator as low as possible. As



Schematic diagram, Emerson BA-199, BA-201.

NEW "PRECISION" SERIES 860

A.C.—D.C. VOLT-OHM-DECIBEL-MILLIAMMETER

A panel type instrument incorporating a large 9 inch, full vision meter and a separate remote control selector unit.



The SERIES 860 Multi-range tester can be employed either as a complete panel mount (shown above) or can be used for remote operation since the separately encased selector unit may be removed for bench use. (As illustrated at right.)

SHUNTS: All shunts are Precision wire wound on impregnated moisture-proof bobbins and individually calibrated against laboratory standards to an accuracy within 1%.

MULTIPLIERS: All voltage metallized multipliers are Precision Series matched against laboratory standards to a close tolerance of 1%.

METER: The Precision large 9-inch meter is of the D'Arsonval type; accuracy 2%; base sensitivity 400 microamperes; rugged bridge type construction; solid one piece magnet. Each meter is individually calibrated for the particular instrument in which it is incorporated in order to maintain the closest possible accuracy. The meter scale employs extra large, easy reading numerals and the AC correction and decibel scales are printed in red.

MULTI-RANGE SELECTOR: The master range selector incorporates ceramic spacers between sections. Contacts are silver plated and of a modern double wiping type to assure low contact resistance. Mechanical construction provides positive snap-in action and is designed for durability.

OHMMETER AND CURRENT CIRCUITS: The use of a novel ring network circuit was specifically designed for maintaining close accuracy in ohmmeter readings regardless of battery voltage variance. The current shunts are also employed in a ring network circuit, thereby reducing contact resistance in the circuit.

OTHER FEATURES: Etched markings on heavy gauge metal panel. Cabled wiring throughout. Highest grade materials employed for lasting satisfaction. Rugged construction.

SPECIFICATIONS

FIVE AC VOLTAGE RANGES at 1000 ohms per volt. 0-10/50/150/500/1500.

FIVE DC VOLTAGE RANGES at 1000 ohms per volt. 0-10/50/150/500/1500.

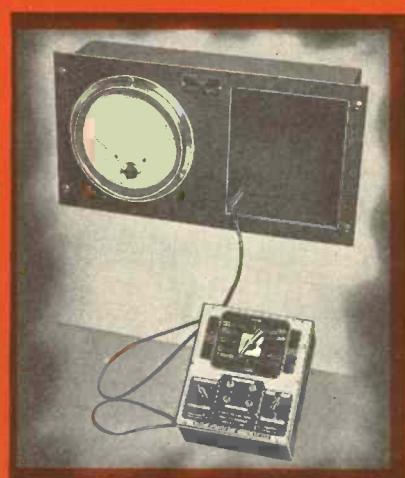
FOUR OHMMETER RANGES 0-400 (20 ohms center); first indication $\frac{1}{4}$ of an ohm. 0-100,000 ohms (800 ohms center). 0-1 megohm (8,000 ohms center). 0-10 megohms (80,000 ohms center).

All ohmmeter ranges are powered by self-contained battery supply incorporated inside of remote control unit.

SIX DC CURRENT RANGES 0-1ma/10ma/50ma/150ma/500ma/ and 10 amperes.

FIVE DECIBEL RANGES from -10 to +59DB. (0DB, +14DB, +23.5DB, +34DB, +44DB.)

FIVE RANGES FOR OUTPUT INDICATIONS (same as AC voltage ranges).



★SERIES 860

Size of remote control selector unit
7 x 8 x 3 $\frac{1}{2}$.

Size of entire panel 20 x 10 $\frac{1}{2}$ x 4.

Panel and control unit constructed of heavy gauge steel attractively finished in baked shrivel black enamel. The panel is backed up with a steel dust cover housing, 4 inches in depth.

Complete with batteries and \$39.50
Net test leads.

SEE THIS AND OTHER "PRECISION" UNITS AT YOUR DISTRIBUTOR . . . OR WRITE FOR CATALOG 38-S

PRECISION *Apparatus Corporation*

821 EAST NEW YORK AVENUE

BROOKLYN, NEW YORK

GENERAL DATA—continued

the sensitivity is increased by alignment, the generator output should be reduced accordingly.

In the data below, values given in microvolts are only approximate.

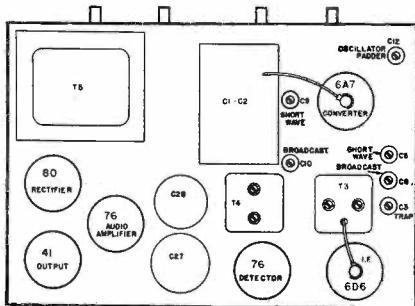
I-f: Set receiver dial pointer to 160; generator set at 456 kc and connected to 6A7 grid through a 0.02 mfd dummy antenna. Adjust i-f trimmers, C15, C16, C17, and C18 (in order given) for an output of 50 microvolts.

Connect generator, still at 456 kc, to antenna lead (blue) through a 0.0002 mfd dummy; dial pointer remains set at 160. Adjust wave-trap trimmer C3 for minimum response.

Short wave band (5.7-18.3 mc): Receiver dial set to 16; generator frequency to 16 mc; connect to antenna lead through 400-ohm dummy antenna. Adjust trimmers C9 and C5 for an output of about 17 microvolts.

Broadcast band (540-1730 kc): Set generator to 600 kc and connect to antenna lead through a 0.0002 mfd dummy. Set receiver dial to 60 and rock through this point while adjusting trimmer C12 for an output of about 10 microvolts.

Set receiver dial to 160, and generator to 1600 kc; use 0.0002 mfd dummy. Adjust C10 and C6 (in order named) for output of about 12 microvolts.



Tube and trimmer location, Silver-tone Model 4668.

Philco 650X

Set dead: 6K5 tube dead, but only a 6F5 in kit. Connected pins 3 and 4, at socket and used the 6F5 for temporary replacement.

Willard Moody

RCA 210

Fading, intermittent operation, sometimes cuts in and out, especially if 58 tube is moved. Due to faulty cathode bypass on the 58 and 2A7. Replace with .1 mfd. 400 v. and leave some slack in the leads to prevent recurrence.

Francis C. Wolveen

RCA 220

Slow motor-boating, present even with volume control retarded. Due to general loss of capacity in condenser block. Replace. Gives trouble with output transformer in damp weather. May be readily identified by hot grids in pentode output.

Francis C. Wolveen

Wells-Gardner 2DL

A-c hum. Be sure that the volume control lugs are not grounded on the flat portion of the metal chassis wall which supports the rubber mounting foot.

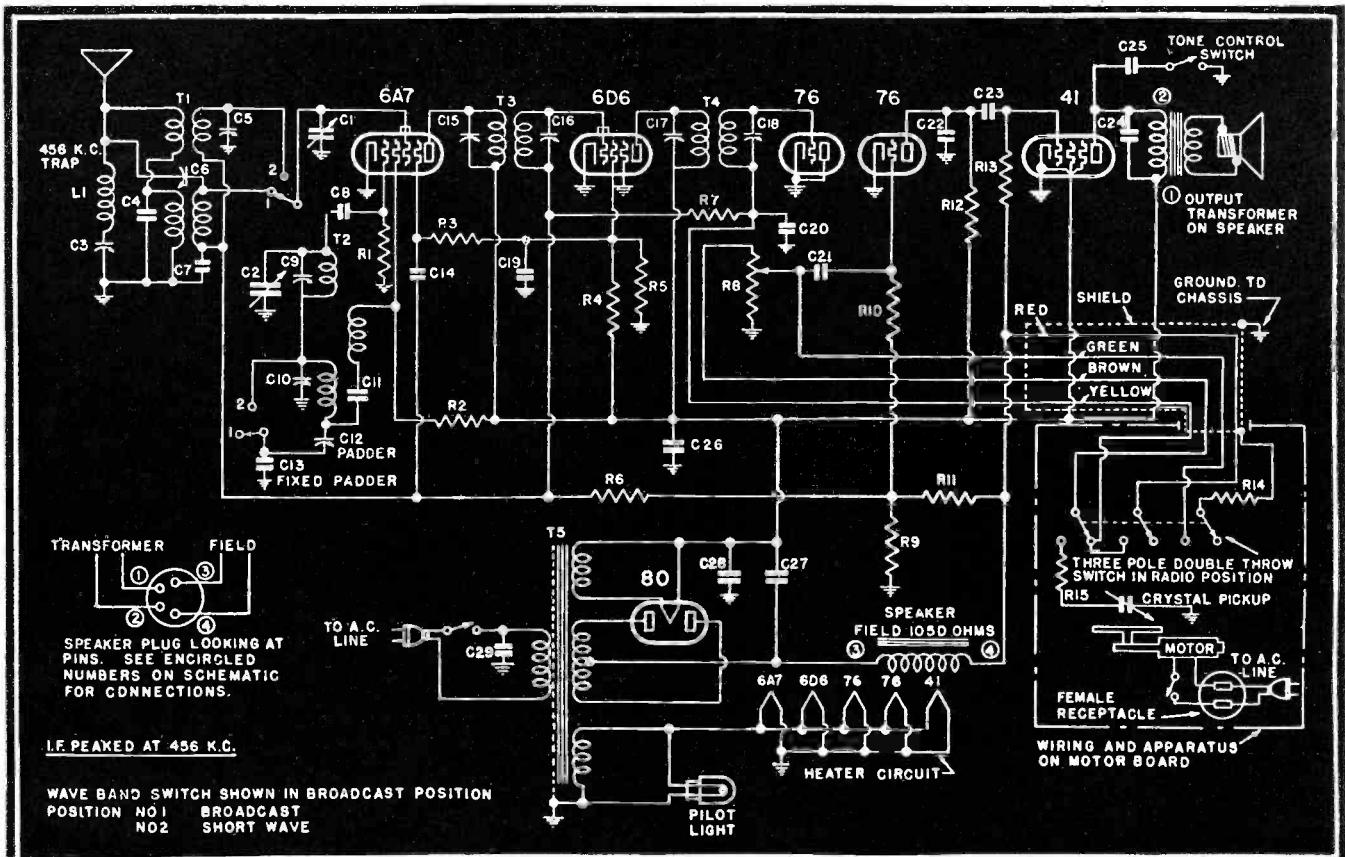
The bottom plate under the chassis must be under the r-f end of the chassis and away from the filter choke. If it is in the center or left side (from back of radio) move it to the right side about one-half inch from the mounting bolt holes.

Wells-Gardner Service Dept.

Wells-Gardner 07A

Volt-divider trouble. The 18,000-ohm section of the voltage divider of this series of receivers has been reported as the source of most of the trouble experienced. Check, and replace if defective.

RCA Service Tip File



Circuit schematic, Silver-tone Model 4668.

Test Equipment . . .

The Capacitor Analyzer as a Service Instrument

WE ARE ALL familiar with the volt-ohmmeter (or volt-ohm-milliammeter) and its application as a service or general laboratory instrument; and we know pretty well just what it will do—afford resistance, voltage, perhaps current readings and permit the speedy and generally quite satisfactory continuity analysis of receivers and amplifiers. But the volt-ohmmeter, for instance, will not provide for the measurement of the electrical characteristics (capacity, leakage, power-factor) of condensers, the accurate determination of high-value resistance, nor leakage readings for dielectric-bodied components.

JUST WHAT IS A CAPACITOR ANALYZER?

A capacitor analyzer is an instrument which provides for: accurate capacity, leakage, power-factor, open and short, and intermittent operation tests on condensers; resistance tests; insulation-resistance tests between coil windings in transformers and lugs in terminal assemblies and sockets, etc., and continuity diagnosis. It permits an accurate and immediate detection of components whose rated characteristics have fallen off to adversely affect receiver performance and an analysis of new condenser and other parts which must be carefully selected for highest functional efficiency when acquired for replacement and custom construction application.

The particular capacitor analyzer which we will use in investigating the applications value of this type of instrument is the Solar CB 1-60 model; it would seem advisable at this point briefly to describe it.

In Fig. 1 we give the circuit diagram of the instrument. Use of a Wien bridge is indicated here—a bridge, by the way, which makes possible not only high accuracy readings of both resistance and capacity, but an independence of reading from line-voltage variations (obviating any necessity for line regulation or line measurement and corrective calculation). Very sensitive detection is brought about through the use of a 6E5 magic eye indicator.

Leakage tests on both paper and electrolytic condensers are afforded through the use of a d-c power supply and a neon lamp. A five-point switch

selects voltage—the range extending sufficiently far to permit tests under the extreme potential conditions encountered in present-day service work. The leakage test feature, of course, aides in determining the efficiency of insulating bodies and the calculation of extremely high resistance.

Forty-five linear inches of calibrated, five-range, color-coded scale make high-accuracy reading easy. Capacity range is from 0.00001 mfd to 70 mfd; and resistance range is from 50 ohms to 2,000,000 ohms. A separate scale for power factor handles all electrolytics and has a direct-reading calibration from zero to 50 percent.

There is no need for detailing hookup matters, as the circuit diagram becomes self-explanatory upon inspection.

RESISTANCE MEASUREMENTS BY THE LEAKAGE-TEST METHOD

Extremely high resistance, such as that in effect between wires in cables, between transformer coil windings, between contact points in terminal strips, between stator and rotor sections of badly insulated variable condensers, between terminals in tube sockets which have suffered flashover (resulting in carbonization and conductive paths), and between chassis and wiring by reason of moisture absorption and lowered dielectric efficiency in the insulating cover-material for the wire, may be determined through leakage test. Here the value of resistance does not read directly on the scale, but is determined by formula:

$$R = 30 \text{ N}$$

where N is the number of seconds per neon flash and R is the leakage resistance in megohms.

By observing the number of seconds per flash, the resistance can be calculated, and where the resistance shows up in any appreciable value, improper insulation is at once indicated. Once the effect is known and the condition causing it detected (the presence, perhaps, of carbon, oil or dust film, or soldering paste), either replacement or cleaning of items under test becomes in order.

A steady neon glow would indicate very low resistance if not a dead short.

PAPER CONDENSER LEAKAGE TESTS

Leakage tests are of course related

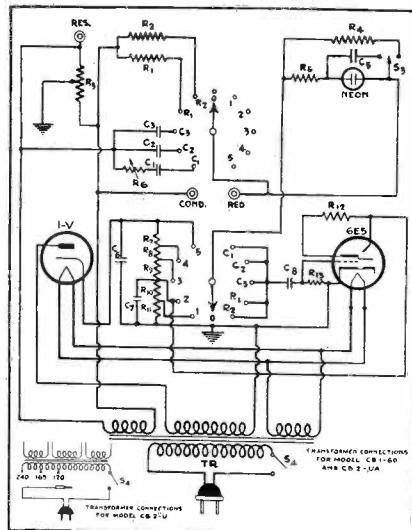


Fig. 1. Capacitor analyzer circuit diagram.

to the resistance tests just discussed and are very important when analyzing condensers for characteristics.

Shorted condensers are indicated by a steady neon glow. Open capacitors naturally give no indication and are held over for capacity test. Intermittent items show up as dead shorted or wide open and, in the latter case, are likewise held over for capacity test, as nothing definite is indicated. Satisfactory condensers give either no neon glow or a flash rate of, or less than one per second, while failing, leaky condensers result in either a steady, dull glow when pretty well "gone" or a flash rate greater than one per second when "well on the way."

More than one flash per second tolerance is allowable in some instances, particularly for paper condensers rated for operation at 25 volts or less; here two flashes would indicate a satisfactory item. On the other hand, there are instances where and when capacitors must be rejected if a flash rate greater than one every four seconds (a leakage resistance less than 120,000,000 ohms) is indicated; condensers to be used in audio-frequency coupling networks (where leaky items effect a loss of grid bias when conventionally connected between the plate of one tube and the grid of a following tube), in band-pass filter systems, in inverse-feedback circuits, and in such noise suppression circuits as the Dickert automatic, must show an extremely low leakage.

It may surprise the Service Man to go over any available chassis and discover how many of the condenser components have a definitely unacceptable leakage rate.

Your test bench is your stock in trade. Is your equipment up-to-date?

TEST EQUIPMENT—continued

ELECTROLYTIC CAPACITOR LEAKAGE TESTS

With the analyzer "S" switch at position 1, 2, 3, 4, or 5, depending upon working voltage for the condenser under test, electrolytics may be similarly tested for leakage.

Intermittent capacitors are indicated by a steady neon glow periodically decreasing or increasing in intensity. Shorted electrolytics show up with a steady glow which does not extinguish. Open condensers, of course, may show no leakage and are held over for capacity test. High-leakage condensers which have been in recent service are indicated by a glow which does not extinguish within five minutes; condensers which are new or which have been on the shelf for some time or taken from a chassis which has been out of operation for several months, are given a somewhat longer time for glow disappearance. Satisfactory condensers—that is, strictly satisfactory and in no need of replacement—should extinguish within one minute or five, depending upon whether or not they have been in immediate service.

We might note the fact that leakage between negatives in common-anode, multiple-unit electrolytic banks—ordinarily very difficult to detect—is quite easily checked with the capacitor analyzer.

Figs. 3 and 4 indicate just how this leakage, which effectively shunts the choke in the negative lead, may be detected. The circuit shown in Fig. 4 is typical of circuits using positive common electrolytic condensers. Leakage between negatives in this circuit shunts the choke in the negative lead and reduces its effectiveness, thereby increasing the hum level.

This condition may be detected in such units by connecting one of the sections, preferably the one of lowest capacity, to the leakage test terminals "COND" of the test instrument with "S" set at the proper voltage. Meas-

ure the leakage in the regular manner and with the first section still connected to the test instrument, short together the negative lead of the second section to the common positive connection, as shown in Fig. 4. If there is appreciable leakage between sections, a very noticeable spark will occur every time the leads are shorted together. This test should be repeated several times, allowing about five seconds each time before the leads are shorted. If a slight spark is noticed the first time or after the leads are kept apart for considerably longer periods than five seconds, the leakage between sections may be neglected for all practical purposes.

CAPACITY MEASUREMENTS

With the test leads connected to

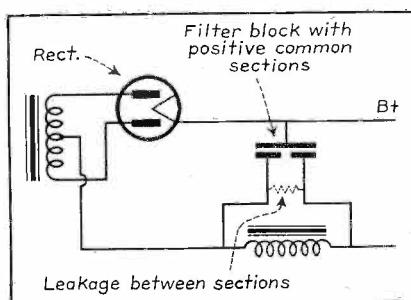


Fig. 3. Filter circuit using condenser block with common positive.

terminals marked "COND" and with range, power factor, and "S" settings adjusted to meet specific capacitor test requirements (Fig. 5), the capacity of

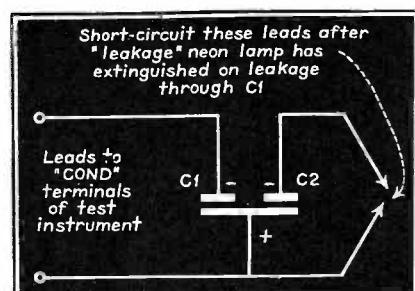


Fig. 4. Connections for testing condenser block with common positive.

replacement and are indicated as open or as shorted (balance at "short" position—or no balance where the short has high resistance). If a balance is obtained and the angle of shadow should show a slight variation, intermittent operation would also be indicated.

When testing paper or mica condensers for capacity, the power-factor control is set for paper-mica reading. When testing electrolytics, on the other hand, this control is set for electrolytic reading, and once a balance has been obtained with the main pointer, the power-factor knob is itself adjusted until the shadow is at maximum angle.

POWER FACTOR

Power factor may be read directly on the power-factor scale for electrolytics once a balance has been obtained and the just-mentioned adjustment effected for maximum shadow. The power factor pointer now reads directly.

High power factor, indicated when

Test Terminals	Capacity Range Mfd	Power Factor Control for Paper-Mica	Power Factor Control for Electrolytic	Place S at	To Obtain Capacity
COND	0.00001 to 0.007	Paper-Mica	C3	Read Directly
COND	0.001 to 0.7	Paper-Mica	C2	Read Directly
COND	0.10 to 20.0	Paper-Mica	Electrolytic	C1	Read Directly

Fig. 5. Control settings for capacity and power-factor measurements.

paper, mica and electrolytics may be directly read. (The capacity control is moved for bridge balance as indicated by maximum 6E5 shadow angle.) Naturally the proper capacity setting for the condensers under test should be known.

Those condensers measuring 30 percent lower than rated capacity are generally discarded. Open condensers, indicated where a balance can be obtained only at "Open" on the capacity scale and after trial adjustments with the switch in C1, 2, and 3 positions, are of course set aside for replacement. Intermittent capacitors similarly call for

a balance cannot be obtained at any position of the p-f control, would call for electrolytic replacement. Low power factor, on the other hand, would suggest high filtering efficiency. It is, frankly, quite difficult if not impossible to arrive at definite values and tolerances, as acceptable power factor becomes largely and logically conditioned by matters of condenser application, but some more or less general rulings may in any event be drawn.

If a balance can be obtained on any setting of the power-factor control, the condenser under test will generally be
(Continued on page 33)

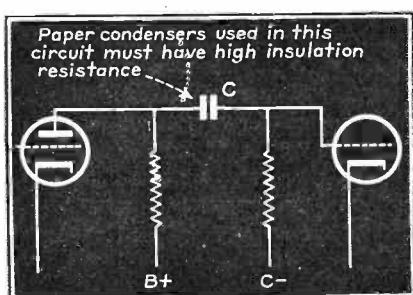
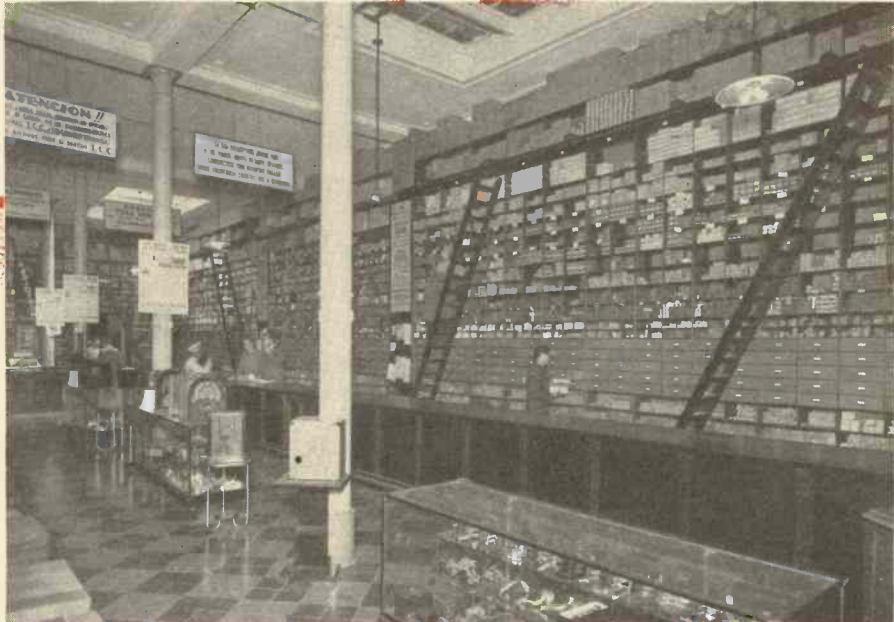


Fig. 2. Paper condensers are used in the circuit of a resistance-coupled amplifier.



YOU'LL FIND THEM ON THE SHELVES OF FAR OFF BUENOS AIRES



A view of the modern metropolitan store on the Calle Rivadavia 869 of Buenos Aires . . . and here is the proprietor of this splendid establishment

The Argentine, Brazil, Sweden, France, Australia . . . the list is long . . . of far away places where the fame of Centralab parts persists.

Smooth controls, permanent resistors, positive selector switches . . . perform their miracles in myriad languages in all parts of the globe.

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Sound Service . . .

Resistance-coupled Amplifier Charts

WE ARE REPRODUCING on page 23 through the courtesy of Raytheon Production Corporation, a series of charts which will be found of great value in the design of resistance-coupled audio amplifier circuits.

The charts are practically self-explanatory. It will be seen that each chart gives data for a group of tubes all of which, in general, possess the same type of characteristics; for instance, it will be found that data for medium-mu triodes (6C5, 6L5G, etc.) and triode-connected pentodes (6J7, 77, etc.) are shown on one chart. Similarly, pentodes are given on a separate chart, and so on.

The charts show voltage gain, peak output voltage, cathode resistor value, screen resistor value (for pentodes only, of course) as a function of both plate voltage and plate-load resistance. Suppose, for example, it is desired to find the peak output voltage obtainable from a triode-connected 6J7 operating at 250 volts plate (supply voltage is indicated in all cases and is *not* to be considered as the actual voltage at the plate of the tube) and with a load resistance of 100,000 ohms. Looking at the chart which gives the information for the triode-connected pentodes, we first locate the 250-volt point on the scale of "Plate Supply Voltage"—this is called the abscissa of the chart. Going vertically upward with an imaginary line from the 250-volt point until we reach the solid-line curve marked " E_o ($R_L = 0.1 M$)", from this point of intersection we follow another imaginary straight line horizontally to the scale "Output Peak Voltage (E_o)—Volts"; this, and the other scales located alongside the charts, are called the ordinates of the chart. Where the imaginary horizontal line meets the ordinate of peak output volts, we read 72 volts. If we want to know the value of the cathode resistor for this tube, under the conditions given, we locate the intersection of our imaginary vertical 250-volt line and the solid-line curve marked " R_c ($R_L = 0.1 M$)". The ordinate marked "Cathode Resistance (R_c)—Ohms" shows that a resistance of about 5500 ohms is required. Note that in several cases the same ordinate applies to more than one chart; where this

occurs, simply extend the imaginary lines across any intervening chart to reach the proper ordinate.

The charts do not show any values for the grid resistor of the following tube; however, the charts were calculated on the presumption that the grid resistor (of the following tube) was twice the value of the plate-load resistor of the tube under consideration. For the 6J7 of our example above, the grid resistor of the following tube would then be 200,000 ohms. If the same value is to be used for both grid and plate resistors, the value of R_g found from the chart should be reduced by 15 percent. If, on the other hand, the grid resistor is to be four times the value of the plate resistor, R_g must be increased by 10 percent.

The condenser which bypasses the cathode resistor is best calculated from a very simple expression. This is $C_b = 7000/R_c$, which means that the value of the cathode bypass condenser in microfarads is equal to 7000 divided by the resistance, in ohms, of the cathode resistor. In our example, this means $7000/5500$ or a value of 1.3 mfd (approximately) for the bypass condenser; this is just about the *minimum* value which can be used.

For the coupling condenser of the resistance-coupled circuit, the value depends upon the grid resistor of the following tube. Here again we make use of a simple equation, $C = 0.003/R_g$. Let us assume that the grid resistor of whatever tube follows our 6J7 is 200,000 ohms, or 0.2 megohms. (We must take the value of R_g in megohms *not* ohms). Dividing 0.003 by 0.2, we obtain 0.015 mfd as the value for the

A voltage-regulator transformer.



Well-dressed, attractive windows invite passersby.

coupling condenser. Values obtained by means of this equation will be such that the 60-cycle gain of the amplifier will be about 75 percent of the gain at high frequencies.

Line Voltage Trouble

AMPLIFYING SYSTEMS used for public address or sound reinforcement break down or fail to give satisfaction to the user as much through fluctuations of line voltage as, probably, through any other single cause. The objectionable effects of poor line regulation manifest themselves in a number of ways of which the most common is variation in sound volume.

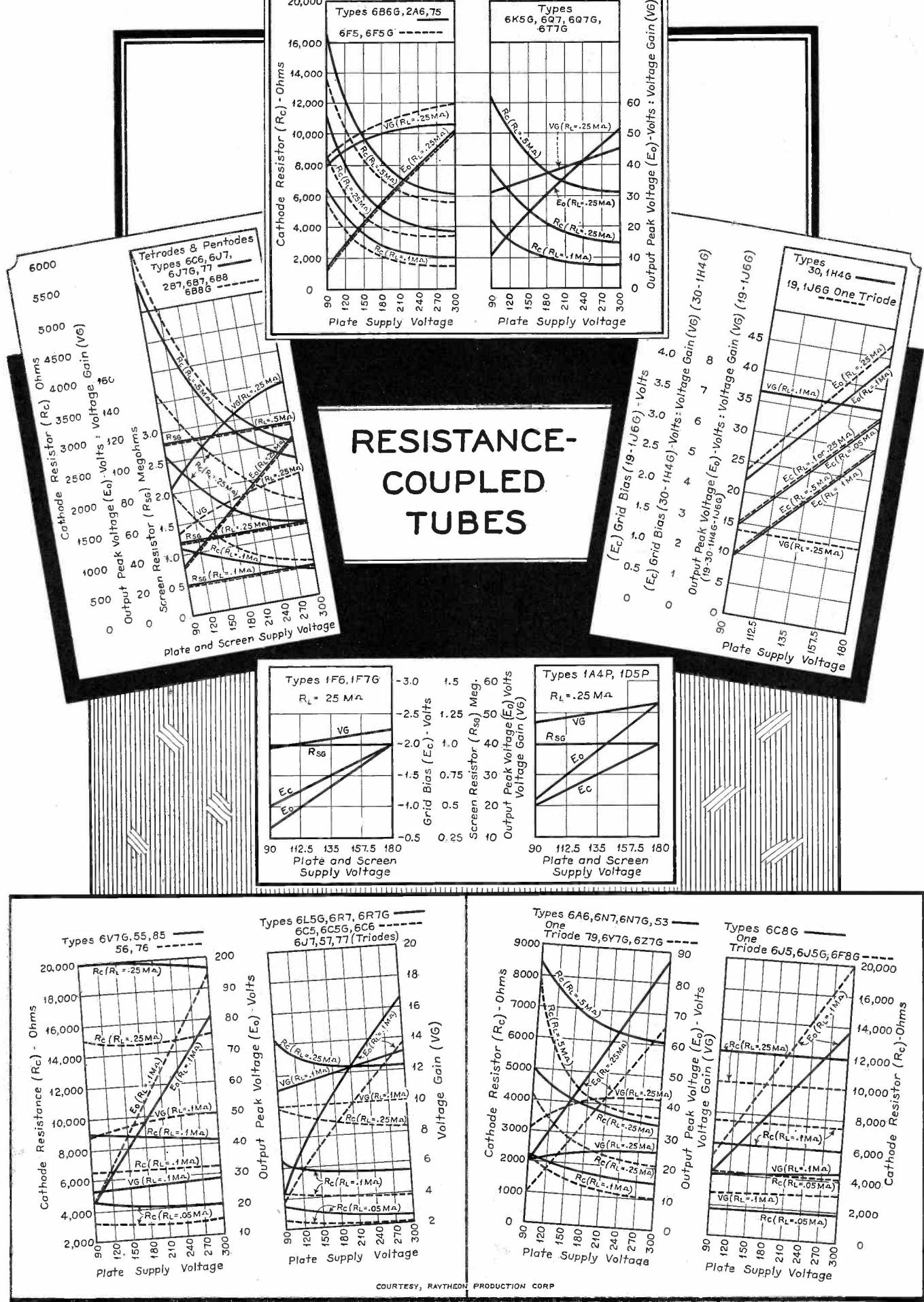
The relatively high voltages used for amplifier power tubes represent from three to six times the potential of the power line. Therefore, if a 115-volt line actually delivers only 90 volts, the proportionate decline in tube plate voltage may be 100 volts—more than enough to produce a distinct difference in volume output. A corresponding increase in power-line voltage augments sound volume to the point where it may be decidedly disagreeable—especially in reinforcement systems in which it is intended to convey an illusion of natural sound, and the audience is not supposed to be aware that amplifiers are used.

The fluctuating power line also influences sound quality. On the basis of extent of line change just mentioned, amplifier tube plate voltages may alter from time to time through a range of 25 percent—a condition under which no amplifier can be expected to perform properly.

Direct damage to equipment also results from poor line regulation and may be broadly classed in two general groups. Breakdown of insulation in a socket, condenser or elsewhere can naturally be expected where sound equipment is subjected to excessive voltages of the order just indicated. Transformers or other conductors may burn out as a result of the excessive current driven through them by such voltages.

A second class of damage is produced by prolonged overheating of component parts where high line voltage is a chronic condition. The wiring of an amplifier may deteriorate, inasmuch as oil-and-cotton insulation dries out, and the cotton itself may char. Rubber insulation dries and cracks. Wax insulation, as used on condensers and other parts, sometimes shows a tendency to soften and run. Tar, asphalt, or pitch used in transformers, and in some types of condensers also softens and runs. Some types of molded insulation become

(Continued on page 34)



Auto-Radio . . .

Crosley Safety-Tune

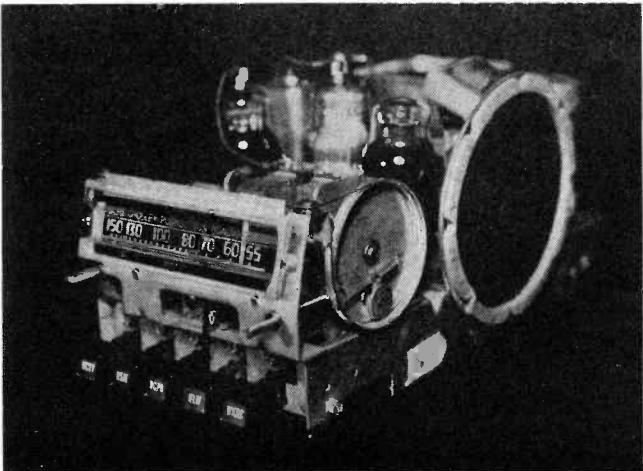
PUSH-BUTTON tuning on an auto set should be looked at as a safety device; as such, it fits into the efforts of governmental agencies and car manufacturers to reduce driving hazards.

There are three methods at present available to obtain push-button tuning, namely, motor drive, capacity switching, and mechanical operation. Each has its devotees and, of course, each possesses its share of disadvantages. The method to be described is that used in the Crosley Safety-Tune Fiver Roamio automobile receiver.

The principle of operation is when a button on the end of a key assembly containing a riveted finger, clamp and setting screw is pressed the finger seats on a rocker arm (finger position determined by setting) on the end of which is staked a gear segment and pulley. The segment meshes and turns a stamped gear on the gang condenser shaft. At the end of stroke the button is released and a spring returns the button to its original position. There are five of these key assemblies in the button box with the rocker arm assembly.

The total pressure required to tune in a station averages $2\frac{1}{4}$ lbs. and never over 3 lbs. The necessary $2\frac{1}{4}$ lbs. pressure for the $\frac{5}{8}$ -inch throw is executed so easily and quickly the change from one station to another appears as instantaneous. The method of setting and locking used permits the setting of any button at any frequency regardless of sequence or proximity. A sheet with complete list of stations is furnished.

Chassis of Crosley Safety-Tune Fiver Roamio auto-radio receiver.



\$\$\$ in auto-radio. Are you getting your share?

The spacing between button centers is $\frac{7}{8}$ incl., assuring ample space for pressing of button by a gloved hand. The buttons and dial are sloping, assuring easy readability. Edge lighting the dial glass enhances beauty and removes all chances of glare. A high degree of accuracy is obtained due to its simplicity. There is no inertia of a motor or time constant of clutches and loads due to remote controls and selector switches to be compensated for.

Manual tuning is accomplished by string drive between manual shaft and pulley on the rocker arm. The shaft of the gang condenser protrudes through its drive gear and a larger pulley is mounted there for a string drive of the dial pointer. The distance of travel of the pointer is governed by the larger pulley's diameter. Part of the dial bracket forms a track upon which the pointer rides. Three small brass pulleys are used as suitable bearings for the pointer drive. It is essential the frictional load be kept to a minimum.

If two buttons are set on the band extremities the angular change of the rocker arm is 60 degrees. The segment to gang drive gear ratio provides the necessary 180-degree rotation for a conventional gang. A small weight is riveted to the large dial drive pulley to serve as a counterbalance. This prevents jarring off a signal while traveling over rough roads or severe bumps. A small hairpin spring provides a constant tension between the double drive gears and the gear segment thus removing all back lash.

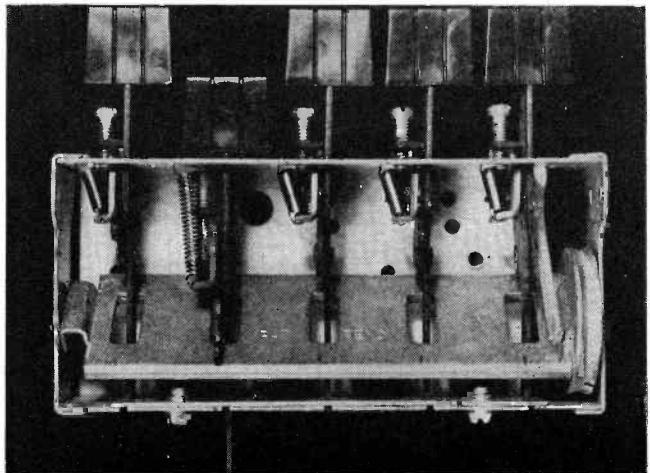
The key finger is riveted to the key

in a manner that leaves the rivet tight to key and the finger is free to swing through a sixty-degree arc to follow the rocker arm. Two ears are stamped out of the key. These are drilled and tapped for the 6-32 setting screw. These ears also provide a support and pivot point for the clamp that locks the finger to the key. It is necessary to have the clamp secure enough to stand sharp sudden taps without slippage, at the same time to assure crawling off the signal does not result while tightening the setting screw. The only actual adjustments used are the gaps in the slots the keys ride through on the box. These adjustments, one to each key on the front of the box, determine the accuracy with which the mechanism will return the gang. These are very simple to adjust. An accuracy of plus or minus one-half kilocycle to plus or minus one kilocycle, can be obtained, depending on the adjustment of the box gap.

The proper procedure in setting a button is to loosen setting screw, tune in the desired station, press button as far as possible and tighten screw firmly. As the average person mistunes a set from one to five kilocycles, depending on the field strength of the station, this surpasses the error of this device.

The manual-tuning drive is coupled to the rocker arm where the power is the greatest. The only additional load is friction and dial pointer which is kept to a minimum. The rocker arm stamping has a heavy reinforcing bar spot welded to it to remove any possibility of twisting and causing an error when

Button box assembly of Crosley Safety-Tune Fiver Roamio auto-radio receiver.

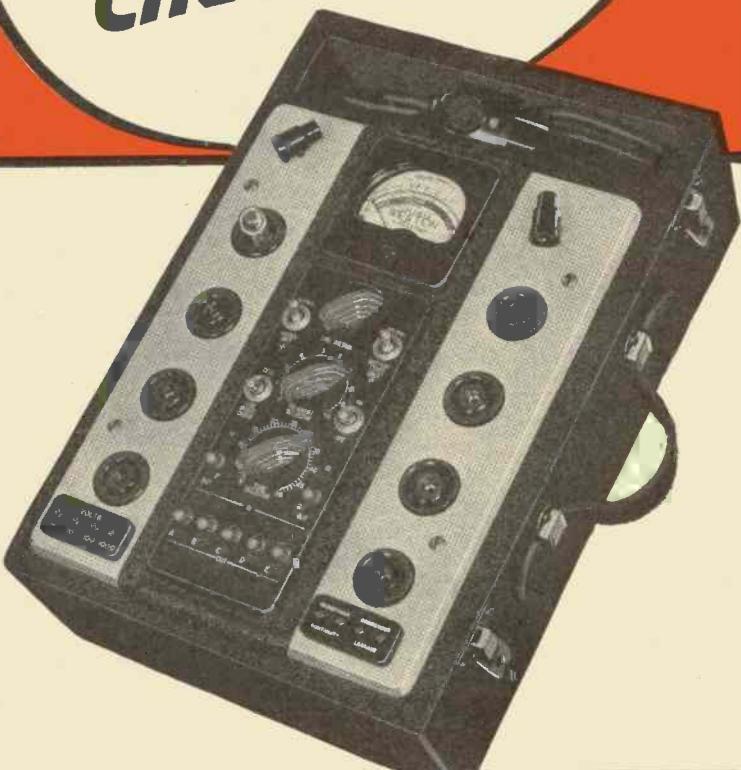




**771 is a compact,
inexpensively priced
WESTON tube-checker
plus continuity tester**

Like servicemen everywhere, you'll find this compact tube-checker, volt-ohmmeter combination the handiest tool in the shop. Its striking appearance makes it ideal for tube-selling in the store. Its voltage and resistance ranges, coupled with its portability, make it ideal for rapid bench testing. And its compactness and light weight make it unequalled for trouble-shooting in the home. Listed below are a few of its outstanding features. But be sure you get *all* the details. Return the coupon today.

Wired for testing latest tubes, and tubes with wandering filaments . . . Neon short check while tubes are hot . . . Cathode leakage test of correct design . . . Individual tests on elements of diodes . . . Voltage ranges for point-to-point testing . . . High and low resistance ranges for continuity testing with built-in filtered power supply . . . Actual condenser leakage measurements—all types of high and low voltage condensers—read in ohms on meter scales . . . Positive line voltage control.



**Model 776
WESTON
Oscillator**

Hand calibrated dial (no trimmers or padders used). Uniform output level regardless of frequency. Constant signal free from drift or shift in frequency. Complete attenuation of signal on all bands. The coupon will bring you full data on Model 776 as well.

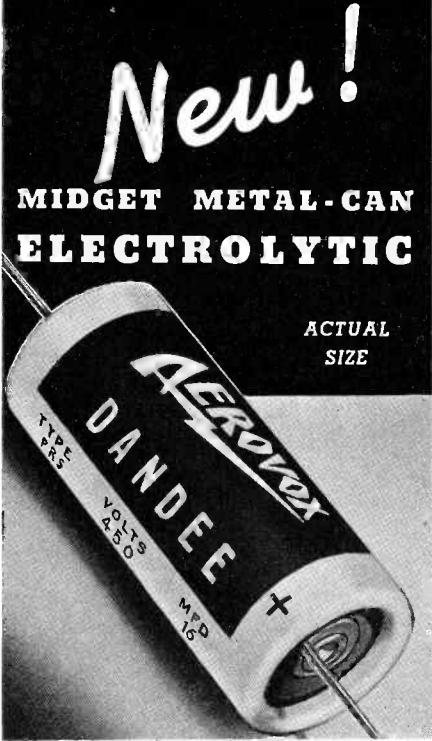
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Radio Instruments**

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- ★ Small—fits anywhere. No larger than usual paper tubular. Yet it packs from 4 to 40 mfd., depending on voltage. 150, 250, 350 and 450 v. d.c. w.
- ★ And it's genuine, full-rated, long-life capacity and D.C. working voltage. Positively no cheating.
- ★ Dry electrolytic section. Hermetically sealed can. Protected and insulated by paper jacket.
- ★ Ends of jacket spun over aluminum can rim. No chance of "shorts" if leads are bent close to can. Jacket can't slip off.
- ★ Polarity-indicating red and black end discs. Corrosion-proof. Thoroughly aged. Individually tested. Yet costs only 40¢ to 90¢ list, depending on capacity and voltage.

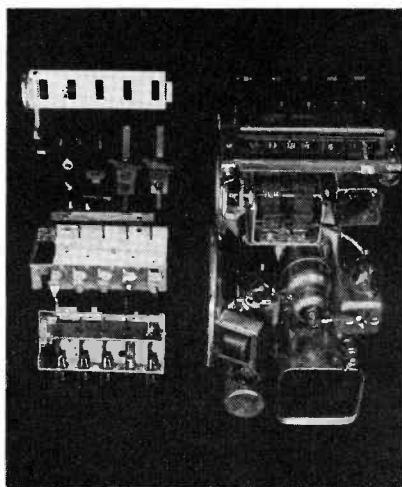
Ask Your Jobber..

- ★ Ask him to show you these DANDEE midget electrolytics. Better still, order an assortment and have them on hand for those midget set jobs.



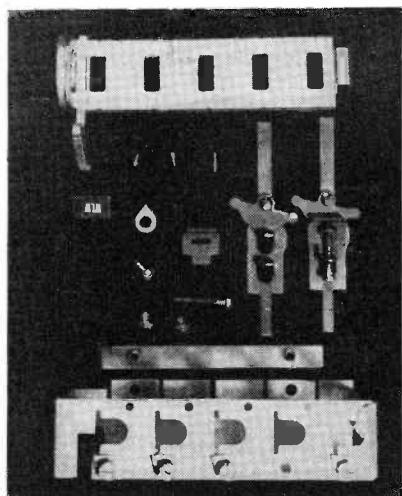
AUTO-RADIO—continued

returning from the opposite directions to the station. A total of seven springs are needed, five alike for the button return, one for manual drive take-up, and one for pointer drive string take-up. The buttons are removable from the keys, being held in place with a flat



Parts and chassis of Crosley Safety-Tune Fiver Roamio auto-radio receiver.

Parts assembly of Crosley Safety-Tune Fiver auto-radio receiver.



spring. They are molded and contain holes for the screwdriver as well as slots in each side for the call letters and celluloid cover to snap into after button is set.

Due to the consistency of the mechanics it is necessary to compensate for the oscillator drift in the receiver. With a properly designed bimetal trimmer shunting the oscillator this drift is reduced to three kilocycles.

Dome Light

Noise: This was noticed particularly in Dodge cars. Trouble can generally be eliminated by a 0.5 mfd condenser.

RCA Service Tip File
(Continued on page 29)

SAY YOU SAW IT IN SERVICE



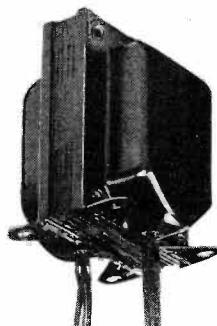
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Goes up in small space—gives world-wide reception. Built of tubular steel telescoping to 6' length. Premax Lock permits erection up to 24'. No guys! No Overhead Wires. Comes complete with 4-section mast, insulator unit and steel ground post. Write today for bulletins and discounts. Lists \$10. Order a sample.

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• SERVICE FOR



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JUNE 8, 9, 10 AND 11, 1938

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• SERVICE FOR

AUTO-RADIO—continued

Philco 928-K

Tubes:

R-f:	78
1st Det:	6A7
Osc:	{ 6A7
I-f:	78
A-v-c:	{ 75
2nd Det:	{ 75
1st A-f:	
Pwr Amp:	41 (2)
Rect:	84
I-f:	260 kc
Speaker:	ElectrodynamiC

ALIGNMENT

Connect an output meter, by means of an adapter, to the plate of one of the 41 output tubes and to the chassis. With the radio and signal generator set up for operation at the prescribed frequency, turn the radio volume control full on and adjust the attenuator of the signal generator to obtain about half-scale reading on the output meter. The shield of the signal generator output lead must be connected to the receiver housing.

With the generator connected to the grid cap of the 6A7 through a 0.1 mfd dummy, set the generator to 260 kc. Adjust trimmers 25, 27, 22 and 24 (i-f transformers) for maximum output.

Change generator connection to antenna receptacle on radio, using a 50 mmf dummy; generator frequency set to 1550 kc. Turn tuning condenser

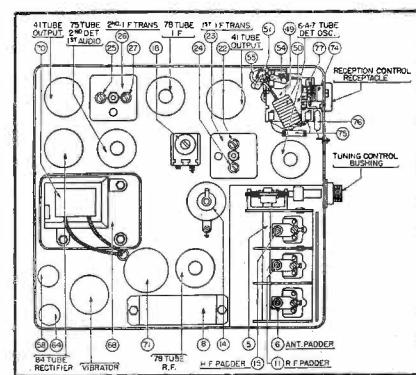


Fig. 1. Schematic diagram, Philco 928-K.

plates entirely out of mesh; adjust trimmers 15, 11, and 6 for maximum output.

Reset signal generator to 580 kc (connections remaining the same) and set tuning condenser to 580 kc. Adjust trimmer 18, while rocking tuning condenser, for maximum output.

Reset generator to 1550 kc; generator connection remaining the same. Turn tuning condenser plates entirely out of mesh, and adjust trimmer 15 for maximum output.

Reset generator to 1,400 kc, connections still remaining the same. Set tuning condenser to 1,400 kc, and adjust trimmers 11 and 6 for maximum output.

When the antenna stage adjustment (trimmer 6) is made with the radio installed in a car, the antenna lead must

be connected to the car antenna in the usual manner. Connect the generator output lead to a wire placed near the car antenna but not connected to it.

Reset signal generator to 600 kc (or, if the set is installed in a car, tune in a weak signal at about 60 on the dial) and adjust antenna compensating trimmer, 3, for maximum output.

Ford Radio

Loud roar: Many Ford auto radios develop a load roar. This may be due to the 84 rectifier. The trouble will generally not show up on tester, but can be checked only by substitution.

RCA Service Tip File

Switch

Intermittent drop in volume: On-off switch may be the source of this trouble. Switch contacts sometimes arc and the consequent oxidation causes a voltage drop across the switch; the drop may be as much as 1½ volts. Obvious remedy is to replace switch.

RCA Service Tip File

Wheels

Noise: Noise originating in the wheels of a car can be reduced by using, or having the car owner use a good grade of graphited grease to repack the wheel bearings.

RCA Service Tip File

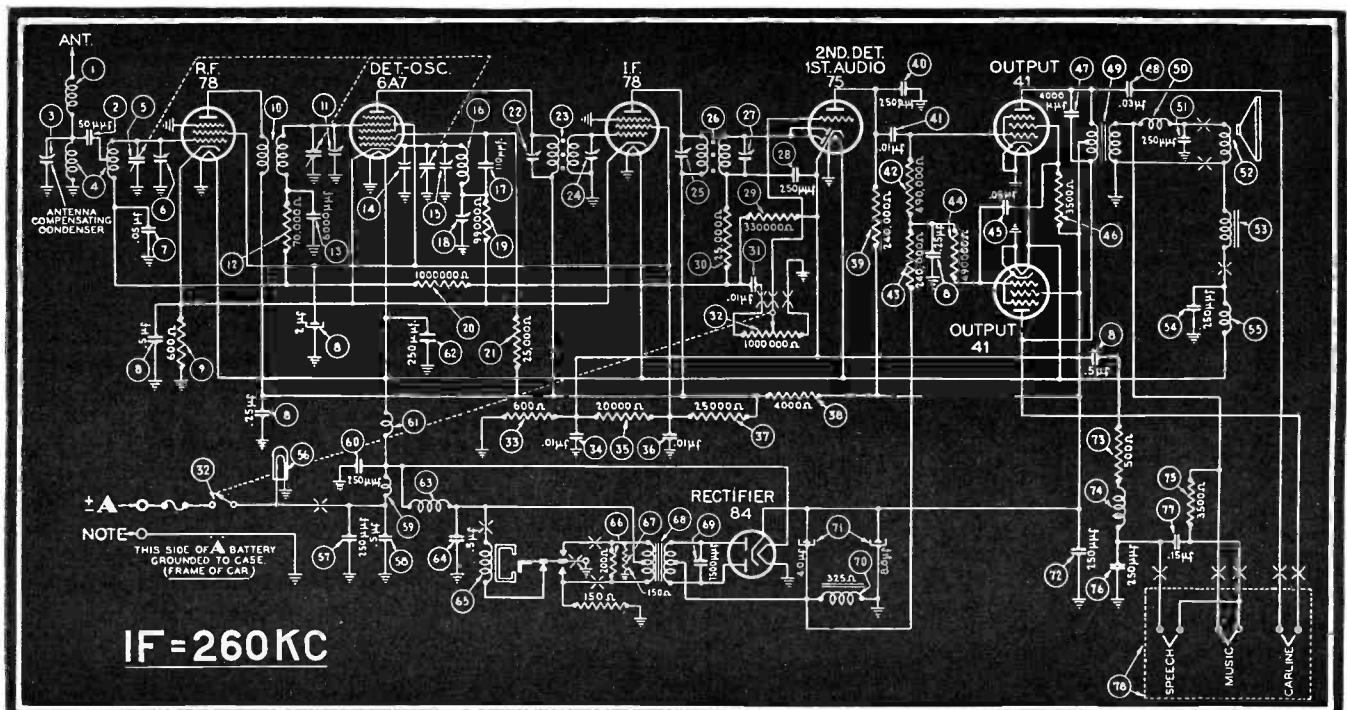


Fig. 2. Top of chassis, Philco 928-K. Trimmer locations may be found on the drawing.

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STURDY BROWN DEVILS

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TEST IT THOROUGHLY!

(Continued from page 8)

cut type is used, as the control is advanced, high frequencies will be eliminated or diminished. If the bass-compensation type is used, as the control is advanced, low frequencies or bass notes will increase in intensity. If a combination control is used both actions will take place, either simultaneously or at different degrees of rotation. All of the types described can be step types or continuously variable controls. To test tone-control action, tune in a station, and, as the tone control is operated listen for the changes described above which pertain to the type control being tested.

Fidelity-Control Operation. A fidelity control is merely a refined tone control. Its operation differs from the conventional tone control in that it generally controls the i-f bandwidth to effect changes in tone. Also, its principal function is to introduce high frequencies by widening the i-f channel. The dial on the cabinet will usually indicate the positions of the control which give various degrees of tone. Test by tuning in a station, and observing whether the indicated changes occur as the control is operated. To perform the test with instruments, an oscilloscope must be used to observe the changes in wave form.

Operation of Resonance Indicator. There are many types of resonance indicator, beams, meters, shadow, eyes, etc. However, with every type the principal of operation is that at resonance a very definite action of some kind will take place, and that action will be present only at resonance. To check for normal operation proceed as follows: learn the normal function of the resonance indicator, then tune in a strong signal and observe whether that function takes place as the signal is tuned to resonance. If the indicator shows resonance before the signal reaches resonance it will not be of any assistance to the person tuning the radio. Indicated resonance and actual signal resonance must occur simultaneously.

Circuit Stability. Sometimes a radio will become inoperative if the line voltage drops below 110 volts, or will oscillate (motorboat) if the voltage exceeds 110 volts. It is suggested that a transformer with a variable output from about 90-130 volts be procured and the set tested at several values of line voltage between these two extremes. Trouble will sometimes show up more readily if, after tuning in a signal, the various controls are manipulated.

Vibrator Noises. Sets powered with

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Positively Checks All Radio Receiving Tubes According to Latest Recommendations of Tube Engineers. Five flush

type sockets provide for all tubes. The tester operation is very simple and indicates condition of the tube for dealer and customer on Direct Reading (GOOD-BAD) colored scale of Triplet instrument. Will also test for inter-element shorts and leakages. Complete in attractive, sturdy, quartered-oak case. Sloping etched panel of silver and black. Suitable for portable or counter use.

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Dealer Price \$15.90

A MODIFIED EMISSION TYPE TESTER
APPROVED CIRCUIT

SAY YOU SAW IT IN SERVICE

vibrator-type "B" supply frequently have a background noise which sounds like a steady crackle or frying. Check for this with antenna removed and volume control set at minimum, half on, and maximum.

Operation of Accessories. There is little specific information which can be given here. The best rule to follow is to determine the purpose of the device, then see whether it performs that function. Information relative to this will generally be found in manufacturers' bulletins, instruction sheets accompanying the radio, your past experience and the pages of radio journals.

CONCLUSION

By this time, the benefits which result from thorough receiver testing should be quite evident, but in order to eliminate any doubt which might exist concerning the time necessary to make a complete receiver test, consider the following:

(1) An average table model set can be tested in less than five minutes.

(2) An average floor model set can be tested in less than ten minutes.

(3) The largest floor model high fidelity set can be completely tested in fifteen minutes.

Customer good-will is by far the most important factor of a successful business. The best way to get, and hold that is by rendering dependable service. Whether the sets you handle are new or serviced, if you are sure the sets you deliver will work, you won't have to worry about call-backs, because they'll be practically nil. It is certainly worth spending 15 minutes test time on every set to prevent hours of profitless servicing time.

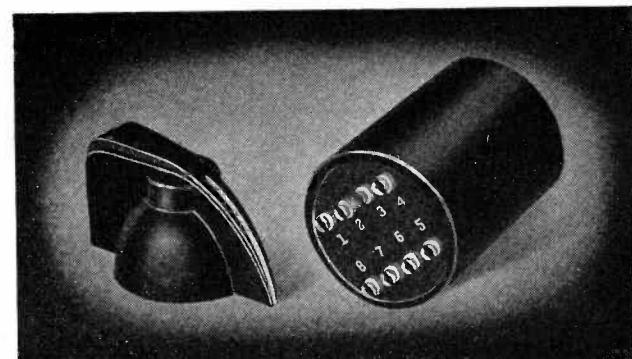


from the LARGEST to the SMALLEST

Typical of the large broadcast equipment manufactured by UTC is the filter choke illustrated on the left, designed for a 100 KW broadcast station and weighing about $3\frac{1}{2}$ ton. This unit is 100,000 times the size of the UTC OUNCERS.

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The OUNCER units have overall dimensions of $\frac{7}{8}$ " diameter by $1\frac{3}{16}$ " height, including lugs. Mounting is effected by two screws opposite the terminal board side.



UTC OUNCER unit compared to smallest bar knob. Illustration, at right, is slightly larger than actual size.

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(Max. Level —5 DB)

Type No.	Application	Pri. Imp.	Sec. Imp.	List Price
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0-2	Mike, pickup, or line to 2 grids	50,200,500	50,000	10.00
0-3	Dynamic mike to 1 grid	7.5/30	50,000	9.00
0-4	Single plate to 1 grid	8,000 to 15,000	60,000	8.00
0-5	Single plate to 1 grid, D.C. in Pri.	8,000 to 15,000	60,000	8.00
0-6	Single plate to 2 grids	8,000 to 15,000	95,000	9.00
0-7	Single plate to 2 grids, D.C. in Pri.	8,000 to 15,000	95,000	9.00
0-8	Single plate to line	8,000 to 15,000	50, 200, 500	10.00
0-9	Single plate to line, D.C. in Pri.	8,000 to 15,000	50, 200, 500	10.00
0-10	Push pull plates to line	8,000 to 15,000 e.s.	50, 200, 500	10.00
0-11	Crystal mike or pickup to line	50,000	50, 200, 500	10.00
0-12	Mixing and matching	50,200	50, 200, 500	9.00
0-13	Reactor, 200 Hys.—no D.C.; 50 Hys.—2 MA. D.C.			7.00

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SAY YOU SAW IT IN SERVICE

closest (in the stem press) to the lead of the trouble-giving element. Generally, it will be found that the hum is due to coupling between a heater terminal and the control-grid terminal. In top-cap tubes, this does not hold true, nor is it likely to be true where the control-grid terminal is shielded (more or less) by reason of being located remotely from the heater terminals; sometimes, the location of the cathode terminal of the tube is such that it shields the control-grid terminal from the heater pins.

Hum from the sources discussed is not particularly noticeable except in high-gain amplifiers; but where it does appear, and especially in the first audio stage, and where the methods described above will not clear the trouble, it may be advantageous to consider the use of special low-hum tubes. These are pentodes (of the 6J7 type) and may be used either as pentodes or, with proper connections and at reduced gain, as triodes. However, it is important that all precautions be taken to prevent the introduction of hum elsewhere in the circuit through faulty layout of parts or heater wiring.

Abstract of RCA Radiotron Application Note, No. 88.

Ford V-8

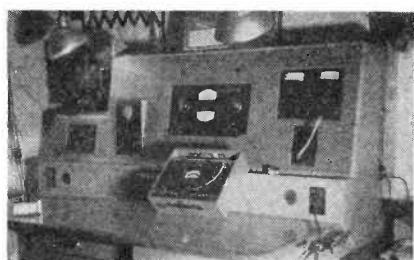
Ignition noise: Stubborn cases of ignition noise in Ford V-8 models can sometimes be cured by taking the two "hot" leads to the distributor and generator and draw them out of the cable in which they are carried. Run them outside the cable, taping them down. These leads are colored red and yellow, and black.

RCA Service Tip File

Tubes

Tight fit: Tight fitting tubes in auto radios may be removed from their sockets conveniently by passing a piece of friction tape around the glass bulb, just below the largest part of the "bulge." Let the ends of the tape overlap, twist the ends together and lift.

RCA Service Tip File



Shop of Cota Radio Service,
Minneapolis, Minn.

• SERVICE FOR

TEST EQUIPMENT—continued

satisfactory for filter service. The power-factor reading for high-voltage wet and etched foil dry electrolytics may for that matter be appreciable without inferring inferior functional value. Be that as it may, it becomes wise policy to select and use for service condensers which indicate minimum percentage power factor when under test, as their

Power Factor Per Cent	Filtering Efficiency
5	0.999
10	0.995
15	0.989
20	0.980
25	0.968
30	0.955
35	0.935
40	0.915
45	0.895
50	0.867
60	0.800
70	0.715
80	0.600
90	0.436
100	0.000

Fig. 6. Filtering efficiency of condenser with various power factors.

filtering efficiency is related to that percentage as well as to capacity.

In some instances the power-factor reading should not be greater than 10 percent; where the electrolytic under test is to be used both as r-f bypass and filter condenser, minimum percentage becomes desirable to prevent r-f oscillation. (Some receivers have separate tuner and power supply chassis, cable-connected; and electrolytics are employed at the tuner at points of both high voltage and screen supply for r-f bypass.)

Engineering Dept.
SOLAR MFG. CORP.

The Test Bench

UNFORTUNATELY, not many Service Men have the facilities of a big research laboratory available, but this need not deter anyone from borrowing some pointers on how best to arrange the test and work bench in the service shop.

First, of course, is a source of power. Here is one of the ways that the big laboratories shine—they usually have everything—ac and dc, 1,000 cycles and perhaps rf, low and high voltages—wired to their work positions. The point for the Service Man to copy is that of positioning the outlets so that it is not necessary to string cables all over the bench top in order to connect the equipment under test to the power sup-

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ply. The best location of the power outlets seems to be on the "apron" of the bench; if the bench does not have an "apron," outlet boxes can be affixed to the underside of the front edge of the bench.

It may be a good idea to use the polarized type of outlets, with polarized plugs on connecting cables. In this way, one can always be certain—provided the outlets are all wired correctly—of which is the grounded side of the power line. Also, make sure that the ground is actually carried through to the outlet box. BX leaves much to be desired, from a standpoint of providing a good ground, so try running a separate ground lead

of heavy copper wire.

Tubes used for test purposes can be kept conveniently in a series of clamps arranged along the back of the bench; or, a wooden strip, drilled to accommodate the tube bases, can be fastened at some other convenient—but not convenient to the reach of a snipped soldering iron or carelessly dropped tools—point near to the bench.

The old rule—"A place for everything, and everything in its place"—while it may seem trite, if adhered to will assist materially in turning out work promptly. Tools and working conditions don't make the workman, but they make his work easier!

SOUND SERVICE—continued

brittle and crack. Electrolytic condensers, both the wet and the so-called dry types, tend to dry out to the point where they may become useless or break down.

The vital damage resulting from such changes is not so much injury to the physical apparatus (which can always be repaired or replaced) as the likelihood that these conditions will at some time interrupt a commercial activity depending on sound equipment. Such interruption may easily cost the user far more than the price of a complete sound system. Typical cases are a restaurant or dance hall on a holiday night, a fair or carnival relying on sound to attract its customers, or a theatre compelled to issue refunds because the show can't go on.

Line voltage irregularities as extensive as those previously mentioned are not uncommon in some communities. They are often unsuspected, inasmuch as lamp bulbs and other domestic equipment, including the average radio set which uses relatively low plate potentials, give no definite indication that this type of line trouble is present. Phonograph motors of the non-synchronous type, as used in many sound or p-a systems, will often show up poor line regulation by departing from proper running speed after they have been adjusted (another way in which faulty power supply impairs sound operations). A-c voltmeter readings taken at random, however, are often unrevealing unless they happen to be made at definite times of the day and evening as indicated below. Most power companies will install a recording voltmeter on request, leaving it connected on the subscriber's premises for as long as a week.

These conditions may be particularly prevalent in industrial communities where factories use a great deal of power; in resort communities, where the decreased demand during certain portions of the year presents an economic objection to installing enough generating equipment to take care of peak loads; in market and shopping communities, especially on pay nights, where street and store illumination impose a strong strain on the power system, and, in general, in any location where electric power demands are even moderately irregular.

Irregularity of power demand almost always means that the generating station is unable to provide full voltage during peak hours. In preparation for

such peaks, output is increased, and the line is likely to read high just before the rush demand appears, low during its course, and high again for a considerable time after it subsides.

It is always a good plan, in installing a sound system of appreciable size and cost, to mention the complications that may be introduced by line fluctuation, and to arrange for the temporary presence of a recording voltmeter, which usually costs nothing. The readings of that voltmeter will very often persuade the sound user to buy an additional item of equipment in the form of a voltage regulator, for the protection not only of his apparatus, but also of sound quality and uninterrupted performance.

Such controls are of several types, of



An open-frame model of the regulator.

which four may be mentioned here. One obvious procedure is to use a series resistor or rheostat. Use of inductances in series with the power line is today practically confined to generating stations. The principle of the saturated core reactor has found some favor in industrial applications, but has a somewhat limited range.

The principle of the tapped transformer remains, so far as sound systems are concerned, both practical and economical. An auto-transformer further combines these advantages with a high degree of flexibility in use. In the model illustrated herewith, "stepless" control is provided by dispensing with taps, and arranging a carbon contact which slides over the transformer wire itself, never making contact with less than one turn. A continuously variable adjustment is thus available, and one that will produce exact compensation for any line voltage encountered, whether low or high.

These voltage controls are available in a number of sizes, from 570 to 2,000 va, covering the complete range needed

for all except the largest and most elaborate sound systems. Moreover, their physical construction is such that two or more can readily be ganged; therefore it is never necessary to install an oversize regulator to provide against future growth of the sound installation. A second unit can always be ganged in if the sound system is subsequently enlarged.

In planning for inclusion of voltage controls in any sound installation, it is necessary to figure not only the power requirements of the amplifier, but those of the loudspeakers and of the phonograph motors if any. As stated, phonograph motors of the common type tend to change speed with line variation, and loudspeakers may either lose efficiency or distort as line voltage goes up and down. When all power requirements are known, it is still desirable to check up on the extent of line irregularity that may have to be overcome. This, as has been explained, can usually be arranged for without cost and should in general be rechecked for each new installation. Distribution line loading and equipment will give different results in different locations of a community supplied by the same common generator. Rechecking line conditions for each new installation also serves another useful function in that, as already indicated, the graphs obtained are very helpful in persuading the user to bear the small additional cost of line protection.

John Peterson
UNITED TRANSFORMER CORP.

Parallel Resistances

THE USUALLY given expression for determining the total resistance of a parallel combination is often awkward to handle.

Instead of $1/R = 1/R_1 + 1/R_2 + 1/R_3$, try it this way: Total resistance of two resistors in parallel is equal to R_1 times R_2 divided by $R_1 + R_2$. For example, if a four ohm resistance is paralleled by a six ohm, the resulting capacity is given by, 4×6 divided by $4+6$, or $24/10=2.4$.

Where there are more than two resistors in parallel, handle it this way: assume we have four ohms, six ohms and eight ohms, all in parallel. Solve for the resultant of the first two (four and six ohms). The answer is 2.4 ohms. Now apply the same method to find the result of paralleling 2.4 ohms and 8 ohms. The answer is 1.85 ohms.

Visit the National Radio Parts Show in Chicago, June 8-11.

AMPLIFIERS

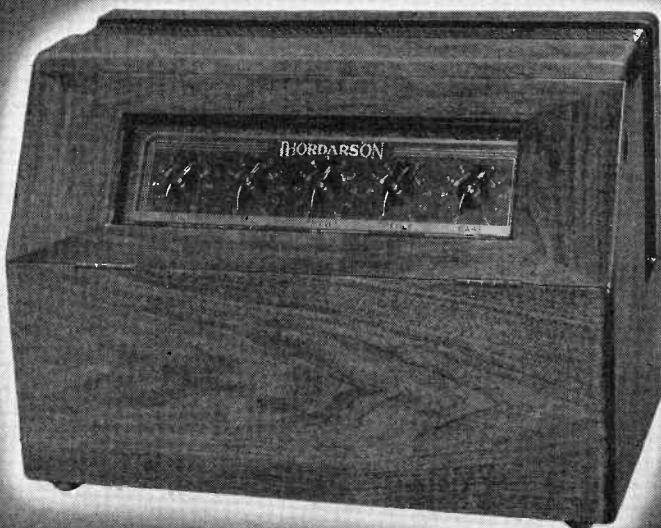
By THORDARSON

Built by Audio Experts for Audio Experts

The Amplifier
of "Tomorrow"
in

- PERFORMANCE
- APPEARANCE

See Your Jobber or
Write Factory for
Catalog No. 600-C



THORDARSON ELECTRIC MFG. CO.
Amplifier Division
500 W. HURON ST. CHICAGO, ILL.

ARE YOU MAN OR OSTRICH?

Why kid yourself, Mr. Serviceman? You can try to "get by" simply by "burying your head" in the ground like an ostrich—but it gets you nowhere fast, and leaves you there!

★ There's so much happening these days that vitally concerns you and the service business that you just can't afford to "go it" alone. You've got to see, hear and know "what's what"—you've got to be "in the swim." ★ That's why the RSA was organized—that's why your place is right in with your fellow-servicemen in this rapidly growing servicemen's organization. It's as important to you as your business or your job!

What is the RSA? What is its Purpose?

What will it do for you?

The Radio Servicemen of America, Inc., is independent, democratic, self-governing—organized to foster greater cooperation and better understanding between radio servicemen all over the country—and to help you do a better, more profitable servicing job. ★ RSA gives its members: ★ Free, expert technical information. ★ Regular mailings of advance information on new circuits. ★ A monthly house organ, exclusively for members. ★ An educational program in the interest of better servicing. ★ A publicity program in newspapers, trade publications, and on the air. ★ A National Speakers' Bureau to provide authoritative speakers for local chapters. National membership costs only \$2.00 A YEAR . . . that's only 4c a week, or less than a penny a day! ★ Are you Man or Ostrich? Don't dodge the issue. Just pin a \$2.00 bill or your check to the application below and drop it in the mail now!

SPONSORED BY RMA AND SALES MANAGERS CLUBS

RADIO SERVICEMEN OF AMERICA, Inc.

JOE MARTY, JR., Executive Secretary

★ INCORPORATED
NOT FOR PROFIT

304 South Dearborn St., Chicago, Ill.

304 South Dearborn St., Chicago, Ill.

Gentlemen: I hereby make application for membership in the RADIO SERVICEMEN OF AMERICA, INC.

Affiliated with Local Chapter in.....
Personal Name.....
Home Address.....
City..... State.....
Firm Name.....
Address
Years' Experience..... Age

Membership in other Associations.....
Whole or part time Radio Serviceman.....
If part time, what portion is devoted to Radio
Servicing (1/4, 1/2, 3/4, etc.).....
What are your other duties.....

It is my sincere desire to become a member and adhere to your principles of fair competition and ethics and if accepted do solemnly swear (or affirm) that I will faithfully fulfill my obligation as a member of the Radio Servicemen of America, Inc.

Signed Applicant

Approved: Chapter Secretary.....

Executive Secretary.....

Enclosed Check M. O. Cash

ASSOCIATION NEWS . . .

RSA

RSA reports the election of Directors for the Board of Directors as follows:

Second district: L. G. Dearing, 1116 N. Walker, Oklahoma City, Oklahoma.

Fourth district: T. P. Robinson, 2712 N. Henderson Avenue, Dallas, Texas.

Fifth District: E. H. Bertelsen, 2344 Thirty-eighth Street, Rock Island, Illinois.

Seventh district: Howard S. Watts, 918 E. Sixth Street, Duluth, Minnesota.

Eighth district: Lee Taylor, 1352 Calatpa, Chicago, Illinois.

Ninth district: Joseph A. Cole, 13065 Camden Avenue, Detroit, Michigan.

Tenth district: Donald H. Stover, 9 S. Galena Avenue, Freeport, Illinois.

Twelfth district: Albert J. Theriault, 2712 W. Twenty-fifth Avenue, Cleveland, Ohio.

Thirteenth district: Gerard G. Larkin, 1375 Pennsylvania Avenue, S. E. Washington, D. C.

Fifteenth district: Carl A. Rauber, Somerville, New Jersey.

Sixteenth district: Kenneth A. Vaughan, 312 Market Street, Johnstown, Pennsylvania.

Seventeenth district: George A. Duvall, 8005 Third Avenue, Brooklyn, N. Y.

Eighteenth district: Henry M. Lutters, 758 E. 230 Street, Bronx, N. Y.

Nineteenth district: John T. Rose, 5 S. Duane Avenue, Endicott, N. Y.
(Twentieth district report missing—Editor.)

RSA reports that the membership has tripled in the last ninety days. Four new chapters have affiliated making the total chapters now operating twenty-seven. Applications are on file from ten more local associations located in every section of the country.

We are in the process of mailing free of charge to all of our members the second of a series of advance technical information. The first issue of our house organ "The Radio Serviceman" was mailed to our members in February and the second mail is going forward in the next few days.

Important Notice: At the meeting of the New York Metropolitan Chapter scheduled for Monday, May 9, at the Hotel Victoria, there will be a talk by A. E. Rhine on the subject "The Actual Cost of Doing Business." The importance of this subject, about which so little seems to be known, warrants an extra effort on the part of everyone to be there. It will be advisable to come prepared with pencil and paper to take notes for future use.

Mr. Rhine, the speaker, is well known in metropolitan service activities; he heads his own service organization.

New Hampshire Chapter

The members of the New Hampshire Chapter met at a dinner on March 1st in Hudson and elected the following officers: Chairman, George J. Craig; Vice Chairman Ray Gallagher; Secretary, Ray Rogers; and Treasurer, George P. LeFebvre.

The next meeting was held on March 22 at which time Mr. Connor of the Sylvania Tube Company gave a very interesting lecture.

Our constitution has been made up in

ASSOCIATION SECRETARIES

All news items and publicity for the June issue should be in our hands not later than May 20. Material for issues other than June should reach us about the 28th of each month preceding date of issue.

It will be appreciated if you will send us two copies of all printed bulletins, organization magazines, etc.

Thank you.—THE EDITORS.

mimeographed form so that all of our members as well as prospective members may have a copy.

Whaling City Chapter

One of the newest local organizations to join the RSA is the Whaling City Chapter located in New Bedford, Mass. The following officers were elected to guide the chapter for the year: President, Fred Fiske; Vice President, J. A. Sumner; Secretary, James L. Shepley; and Treasurer, Walter England.

Regular meetings are held by the Whaling City Chapter on the third Wednesday of every month in the Labor Temple at New Bedford.

Boston Chapter

The Boston Chapter members were guests at a lecture held in The Norfolk House Centre on March 21 at which time Mr. Connor of the Sylvania Tube Corporation spoke.

The Boston Chapter is slowly but surely correcting many of the evils of the service industry which have been prevalent in the Boston area.

The RTG of Boston, under the leadership of A. C. W. Saunders has just opened its new headquarters for the purpose of embarking on a program of higher education in the Sciences of Radio Phenomena. Mr. Saunders is Vice President of the RSA.

Cleveland Chapter

The star reporter of the Cleveland Chapter, Neal Bear, has succumbed to the urge of spring and gotten himself a job on the road. Therefore, the deemed reporter, L. Vangunten, otherwise known as the Official Observer of the Cleveland Chapter, reports that the first meeting held in March consisted of a full display of new Hickok test equipment at which time the lecturer went thoroughly in the how and why of the operation of such equipment.

Chicago Chapter

The first March meeting was held early in that month at which time the guest speaker was Paul Jackson of the Jackson Electrical Instruments Company. A total of more than 400 members and guests were present and it was necessary to turn away a number of servicemen who came late. The cooperative advertising program of the Chicago Chapter was discussed at this meeting and a large number of members signed up to participate.

At the meeting held March 14, the RMA

Service Section conducted an open forum on the best type of service notes for use by servicemen. After this discussion, the meeting was turned over to Mr. Bennett of the Howard Radio Company, who very thoroughly covered the remote tuning chassis manufactured by his company.

The feature of the March 21st meeting was a discussion of Radio Service Business Methods by L. F. Muter, Sid Shure, and J. J. Kahn. Further details of the cooperative advertising program were announced and additional members signed up to participate.

March meetings will close with a talk by Ralph Hill of the Ohmite Mfg. Co. on selling service, and a talk on advertising in the radio service business by Ralph Glover of Shure Brothers. Final details will be available on the cooperative advertising program.

The Chicago Chapter has now some real tangible property in the form of a new printing press, and are we getting on in true Gutenberg style. Proofreader Ray Mason and journeyman-typesetter Stan Gazinski (he journeys from Milwaukee Avenue to Touhy Avenue; for every print job) are turning out some swell work. Even two-color jobs have become an accepted standard. There is every prospect the investment will prove to be profitable both to chapter and members alike. The successors to Gutenberg are now printing all our meeting notices, chapter stationery, business cards, imprints, etc. Just give the boys a chance, they'll show you.

Our Chapter library, which is always at the disposal of every member and also serves as a source of information to the national office, stands a good chance to become more complete than ever. Chapter efforts to solve the problem of tracing information on private brand sets are showing results. We sought and received pledges of cooperation from most manufacturers to help us identify those semi-orphans. Judging by the progress made we should be in possession of most of the data for tabulation within a comparatively short time; and won't that be a good remedy for many a headache.

Activities of the pioneer group in Chicago are at fever pitch to put over an "Old Set Repair Week." If the broadcasters come through with the promised support success is assured. If they do, we'll start April 18th. Our success will mean national success. So wish us luck.

Interstate Chapter

The Interstate Chapter met on March 15th at the Midwest Timmerman building and the business part of the meeting was opened by a discussion on the formulation of a list of slow-pay customers which could be operated as a credit information bureau for the benefit of all the members. The motion adopted, such a list was carried over until a following meeting in order that more discussion may be had. The speaker of the evening was Mr. Mohaupt of the Radio Training Association of Chicago. He covered in great detail and with utmost clarity the subject of Cathode Ray Oscilloscope for use in service work. Joe Marty, Jr., Executive Secretary of the RSA was present and was called upon for

(Continued on page 47)

sell
collect
then pay

That's how the Tung-Sol Consignment Plan works for dealers who can qualify. Yes, Tung-Sol, without any premium for financing, places a stock of tubes in the dealer's care...the dealer sells them...deducts his profit...and pays once a month for those sold. A simple, clean-cut plan that assures full profit from every tube sale. Capital usually tied up in tubes is released for other profitable investment;—and the dealer is protected from losses due to slow turnover—reduction in price, obsolescence and cut-price competition. The best quality tubes, backed by a sound merchandising policy—a combination that will put your tube department on a money-making basis.

If, as a reputable dealer, you are interested in increasing your tube profits you'll undoubtedly want complete details—Write our sales office nearest you.



Dept. D

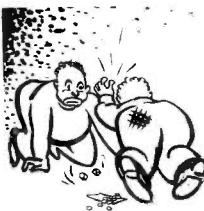
TUNG-SOL

Tone flow Radio Tubes

TUNG-SOL LAMP WORKS, INC.

Radio Tube Division

SALES OFFICES: ATLANTA • BOSTON • CHICAGO • DALLAS
 KANSAS CITY • LOS ANGELES • DETROIT • NEW YORK
 GENERAL OFFICES, NEWARK, N.J.



YOU ARE NOT GAMBLING WITH
UTAH!
EXCLUSIVE DESIGN
VIBRATORS!

HERE'S WHY!

First ... They're the Toughest Ever Built!

We give vibrators terrible abuse in our laboratories—then build UTAH's so they can take it! UTAH research is responsible for practically every major improvement in vibrator design. And the 1938 UTAH vibrator, with exclusive patented features, is the finest and toughest ever made. UTAH vibrators can really "take it," and they give greater efficiency besides. Be sure you use UTAH's on your next job.

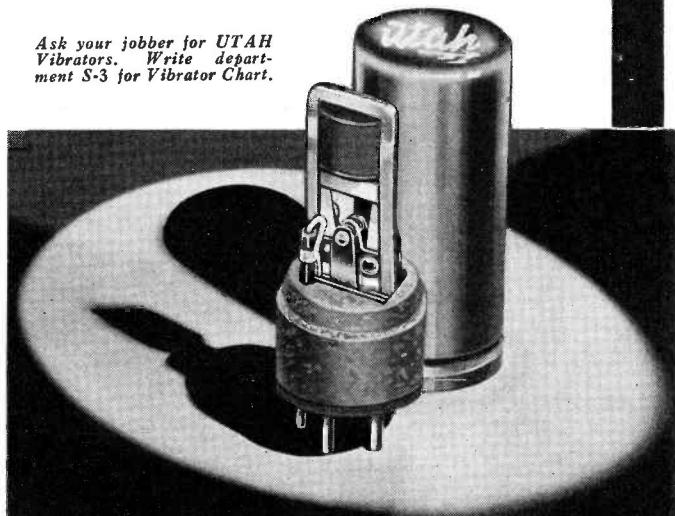
Second ... UTAH VIBRATORS ARE PRICED RIGHT!

Even though UTAH vibrators work better, and last longer, they cost no more. They have earned such popularity through outstanding performance, that quantity production absorbs the cost of their extra features. You get most for your money when you buy UTAH's.

And

Because just a few types are needed to service all radios, your jobber has a complete stock. That makes it easy for you to service ANY radio.

Ask your jobber for UTAH Vibrators. Write department S-3 for Vibrator Chart.

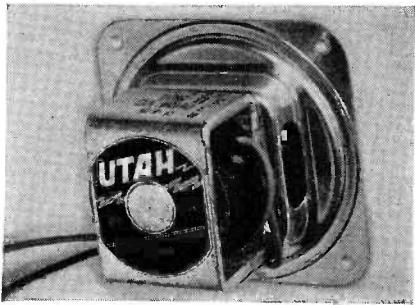


UTAH RADIO PRODUCTS CO.
 CHICAGO, U.S.A.

BUENOS AIRES—UCOA RADIO PRODUCTS CO.

"16 YEARS OF LEADERSHIP"

THE MANUFACTURERS . . .



UTAH ANNOUNCES TWO SPEAKERS

Two 3½" speakers have been announced by Utah, one p-m dynamic and one electrodynamic. Utah claims vast improvement in the performance of these small speakers; among them are the proportioning of the generated harmonics in the cone surface to enable these small speakers to produce exceptional tone quality.

Stocks of these two new speakers are now in the hands of distributors. Models will be exhibited in the Radio Show, June 8th to 11th in the Utah headquarters, Room 561, Stevens Hotel and in the Utah Booths 113 and 115, Marconi Boulevard, Radio Parts City, Stevens Hotel, Chicago.—SERVICE.

CLARION "UNIFIED" SOUND SYSTEMS

The Transformer Corporation of America, through its newly established organization, the Clarion Institute of Sound Engineers, announces a complete new line of "unified" sound systems at low prices.

Systems feature facilities with sales appeal. Beam power tubes, dual stage reverse feed-back, luminous "glo-dials," multi-impedance output transformers and dual line voltage inputs are only a few of the advantages offered by Clarion.

The new systems are available only through C.I.S.E. factory authorized agents. Complete catalog and other information may be had by writing to the Clarion Institute of Sound Engineers, 69 Wooster Street, New York, N. Y.—SERVICE.

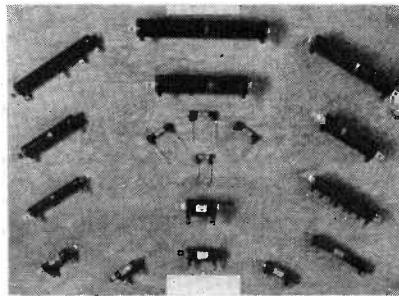


HICKOK MUTUAL CONDUCTANCE TESTERS

The Hickok Electrical Instrument Co., Cleveland, Ohio, announces a new series of their patented Dynamic Mutual Conductance Tube Testers with new Hickok Square Meters having translucent, illuminated meter dials.

Hickok Mutual Conductance Tube Testers are the only dual reading units made—with indication of D M C in Micromhos and also as "Good, Bad, Doubtful." Just one setting to make. Easy to operate and to understand. No complications and no customer confusion.

Important features are said to be:—Sufficient plate current to accurately check both emission and mutual conductance; checks gas content; detects both short and open elements and open suppressor grid; short tests made hot or cold.—SERVICE.



LECTROHM WIRE-WOUND RESISTORS

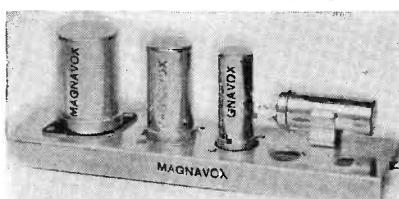
The resistors illustrated herewith are representative of a complete line of wire-wound vitreous enamel units, with ratings of from 5 to 200 watts, being furnished by Lectrohm, Inc., 5133 W. 25th Place, Cicero, Ill. These units can be obtained in either fixed, tapped, or adjustable types with choice of pig-tail or soldering-lug terminals.—SERVICE.

ALADDIN PUSH-BUTTON TUNER

Aladdin Radio Industries, Inc., 466 W. Superior St., Chicago, Ill., have just announced the PBH tuner, an automatic device designed for superheterodyne receivers with 456 to 465 kc intermediate frequencies. The unit consists of two circuits, antenna and oscillator. Six buttons are provided.—SERVICE.

MAGNAVOX ELECTROLYTIC CONDENSERS

A series of electrolytic capacitors, known as the Molanode, has been announced by the Magnavox Co., Fort Wayne, Ind. Simplicity in mounting, low cost, and standard ratings are among the features claimed for these condensers. According to the company, these condensers are the culmination of several years of intensive development.—SERVICE.



AEROVox TINY METAL-CAN ELECTROLYTICS

A new metal-can electrolytic with insulating jacket and of compact dimensions is announced by Aerovox Corporation, 70 Washington St., Brooklyn, N. Y.

The Dandee condenser is available in capacities of 4, 8, 12, 16, 24, 30 and 40 mfd, and in working volatages of 100, 250, 350 and 450.

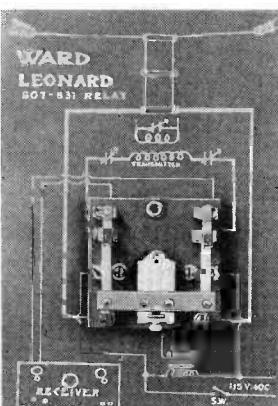
Despite its diminutive size, the Dandee is said to be a full-fledged metal-can hermetically-sealed electrolytic, electrically and mechanically protected by a strong paper jacket. The 3½" tinned pigtail leads provide for connections and support the unit. The edges of the protective tubing are spun over the edges of the metal can so that the leads, even when bent at right angles close to the unit, cannot short. Polarity is clearly indicated by the red sealing disk at one end and black at the other.—SERVICE.

AVNET COWL AERIALS

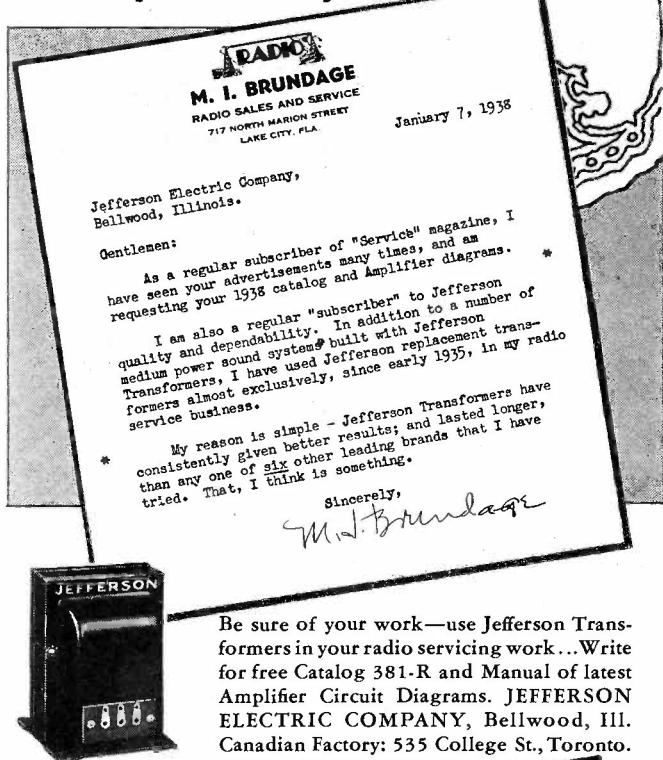
Available in models which incorporate both aerial and parking light, as well as in more conventional models are the aerials announced recently by the Chas. Avnet Co., 156 Chambers Street, New York City.—SERVICE.

WARD LEONARD COUNTER DISPLAY

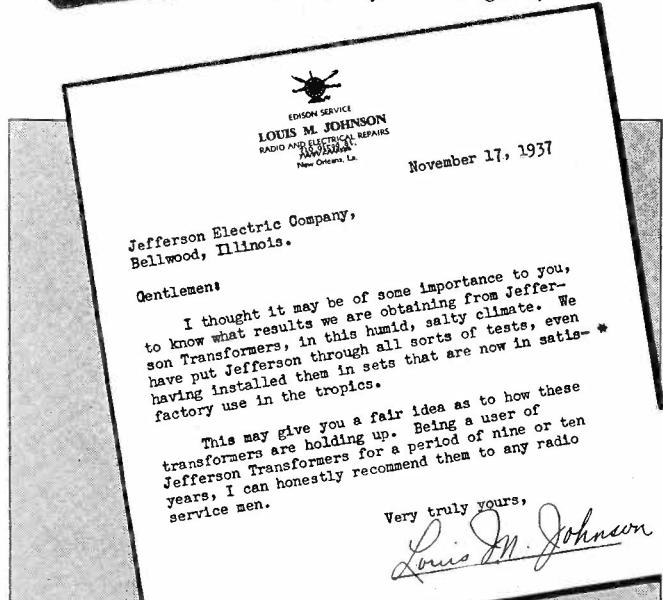
A display unit for the Ward Leonard 507-531 antenna changeover relay has been made available to jobbers and dealers by the company.—SERVICE.



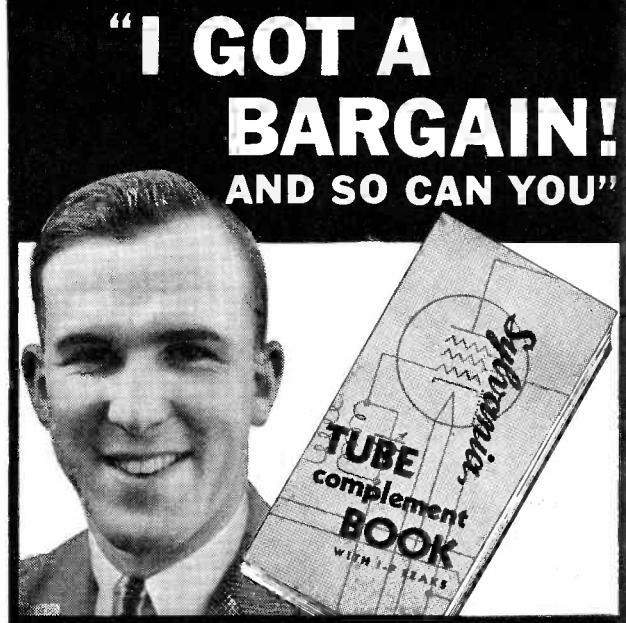
**A Subscriber
of Service
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subscribes to
JEFFERSON Quality
and Dependability**



Be sure of your work—use Jefferson Transformers in your radio servicing work... Write for free Catalog 381-R and Manual of latest Amplifier Circuit Diagrams. JEFFERSON ELECTRIC COMPANY, Bellwood, Ill. Canadian Factory: 535 College St., Toronto.



**JEFFERSON
RADIO
TRANSFORMERS**



"I invested 25c in the new Sylvania Tube Complement Book . . . and already it has paid for itself many times over. I'll say I got a bargain!"

ONE item alone—a tube complement listing for 10,386 different radio models—will save you lots of valuable time and gasoline when you're out servicing sets.

But look at these additional features the Sylvania Tube Complement Book gives you:

1. Most complete compilation of i-f peaks available today.
2. Helpful articles on tube selling, etc.
3. Names and addresses of all active radio receiver manufacturers.

It's 200 pages long . . . it's crammed full of valuable servicing information . . . and it's built just right for your service kit! Tear out the coupon—send it today for YOUR copy of the Sylvania Tube Complement Book. Or see your jobber.

Hygrade Sylvania Corp. also manufactures the famous Hygrade Lamp Bulbs.

SYLVANIA
Set-Tested Radio Tubes

HYGRADE SYLVANIA CORP.
Emporium, Pa.

S-48

Enclosed please find 25c. Send me my copy of your new Tube Complement Book right away.

Name

Address

City State.....

Dealer Service Man
 Amateur Experimenter

Name of Jobber.....

MADE BY
Engineers FOR Engineers



Antenna systems, P.A. cables, hook-up wires bearing the nationally identified CORWICO diamond trademark are produced in an adequately equipped plant to do their job 100 per cent. The illustrious NOISE-MASTER all-wave antenna illustrated above, licensed by A.A.K., is warranted to eliminate man-made static on broadcast as well as shortwave lengths . . . and to improve reception in any locality.

Write for complete information regarding this and other CORWICO products, made by engineers for engineers.

CORNISH WIRE CO., Inc.
30 Church St., New York City



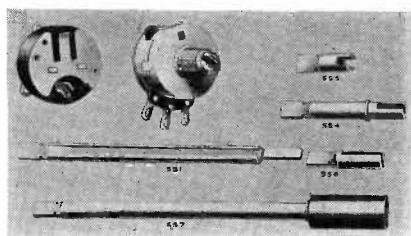
RADIO-WIRE
products

The Replacement Parts Market Is Thriving . . .

Distributors of Parts and Accessories and the Servicing Trade of the country are doing business, plenty of it.

Get your share by advertising in May SERVICE. Forms close the fifth.

MANUFACTURERS—continued



MALLORY-YAXLEY CONTROLS

Mallory-Yaxley announces a new line of Midget Volume Controls—plain, single tap, double tap and duals—available in resistance values from 5,000 ohms to 3 megohms inclusive and in all necessary tapers.

They are said to have flexibility, adaptability, universality, and attachable switches where necessary. A new feature of this new development is a line of 17 plug-in shafts, which give the 56 controls a range of over 1,000 replacements! A special or exact replacement is made by merely plugging in the required type of shaft. A small stock of the new controls and shafts assures the Service Man of a replacement for almost any midget—and for a few of the old large style controls (where little or no current is to be carried by the control).

Complete information is available from any Mallory-Yaxley Distributor.—SERVICE.

NEW MODEL ANNOUNCED BY VOCAGRAPH

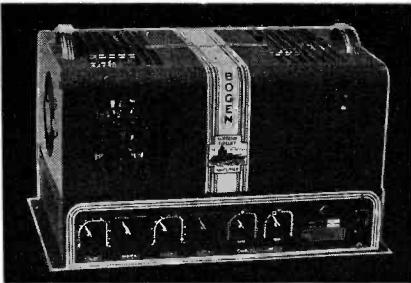
To meet the rapidly increasing demand for high power sound equipment operating from both 6-volt battery and 110-volt line, Vocagraph Sound Systems, 164 N. May St., Chicago, Ill., has just announced their Model 30-M30 mobile amplifier.

Although primarily designed for highest



possible power from storage battery power, the use of beam power output tubes makes possible the same quality of reproduction that is to be secured from a good power line operated sound system.

Added convenience of operation is secured through the use of a built-in a-c power pack, eliminating the necessity of any external units. Instantaneous change-over from a-c to d-c operation is made by the flip of a single switch.—SERVICE.

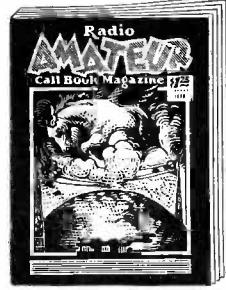
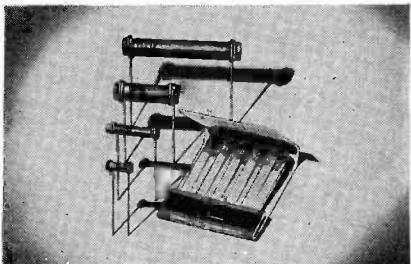


BOGEN AMPLIFIER

An 18-watt amplifier with two input channels for microphones and two for phonograph has been announced by David Bogen Co., 663 Broadway, New York City. The amplifier also incorporates electronic bass and treble tone control. The output transformer is tapped. Further details are available from the manufacturer.—SERVICE.

CENTRALAB CERAMIC CONDENSERS

Centralab, 900 E. Keefe Ave., Milwaukee, Wis., has introduced a line of ceramic condensers said to have exceptionally favorable temperature-capacity characteristics. Capacities range from 10 to 1000 mmf, depending upon the physical size of the unit.—SERVICE.



SERVICEMEN

who are

RADIO AMATEURS

buy a fresh copy today of the

RADIO AMATEUR CALL BOOK

The CALLBOOK is the only publication that lists all licensed radio amateurs in the United States and over a hundred and seventy-five different foreign countries.

Each issue also contains a world map showing amateur prefixes, press time and weather schedules, amateur prefixes listed alphabetically and by countries and a world time conversion chart.

Complete . . . Accurate . . . Up-to-Date

Issued Quarterly

MARCH . . . JUNE . . . SEPTEMBER
and DECEMBER

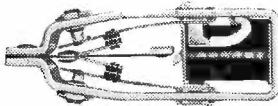
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Radio Amateur Call Book, Inc.
608 S. Dearborn St., Chicago, Ill., U. S. A.

NOW!

ADJUSTABLE— SERVICEABLE— AUTO-RADIO VIBRATOR



JAMES VIBRAPOWR

Never before could you sell auto radio owners a vibrator which does not have to be discarded. James Vibrapowr Units can be serviced—put in first class condition and your profit for this service is nearly equal to the profit you make on the sale of the original unit. Furthermore, James Vibrapowr Units are a quality product and have more genuine selling features than any other vibrator.

PRICE . . .

LIST \$2.95—Types for 80% of all receivers now available. Attractive discounts to Jobbers and Dealers. Write at once for literature, replacement charts and trial offer.

PAULEY-JAMES CORP.
4619 Ravenswood Ave., Chicago, Ill.

SELL CROWE

Remote Controls for Auto Radios

INTERCHANGEABLE

NEARLY four million auto radio sets, new within the last three years, offer you an unusual opportunity. Sell Crowe On-the-Panel Controls to reinstall these still-serviceable radios in new cars. Sell them to replace old-fashioned under-dash or steering column controls in owners' present cars.

All Cars . . . Most Radios

Crowe Controls are interchangeable for all cars and most makes of radios. Airplane or porthole dials make it easy to exactly match manufacturer's car styling. Easy to install. Economical to stock. Standard equipment on leading makes of radios.

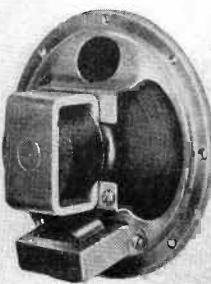
See Your Jobber

Go after your share of this replacement business. Get a stock of Crowe Controls from your Jobber.

ASK FOR BULLETIN

CROWE NAME PLATE & MFG. CO.
1775 GRACE STREET CHICAGO
CABLE ADDRESS: CRONAME - CHICAGO

MANUFACTURERS—continued



JENSEN SERIES "S" SPEAKERS

With the intention of more nearly meeting the demands for replacement speakers in radio servicing, Jensen has just announced a new line of speakers featuring high quality with low cost. These speakers are being manufactured in 5, 6 and 8" sizes. They are compact and light, yet ruggedly built. All are offered with adjustable impedance transformer or fixed impedance transformers and are available with an assortment of field coils. Full descriptive literature available on request from the Jensen Radio Manufacturing Company, 6601 South Laramie Avenue, Chicago, Illinois.—SERVICE.



SHURE "MILITARY-TYPE" HAND MICROPHONES

A series of carbon and crystal "Military-Type" Hand Microphones, completely functional in character and modern in appearance, has been announced by Shure Brothers, "Microphone Headquarters," 225 W. Huron Street, Chicago, U. S. A.

One of the outstanding features of the new microphone is said to be the entirely new case design which not only eliminates the conventional handle, but makes the microphone fit naturally and conveniently in the palm of the hand, thus providing a new ease in handling and operating.

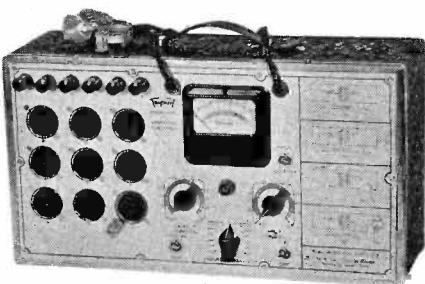
The "Military-Type" microphone is small, light and compact. May easily be slipped into the pocket when not in use. It is especially advantageous in portable equipment because of the small storage space and simplified handling it requires.

An improved spring-lever type positive-action switch (which operates both "press-to-talk" and on-off) is optional. Relay contacts can be furnished.

In addition to the standard units, Shure "Military-Type" Hand Microphones are also available in exclusive new anti-noise "close-talking" models based on a new design principle which makes possible true high intelligibility close-talking performance with practically complete elimination of background noise.—SERVICE.

(Continued on page 42)

Now you can test All Automotive and Home Battery Radio 6v. VIBRATORS



with Model 1670
VIBRATOR-TESTER
An Approved
DeLuxe Model

DEALER PRICE \$24.00
(Metal Case)

Locate Service Troubles Quickly . . .
Sell More Vibrators

- Tests All Types 6 V. Vibrators
- Three Scale Triplett Instrument
- Uses Approved 5000 Ohms Load

This new Triplett Vibrator Tester has been constructed with the engineering cooperation of leading manufacturers of vibrators. It will test all types and makes (6 volts) as used in automotive and home battery receivers. A load of 5000 ohms recommended by vibrator engineers is applied. The 3-scale meter shows the following: 0-10 volt scale shows voltage input to the vibrator; the GOOD-BAD scale shows output; scale marked 0-100 per cent shows per cent of output voltage as reflected by change in input voltage. Low damped meter permits needle to follow voltage fluctuations caused by faulty vibrator contacts. Sold with complete instructions on how to test.

Model 1670 in Portable Metal Case with Black Wrinkle Finish . . . Attractive Etched Panel. **DEALER NET \$24.00**

Model 1670 in Portable Leatherette Case with Removable Cover and Compartment for Accessories. **DEALER NET \$28.00**

See Your Jobber Write for More Information



The Triplett Electrical Instrument Co.
174 Harmon Dr., Bluffton, Ohio

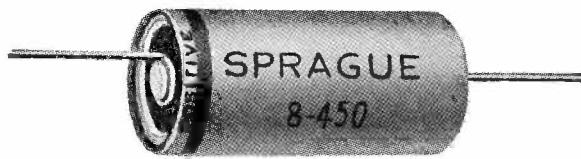
Please send me Details on Model 1670
 Complete Catalog

Name

Address

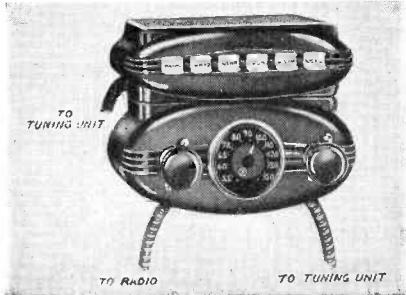
City State

MANUFACTURERS—continued



SMALL-SIZE CONDENSERS INTRODUCED BY SPRAGUE

A new line of small etched-foil tubular dry electrolytic condensers known as Sprague "Atoms" has been introduced by the Sprague Products Company, North Adams, Mass. An 8 mfd, 450 volt unit for instance is only $\frac{3}{4}$ " in diameter and $1\frac{5}{8}$ " long. Other sizes are proportionately small in size as well as low in price—including several popular Dual Cardboard types which are a feature of the line.—SERVICE.



PUSH-BUTTON TUNING UNIT

F. W. Stewart Mfg. Corp., 340 W. Huron St., Chicago, Ill., have announced a push-button tuning unit for use with all types of auto radios. The unique design is said to be easily and quickly attachable to either instrument panel or steering post of the car. Further details are available from the manufacturer.—SERVICE.

OPERADIO 35-52 WATT AMPLIFIER

Employing beam power tubes, three input channels, and non-restortant equalizers, the Operadio Model 835 is claimed to deliver plenty of undistorted output power.

The amplifier is available in base-mounting type which can be fastened to relay rack, wall or table.

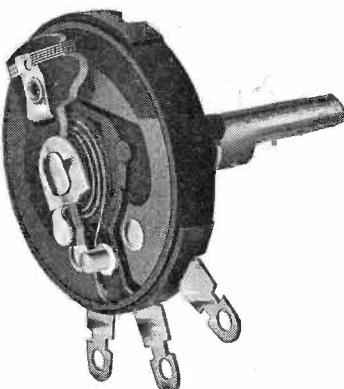
Full details may be obtained from Operadio Mfg. Co., St. Charles, Ill.—SERVICE.



SILENT-SPIRAL CONNECTOR FEATURED ON IRC CONTROLS

Due to the tremendous popularity of the Silent-Spiral Connector which eliminates metal-to-metal sliding contact, this feature has now been added to all IRC Metallized Type Controls sold through the jobbing trade. This exclusive IRC feature was available formerly only on special replacement controls.

By providing continuous electrical connection by means of a spiral coil spring between center terminal and volume adjustment arm, the IRC Silent Spiral Connector is said to do away with one of the most common causes of noise in ordinary controls after they have been in service awhile. Combined with the famous IRC 5-Finger Silent Contactor it provides double assurance of controls that are permanently quiet and trouble-free. These controls are manufactured by International Resistance Co., 401 N. Broad St., Philadelphia, Pa.—SERVICE.



POCKET VOLT-OHM-MILLIAMMETER

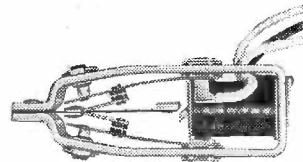
The Million Radio & Television Laboratories, 671 W. Ohio St., Chicago, Ill., have announced a pocket model instrument which combines d-c voltage ranges of 0-5-250-500-1000 at 1000 ohms per volt; 0-1-5-50-500 mils dc; 0-1000 and 0-500000 ohms. The instrument is also available with a-c voltage ranges.—SERVICE.



PAULEY-JAMES VIBRATORS

The Pauley-James Corporation of 4619 Ravenswood Ave., this city, has been formed for the purpose of manufacturing and distributing a new auto radio replacement vibrator. Trade name of the new device is "Vibrapowr" and its manufacturers claim many outstanding improvements in design, quality and electrical and mechanical characteristics.

In addition to a radically different mechanical design the manufacturers of "Vibrapowr Units" claim to have the only vibrator on the market which incorporates adjustability with a self cleaning, wiping action of the contact points. They point out that any good vibrator should have a useful life of from 2000 to 3000 hours. However this life cannot be attained unless some provision is made which enables the radio service man to clean and adjust the contact points after each 1000 hours of service. Filing and readjusting the points in a "Vibrapowr Unit" is accomplished without the use of an oscilloscope, meters or gauges. The method of procedure is practically the same as that employed in automobile distributor work.—SERVICE.

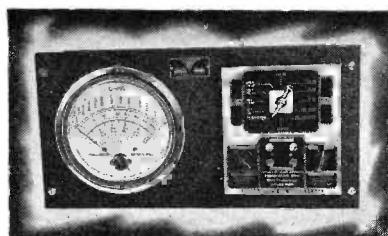


NEW PRECISION INSTRUMENTS

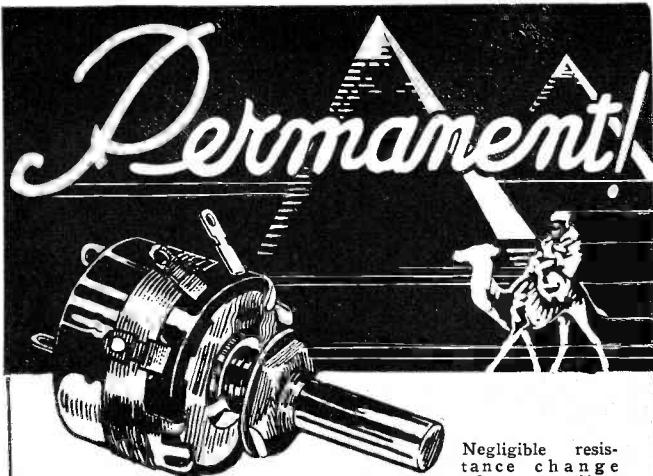
Precision Apparatus Corp., 821 E. New York Ave., Brooklyn, N. Y., has announced a new multi-range volt-ohm-milliammeter which also includes a decibel meter. Employing a 9-inch meter, the device is said to be most unique in that the selector switch assemblies are mounted in a box which is quickly detachable from the main body of the instrument in which the indicating element is mounted. This permits the user to take the instrument to a convenient working point and obviates the danger of dropping the meter or otherwise damaging it. The remote control box is joined to the main panel with a six-foot cord. Ohmmeter ranges of 0-400-100,000-1 meg-10 megs; a-c and d-c voltage ranges of 0-10-50-150-500-1500; millampere ranges of 0-1-10-50-150-500; ampere range of 0-10 for auto radio testing; decibels from -10 to 49 in five ranges.

Precision is also announcing the series 510 Electronometer; this device resembles the Series 500 instruments but is lower in cost. Complete ballast-tube testing is provided for.—SERVICE.

(Continued on page 44)



• SERVICE FOR



• Those splendid characteristics found in the new CLAROSTAT controls are maintained during a long service life. Indeed, such controls can be installed and then forgotten. They simply "stay put," with all that implies to your good will, profits, and future trade.

Free MANUAL . . .

Be sure you have our new 208-page pocket-sized service manual in your working library. Ask local jobber or write us for your copy.

CLAROSTAT Manufacturing Co., Inc.



285-287 NORTH SIXTH STREET
BROOKLYN, NEW YORK, U.S.A.

• OFFICES IN PRINCIPAL CITIES •

Negligible resistance change after cycling 10,000 times.

- Antenna and C-bias control still perfect after 28,000 cycles.

- Controls quiet from first to last.

- Shafts turn freely and snugly.

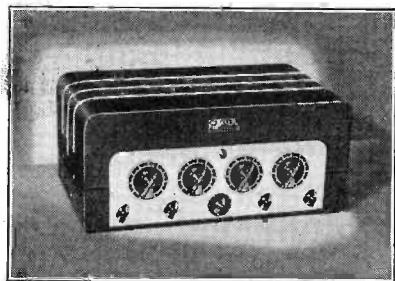
- Power switches remain OK.

INTRODUCING



A
"Masterpiece"
in
fine Amplifier
construction

Licensed under E.R.P.I.



- * Five Channel Input
- * Volume Expansion
- * Volume Compressor
- * Bass Compensator
- * Treble Compensator
- * Master Gain Control
- * Beam Power Tubes
- * Inverse Feed-back
- * 15 Tubes—Six-Stages

Acoustic feedback is reduced to a minimum through the use of bass and treble compensating controls and also by a volume compressor feature. Three dimensional reproduction of recording is accomplished by volume expansion.

Other features include: five input channels that provide for electronically mixing four "mikes" with a phono unit; beam power tubes; master gain control; and advanced, precision design throughout . . . yet model 460 is moderately priced. Write for complete details on this and other Bell sound equipment.

BELL SOUND SYSTEMS, INC.

61-62 East Goodale Street, Columbus, Ohio
Export Office: 308 W. Washington St., Chicago, Ill.

The MOST COMPLETE 1938
Everything in Radio
RADOLEK
RADOLEK RADIOPRIFT
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FREE!
RADIO BUYING GUIDE

Send for the NEW 1938 RADOLEK Catalog Now!

Everything you need in radio. It's all in this new RADOLEK RADIO PROFIT GUIDE. Every repair part for every receiver. Newest radio receivers. New 1938 model public address amplifiers, outputs for 5 to 100 watts. Test instruments. Technical books. Special equipment. Leading standard brands. Every item guaranteed. It must be right or we make it right. And everything under one roof. You get what you want promptly, and exactly what you want. Radolek's immense stock plus Radolek's efficient organization insures you fastest service. 25,000 service men depend on this service and benefit by Radolek's lowest prices. Send now for your copy of Radolek's Radio Profit Guide. It will help you make more money.

---RADOLEK---

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Send me the Radolek Radio Profit Guide FREE.
Name
Address
Serviceman? Dealer? Experimenter?

To SERVICEMEN and DEALERS

TRIAD

has available a new Ballast Resistor Chart FREE upon request. Ask for Bulletin No. 115.

COMPLETE LINE OF RADIO RECEIVING TUBES BALLAST RESISTOR UNITS

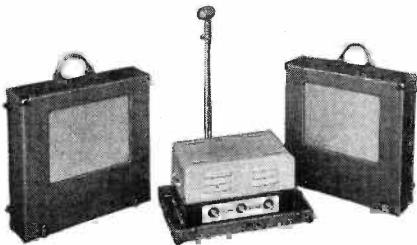
A Profitable Line to Handle

Write for Particulars

TRIAD MANUFACTURING CO., INC.
PAWTUCKET RHODE ISLAND

THE QUALITY NAME IN RADIO TUBES

VOCAGRAPH << LOWER PRICES *make Sound easy to sell!*



Don't let sales slip through your fingers. VOCAGRAPH low prices and money-back guarantee of performance will close the deal every time. Compare these values and ask your distributor or write the factory for engineering data on the complete line.

TWELVE WATTS-\$17.70

Push-pull '42 output. High gain for use with velocity or crystal mike. Full-range tone control. Output impedance 4 and 8 ohms. For use with P. M. speakers. Complete, fully portable with crystal microphone, speaker, and carrying case, only \$47.40.

TWENTY WATTS-\$26.10

Three channel input. High gain for crystal, velocity, etc., mikes. Push-pull beam power output. Impedance selector for 2, 4, 8, 166, 250, and 500-ohm output. Fully portable with crystal microphone, dual speakers, and carrying case, only \$70.80.

THIRTY WATTS-\$39.90

Three channel input. Beam power push-pull output. Variable impedance selector. Extreme fidelity with Colortone frequency compensator. 135 Db gain. Fully portable with dual speakers, folding floor stand, carrying case, etc., only \$99.00.

FREE—Sound Rental Sign



VOCAGRAPH SOUND SYSTEMS
162-B N. May St., Chicago, Ill.

Free from your distributor, a large sign advertising your "Sound Rental Service." See him for this business builder or enclose 10c with this coupon.

MANUFACTURERS—continued



ATR REPLACEMENT VIBRATORS

ATR auto and farm radio replacement vibrators are said to be of new design and construction utilizing 3/16" diameter tungsten contacts, which assure increased life and reliable service.

A complete new line of replacement vibrators at drastic list price reductions has recently been announced by the American Television and Radio Company, St. Paul, Minnesota.

A replacement vibrator guide covering all 1938 ATR Auto and Farm Radio Replacement Vibrators is available free of charge direct from the factory.—SERVICE.

DON'T FORGET!

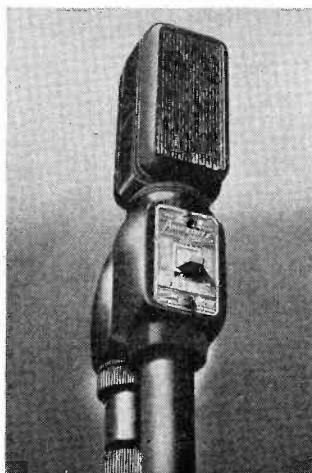
National Radio Parts Trade Show—Hotel Stevens—Chicago—June 8 to 11—Better be there!

AMPERITE COMPACT VELOCITY

The new Amperite compact velocity is said to be the smallest velocity ever made. It is complete with output transformer, cable connector and switch. In spite of its size it has the output of a large velocity, -70 db open line. Has a frequency response from 60 to 7500 cps plus or minus 2 db. Can be used for speech or music and is obtainable in either low impedance (model ACL) or high impedance (model ACH).

Although designed to fit the standard 5/8-27 microphone stand it also makes an excellent hand microphone. The case is of molded rubber trimmed with chrome.

Further details may be obtained from Amperite Co., 561 Broadway, New York City.—SERVICE.



DIRECTIONAL CONTROL

Uni-Directional
Bi-Directional
Non-Directional
Response All
In One Unit



SHURE "TRI-POLAR"

Crystal Microphone

With the three basic directional characteristics instantly available through a three-point selector switch, the Tri-Polar gives you true directional control, eliminates feedback and background noise. Model 720A "Tri-Polar," complete with 25 ft. cable, lists at \$39.50. For complete information, ask your Jobber or write for the Shure Technical Bulletin.



NEW REMOVABLE BAFFLE for the Shure 700A Crystal Microphone—designed to reduce feedback and cut down background noise. Write for full details. Model A90A Directional Baffle lists at \$2.50. Model 700A "Ultra" Wide-Range Crystal Microphone, complete with 7 ft. cable, lists at \$25.

Shure Patents Pending. Licensed under patents of the Brush Development Company.

SHURE M
MICROPHONES & ACOUSTIC DEVICES

WHEN YOU CHANGE YOUR ADDRESS

Be sure to notify the Subscription Department of SERVICE at 19 E. Forty-seventh St., New York City, giving the old as well as the new address, and do this at least four weeks in advance. The Post Office Department does not forward magazines unless you pay additional postage, and we cannot duplicate copies mailed to the old address. We ask your cooperation.

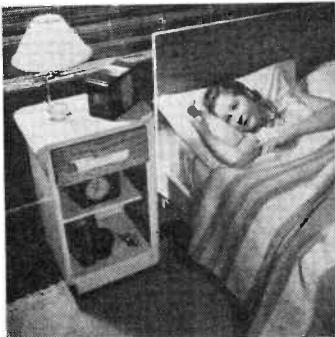
An Accessory for Profit . . .

YOU'LL FIND the Brush "Hushatone" (pillow speaker) a profitable accessory because it is a new item that appeals to the desire for comfort and carries a price that promotes a large volume of business.

In the home the "Hushatone" is ideal for use in bed, on a couch or a comfortable chair.

In hospitals and sanatoriums it has a natural use. Convalescents and bedridden patients welcome the "Hushatone" because of the pleasure and convenience it gives them.

Get in your order today and increase your profits by recommending the "Hushatone" for personal radio sets.



The BRUSH DEVELOPMENT Co.
3318 PERKINS AVE., CLEVELAND, OHIO

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



DON'T SQUAWK
...about business..

**EQUIP YOURSELF
TO DO MORE and
BETTER BUSINESS**
Get FREE equipment
the easy National Union way !

BUY N.U. TUBES and CONDENSERS

Sure you can do more business . . . make more money! You have to be well equipped to do it though. That's where the National Union Plan for Service Engineers comes in. Through the National Union plan you can get FREE all kinds of Testers, Meters, Manuals, etc. All you do is agree to purchase a certain quantity of National Union tubes and/or condensers, make a small deposit, which is later refunded as a merchandise credit . . . and the equipment you need is shipped to you at once. Investigate! Get the whole story from your nearest N.U. distributor . . . ask who he is if you don't know.

N.U. TUBES and CONDENSERS ARE QUALITY PRODUCTS

Thousands of top notchers in the Radio Service Engineering profession are depending on National Union quality. It's the kind of precision and value that makes good friends for you. National Union quality will never let you down. . . . The National Union guarantee is your assurance.

NATIONAL UNION RADIO CORPORATION
570 Lexington Avenue, New York City

S-438

Who is the nearest N.U. distributor?

Name _____
Address _____
City _____ State _____

Model SS

MILLION
POCKET VOLTOHM
MILLIAMMETER

0-5-50-250-500-1000 Volts D.C.
at 1000 ohms per volt.
0-1-5-50-500 M.A.

0-1000 Ohms
0-500M Ohms
3 inch meter

\$9.95

Model SA with AC Voltage Scales.... \$12.95

Write for particulars

MILLION RADIO AND TELEVISION LABORATORIES
671 W. OHIO STREET CHICAGO, ILL.

**A GOOD NAME
GOES A LONG WAY**



Ken-Rad Tubes make friends for you because they give clear, dependable radio reception. The Ken-Rad name is known for highest quality.

KEN-RAD TUBE & LAMP CORPORATION OWENSBORO, KY.

KEN-RAD
DEPENDABLE RADIO TUBES

HIGHLIGHTS . . .

C-D MERCHANTISING HITS NEW HIGH

Cornell-Dubilier's jobber merchandising program reached a new peak recently, when they supplied to each of their jobbers cleverly conceived display cards featuring "the tiniest electrolytics ever developed," the C-D type BR "Beavers." The new counter display is C-D's fourteenth, the second of their second series.

These point-of-sale reminders are highly effective jobber sales aids, asserted C-D Salesmanager Leon L. Adelman, pointing to the noticeable sales jumps of the units featured on these counter placards.

Jobbers desiring information on this effective method of boosting capacitor sales are invited to write to the Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey.

WARD LEONARD APPOINTEE

Ward Leonard Electric Co. announces the appointment of Charles D. Southern, 430 W. Rudisill Blvd., Fort Wayne, Indiana as their representative for the sale of Ward Leonard radio products. Mr. Southern's territory covers the entire state of Indiana.

RADIART PROMOTES BURCAW

In recognition of noteworthy achievement in jobber relations, L. K. Wildberg, President of The Radiart Corporation, announces the appointment of Kenneth C. Burcaw to supervision of Radiart sales throughout the western portion of the country.

E. R. STOECKLE DIES IN EAST

Dr. Erwin R. Stoeckle, vice-president of the Globe-Union, Inc., battery and radio apparatus manufacturers, and one of Milwaukee's outstanding physicists, died at Boston, Mass., March 4, where he had gone a few weeks ago for an eye operation. He was known in scientific circles chiefly for his pioneer discoveries and developments in the field of the electron tube, particularly the radio vacuum tube. His scientific affiliations included the American Institute of Electrical Engineers, the American Physical Society, the Institute of Radio Engineers and the American Association for the Advancement of Science. In 1934, he was president of the Engineers' Society of Milwaukee.

STANCOR SERVICE GUIDE

Long awaited by the trade, Stancor's new Service Guide No. 125 has just been issued.

It contains accurate listings of over 2800 sets, and the necessary transformers and chokes to service them. All popular manufacturers are represented. To insure accuracy the material was secured from factory service notes and all 8 Rider manuals. The information is clearly presented and very easy to find. As additional assistance, the book also contains the tube set up of all sets listed. Much other valuable information is given that should prove beneficial.

The Guide is free and may be obtained through the jobbers throughout the country or direct from the Standard Transformer Corporation, 1500 N. Halsted St., Chicago.

SHOW NEWS

The National Radio Parts Trade Show announces the forming of a Personal Service Bureau to function not only during the period of the Trade Show at the Stevens Hotel in Chicago, in June, but to handle advance registrations for the show and make hotel reservations.

The Personal Service Bureau, as the name implies, is a department to relieve those who attend the show of perplexing problems. It will act as an information bureau and assist strangers in the city to find their way about with greater ease. During the period of the Show, the Bureau will have quarters conveniently located on the exhibition floor. Its personnel will be at the service of the show, its participants and guests.

Those who plan to attend can avoid waiting in line to register by making their registration now. The Personal Service Bureau will take registrations and prepare the badges which can be picked up at once at an Advance Registration Desk.

Anyone who wishes to register in advance and who has not received a blank can obtain the necessary form by dropping a post-card to the Personal Service Bureau of the National Trade Show, 53 W. Jackson Blvd., Chicago.

Representatives of the trade from Canada and foreign countries will have their own headquarters on the Exhibition Floor. Special booths for the use of Canadian and foreign representatives and distributors and manned to facilitate the delivery of messages and calls are being provided by the show management.

PRESTO REPORTS GOOD SALES

Sales of Presto sound recording equipment in 1938 soared to a 78 per cent increase over the first quarter of 1937.

Dealers at the rate of two a day have been adding the Presto line, taking advantage of the steady increase in recording equipment sales as a hedge against seasonal trends in other lines.

Radio and musical instrument dealers report that the novelty appeal of recording phonographs in window and store displays invariably produces an increase in store traffic and thus helps the sale of other products as well.

Repeat business in blank discs is booming. March sales were 123 per cent over the same month last year.

BROWNING FOLDER

A folder describing the Browning 83 kit is available from Browning Laboratories, Inc., Winchester, Mass.

JFD CATALOG

A catalog describing auto-radio accessories is available from the JFD Mfg. Co., 4111 Ft. Hamilton Parkway, Brooklyn, New York.

TRIPPLETT BULLETINS

New price sheets, Nos. 47-T and 47-I have been released by The Triplett Electrical Instrument Co., Bluffton, Ohio. Copies may be obtained by writing to the company.

BARR APPOINTED SALES MANAGER FOR VOCAGRAPH

Topping off a general expansion program completed on their first anniversary comes the announcement by John Meck, president of the Electronic Design Corporation, that Bob Barr has been appointed sales manager of their Vocagraph Sound Systems Division.

This brings together again a team that was first formed when John Meck and Bob Barr were respectively sales manager and sales promotion manager of Clough-Brengle, Barr succeeding to the position of sales manager when his team-mate left to form this organization.

Further strengthening of Vocagraph's service to sound jobbers and dealers is made possible by the appointment of two new field representatives. Henry P. Segel of Gardner, Mass., will cover the New England states, with a complete warehouse stock at Gardner. New York state will be covered by James Vawter of Buffalo, N. Y., another new appointment.

TUNG-SOL SIGN FEATURES TUBE TESTING SERVICE

A new and attractive metal sign is offered to dealers by Tung-Sol Lamp Works, Inc. (Radio Tube Div.) of Newark, N. J. The sign beautifully lithographed in five colors, is 17" x 11" and has a 2" flange punched to facilitate mounting. It is of 22-gauge metal coated with DuPont Deluxe varnish that provides both a high lustre and permanency of finish even after exposure to extreme weather conditions. Since the sign features tube testing and is illustrated with tubes, it identifies the dealer as a technician. Response by dealers has already been very favorable and those who wish to know how they may obtain one should write their nearest Tung-Sol wholesaler.

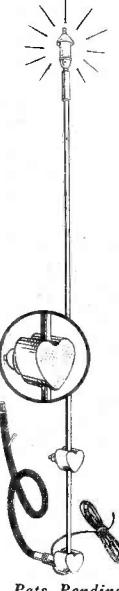
IRC RESISTOR AND VOLUME CONTROL CATALOG NOW AVAILABLE

A completely new and attractively printed 12-page catalog, detailing the complete merchandising line of IRC Standard Resistors and Volume Controls has just been issued by the International Resistance Company, 401 North Broad Street, Philadelphia, Penna. Copies may be obtained upon request to IRC jobbers or direct from the manufacturer.

In addition to the standard IRC items such as the Type BT Insulated Metallized Resistors, Power and Precision Wire Wound Resistors and Motor Radio Suppressors, the catalog includes a number of items recently added to the line. Among these are the IRC Type CS Volume Controls featuring both the Silent Spiral Connector and the well-known 5-Finger Element Contactor; IRC Special Replacement Controls; Type BW Insulated Low Range Resistors; Type MW-2J Insulated Center Tap Wire Wound Resistors; Ultra-High Range Metallized Resistors; as well as seven new Precision Resistor Types; and the new, improved IRC Resistance Analyzer and Indicator which is direct reading and continuously variable from 0 to 1.0 megohm.

FLASH...

NOW THE
ELECTENNA



Auto-aerial

Combination auto-radio antenna and parking light which mounts to side of car with beautiful heart shaped onyx or black insulators. ELECTENNA has a three-purpose shielded loom coupling unit which automatically shields, grounds extraneous noises and connects auto antenna to the receiver. Parking light can also be connected to operate as a pilot light indicating whether set is on or off. Highly efficient auto antenna as well as ornamental and useful. Made of solid brass and finished in lustrous durable chromium.

List \$5.00

Electenna is but one of 57 different types of auto-aerials made by us. The whole Avnet line is shown in our new catalog. Write for copy and discounts.

CHAS. AVNET COMPANY
156 Chambers St., New York, N. Y.

Pats. Pending

Did You Know?

THAT

- the Browning 83 four-band kit receiver can be operated from a 6-volt storage battery by means of a Mallory Vibrapack?
- the same Wright-DeCoster speaker is employed as with the a-c. job?



- the 83 makes an ideal vacation receiver because of its low noise level and high sensitivity on both broadcast and short wave bands?
- the 83 can be converted from battery to a-c. operation at a minute's notice?
- you can readily install the 83 in a customer's console?

INCREASE YOUR SUMMER PROFITS WITH THE

BROWNING 83

A Satisfied Customer Is Your Best Advertisement

BROWNING LABORATORIES, Inc.
750 Main Street Winchester, Mass.

ASSOCIATION NEWS—cont.

a few remarks as regards the progress of the work being done.

Detroit Chapter

The Detroit Chapter will be hosts to John Rider on April 4 at which time a huge number of servicemen in Detroit and vicinity will be in attendance. A large promotion program for this meeting has been successfully carried out and late comers will have no chance even to get in the hall.

Detroit has been suffering from the business recession attendant on the whole country and particularly so as regards the automobile industry; however in the last few days business has increased to a noticeable degree. The Detroit Chapter under the leadership of Joe Cole has evolved a worthwhile and workable plan whereby all full time servicemen may become members of the RSA and in so doing receive recognition for the position they hold in the profession.

Oklahoma City Chapter

Oklahoma City Chapter reports through its secretary, L. G. Dearing, that they are contemplating a membership drive in the near future which should result in doubling the membership of the chapter.

Nashville Chapter

One of the newer chapters to join the RSA is the Nashville Chapter. They are just getting started on the work under the able leadership of Frank Clark and R. Thomas.

PRSSMA

Meetings are lining up at a lively rate and the calendar shows right now a full schedule for the next three months. See:

April National Union
May Motorola
June Internat'l Resistance Corp.

Each of these manufacturers is now lining up features to present a most interesting meeting. Mark down that first Tuesday every month.

The last meeting sure brought them out . . . but where was Bob Thorn? The movies were swell, once they got them working right.

We sure were glad to welcome some of our old friends back again. George Montgomery, former service manager of Lewis Buehn & Co., now working out in Norristown. Stop in again, George!

Elmer Buder, the man who knows more about putting them up (aerials) than what they are for, was there with his friend, Al Haas, the radio brain storm.

Mort Moskowitz, of M. & H. Sporting Goods, stopped in with our friend, Dan Fairbanks, of IRC. Dan still holds his Honorary Membership card.

Ask Paul Freed about the new radio musical instrument he is working on. (This is supposed to be a big secret!)

We elected George Greenberg to the Advisory Board, and his wife now seconds the nomination with a baby boy. Good Luck, George!

Elwood Walker's getting ready to skip up the middle aisle . . . wedding bells to the accompaniment. Congratulations, El, but don't forget to see us, both before and after the honeymoon.

BOGEN SOUND SYSTEMS

"Always First with the Latest"

Bogen has consistently pioneered important improvements in sound. Recent surveys of sound specialists show that Bogen equipment is gaining preference rapidly because of its advanced design and high performance.

UNIVERSAL MOBILE SYSTEM

For 6 volt DC and 110 volt AC

A TIMELY SYSTEM FOR THIS PERIOD OF THE YEAR—FOR MOBILE OR STATIONARY JOBS.

No plug in power packs. Instantaneous switch over. 28 watts undistorted—peak 35 watts. Universal microphone input. Duo stage electron mixing. "Standby" switch for battery economy.

CP28D System . . . list \$256.50

Consists of C-28 amplifier with phono assembly, Sylvania tubes, "Transducer" bullet hand mike, with 25 ft. shielded rubber covered cable, 2 Jensen PMI2B dynamic speakers each with 10 ft. rubber covered cable and polarized plug.

DAVID BOGEN CO., Inc.

663 Broadway, New York City



PIONEERS IN PUBLIC ADDRESS DEVELOPMENT

SERVICE MEN

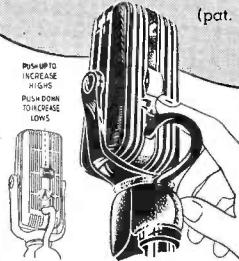
. . . in addition to being our readers, are among our most valued contributors.

Perhaps SERVICE can use an item on that interesting job YOU did yesterday.

AMPERITE offers "ADJUSTABLE RESPONSE"*

... made possible by
**THE ACOUSTIC
COMPENSATOR**

(pat. pend.)



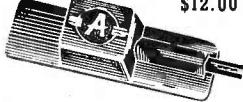
*Higher or
lower pitch
with the
same micro-
phone.

With the flip of a finger you can now (1) lower or raise the response of the microphone... (2) adjust the microphone for most desirable response for close talking or distant pickup... (3) adjust the system to any "taste", room condition, or equipment.

MODELS RBHk; RBMk, with Acoustic Compensator, frequency range 40 to 11000 cps, output, -65 db., complete with switch, cable connector and 25' of cable..... \$42.00 LIST

NEW LOW-PRICED CONTACT "MIKE"

\$12.00 LIST



The new popular-priced Amperite Contact Microphone can be used on most radio sets made since 1935 and on all P.A. systems. It "makes an ordinary violin sound like a Strad" ... gives a small piano the tone of a Grand. And yet, there is no distortion. No unnatural effects. No "fingering noises." No changes in strings or instrument. Attached without tools.

Operates with either high or low gain amplifiers. Has frequency response of 40 to 9000 cps. Output, -40 db. 20' of cable.

**MODEL SKH (Hi-imp.); SKL (200 ohms), \$12.00 LIST
Professional Model KTH (or KTL). \$22.00 LIST**

NEW COMPACT "MIKE"

A new velocity microphone of compact size, having a head only 1 1/4" x 2 3/8" x 1 1/4". Good for speech and music. May be used as hand mike as well as for stand mounting. Complete with output transformer, cable connector and switch. Output, -70 db. into open line. Frequency response 60 to 7500 cycles.

MODEL ACH (Hi-imp.); ACL (200 ohms)..... \$25.00 LIST

MODEL RAH...\$22.00 LIST

P.A. Men, you can improve those "price" jobs by using the popular Amperite Model RAH (or RAL). You will get better results because (1) it is excellent for both speech and music; (2) has flat response without undesirable pecks; (3) reduces feedback; (4) stands up under rough handling and changes in temperature, pressure or humidity. . . Frequency range 60 to 7500 cps. Output, -68 db.

**MODEL RAH (Hi-imp); with 12' of cable; RAL (200 ohms) with 8' of cable,
ONLY \$22.00 LIST**

Write for Complete Illustrated Bulletins and Valuable Sales Helps.

AMPERITE 651 BROADWAY, N. Y.
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AMPERITE *velocity* **MICROPHONE**

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East Cleveland, Ohio

R **R**

SALES of RADIART'S 1938 LINE of AERIALS, for only 4 MONTHS are 9 times as large as total sales of the 1937 line

Now!

A Balanced Assortment of 50 Ten Watt WIRT RESISTORS

FOR ONLY \$10 VALUE \$12

Lifetime CABINET absolutely FREE

Resistors are all FIRST QUALITY, WIRT WIRE WOUND, protected from injury by Wirt PHENOCOTE, the non-absorbent, non-hygrosopic coating and laboratory tested for humidity and accuracy.

The cabinet is made of well seasoned bass wood rubbed to a beautiful natural finish—6 drawers of three-ply wood—24 compartments—removable partitions. Order yours NOW from your jobber. If your jobber cannot supply you send in the coupon below, with your jobber's name.

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SMALLER . . . METAL SEALED

Solar MINICAP *tubular* Dry Electrolytic Capacitors mark more than an advance in an art. They occupy less space, have longer life because of permanent sealing and are more convenient to use. Costing less to produce, they are sold at prices offering new economy . . . in line with the times.

Make use of their
INBUILT QUALITY . . . OUTSTANDING UTILITY

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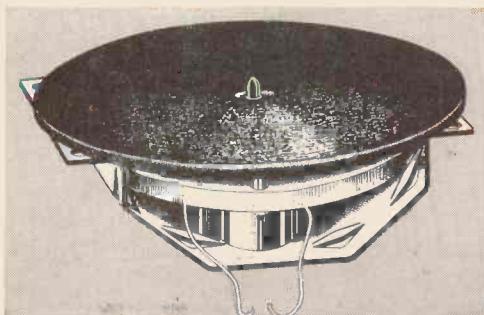
**BOY! HERE'S
A MONEY-
MAKER!**

NEW RCA CRYSTAL PICK-UP AT SENSATIONALLY LOW COST



\$495

List Price
Stock No. 9842



RCA Synchronous \$650
Reaction Motor and LIST
Turntable—at lowest price ever! . . .
Stock No. 9841

- ✓ Free from wows
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- ✓ Matches finish of pick-up shown above
- ✓ Easy starting
- ✓ Improved Stability
- ✓ Rubber spindle cap prevents vibration pick-up by records
- ✓ Comes with 8" leads
- ✓ Maximum power consumption—10 watts
- ✓ Turntable diameter—7"



Parts FOR PROFIT

RCA MANUFACTURING CO., INC., Camden, N. J.
A Service of the Radio Corporation of America

With so many people again record fans, the sales of record playing parts have mounted steadily. Now, they'll literally *leap* skyward! For the amazingly low price of this new RCA Crystal Pick-up makes it easier for your customers to buy!

And look at the swell features you can offer at this very low cost!

- High impedance—100,000 ohms at 1,000 cycles
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- Needle position offset—to assure true tracking
- Wide frequency response—70 to 7,000 cycles
- Swiveled pick-up arm—for easy needle insertion
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- Shock-proof mounting parts included
- Brown wrinkle finish

Over 325 million RCA radio tubes have been purchased by radio users...In tubes, as in parts and test equipment, it pays to go RCA All the Way.

RCA presents the Magic Key every Sunday, 2 to 3 P.M., E. S. T., on the NBC Blue Network.