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P. R. MALLORY & CO., Inc., INDIANAPOLIS, INDIANA

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 PRECISION PRODUCTS

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 VOLUME CONTROLS • ROTARY SWITCHES •
 SINGLE AND MULTIPLE PUSH BUTTON SWITCHES
 • RESISTORS • RADIO HARDWARE

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FOR SERVICEMEN

*Keep them profitable
with dependable
test equipment!*



**NOW AVAILABLE
FOR FM AND TELEVISION**

WESTON
Model 787
UHF Oscillator



Fundamental frequency coverage from 22 to 150 megacycles. No harmonics . . . no band switching. Used with portable antenna or standard output leads. Reads 40 kc per division at 40 mc. Self contained battery operation; compact and extremely portable.

Today, as never before, the American public *wants radio* and can afford to pay for radio. Proof is that the demand for new sets has virtually doubled. But with long deliveries prevalent in so many fields, more old sets probably will be retubed and repaired than ever before. » » » A period like this is *made to order* for the servicemen with WESTON Test Equipment. For WESTONS help produce greater profit on every job. Measurements are simpler, surer . . . trouble can be spotted quicker . . . when these basic, direct-reading instruments are used.

But the *big profit* from WESTONS is shortly to come; for FM and television are rapidly getting into stride. *These same WESTON Test Instruments fully meet the new servicing problems involved. No new and expensive equipment will be needed for the job. Thus it pays . . . and continues to pay . . . to use dependable WESTONS for all servicing needs.* Weston Electrical Instrument Corporation, 604 Frelinghuysen Avenue, Newark, N. J.

WESTON

Test Instruments



A Monthly Digest of Radio and Allied Maintenance
Reg. U. S. Patent Office

WITH THE outbreak of hostilities the country requires that every man do his utmost toward the common end. Many of our readers have already joined the armed forces. Others are working in the war industries. Those of you who are not directly employed in these categories have a full responsibility, none the less, toward the ultimate goal of victory.

No half-way measures will do in time of war. There is no "just as good". You must do your very best on every single job that comes to your shop for repairs. You must make sure that the repaired receiver will stand up for a long time without additional servicing. And, too, you must operate in the most efficient manner so that you can do the most work in the least possible time. This is important not only because there will be more sets to repair with fewer men employed making the repairs, but also because you may be needed for additional duties in connection with civilian defense. With this latter thought in mind, we suggest that you register immediately with your local defense council. Your technical ability makes you especially useful for this type of work.

LAST MONTH in this column we requested our readers to write to us concerning their problems in connection with shortages of parts and materials. We hope that the meagre response to that request was due to the fact that most of you are able to obtain every item that you need.

We have planned a series of timely articles designed to help you solve the problems caused by shortages during your everyday work. The second article of the series appears on pages 9, 10, 11 of this issue. The information is presented in a direct instructional manner . . . it tells you exactly what to do in the event of a shortage of a specific part.

We are especially eager to know from you just what problems are troubling you and what you have been doing up to now. With such advices from the field we can better make the series of articles fit your own particular problems.

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BRYAN S. DAVIS
President

F. WALEN
Secretary

Chicago Office:
608 S. Dearborn Street
C. O. Stimpson, Mgr.
Telephone: Wabash 1903

Published Monthly by the
Bryan Davis
Publishing Co.
Inc.

19 East 47th Street
New York City

Telephone: PLaza 3-0483



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Tearo Book Depot
Melbourne, Australia:
McGill's Agency

Entered as second-class matter June 14, 1932, at the Post Office at New York, N. Y., under the Act of March 3, 1879. Subscription price: \$2.00 per year in the United States of America and Canada; 25 cents per copy. \$3.00 per year in foreign countries; 35 cents per copy.

Defense Savings Pay-Roll Allotment Plan

Now company heads can help their country, their employees, and themselves

voluntary pay-roll allotment plan

- helps workers provide for the future
- helps build future buying power
- helps defend America today

This is no charity plea. It is a sound business proposition that vitally concerns the present and future welfare of your company, your employees, and yourself.

During the post-war period of readjustment, you may be faced with the unpleasant necessity of turning employees out into a confused and cheerless world. But you, as an employer, can do something *now* to help shape the destinies of your people. Scores of business heads have adopted the Voluntary Pay-roll Allotment Plan as a simple and easy way for every worker in the land to start a *systematic* and *continuous* Defense Bond savings program.

Many benefits . . . present and future. It is more than a sensible step toward reducing the ranks of the post-war needy. It will help spread financial participation in National Defense among all of America's wage earners.

The widespread use of this plan will materially retard inflation. It will "store" part of our pyramiding national income that would otherwise be spent as fast as it's earned, increasing the demand for our diminishing supply of consumer goods.

And don't overlook the immediate benefit . . . money for defense materials, quickly, continuously, *willingly*.

Let's do it the American way! America's talent for working out emergency problems, democratically, is being tested today. As always, we will work it out, without pressure or coercion . . . in that old American way; each businessman strengthening his *own* house; not waiting for his neighbor to do it. That custom has, throughout history, enabled America to get things done *of its own free will*.

In emergencies, America doesn't do things "hit-or-miss." We would get there *eventually* if we just left it to everybody's whim to buy Defense Bonds when they thought of it. But we're a nation of businessmen who understand that the way to get a thing done is to *systematize* the operation. That is why so many employers are getting back of this Voluntary Savings Plan.

Like most efficient systems, it is amazingly simple. All you have to do is offer your employees the convenience of having a fixed sum allotted, from each pay envelope, to the purchase of Defense Bonds. The employer holds these funds in a separate bank account, and delivers a Bond to the employee each time his allotments accumulate to a sufficient amount.

Each employee who chooses to start this savings plan decides for himself the denomination of the Bonds to be purchased and the amount to be allotted from his wages each pay day.

How big does a company have to be? From three employees on up. Size has nothing to do with it. It works equally well in stores, schools, publishing houses, factories, or banks. This whole idea of pay-roll allotment has been evolved by businessmen in cooperation with the Treasury Department. Each organization adopts its own simple, efficient application of the idea in accordance with the needs of its own set-up.

No chore at all. The system is so simple that A. T. & T. uses exactly the same easy card system that is being used by hundreds of companies having fewer than 25 employees! It is simple enough to be handled by a check-mark on a card each pay day.

Plenty of help available. Although this is *your* plan when you put it into effect, the Treasury Department is ready and willing to give you all kinds of help. Local civilian committees in 48 States are set up to have experienced men work with you just as much as you want them to, and no more.

Truly, about all *you* have to do is to indicate your willingness to get your organization started. We will supply most of the necessary material, and no end of help.

The first step is to take a closer look. Sending in the coupon in no way obligates you to install the Plan. It will simply give you a chance to scrutinize the available material and see what other companies are already doing. It will bring you samples of literature explaining the benefits to employees and describing the various denominations of Defense Savings Bonds that can be purchased through the Plan.

Sending the coupon does nothing more than signify that you are anxious to do *something* to help keep your people off relief when defense production sloughs off; *something* to enable *all* wage earners to participate in financing Defense; *something* to provide tomorrow's buying power for your products; *something* to get money *right now* for guns and tanks and planes and ships.

France left it to "hit-or-miss" . . . and *missed*. *Now* is the time for *you* to act! Mail the coupon or write Treasury Department, Section A, 709 Twelfth St. NW., Washington, D. C.



FREE - NO OBLIGATION

Treasury Department, Section A,
709 Twelfth St. NW., Washington, D. C.

Please send me the free kit of material being used by companies that have installed the Voluntary Defense Savings Pay-Roll Allotment Plan.

Name _____

Position _____

Company _____

Address _____

A MESSAGE FROM THE PUBLISHER

*"For want of a nail, the shoe was lost—
For want of the shoe, the horse was lost—
For want of the horse, the rider was lost—
For want of the rider, the battle was lost—
For want of the battle, the kingdom was lost—
And, all for the want of a horseshoe nail. . . ."*

YES, and for lack of a properly operating radio receiver, lives may be lost. Civilians in the wrong places—or doing the wrong things—contributed to the fall of Belgium and France. And it mustn't happen here!

In this war you, as a Service Man, have a tremendous responsibility—one that will be progressively more difficult for you.

In the first place, there are fewer of you now employed in commercial radio servicing. From day to day more young and relatively inexperienced men will have to pinch-hit in receiver servicing for the public. Service Men are already in our armed forces or in positions of responsibility in our expanded production activities. Each passing month will see more of you called to new positions where your technical ability makes you indispensable.

If you're leaving the service field, tell your jobber and associates what instruments and replacement parts you have and be prepared to sell them (at a fair price) to some other Service Man who may need them. Don't let them gather dust where they'll do no good.

As radio sets in the hands of the public become older, they'll require more repairs. As war production increases, replacement parts will be harder to get and your ingenuity will be called into play as never before. Many of you will recall the old "professional set-builder" days. They may come back. It would be well right now for you to start thinking about the reclamation possibilities inherent in old trade-in receivers. Check the discard pile for possible utility value. Save wire, save solder, save everything that can possibly be used again. Take good care of your instruments, too. Maybe it won't be so easy to replace them.

Right now, get your name on file with your local broadcasting station, fire and police departments. They may need your help in some emergency.

As for *SERVICE* magazine, we'll do our best. Part of our text from now on will be devoted to the requirements of new and relatively inexperienced Service Men. All of it will be technical data which we'll try to make of the utmost value to you.

We, as publishers, must conserve also—and you can help in one respect. Make your copies of *SERVICE* do more work. Place them at the disposal of your associates—make one copy do the work of two or more. That'll help us conserve on paper and other supplies.

And remember, you, your work and your abilities are vitally important today. You are truly *SERVICE* men giving essential service to your country, your community and your neighbors.

Bryan S. Davis

EXPANDING SERVICE OPPORTUNITIES

Civil Defense Communications Networks . . . Communications Receivers

By Alfred A. Ghirardi

REPORTS from Service Men in many areas are highly encouraging. Many are being engulfed in a flood of business such as they have never seen before. How long it will continue is difficult to forecast.

On the whole indications point to excellent business for both dealer and Service Man. We are in an emergency, however, and it a wise Man who takes all factors into consideration in planning for the future. For one thing you must anticipate your parts requirements. Even now some trouble is encountered in obtaining certain parts and the days when one could obtain 24-hour delivery on any parts by a phone call to his jobber are already past history. It is the better part of wisdom to place parts orders in larger quantities in order that adequate stocks can be maintained on hand.

Then there is the question of seeking the most desirable types of business. In lean years any business was good business. Repair jobs done on cheaper mid-ged receivers, for instance, were often handled unprofitably, simply because to quote a legitimate charge would have been all out of proportion to the cost price of the receiver. You either had to quote a price too low or see the set owner walk out. With better times one need have less hesitance in quoting legitimate prices and thus cure one of the industry's greatest headaches, born of the low-priced mid-ged.

Competitive price-cutting can logically be tapered off, as can also certain other practices, indulged in by a minority but which in recent months have been brought unfavorably to the attention of the public and have reflected on the entire fraternity. The better business which is now being enjoyed by a great many of us represents a real opportunity for a thorough housecleaning so far as service methods and price structure are concerned, and for the establishment of minimum price scales.

Such activity may tend to reduce the

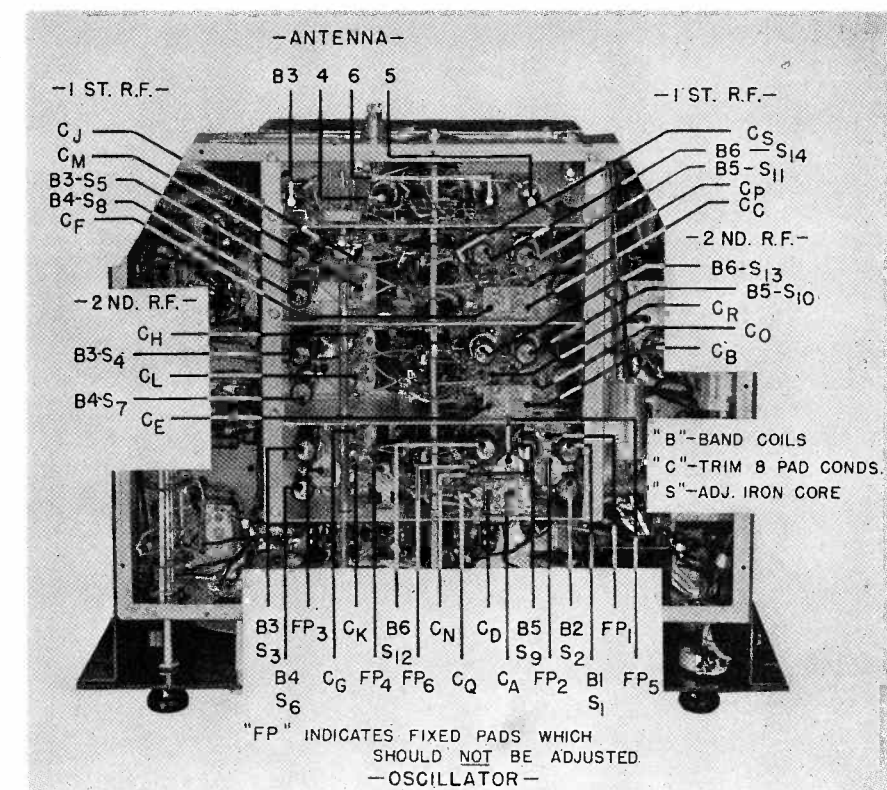


Fig. 2. The alignment of a communications receiver is somewhat more complicated than that of a broadcast receiver.

potential volume of repairs handled but the important point is that the price per job will be more acceptable. The customer will not expect a \$4.00 repair job on a \$6.95 mid-ged to be done for \$1.50! Perhaps he'll junk the receiver and buy a new one. This won't put any profit in your pocket—but neither would the \$1.50 repair job!

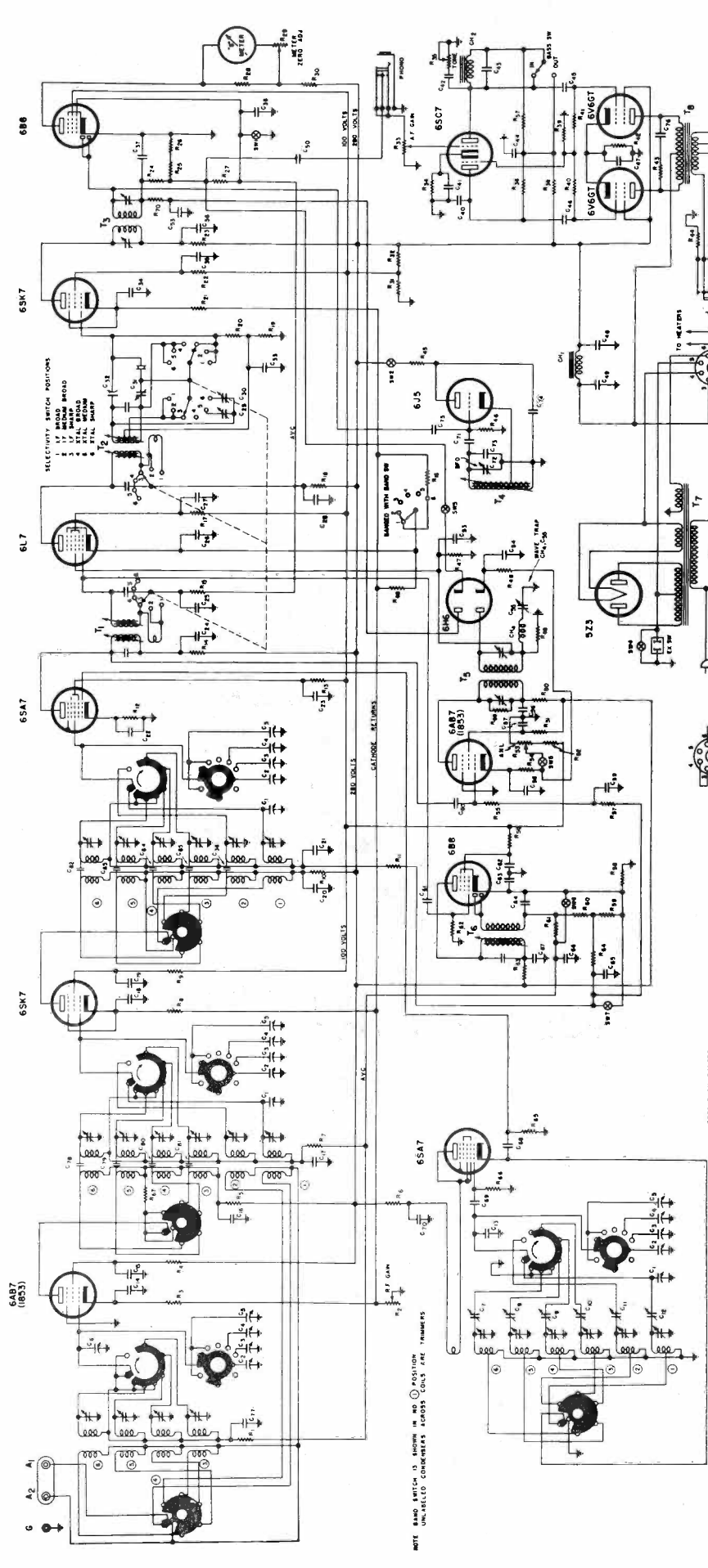
The actual volume of repair business would, on the other hand, probably not be decreased because a lot of larger receivers which have been inoperative will be hauled out for repair. Heretofore such jobs have been considered not worth while by many owners when, for

the price of a repair on the big receiver, he could buy a new mid-ged. But when he finds that bargain repairs on his mid-ged are no longer available, his attitude is likely to change, especially as the prices of mid-geds are going up in keeping with most other things.

Present-day conditions will thus help to replace unprofitable repair work with a type that is more profitable. But you are by no means limited to playing a passive role of watchful waiting. A promotion campaign waged by hand-bills, direct mail, local paper advertising, window cards or personal solicitation, provides a means for bringing these older receivers out of hiding and into your shop.

The avenues of new business are by no means limited to this particular type

CIRCUIT DIAGRAM - SUPER SKYRIDER - SX-28



C 1	Band No. 1 Tuning Condenser	3,000	R 50	1,000	R 17	1,000	R 34	1,000	R 51	1,000
C 2	Main Tuning Condenser	1,000	R 51	3,000	R 18	100,000	R 35	500,000	R 52	50,000
C 3	3 Plate Bandspread Condenser	50,000	R 52	100,000	R 19	10,000	R 36	100,000	R 53	50,000
C 4	4 Plate Bandspread Condenser	50,000	R 53	300	R 20	300	R 37	100,000	R 54	600
C 5	5 Plate Bandspread Condenser	2,160 mmf	R 54	1,000	R 21	400	R 38	50,000	R 55	500,000
C 6		50 mmf	R 55	3,000	R 22	1,000	R 39	200,000	R 56	1,000
C 7		2,982 mmf	R 56	15,000	R 23	3,000	R 40	250,000	R 57	100,000
C 8		2,276 mmf	R 57	100,000	R 24	50,000	R 41	250,000	R 58	200
C 9		1,600 mmf	R 58	300	R 25	300	R 42	200	R 59	250,000
C 10		876 mmf	R 59	1,000	R 26	250,000	R 43	20,000	R 60	250,000
C 11		515 mmf	R 60	3,000	R 27	500,000	R 44	5,000	R 61	500,000
C 12	Temperature Compensated		R 61	100	R 28	100	R 45	20,000	R 62	500,000
C 13	.02 mfd		R 62	500	R 29	30,000	R 46	50,000	R 63	3,000
C 14	.02 mfd		R 63	1,000	R 30	1,000	R 47	100,000	R 64	500,000
C 15	.02 mfd		R 64	3,000	R 31	1,000	R 48	100,000	R 65	500,000
C 16	.02 mfd		R 65	11,000	R 32	100,000	R 49	100,000	R 66	50,000
C 17	.05 mfd		R 66	500,000	R 33	300				

C 38	100 mmf	C 71	50 mmf
C 39	.02 mfd	C 72	.02 mfd
C 40	.02 mfd	C 73	.02 mfd
C 41	.02 mfd	C 74	.05 mfd
C 42	.05 mfd	C 75	.05 mfd
C 43	.05 mfd	C 76	100 mmf
C 44	.02 mfd	C 77	250 mmf
C 45	.02 mfd	C 78	.02 mfd
C 46	20 mmf	C 79	.05 mfd
C 47	20 mmf	C 80	.02 mfd
C 48	20 mmf	C 81	.02 mfd
C 49	20 mmf	C 82	.02 mfd
C 50	.02 mfd	C 83	.05 mfd
C 51	.05 mfd	C 84	.02 mfd
C 52	.02 mfd	C 85	.01 mfd
C 53	.02 mfd	C 86	50 mmf
C 54	100 mmf		

C 55	100 mmf	C 61	100 mmf
C 56	.02 mfd	C 62	.05 mfd
C 57	500 mmf	C 63	.05 mfd
C 58	10 mfd	C 64	40 mfd
C 59	.02 mfd	C 65	30 mfd
C 60	5000 mmf	C 66	30 mfd
C 61	3000 mmf	C 67	.02 mfd
C 62	10 mfd	C 68	.05 mfd
C 63	.05 mfd	C 69	.02 mfd
C 64	.05 mfd	C 70	.05 mfd

FREQUENCY RANGES
 1. 1580 TO 1590 KC
 2. 1580 TO 1590 KC
 3. 1580 TO 1590 KC
 4. 1580 TO 1590 KC

ALL .05 MFD CAPS. MUST BE 50V. ALL .02 MFD CAPS. MUST BE 100V. ALL .01 MFD CAPS. MUST BE 250V. ALL .005 MFD CAPS. MUST BE 500V.

SHOWING PLATE VOLTAGE FOR DC OPERATION

FROM DC OPERATION CONNECT
 1. TO PIN 2
 2. TO PIN 3
 3. TO PIN 5

of job. In fact it is the primary purpose of this article to present suggestions for increasing the scope of your business by trying in with the special conditions brought on by the present emergency conditions.

In January, 1941, issue of Service, an

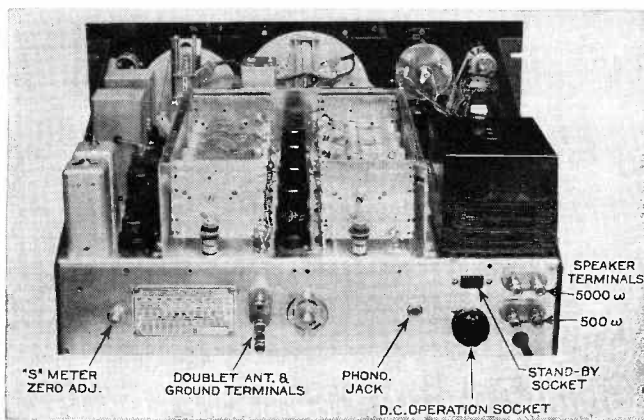


Fig. 3. (Right) Communications receivers, generally, are well shielded and are more sturdy than home sets.

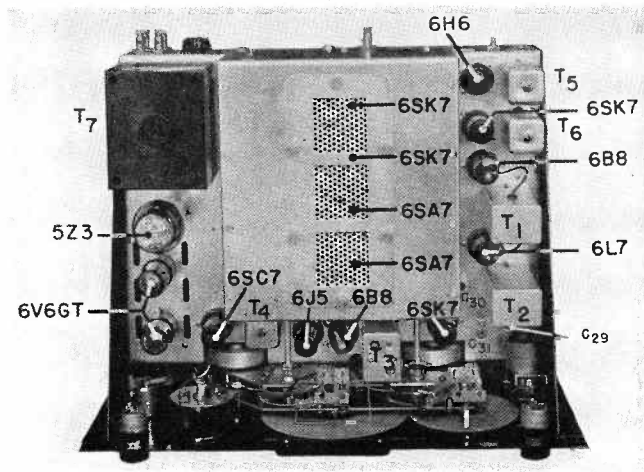


Fig. 4. (Left) The rear panel of a communications receiver provides many more connections than are found on bc sets.

article by Holmes Webster called attention to the increasing number of homes in which receivers of the "communications" type were being employed,¹ primarily to provide an effective means for direct, short-wave reception of the war news from foreign countries. It was pointed out that this type of receiver offers a particularly attractive type of service job both because it is above the average in cost price and therefore logically subject to a more satisfactory scale of service charges, and because the owner doesn't wait until it is inoperative before he wants service. He demands from his receiver much higher than average sensitivity, signal-to-noise ratio, selectivity, etc., and therefore requires more frequent realignment or other adjustment jobs than would the owner of an ordinary home receiver. He wants consistent reception from short-wave stations 2000 or more miles distant and recognizes that his receiver must be kept "in the pink" if it is to accomplish this.

Since publication of this article, the trend of the public toward communications receivers has become increasingly marked. During a stroll along Fifth and Madison Avenues just recently several radio stores in New York's exclusive shopping areas were found to be featuring this type of receiver in their windows. No better evidence of the still growing public interest could be found. In past years only hams and technical men were interested in such receivers—and they do not go shopping on Fifth Avenue for their technical equipment. Their very presence in these expensive display windows proves not only public acceptance but actual demand.

Further on in this article these receivers will be discussed from the standpoint of the service man, but first an-

¹"Communications Receiver," by Holmes Webster, SERVICE, Jan. 1941, p. 23.

other field of effort that should be distinctly worth while will be discussed. This is in connection with the emergency radio communication networks that are being organized for local operations in cities, towns and villages throughout the country as an important part of the National Civilian Defense movement, and of the augmented defense activities of local Red Cross Chapters.

Civil Defense

It is the function of these networks to provide the communications arm of these services so that in case of emergency the civilian defense will not be hampered by a breakdown of the more common communications media includ-

HAMS OFF THE AIR

AMATEUR radio stations have been officially ruled off the air by the Federal Communications Commission on Sunday, December 7, after the announcement of the outbreak of hostilities with Japan. However, those hams who are engaged in direct civilian defense work and those who are officially cooperating with local defense councils will have their licenses restored by the FCC through request of their particular defense councils.

ing the telephone, police and fire department telegraph systems, etc. The networks are manned by the U. S. licensed radio amateurs equipped for the most part with ultra-high frequency (2½-meter) transmitting and receiving units which they carry around either on foot or in a car. Thus far such equipment is mostly owned by these ham volunteers themselves although in some cases, and this will probably be a growing tendency, the equipment is purchased by the

local Defense Council and operated by hams.

Usually there is a higher-powered, fixed transmitter which acts as the central control station, capable of being heard by, and of hearing each of the mobile or portable units. In emergency drills these mobile units are spotted at the scene of the mock disaster, at police headquarters, Red Cross headquarters, fire houses, etc., so that messages can be instantly passed back and forth between these or other strategic points.

It may be well to point out here that the work being done by the local and National Defense Councils is no game. It is taken very seriously by the government, local authorities and the public. At Fairfield, Conn., a simulated disaster brought out some 300 workers of the local organization, three fire companies, local and state police cars, ambulances, doctors, nurses, and emergency trucks from the local power and telephone companies. In this case the radio network, consisting of licensed amateurs using portable transceivers supplied by the Fairfield Defense Council, provided all communication facilities, from transmitting the first emergency call to police, fire and Red Cross headquarters, to flashing the final "all clear" signal which terminated the demonstration.

Photos and movies were made during the demonstration with the result that probably every resident of the town was made thoroughly familiar with what had transpired and who had participated.

In Westchester County, New York, the defense communications are handled by the Westchester Amateur Radio Association, a county-wide organization with eighty odd amateur members. This organization can put approximately thirty members out in the field at a moment's notice, each equipped with his own portable or mobile 2½-meter transmitting and receiving unit. It cooperates with the Defense Councils of individual towns within the county and, in addition to handling the communications end of defense activities, has established train-

ing classes to provide the technical and other instruction enabling trainees to obtain amateur radio operators and station licenses.

For you this activity offers a three-fold opportunity—(1) for patriotic service, (2) for building good-will and (3) for direct service business which may

with conventional all-wave receivers in two basic respects. (1) Operating requirements of the former are more critical, involving extreme degrees of sensitivity, selectivity and freedom from noise. These requirements make tube quality and alignment more important and critical. (2) There are a number

through a high noise level, and to permit operation at times when loudspeaker output might disturb others.

Stand-by switch—used in amateur and commercial stations to kill the receiver during periods of transmission. Disconnects plate supply from all tubes.

Band-spread tuning—usually a separate tuning control to facilitate tuning within a selected short-wave band.

Crystal filter—to provide a much higher degree of selectivity than is obtainable with tuned circuits alone. Especially useful for cw reception where radical side-band cutting is of no consequence.

"S" meter—provides a measure of the relative strength of the received carrier. Aids the operator in giving signal-strength reports to stations worked (amateur application). Often a milliammeter in plate circuits of one or more i-f stages where it reflects changes in plate current resulting from variations in avc voltage. Sometimes employs a separate "meter tube", the combination functioning as a v-t voltmeter to measure avc voltage directly.

Noise Limiter—to reduce automobile ignition and similar noises which may cause serious interference when receiving weak short-wave signals. Usually this feature takes the form of a "noise gate" which functions to block the audio system during individual noise impulses of greater amplitude than the voice modulation. Such a system often utilizes one section of the detector diode, in a resistance-capacity network so arranged that the diode becomes conductive during strong noise impulses, effectively shorting the noise to ground. In some cases the noise system is of the Lamb type and utilizes extra tubes. In this system (included in Fig. 1) noise is picked off the i-f system, amplified and rectified, then fed back to one of the i-f tubes in the form of negative voltage impulses which cancel corresponding positive noise impulses on the carrier by momentarily decreasing the sensitivity of this i-f tube.

Figure 1 shows the schematic circuit of a modern, high-grade communications receiver, the Hallicrafters "Super Skyrider" SX28. The actual circuit arrangements which provide the above features can be determined by a study of this diagram; also other points of difference between this and the conventional broadcast receiver circuit. The photographs of Figs. 2, 3 and 4, showing this same receiver, will serve to illustrate certain physical differences in general layout and construction, one of the most important of these being the greater sturdiness of the communications receiver. In some of these photos, the cabinet, shield covers over condenser and coil assemblies, and bottom plate, have been removed. With these in position this receiver weighs 75 pounds—a good indication of its husky construction.

There are many features which a good broadcast receiver and communications receivers have in common but which are likely to be more highly developed in the latter. Thus the communications receiver may provide up to six degrees of selectivity adjustment, dual or even triple avc, at least one and often two r-f stages, etc.

The alignment operation is a more critical one in the case of the communication receiver, especially where crystal filter is employed. Evidence of this is given in the r-f alignment chart shown in connection with Fig. 2 and in the following manufacturer's instructions:

Control Settings for Alignment

Tone control at maximum high-frequency
(Continued on page 21)

RF ALIGNMENT							
Connect hot lead of signal generator to A ₁ —through dummy antenna shown in table. Leave jumper connected between A ₂ and G. Ground of Generator to Chassis.							
Band	Rec. Dial Setting	Sig. Gen. Freq.	Dummy Antenna	HIGH FREQUENCY END			LOW FREQUENCY END
				Adjust Osc. With	Adjust Trimmers for Max. Gain		Adjust Osc. With	Permeability Tuned By
1	1.4 mc	1.4 mc	200 mmf	C _A	C _B	C _C	S ₁
1	.6	.6	200 mmf	....	....	....	S ₁
2	2.8	2.8	400 ohms	C _D	C _E	C _F	S ₂
2	1.6	1.6	400 ohms	....	....	....	S ₂
3	5.6	5.6	400 ohms	C _G	C _H	C _J	S ₃
3	3.2	3.2	400 ohms	....	....	....	S ₃ S ₄ S ₅
4	11	11	400 ohms	C _K	C _L	C _M	S ₆
4	6	6	400 ohms	....	....	....	S ₆ S ₇ S ₈
5	20	20	400 ohms	C _N	C _O	C _P	S ₉
5	11	11	400 ohms	....	....	....	S ₉ S ₁₀ S ₁₁
6	36	36	400 ohms	C _Q	C _R	C _S	S ₁₂
6	22	22	400 ohms	....	....	....	S ₁₂ S ₁₃ S ₁₄

Fig. 5. R-f alignment operations for the Hallicrafters SX28 communications receiver. The trimmer locations are shown in Fig. 2.

result. The patriotic motive is so obvious that it need not be discussed. The other two are less obvious and therefore do rate at least brief explanation.

To the public this sort of activity represents radio in a new, advanced and quite wonderful aspect. If the local Service Man, supposedly an oracle on radio matters, does not participate, the public (especially in smaller communities) is likely to form the opinion that he is either not technically qualified for this new (to the public) form of radio, or that he is unwilling to devote a small portion of his time to a patriotic purpose which he is especially qualified to serve. Either opinion, whether justified or not, is bad for business. Participation, on the other hand builds good-will and is a constructive aid to business.

The direct business which may result from participation may consist of an appointment to take charge of maintenance of community-owned emergency equipment, of repair or alteration jobs on equipment owned by individual members of the emergency net, of installation jobs where the equipment is to be used in mobile service, of jobs involving the adaptation of dry-cell powered equipment to operate from car battery and vibrapack, or from the power lines, etc. While the amateur operators are usually entirely capable of doing these jobs themselves they, often business and professional men, may not have the time or desire, particularly as some of them are already making a sacrifice in giving the time necessary to attend drills and otherwise performing the duties involved in their defense activities.

Communications Receivers

Servicing communications type receivers differs from the procedure used

of features included in this type of receiver that are not encountered in standard types.

Despite the critical nature of these receivers, standard service equipment of good quality will prove adequate. Some advantage is to be gained if the shop is equipped with a laboratory-type signal generator which will aid in accurate measurement of fractional-microvolt sensitivity, 0.5 kilocycle selectivity, etc., but this is not essential. A standard signal generator will enable reasonably accurate checks of these features which will serve in lieu of actual quantitative measurements. It must, however, be one that is accurately calibrated, capable of maintaining its output frequency constant and should provide a high degree of attenuation in order that service operations can be performed with an input equivalent to an extremely weak signal. The other equipment required includes only the conventional.

Following is a listing of special features employed in communications receivers. All of these features are not found in all receivers of this type although some of the best include them all and for that reason you would do well to familiarize yourself with all.

Beat-frequency oscillator—employed in heterodyne reception of cw code and for locating weak phone stations.

AVC off-on switch—cutting out avc permits more satisfactory code reception and usually somewhat higher sensitivity when listening to extremely weak phone signals.

Manual r-f gain control—provides means for sensitivity control when operating without avc.

Headphone jack—permits use of headphones for better reception of weak signals, to aid in understanding weak signals

SOLVING SHORTAGE PROBLEMS

In Interstage R-F Circuits

By **ROBERT G. HERZOG**

EDITOR

LAST MONTH, on these pages we discussed the possibilities of using alternate values in the input circuits of typical tuned-radio-frequency stages.¹ Some of the circuits discussed contained the same or similar elements to those included in this month's article. Thus, for example, the resistor, R_c , as mentioned last month, represents the resistance in the cathode circuit which will provide the proper grid bias for the stage during those periods of operation when little or no signal is received. During such periods, or during tuning, when no carrier is present in the set the only bias available for the tuned r-f stage originates across the cathode resistor R_c .

Circuit Considerations

The by-pass condenser C_{bp} , also mentioned last month, is used to present a low-impedance path to ground for signal currents. Without C_{bp} , these currents would build up across R_c and cause degeneration. Although self-bias in the cathode circuit is indicated some manufacturers employ other means to obtain the no-signal bias for

THE PROMINENT receiver design engineers listed below have agreed to serve as an editorial advisory board in connection with the articles of this series:

Patrick A. D'Orio
Assistant Chief Engineer
BELMONT RADIO CORPORATION

Marcus Glaser
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DEWALD RADIO MANUFACTURING CORPORATION

Dorman Israel
Chief Engineer
EMERSON RADIO & TELEVISION CORPORATION

William E. Cairnes
Chief Engineer, Home Set Division
GALVIN MANUFACTURING CORP.

Barnett Trott
Chief Engineer
GAROD RADIO CORPORATION

Garrard Mountjoy
Engineer
RCA LICENSE LABORATORIES

Lewis Winner
Editor
COMMUNICATIONS MAGAZINE

Henry Howard
Contributing Editor
SERVICE MAGAZINE

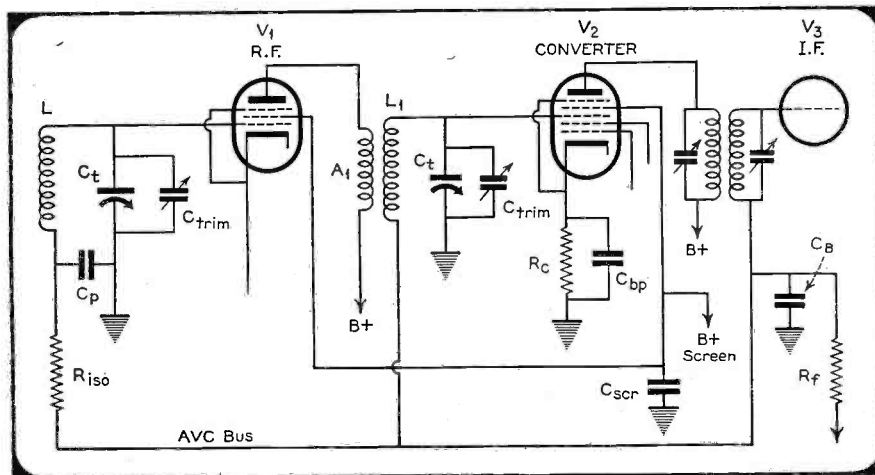
The secondaries of the r-f (L) and the converter (L_1) coils are tuned by the condensers labeled C_t which are parts of the gang assembly. The condenser C_p in series with C_t is sufficiently large so as to have a negligible effect on the tuning range and characteristics of the tuned circuit. The condensers C trim are used to align the

The purpose of these resistors is to isolate the various tuned stages of the receiver. Where an r-f stage is used such isolation is essential if the receiver is to operate without interstage feedback. However, the grid return of the converter stage together with that of the i-f stage (see Fig. 1) may be connected directly to the avc bus without individual isolation. No ill effects result in such cases because of the difference in frequency between r-f and i-f.

In the accompanying circuits in the plate of the r-f amplifier tube is connected to a coupling circuit which feeds the energy to the grid of the next stage.

Figs. 1 and 6 show a typical tuned r-f transformer which feeds the signal energy from the radio-frequency amplifier tube to the grid of the converter. The secondary of the coil and the tuning condenser provide additional selection for the signal. As in the case of the r-f amplifier the combination of L_1 and C_t will be resonant to some particular frequency at any given setting of C_t and a voltage at that frequency will appear across L_1 . The voltage is led into signal control grid of converter tube. Although inductive coupling is shown additional capacitive coupling, such as a "gimmik" or "coupling turn" is usually employed.

Figs. 3, 4 and 5 show various r-f interstage coupling methods found in re-



I-f and converter grid returns may be connected together without isolation because of the difference of frequency.

these stages. These were fully discussed last month.

1. "Solving Shortage Problems in Input R-F Circuits," by Robert G. Herzog, SERVICE, Nov. 1941, p. 5.

sections of C_t to track with each other and with the oscillator section.

It will be noticed, in Figs. 1 and 2, that the resistors R_{iso} are shown connected between the lower end of the tuning coils and the bus which supplies the automatic volume control potentials.

cent receiver models. In these circuits the gain of the r-f stage is left entirely to the tube itself, and no selection is given to the signal frequency.

In the superhetrodyne receiver the greatest step-up in r-f amplification is obtained in the intermediate frequency amplifier. Greater amplification can be secured because of the fact that a relatively low frequency can be used, such as 455 kc, where the r-f losses are much less than at the higher frequencies. To transfer the incoming radio signal to the frequency of the i-f amplifier it is necessary to use a local oscillator, within the receiver, tuned to a frequency above or below (usually above) the incoming radio signal by an amount equal to the frequency at which the i-f performs.

In most present day superhetrodyne receivers the first detector tube (V_2 in the accompanying illustrations) is usually of a type which combines the functions of mixer and oscillator in a single envelope. There are any number of tube types in use which provide characteristics that give good performance of both functions at the same time.

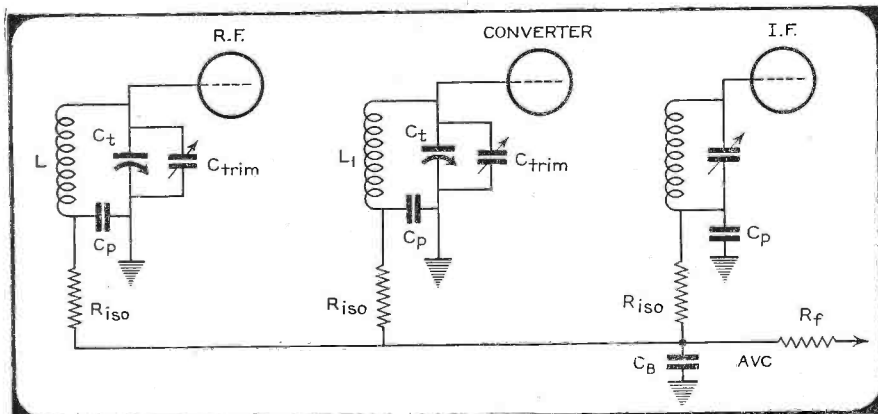
The resistor R_z and its associated condenser C_B , in the avc circuit are provided as a filter network to smooth out pulses in the rectified control voltages. In circuits where one or more grid returns are connected directly to the avc bus, such as that shown in Fig. 1, the condenser serves the additional function of completing the tuning circuits.

Voltage is generally supplied to the screens of the several r-f and i-f tubes from a common point on a divider network. This point is by-passed (by the condenser C_{scr} in the illustrations shown) to prevent coupling between the stages connected thereto. The by-pass is essential if the receiver is to operate without interstage feedback.

Individual Variations

Figs. 1 to 6 illustrate r-f interstage

Fig. 2. Some receivers employ isolation networks for each r-f and i-f grid return.



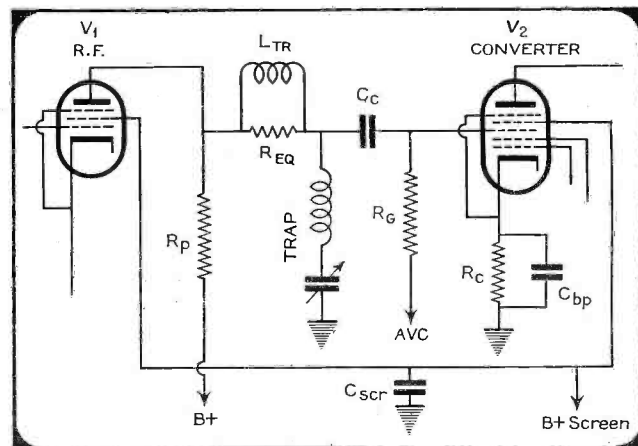
circuits in use in present day radio receivers. Figs. 1 and 2 show the avc isolation and filter circuits in some detail. Similar connections are used with the other circuits shown. Values commonly employed by receiver manufacturers for the resistor(s) R_{iso} and the condenser(s) C_p were discussed in these columns last month and the same information applies to the respective circuits shown herewith. The information also applies to circuits wherein the antenna input coil, or loop, is connected directly to the control grid of the converter tube.

Values ranging from 1.0 to 2.2 megs are found in different receivers for the avc filter resistor R_f . Condenser C_B ranges from 0.05 to 0.1 mfd. in different receiver models.

Where more than one r-f or i-f screen is connected to a common point on the divider, the screen by-pass, C_{scr} may range from 0.05 to 0.1 mfd. Individually isolated stages may often employ values as low as 0.01 mfd.

Fig. 3 shows the simplest of the resistance-coupled interstage r-f arrangements. The plate load resistance R_p , across which the output voltage of the r-f tube is developed, has a value somewhere between 3,000 and 10,000 ohms,

Fig. 5. The trap circuit indicated is employed to filter extraneous signals of the i-f peak. A substitute may be made from a coil and condenser taken from an old i-f transformer. Only one coil or half of the transformer is required. Similar wave-trap arrangements are sometimes connected in other positions in the receiver circuits instead of as shown.



depending upon the particular manufacturer's design. The condenser C_c , which feeds this voltage to the control-grid of the converter tube, has a value

between 50 and 250 mmfd. Values used by different manufacturers for the converter grid-load resistor vary between 5,000 and 500,000 ohms.

Fig. 4 is the same as that of Fig. 3, except for the addition of the peaking circuit consisting of the coil L_{TR} and the resistor R_{EQ} . Elements such as these are sometimes employed, more often in multi-band receivers, to improve the signal amplification gain in the circuit, particularly in the higher-frequency band.

The resistor R_{EQ} is connected across the coil L_{TR} to broaden its characteristic. Use of the resistor spreads the characteristic over a larger portion of the band. The value of R_{EQ} depends upon the coil L_{TR} . A similar peaking circuit is included in Fig. 5.

The coil and variable condenser labelled "TRAP" in Fig. 5, is a typical i-f wave trap designed to filter extraneous signals, of the same frequency as the intermediate amplifier, from the remaining receiver circuits and the loudspeaker. It is tuned and requires adjustment to produce a *minimum* of interference at the intermediate frequency.

Occasionally an additional resistance-capacity r-f filter network is employed

in the plate return circuits of higher priced receivers. This is exemplified by the resistor R_{rt} and the condenser C_{rt} of Fig. 6. Resistances used in such circuits by different manufacturers range from 2,000 to 10,000 ohms and condensers vary from 0.01 to 0.1 mfd. The use of such a filter further isolates the various r-f circuits and improves stability.

Alternate Values and Repairs

The following suggestions are given only as possible alternatives in the advent that you should find difficulty in obtaining the exact parts required for a particular repair. It cannot be over-emphasized that, at best, the alterations mentioned will produce only a makeshift. More than one of the substitu-

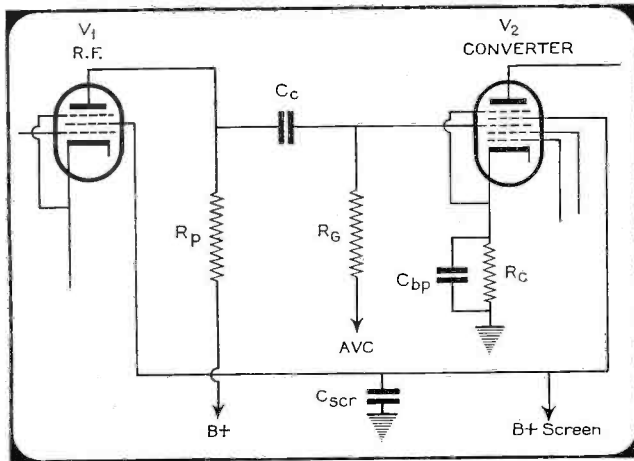


Fig. 3. The simplest resistance-coupled r-f interstage circuit. No traps or equalizers are employed.

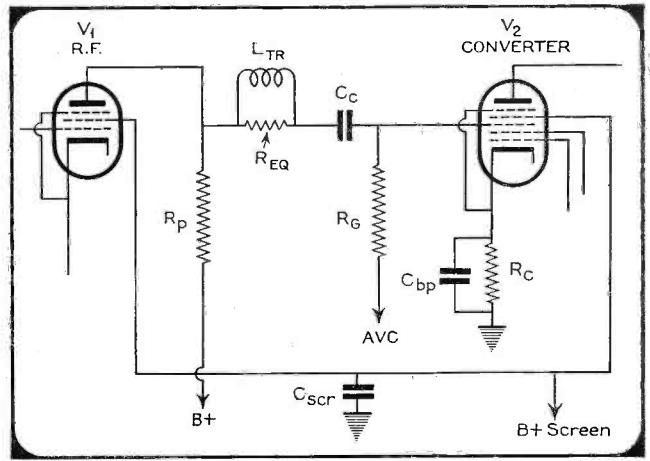


Fig. 4. The coil and resistance shown form an equalizer circuit that helps improve the gain.

tions indicated will certainly produce noticeable effects in the receiver's per-

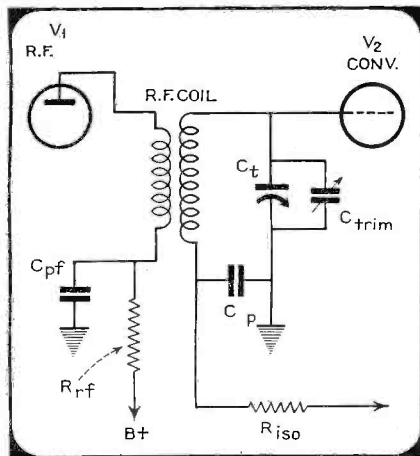


Fig. 6. Higher priced sets often employ resistance-capacity filter in plate circuit of each stage for complete isolation.

formance. In every case exact value prescribed by set manufacturer's specifications should be used if at all available.

As mentioned last month¹ breaks in coils can usually be repaired. In coil sections with 100 turns or more, a single turn may be removed, the loose ends scraped, twisted together and soldered. A narrow strip of cardboard temporarily slid under the break will protect the winding during the soldering operation.

It is important to note that the mutual inductance of the r-f transformer (See Figs. 1, 2 and 6) is an essential element in the gain of the r-f stage. This mutual inductance is affected by the physical arrangement and positioning of the two windings. For this reason, if any winding is replaced you should make it a point to use the same size wire and number of turns and to place the new winding in exactly the same position as the old one.

Defective wave traps, such as the one illustrated in Fig. 5, can be replaced with a coil and condenser salvaged

from an i-f transformer having the same frequency range.

Since a 20 percent variation in the screen voltage will cause no readily detectable effects in the receiver's operation, changes in resistor values are permissible in these circuits, provided that such changes will not produce a greater voltage variation. Larger by-pass condensers in such circuits are generally an improvement and up to a 20 percent reduction in capacity will not affect operation seriously.

The resistors R_{iso} and R_f and their accompanying condensers C_p and C_B are not critical and a 20 percent variation is easily permissible. However, R_{iso} and C_p , and also R_f and C_B where the grid returns are connected directly to them, affect the time constant of the receiver's avc circuits. For this reason any large change in the value of any one should be followed by a similar alteration of the value of the other component, in the opposite direction.

Possible substitution of the cathode resistor R_c and its condenser C_{bp} was discussed last month—in general, 25 percent alteration in value, in a single stage, will have little effect on receiver performance.

Similarly, a 25 percent alteration of the value of the plate-load resistor, R_p , or the grid load, R_g , will have little effect on the operation of the receiver.

The inductance of the coil L_{TR} and the resistance R_{EQ} are much more critical. In the event that the replacement of either is necessary it is advisable to use the same values as indicated in the original design.

Band Switches

While the function of a band switch is merely that of shifting connections, these shifts may cover a lot of territory. Such switches are not only called upon to change over from one coil to another but usually short out unused windings, connect windings in series or parallel, change antenna connections, band-spread ranges and the like. Because of the complications of these

functions it is advisable *not* to make replacements which will alter the design of the circuit.

Where a single wafer of a multi-deck switch is defective it should be possible to replace that wafer alone. Chips or cracks in wafers can often be mended with ordinary household cement.

As for poor contacts—every Service Man knows what a little carbon tetrachloride will do toward cleaning these and cutting out noise.

Summary

In the interstage r-f coupling circuits pictured in the accompanying illustrations, many of the parts shown were discussed last month¹. The same considerations apply to the respective components in the units shown herewith.

R-f coupling circuits are used to lead the signal voltage from the input tube plate to the converter stage control grid. Where r-f transformers are used some gain and signal selection is obtained in the coupling unit as well as in the tube. In resistance-coupled circuits the only increase in the signal voltage is obtained from the tube. No selection is offered the signal in such stages.

Increasing the value of r-f by-pass condensers in plate, screen and cathode circuits generally improves the stability of the circuit in question. A decrease in value up to 20 percent is often permissible in these same circuits.

Except for the trap and equalizer circuits, substitution of resistor values for those shown in the diagrams herewith is usually permissible, up to plus or minus 25 percent of the specified value. In avc circuits, however, the resistors and their associated condensers affect the time constant of the circuit. Any large change in one component (resistor or condenser) should be offset by a corresponding change in the value of the other, in the opposite direction.

CIRCUITS

By HENRY HOWARD

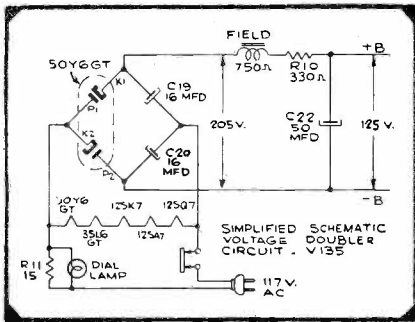


Fig. 1. RCA V135 bridge type voltage doubler circuit.

IT LOOKS like the time is approaching when the ingenious Service Man with an inventive twist and a little mechanical ability may outstrip the average guy with a lot more experience. As replacement parts become scarcer, substitutions will have to be made. For instance, when the primary of a push-pull input transformer opens up, impedance-resistance coupling can be used with the secondary acting like a tapped choke or 1:1 auto-transformer. Low-frequency i-f transformers can be fashioned from 455-kc coils in series. Power and filter components can be subjected to considerable juggling as long as ratings are not exceeded. We have previously taken up the speaker problem.

Trends

The following trends also seem well marked:

(1) Record changers and players are more popular than ever. Hope these parts hold out for a while. Plenty service jobs on changers—to say nothing of extra profits selling the new permanent needles.

(2) It looks like the coming season will not see many personal sets as the miniature tubes are finding considerable application in defense projects and may not be available for broadcast receivers.

(3) Airplane full-and semi-dials are coming back. Not having to thread string around wobbly pulleys will add a few years to your existence—and should save plenty cussing.

(4) Power transformers are becoming scarce; there will be more and more a-c, d-c and transformerless sets. Those with more power output will use voltage-doubler systems.

(5) Wooden knobs are replacing bake-and spring insert types are favored over screw machine hardware for shaft fastening.

(6) Chassis are coming with zinc or lead coatings—no cadmium available.

(7) Many of the new midget cabinets are of wood, but we expect to see new plastic mixes for 1942.

(8) Volume controls and switches are being designed without bushings, as screw machine parts are harder to get.

(9) Companies are becoming more signal-to-noise conscious: tuned radio frequency stages help considerably—and are we glad to note this trend!

(10) Some manufacturers are now supplying variable condensers with steel

The voltage regulation of this combination is poor—meaning that there is a substantial voltage change for a small change in load.

Alternate Speaker

Coronado Model C5D14, which originally had a p-m speaker, is now being supplied with an electro-dynamic. The field is excited by replacing the filter resistor R_1 , shown in Fig. 2. This is just a bit more evidence of the scarcity of p-m's.

Permeability Tuning

Ward's *Airline Model 14BR911A* features permeability tuning with individual slugs in all coils on all bands, including i-f padding and a tuned r-f stage. This includes four spread bands as well as broadcast. Note the input circuit in Fig. 3 showing the high-pass filter antenna-coupling circuit consisting of a 0.0005 mfd and two 25000-ohm shunt resistors feeding the low side of the loop. The broadcast loop circuit has four elements—all in series—besides the trimmer condenser. This 9-tuber also has independent bass and treble tone controls having three positions each. Looks like quite a job.

Antenna Connections

Speaking of antenna circuits, *Garrod C200* has antenna posts for long and short antennae, a loop receiver. The short aerial feeds the loop coupling turn in series with a 0.006 mfd, while the long antenna has to overcome a 0.0001-mfd in addition. Looks like the old "Local-Distance" switch before remote cut-off tubes were perfected.

Fig. 3A. Airline 14BR911A features permeability tuning.

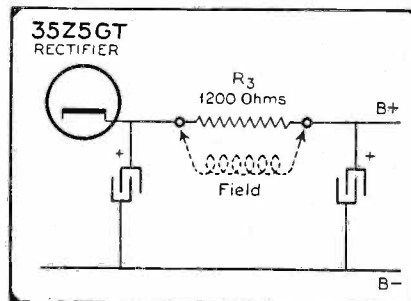
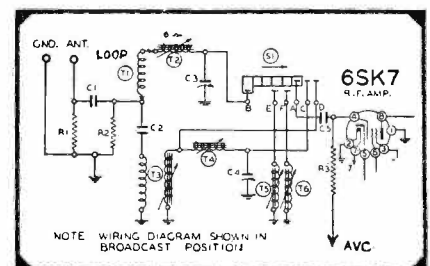


Fig. 2. Coronado C5D14 provides for either p-m or electrodynamic speaker.

plates for both rotor and stator except that the outside rotor plates are of aluminum. This is done to minimize microphonics—or acoustic coupling from speaker to tuning condenser. When the condenser vibrates the sound waves actually modulate the oscillator, causing considerable distortion if not outright howling. The aluminum end plates are soft and much less responsive to disturbances than springy steel.

(11) There is a movement on to change i-f coil design to eliminate shields in small receivers. It seems that, with careful placement, the second detector shield may be omitted. We hope this trend doesn't cause too many headaches with oscillating sets.

Voltage Doubler

Fig. 1 shows the voltage-doubler circuit employed in the *RCA Model V135*, which uses a 50Y6GT and a pair of 16-mfd condensers. Note that the voltage output is 205, but this is dropped to 125 by the field and resistor.

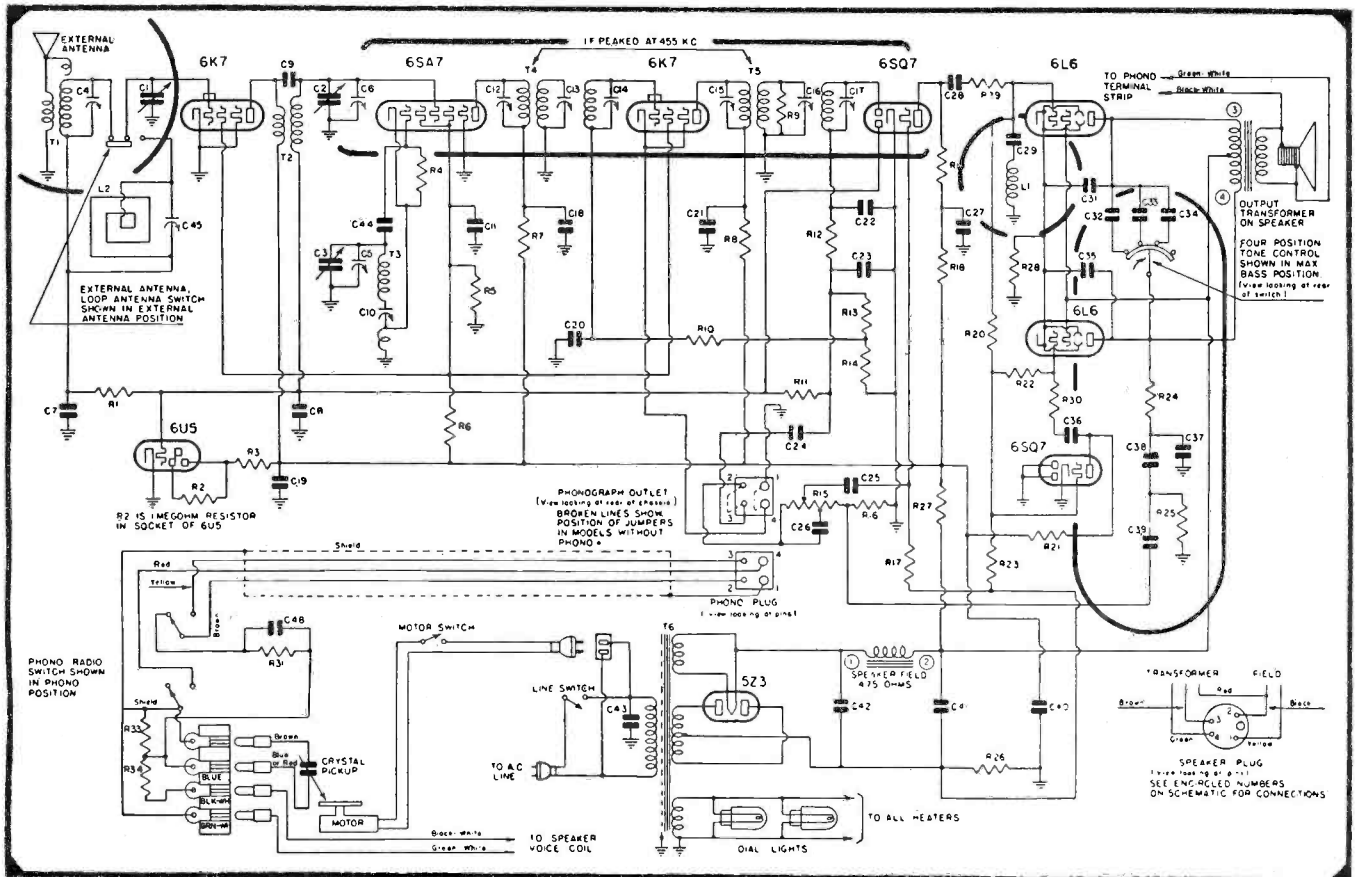


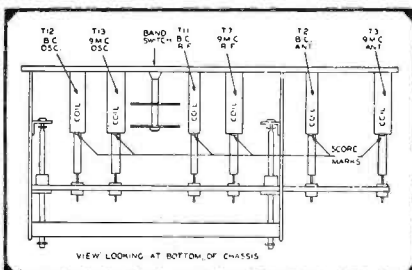
Fig. 5. Emerson DS365, DS372 presents many interesting circuit features.

Then, *Stewart Warner* uses a high-impedance primary coil for coupling the external antenna to the loop. This primary is shunted by a 110-mfd condenser which resonates at a lower frequency than the broadcast band. This increases the sensitivity to the lower frequencies.

Output Tube Bias

DeWald 563 gets an increase in power output by deriving grid bias for the power tube from rectified r-f. This permits the entire B voltage to be used on the plate and screen grid. Fig. 4 shows the method of obtaining the bias and its filter system. Voltage is taken directly from the oscillator grid, which has a potential of -11 volts, and is fed to a divider consisting of two quarter megs in series. Hence, the power tube grid is biased at $5\frac{1}{2}$ volts. The filter consists of the first quarter meg and the 0.0001-mfd first a-f plate condenser.

Fig. 3B. Adjustments on the coil cores are provided for alignment.

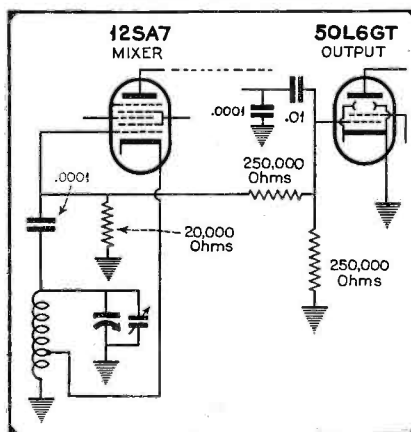


What little r-f ripple remains can't possibly get through the power stage and apparently has negligible effect on quality.

Variable Selectivity

There seems to be a trend toward high-fidelity with triple-tuned i-f trans-

Fig. 4. DeWald 563 obtains bias from oscillator grid circuit.



formers giving flat top band-pass effect as well as variable selectivity. *Emerson DS365 and DS372*, 8-tube phono combination with a three gang condenser and t-r-f stage, are single-band receivers featuring triple tuning in the i-f stages. See Fig. 5. An antenna switch and transformer are provided to switch from loop to outside aerial. The audio end is equally interesting. Coup-

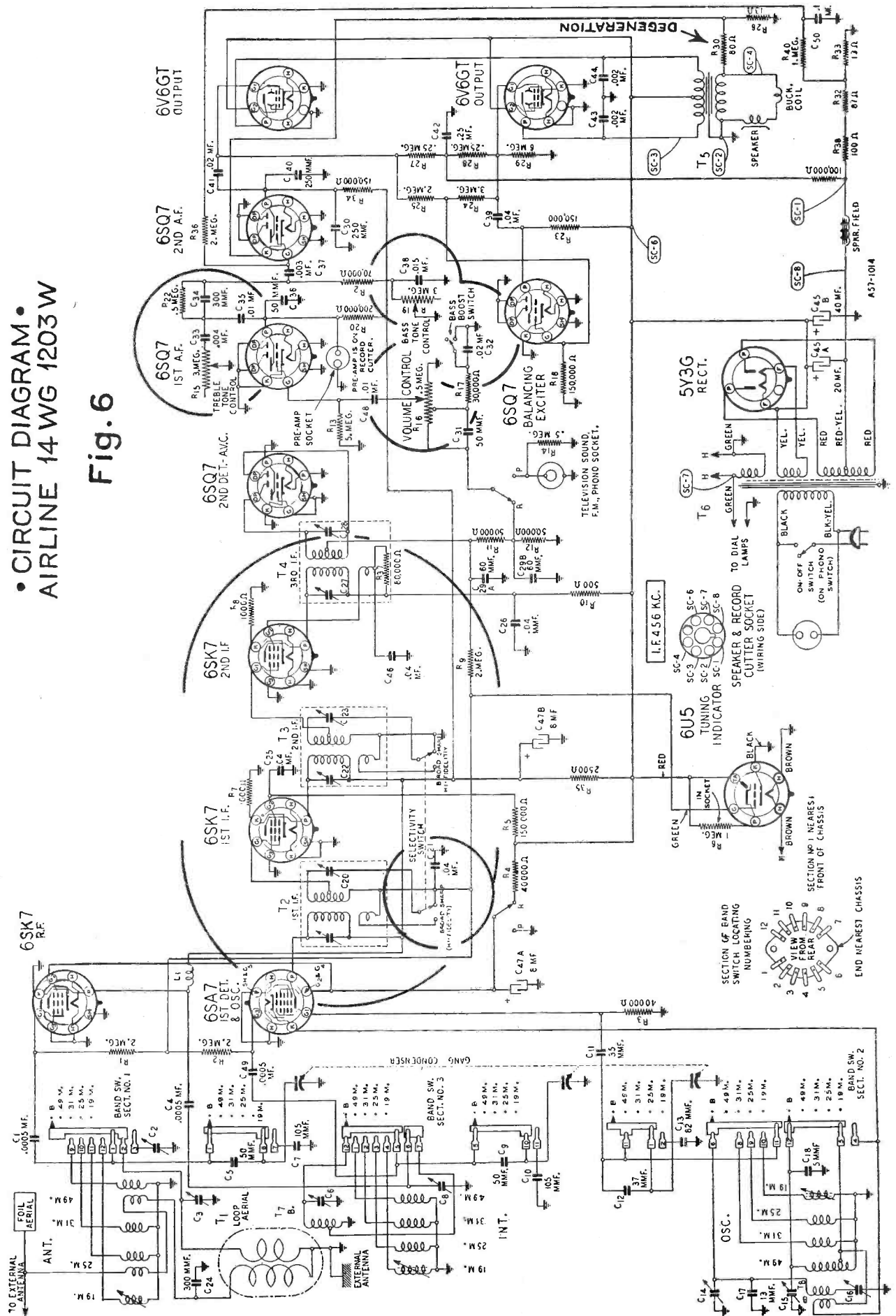
ling from the first audio to the first 6L6 is through a 0.1-mfd condenser and 50,000 ohms. This condenser-resistor coupling system is getting quite fashionable. Note the 10-kc series trap, or filter, in the grid of the first 6L6. With wide-band i-f amplification, it is important to kill the 10-kc beat from an adjacent channel station which would spoil reception were it to get through to the speaker. Note the double bass-compensated volume control and four-position tone control. Here's one item that isn't cut and dried.

Ward's Airline Model 14WG1203-W has two degrees of selectivity. The band width is increased by providing additional coupling in the i-f transformers as shown in Fig. 6. Note that the grids are tapped down on the secondaries and that push-pull or full-wave detection is used. This set has 5 bands, t-r-f, two i-f stages, a second a-f stage to make up for degeneration and an elaborate tone control system.

The high side of the volume control is tapped on to a voltage divider giving only half the developed detector voltage. This, of course, is in the interest of better quality by virtue of less loading of the detector and better r-f filtering. The volume control itself has a shunt circuit for equalizing and bass boost. The treble and bass tone controls

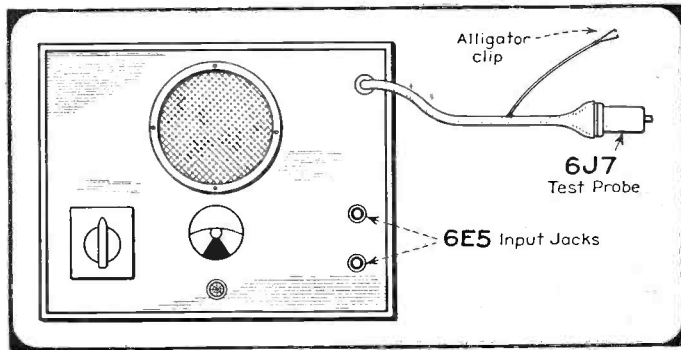
• CIRCUIT DIAGRAM •
AIRLINE 14 WG 1203 W

Fig. 6



A - F C I R C U I T T E S T E R

By WILLARD MOODY



The 6J7 input tube is used as the test probe for the instrument described in these columns. The device provides a simple, inexpensive testing unit designed to locate trouble in audio stages of receivers and amplifiers

tuted a single heater winding on the power transformer will suffice for both the rectifier and amplifier tubes.

The chassis is of no special construction and any small one, with a suitable metal front panel, may be employed for the unit. For maximum convenience the device should be made as small as possible. In general, the entire instrument can be made from parts found around the shop.

The input tube and socket are mounted at the end of a long shielded cable. For best results the tube's plate lead should be separately shielded inside this cable. A short bus-bar may be soldered to the grid contact on the top of the 6J7 tube. However, since this lead will act as an antenna, to pick up extraneous signals, it should be kept as short as possible, preferably less than $\frac{3}{4}$ ths of an inch.

The loudspeaker may be anything from three inches, up. It may have a p-m or an electrodynamic field. Where a p-m speaker is used, the B supply for the instrument should employ a choke filter, rather than a resistance. Since the device is to be used to trace hum, it is desirable that it be as hum-free as possible.

THE INSTRUMENT described in this article is nothing more than an external amplifier arranged so that it may be used conveniently to indicate trouble in audio circuits in radio receivers, amplifiers and electronic equipment. A 6E5 is also provided for checking of the avc voltages at any point in the receiver without loading the circuit under test.

I have found innumerable uses for the device, on my own bench, and find that it speeds up my work. For example, a G. E. FA80 came in for repairs. The set was inoperative. By connecting the probe to the grid circuits of the 6R7 first audio stage, the receiver's output was heard in the test speaker. This localized the trouble in the audio section of the G. E. receiver. A new 6R7 made the set operate . . . yet this tube checked O. K. in a good tube tester.

In spite of the fact that the set operated with the new tube, considerable distortion was present in the signal heard from the loudspeaker. By moving the test probe of the external amplifier to the voice coil of the loudspeaker, the distortion was definitely traced to the speaker itself.

In another instance the trouble in a distorting G. E. GD62 was located in the plate to grid coupling condenser, by means of this instrument, in short order.

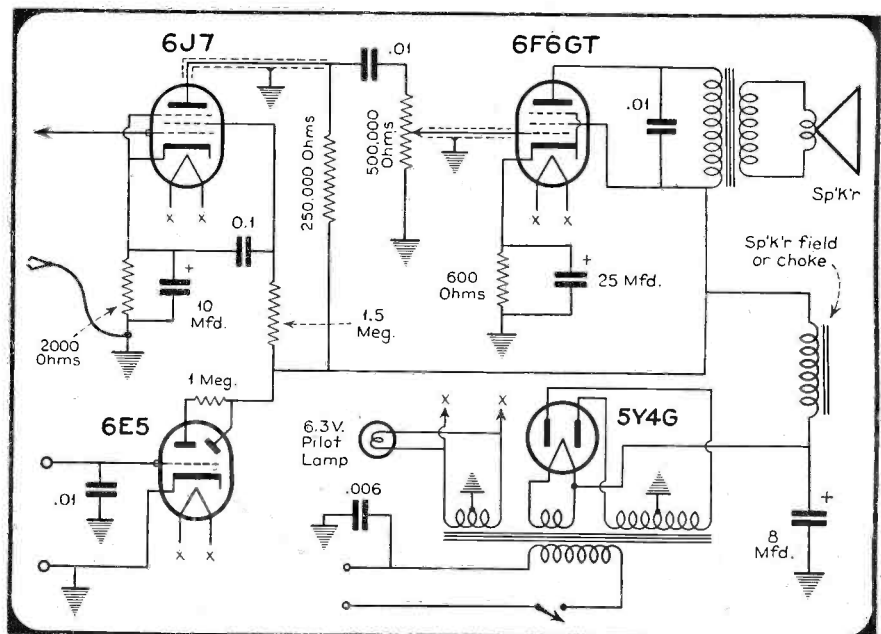
This checker is particularly useful in tracing the source of hum or distortion throughout receiver or amplifier circuits.

The 6E5 visual indication comes in

handy as an output meter (connected to the avc circuits) during alignment of a receiver's r-f and i-f circuits.

The instrument comprises a two-stage resistance-coupled amplifier which utilizes two metal tubes and a glass tube rectifier. A 6F6 is specified for the output stage, but any similar type, such as a 6K6, for example, may be used. Likewise, any other rectifier, such as the type 80 or even a 6X5 or 84, may be used instead of the 5Y4G rectifier. In the event that the 6X5 or 84 is substi-

The a-f tester can be made with simple parts usually available around the service shop.



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BETTER RADIO SERVICE



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Complete line ... Same Super Quality as found in N. U. Tubes. Just try them.



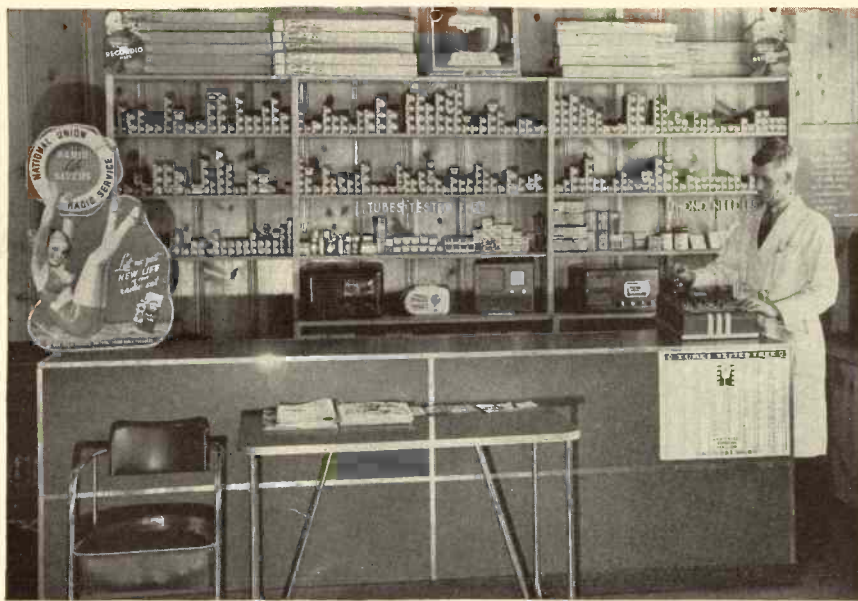
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NATIONAL UNION invites ...

All radio service dealers to enjoy the benefits of the N. U. Shop Equipment Plan. The latest in tube testers and test equipment are available to you, immediate delivery. More than 60,000 completed deals prove the success of this plan. Investigate now.

ADDITIONAL PRODUCTS

Sound X|tra tubes, panel lamps, cathode ray tubes, exciter lamps, sound equipment, photo electric cells, sound accessories, dry batteries, flash light bulbs

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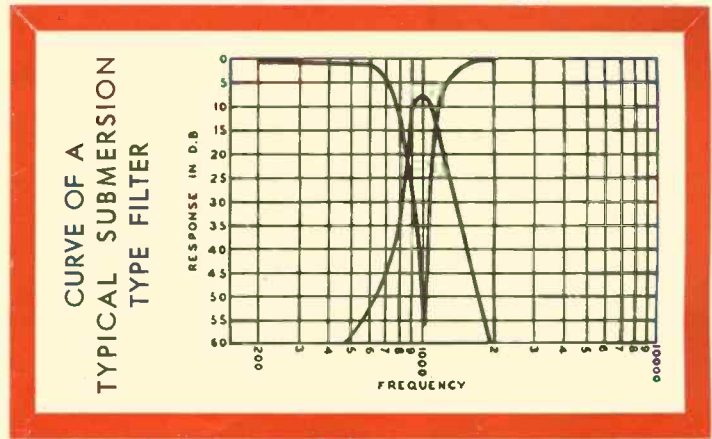
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These units are designed to take the most extreme of Navy tests, which consist of five complete submersion cycles under salt water over a very wide range of temperatures.



The same engineering development which perfected these units can be applied to the solution of your transformer problem.

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PERMEABILITY TUNING

Alignment Procedure

THE FOLLOWING is the procedure for aligning Philco and other tuning units after a coil or core has been replaced. The unit should be aligned after it has been installed in the receiver:

1) Complete alignment.

a) Turn the control knob clockwise as far it will go.

b) Adjust antenna and oscillator cores according to dimensions given in Figs. 1, 2 and 3.

c) Set up the signal generator, connecting the lead through the proper dummy to the antenna connection. Tune the signal generator to the set. The signal should come in between 1570 and 1615 kc.

d) Adjust the antenna padder to this signal.

e) Set the signal generator to 900 kc and tune the set to receive maximum signal at 900 kc. Adjust the antenna core for maximum signal at 900 kc.

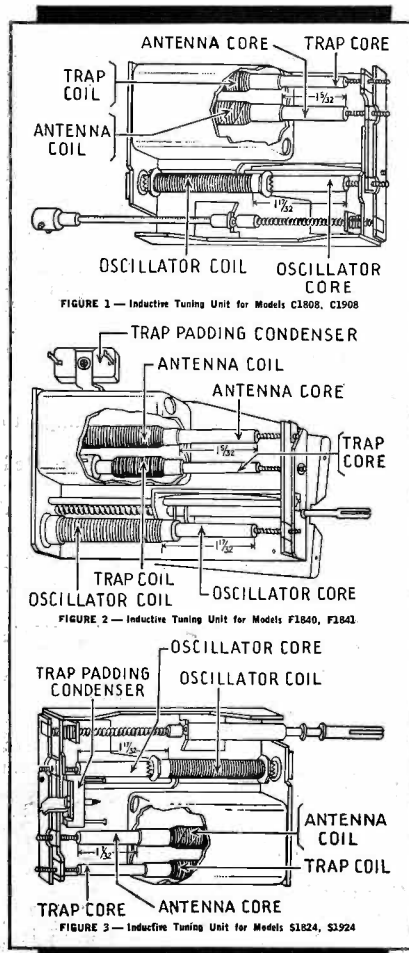
f) Set the signal generator to 1400 kc and tune the set to 1400 kc on the dial. Adjust the antenna padder for maximum signal.

g) Repeat e and f until there is no further improvement.

h) Set the signal generator to 580 kc and tune the set to 580 kc. Adjust the oscillator tracking coil core for maximum signal. "Rock" the tuning control while making this adjustment. Tune the control to the signal and adjust the oscillator tracking coil core for maximum signal. Rotate the tuning control back and forth slightly until maximum signal is obtained. Then re-adjust the oscillator tracking coil core for maximum signal. Repeat this procedure until no further improvement is noticed.

i) In case a wide adjustment was necessary in h, the adjustment of e, f and h should be repeated. The unit should then be perfectly aligned at 1400 kc, 900 kc and 580 kc.

j) Tune the signal generator to 550 kc and tune the set for maximum signal.



The illustrations indicate the alignment adjustments for various models of Philco auto-radio receivers. Similar adjustments are provided on other permeability tuning units.

k) Peak the generator to 1460 kc, the image frequency of 550 kc.

l) Adjust the trap core for minimum signal as in 1 or 2 below.

1) If the unit uses a fixed trap condenser adjust the core.

2) If the unit uses a padder trap condenser set the core so that the screw end of the core is 11/32-in. from the bakelite cross head and adjust the padder for minimum signal.

m) Repeat steps e, f and h described above since the wave-trap adjustments will affect the alignment at 580, 900 and 1400 kc.

n) Set the signal generator at 900 kc and tune the set for maximum signal. Slide the pointer to the 900 kc mark on the dial scale.

2) Alignment When Only Antenna Coil or Core Is Replaced.

a) Turn the tuning control knob clockwise as far as it will go.

b) Adjust the antenna core according to directions given in Figs. 1, 2 and 3.

c) Tune the signal generator to the receiver and adjust the antenna padder to this signal.

d) Tune the signal generator to 900 kc and tune the set to this signal. Adjust the antenna core for maximum output.

e) Set the signal generator and receiver to 1400 kc and adjust antenna padder for maximum output.

f) Repeat d and e until no further improvement is noticed.

g) Check and adjust the oscillator tracking coil core at 580 kc if necessary.

3) Alignment When Only Oscillator Coil or Core Has Been Replaced.

a) Set the signal generator and receiver to 580 kc. Adjust the oscillator tracking coil core for maximum signal by the "rocking in" process as described in 1(h).

b) Check and adjust the antenna padder at 1400 kc.

c) Repeat step (a) if necessary.

4. Alignment When Trap Coil or Core Has Been Replaced.

a) Follow instructions in 1), j, k, l, n.

5. Proceed as in 1) Above When Parts in More Than One Circuit Are Replaced and When Oscillator Coil or Core Is Replaced.

Note:—When cores are moved in aligning the receiver or replacing parts, it will be necessary to reseal the core screws to the retaining nuts.

Your country needs your help to win this war. Buy United States Defense Savings Bonds. See page 3 of this issue.

ASSOCIATIONS

Radio and Electrical Appliance Service Association, Inc.

With over a hundred paid-up members already on the rolls, the Radio and Electrical Appliance Service Association, Inc., has scheduled a general meeting for enrolling new members for Dec. 16 at the Manhattan Center in New York City. Invitations had been sent to every radio and electrical appliance shop in Greater New York and a large turn-out was expected.

New York Councilman Hugh Quinn is scheduled to deliver the opening address. Talent has been borrowed from several broadcast stations and promise was made that the evening would be profitably spent by those attending.

Robert G. Herzog, Secretary.

Radio Servicemen's Association of Luzerne County

J. Austin Renville of Luzerne was elected president of the Radio Servicemen's Association of Luzerne County on Nov. 18 at a meeting held in the Chamber of Commerce rooms, Miners National Bank, Wilkes-Barre. Mr. Renville succeeds Edward Buckmen, Lee Park. Others elected were: Pat Manville, vice president; C. F. Bogdan, secretary, and John Kennedy, treasurer. Board of directors elected were: David Thomas, Max Frederick and Joseph Sin-cavage.

C. F. Bogdan, Secretary.

Radio Technicians Association of Long Beach

The new officers of the RTA are: F. E. Smith, president; Duane Davis, vice president; Harold Barnett, treasurer; Roy Rutney, secretary.

H. E. Ward, Retiring President.

RADIO SERVICEMEN OF AMERICA

RSA Directors

Three RSA Districts will elect representatives to the National Board of Directors of RSA next spring. Nominations, in accordance with the provisions of our by-laws, are now in order and must be received at National Headquarters before Feb. 15, 1942.

The present directors for these districts are: Edward H. Gordon, District 5 (Iowa and Missouri); Fred Olson, District 7 (Wisconsin, Minnesota, North Dakota, South Dakota, and the Northern Peninsula of Michigan); S. W. Christie, District 9 (Michigan, excepting the Northern Peninsula, and Ontario, Canada).

Chicago Chapter

These are times when new and important problems confront our business and yours. The present emergency has placed the radio Service Man in a bewildering predicament as concerns his planning for the future.

To discuss these problems—to find solutions to them—the Chicago Chapter held an open meeting on Nov. 26, at the Stevens Hotel, Chicago.

Harold Cunningham, national treasurer, discussed the question: "Can a service shop make a satisfactory income for its owner in the light of new taxes, national material

shortages, and other problems before us?" Robert L. Shless, Chicago business and advertising executive, spoke on "How the Service Man can best use his time and money to build a substantial income during the uncertain period ahead of us." He presented definite plans and thoughts for the betterment of the servicing industry.

Entertainment was provided by personal appearances of two of Chicago's popular radio stars, Ulmer Turner and Betty Ames.

Al Kilian, Secretary.

Danville Chapter

G. R. McKinney presided at our meeting of Nov. 13. Program Director Mc-Ardle had a program on technical radio terms. He lined the boys up and fired the questions to them. They were sure bewildered—and still are, in fact.

We decided to repeat our last year's Christmas program of repairing sets donated for presentation to others less fortunate than ourselves to spread some happiness for Christmas. Advertising Chairman Lyal Cummings was instructed to go ahead with the publicity, and members were asked to donate a few evenings to this worthwhile project.

The winter term of "School" started with the Nov. 27 meeting. Members were warned, "You can't afford to be without the knowledge ye shall gather."

Cal Stapp, Editor.

Fremont Chapter

Fremont Chapter held a meeting Wed., Nov. 12, at which Mr. Arvin of Mallory Co. gave a very interesting talk on vibrators, electrolytics and volume controls, and on that timely subject, priorities. The speaker came through the courtesy of Warren Radio, Toledo. Guests came from Toledo and Sandusky.

D. R. Bruns, Director District 12.

Interstate Chapter

Our meeting of Nov. 18 was held at the home of Harold Anderson, Moline, Ill., vice-president L. H. Moorhead presiding.

Dr. Harvalik of St. Ambrose College explained in detail the course to be started at the College in preparation for communications license. Applications were on hand for those wishing to attend.

Nominations for 1942 Chapter officers were made, to be voted upon next meeting. The meeting was then turned over to Howard Spidel of the Midwest Timmermann Co., who gave us a complete demonstration of the Chanalyst in conjunction with the RCA Dynamic Demonstrator. This demonstration gave the boys a very good chance to see what this test equipment will do and it answered questions pertaining to the use of the instrument.

The group then retired to a feast of baked ham and all the trimmings—thanks to Mrs. Anderson.

O. W. Olson, Secretary.

Jamestown Chapter

On Nov. 11, talking technicolor moving pictures of the Thaw Asiatic Expedition were presented through the courtesy of ESSO gasoline. On Nov. 25, the General Motors Show on National Defense was presented following the regular meeting. Another of these interesting shows was

scheduled for Dec. 15 at the Hotel Jamestown.

General Electric will give a demonstration of FM at a meeting in January; the date has not yet been selected. One or two banquets are being planned and members who fail to attend these meetings are going to miss the best the Jamestown Chapter has ever sponsored.

Norman W. Smith, Secretary.

LaPorte Chapter

Our meeting on Nov. 12 was held at the Y. M. C. A. and various ideas and plans were exchanged on how to promote more educational meetings. An outstanding plan was outlined as to how the Chapter could put these over in a big way and with little expense.

Our chapter has adopted Johnstown Chapter's system of chassis marking and we wish to thank them for the idea. We will have ten spaces instead of eight within the circle. This will allow us to break down our estimates a little more.

On Dec. 8 we had a Christmas party along with our regular business meeting—more about it next month.

Stan Kubit, Secretary.

Northeastern Iowa

We had a very nice meeting up here at Waukon last month and had a good turnout; some of the boys from across the river in Wisconsin came over and were very much enthused about the organization. The technical portion of the meeting was a very interesting discussion on the use of various test equipment; the Chanalyst and RCA Demonstration Board were used.

J. Harold Lindblom, Temporary Chairman.

Oklahoma City Chapter

Excessive rainfall has been slowing up business here this fall, although most service shops report they have all the business they can handle. Many shops have lost their Service Men to the Army, Navy, or the defense program.

Our chapter has voted to change from two business meetings per month to one, held on the second Tuesday of each month. Social and technical meetings are to be called whenever desired.

Chapter President R. B. Cherry returned from Colorado with a deer!

Glen Dearing, Director District 2.

Pittsburgh Chapter

We held our Semi-Annual Dinner Dance at the "Anchorage," a high-class night club on the Alleghany River Boulevard on Nov. 25. It was the best affair of its kind yet held. Entertainment was from local broadcast stations.

Our recent meetings have been business meetings with no outstanding programs. However, we have a series of lectures planned starting with the Dec. 12 meeting that are real good. "Mathematics in Radio" will be the first, a Carnegie Tech professor to be the speaker; "Physics in Radio," the second, by a Bureau of Mines expert; "Electronics in Radio," the third, by a professor from Pitt; and "Business Administration," by a Duquesne University professor. These will be half-hour lectures in practical style at the beginning of each meeting.

The volume of repair and service work is at a high here, and competent Service Men are few and far between.

Richard G. Devaney, Publicity.

EXPANDING SERVICE OPPORTUNITIES

(Continued from page 8)

position; bfo at O-Bass switch at Bass IN-A-F Gain at maximum; R-F Gain at maximum; Band switch on 0.55 to 1.6 mc. band for i-f alignment, or on r-f band to be aligned; selectivity control at sharp; I-F-Send-Receive switch at Receive-Crystal phasing at #3 on left side; anl at Off; avc at Off.

Important: Turn bandspread control so that logging scale reads 100; Antenna trimmer adjusted for maximum gain at each r-f alignment point on Bands 3-4-5-6. Antenna trimmer not in circuit on bands 1 and 2.

IF Alignment: Tune main dial to 1400 kc on 0.55 to 1.6 mc band. Connect the hot lead from the signal generator to 6SA7 mixer terminal No. 8. Ground other lead to chassis. Roughly adjust the aligning screws of T1, the lower screw of which is accessible through hole in right mounting bracket, for maximum gain. Now adjust lower screw on T2 (do not adjust upper screw). Also adjust C31 and the air trimmer condenser at the top of T3 for maximum gain.

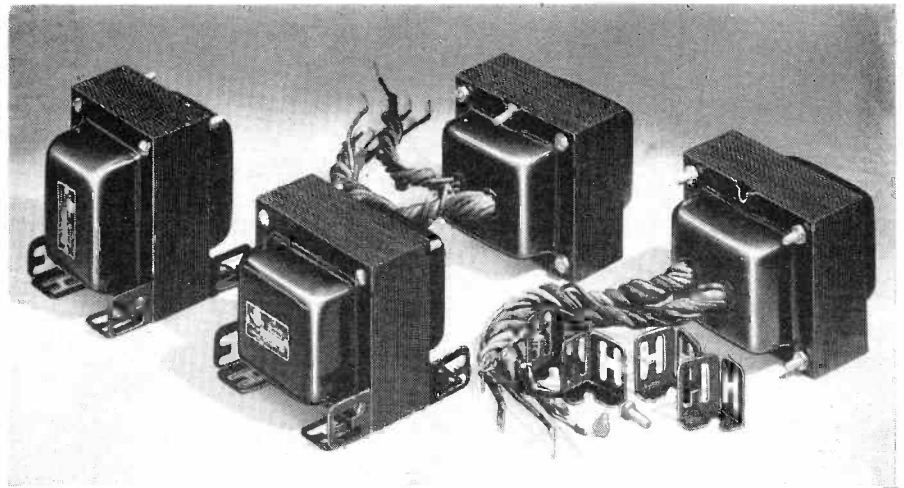
Switch to "Crystal Broad" Position—Turn on bfo and adjust to a tone of about 1,000 cycles. Vary the frequency of the signal generator while adjusting the top screw on T2 until the output goes through a maximum, dips down and starts going up again. Adjust the phasing control for maximum selectivity and then back off the top screw on T2 until the output reaches a minimum value between the two maximum values first noted. The frequency of the signal generator should be varied over a small range while adjusting the top screw of T2. A swishing note, in contrast to the usual sharp crystal tone will be apparent when the correct adjustment has been reached.

Switch to "Xtal Sharp" and adjust C30 for maximum output while varying signal generator frequency. Two points of maximum output will be noted corresponding to two adjustments of C30. Either one of these points may be used at which to leave C30. A sharply peaked tone will result at the correct adjustment.

Switch to "Xtal Medium" and adjust C29 till the output is midway between the outputs reached while aligning the "Xtal Sharp" and Xtal "Broad" positions. The apparent sharpness of tone should be midway between the "Sharp" and "Broad" positions.

Switch again to "Xtal Sharp" and set the signal generator to exact crystal frequency. Set bfo front panel control to a tone of approximately 1,000 cycles. Switch again to "Sharp IF" and carefully realign the i-f transformers as earlier described in the first paragraph of these instructions.

It is not the intention to suggest in this article that the communication receiver and the defense fields offer opportunities which will revolutionize the service business. They do, however, represent types of expanded service activities which are highly desirable from the standpoint of the progressive Service Man who is more interested in



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- ★ More universal THAN ANY OTHER power transformer.
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STANCOR universal power transformers are the most popular ever introduced to the industry. They cover the widest range in electrical and physical requirements in a minimum number of units. They provide the choice of five mounting positions, all desirable voltage combinations and many special windings not incorporated in any other group of transformers. Leading jobbers in all principal trading areas carry a complete line of Stancor transformers.

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ALL Stancor replacement transformers are tropic impregnated and at NO EXTRA COST!



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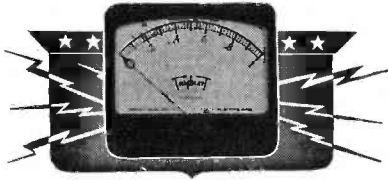
increasing the unit price of his jobs than in increasing the quantity of low-priced jobs.

Nor do these two suggested activities represent the only avenues over which the achievement of such a desire can be attained. Electronic equipment is finding a tremendous variety of applications in the present expanding industrial program and offers proportionately increasing opportunities for men qualified to service it. This and other fields of potential profit for the service man will be made subject of the coming articles in this series.

STEWART-WARNER HUDSON SA40

Chassis wiring improperly placed: If the leads from the on-off switch and other leads in the vicinity of the A filter assembly are not properly located, they may interfere with free motion of the dial cord or the condenser-drive gear sector. Dress these leads so that they cannot touch the moving parts.

Binding between sector and pinion gears: Excessive friction between these gears can be reduced by changing the position of the pinion gears so that the set screw points upward when the gang is completely closed. This draws the pinion gear slightly farther away from the gear sector, reducing the pressure between them.



For Triplet Customers Only

Long before the state of emergency was proclaimed, the Triplet Company was getting ready to do its part in building our national security. We knew that we must meet important new responsibilities. At the same time, we felt keenly our continuing obligations to our customers—old friends with whom we have had happy business relations through many years.

We doubled—then tripled—our output to fill the needs of our old accounts. We added to our production facilities . . . hired many more men . . . are working extra shifts at time-and-a-half.

All this has not been enough. We have been called on to produce more and more for national defense. We are proud of the job we are doing to help meet the emergency, but it is difficult not to be able to serve our old friends equally as well. In the face of these conditions, the Triplet Company has adopted these policies "for the duration."

FIRST: We will continue to serve you by our service to our mutual responsibility—the national emergency.

SECOND: We will continue to do everything we can to fill orders from our regular customers, even though some deliveries may be temporarily delayed. No business from new accounts has been nor will be accepted until after our old friends have been served, except where priorities make it impossible to do so.

THIRD: Our engineering and research departments will continue to work on the development of superior equipment and improved methods to serve you still better when we can resume normal operations.

The present emergency is incidental and as we work towards the future, we will do our best to continue to merit your confidence and loyalty.

Ch. Triplett

President
The Triplet Electrical
Instrument Company

MANUFACTURERS OF PRECISION
ELECTRICAL INSTRUMENTS

22 • SERVICE, DECEMBER, 1941

RECORDER ADAPTOR

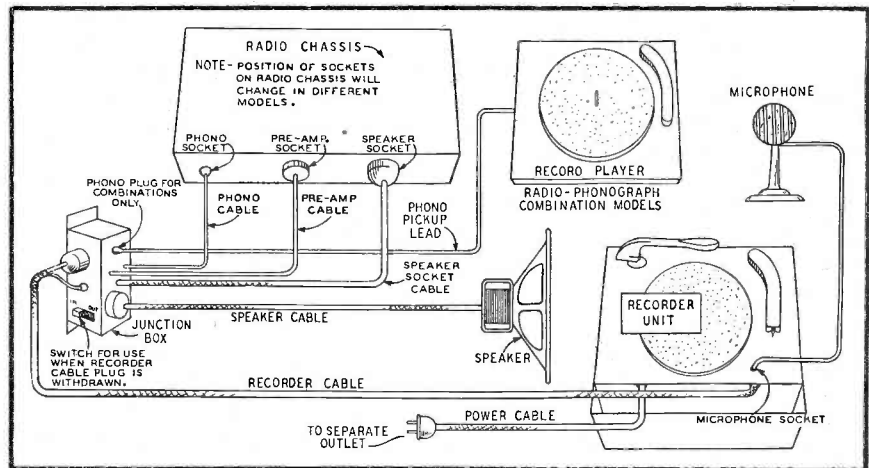
(See Front Cover)

A RECORDER adaptor, Ward's Airline Model, 14WG499 record maker, phonograph record player and public address system, is shown on the front cover. The device is made specifically for use with the larger Airline radio receivers and phonograph combinations, but may be adapted to any receiver by an experienced Service Man. Many of the Airline models have been suitably wired with the necessary

which operates upon moving the cutter arm away from the rest.

Note the 100,000-ohm resistor in series with the 0.05-mfd coupling condenser in the preamplifier output circuit.

The junction box may be permanently secured to the receiver cabinet which makes it convenient for either a permanent or transient installation of the recorder. When it is desired to re-



Airline WG499 is a record maker, record player and public-address system for use with larger radio receivers.

sockets for the plug connections provided on the adaptor.

The Model 14WG499 consists of the following items:

- (1) A heavy motor and turntable with a crystal pickup and crystal cutter.
- (2) A two-stage, high-gain preamplifier with 6SJ7 pentode type tubes in each stage.
- (3) A junction box to facilitate the many interconnections.
- (4) Shielded cables for phono socket input, preamplifier power leads, speaker and output transformer.

The adaptor boasts of such features as grid-leak (contact potential) bias for the input amplifier stage; volume control in the second stage; resistance-capacity decoupling circuits, all the way through, to permit high-gain amplification with maximum stability; cutter auto-transformer, with a 5,000-ohm fixed primary load; neon volume-level indicator, operating across one-third of the auto-transformer secondary; speaker muting switch on the microphone volume control; and a recorder switch

move the recorder itself after use, the recorder plugs may be removed from the junction box and the switch set to the "Out" position.

Through a simple switching system, the composite set-up may be used as a public-address system with the preamplifier feeding the audio system of the receiver. Provision is also made to record radio programs and to cut in the mike while so doing.

RCA 28X, 28X5

Hum modulation: This form of hum becomes evident when a station's carrier is tuned in, and disappears when the set is tuned between stations. The hum may be present on only a few locals, or on many stations, depending, among other things, on the type and installation of the a-c supply line.

If hum modulation exists, check to see that there is an 0.05-mfd., 400-volt capacitor connected from the plate of the 25Z6GT rectifier to —B. Add this capacitor if necessary. The capacitor acts to by-pass r-f signals around the rectifier tube.

Advertisers in SERVICE are world renowned for the quality of their products. Insure your work by buying from them.

JANUARY, 1941 – DECEMBER, 1941

An asterisk preceding a listing indicates that a partial or complete circuit accompanies the text.

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RCA Phonograph Motors	Mar. 20
RCA HF6. By Willard Moody	Aug. 22
*RCA 9TX31, 9TX32, 9TX33	Jan. 34
RCA U10. By Willard Moody	Jan. 31
RCA 14AX, 14AX2	Nov. 30
RCA 15BP Series	Mar. 12
RCA 15X	Nov. 30

†This material is obtained from our readers and is representative of the actual experiences of the Service Man in the field.

RCA 16K, 16T3, 16T4, 17K, 18T, 19K, 110K, 111K	Mar. 12
RCA Q16	Nov. 22
*RCA 25BK, 25BT3	Dec. 30
*RCA 25BT3	Dec. 30
RCA 28T	Nov. 22
RCA 28X, 28X5	Dec. 22
RCA U40, U42, U46, etc.	Aug. 32
*RCA U45, K105, V205	Dec. 30
RCA 45X1, 45X2	Nov. 30
RCA 46X Series	Nov. 30
RCA 0-50, U50	Mar. 12
RCA 94BP1	Mar. 12
RCA 96T. By Willard Moody	Aug. 22
RCA R98	Feb. 29
RCA 98YG. By Willard Moody	Aug. 22
RCA V100	Nov. 22
RCA V105	Nov. 30
*RCA CV112X Converter	Dec. 30
RCA RP158, RP160, RP162	Nov. 30
RCA V175	Nov. 30
*Silvertone 6336, 6436	Feb. 29
Stewart-Warner 02-4C1, 02-5T1, 02-428, 12-4D1, 205CA, 205CK	Aug. 31
Stewart-Warner Hudson SA40	Nov. 29
Stewart-Warner Hudson SA40	Dec. 21
Stromberg Carlson 231R. By Willard Moody	Nov. 30
Wells Gardner 2D2-7C. By J. K. Rose	May 14
*Wells Gardner 5B8-1, 6B7-1	Nov. 30
Wells Gardner 5B12-1. By J. K. Rose	Aug. 26
Wells-Gardner 5C16-17	Feb. 29
Wells-Gardner 5D2-6	Oct. 23
Wells-Gardner 5D2-7C. By J. K. Rose	May 14
Wells-Gardner 5D8-1	Nov. 30
*Wells-Gardner 5B8-1, 6B7-1	Nov. 31
Wells-Gardner 6A43-1, 04WG614, 619, 621, 621NI	Aug. 22
Wells-Gardner 6C17, 6C18	Aug. 22
Wells Gardner 6D3-1	Oct. 23
Wells-Gardner 7A41-3, 7A41-5, 04WG732. By J. K. Rose	June 28
Wells-Gardner 9A46	Aug. 22
Wells-Gardner 9A46-3, 9A46-4	Jan. 34
Westinghouse 366. By Willard Moody	Aug. 22
Wilcox-Gay A89, A91, A92, A93, A94, A101	Mar. 20
Wilcox-Gay A93, A94	May 14

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	Issue Page
Contact Time vs. Allowable Current for Two Year Old Child	Oct. 14
Comparative Battery Packs for Portables	Apr. 12
Comparative Numbers of Batteries for Portables	Apr. 13
Complete List of New Broadcast Frequency Assignments	Feb. 18, 20
F-M Broadcasting Stations	Apr. 14
Hallcrafters SX28 Alignment Procedure	Dec. 8
Possible Meter Failures	Nov. 11
Reactance Charts	Aug. 13
Replacement Batteries for Portables	May 10
Replacement Batteries for Portables	June 7
Replacement Batteries for Portables	July 8
Special Batteries	Apr. 35

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	Issue Page
*External Antenna Coupler	Nov. 25
Loop Receivers	Jan. 12
*Permeability Tuning. By H. I. Dansiger	Nov. 35
*Permeability Tuning	Oct. 3
Permeability Tuning Alignment Procedure	Dec. 19

An asterisk preceding a listing indicates that a partial or complete circuit accompanies the text.

COMMUNICATIONS RECEIVERS

	Issue Page
*Communications Receiver. By Holmes Webster	Jan. 23
*Crystal Filter Circuit	Apr. 16
*Echophone EC3 Communications Receiver. By Holmes Webster	Sept. 20
*Hallcrafters SX25 Communications Receiver	Jan. 24
*Hallcrafters SX28 Communications Receiver	July 14
*Hallcrafters SX28	Dec. 6
*Hallcrafters S29 Beat Oscillator and Noise Silencer	Mar. 12
*Hallcrafters S31	June 28
*Hammarlund HQ120X Communications Receiver	Apr. 15
*Howard 437A Communications Receiver	Mar. 14
RCA AR77 Communications Receiver	May 15
*RME99 Communications Receiver Set Provides Code Practice	Aug. 16 June 32

COVER DIAGRAMS

	Issue Page
*Alert Receivers (RCA)	Aug. 20
*Audio and Output of F-M Receiver (Meissner)	Apr. 7
*Band Spread Superheterodyne (De Wald)	Mar. 10
*Battery Portable with Vibrator B Supply (G.E. LB530)	June 11
*Combination F-M A-M I-F (Pilot 12 Series)	July 5
*Low-Power Vibrator Power Supply (Zenith 4B639)	Nov. 12
*Push-Button Tone Control (Zenith)	Sept. 5
*Radio-Phono-Recorder Switching (Stewart Warner)	Feb. 8
*Recorder Adaptor (Airline 14WG-499)	Dec. 22
*Short-Wave Adapter for Auto Sets (Philco SW1)	May 12
*Transformerless Radio Recorder Phonograph Combination (G. E. J629)	Jan. 7
*Universal 6-Volt, 110-240 Volt Receiver (Sparton)	Oct. 6

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	Issue Page
*Alert Receiver (RCA) Defense and the Service Man. By Farley Charrell	Apr. 5
*Expanding Service Opportunities. By Alfred A. Ghirardi	Dec. 5
Junk Ain't Patriotic. By Farley Charrell	May 16
Know Your Meter. By Alfred A. Ghirardi	Nov. 9
Message from the Publisher. Metals for Tubes. By Lewis Winner	Dec. 4 Nov. 21
National Defense and Radio. By Lewis Winner	July 3
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The Radio Locator	Sept. 12
Shortages. By Charles Golenpaul	Aug. 25
Shroud of the Stumblebum. By Farley Charrell	Jan. 20 June 30
*Solving Shortage Problems in Input R-F Circuits. By Robert G. Herzog	Nov. 5
*Solving Shortage Problems in Interstage. R-F Circuits. By Robert G. Herzog	Dec. 9
War Efficiency	Dec. 2
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(See Tuning Mechanisms)

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Fence Controllers. By Jay Allen	Oct. 14
Industrial Application for R-F	Dec. 15
R-F Rotates Steel Balls	Dec. 15
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	Issue Page
*A-F Circuit Tester. By Willard Moody	Dec. 16
*Alert Receiver (RCA)	Aug. 20
Automatic Record Player (RCA) Batteries for Portables. By Robert G. Herzog	Aug. 27 Apr. 12
*Capacity and Inductance Measurement. By J. E. Wilson	Aug. 12
*Checking Condensers. By Lewis Winner	Jan. 14
*Circuits. By Henry Howard	Jan. 7
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*Circuits. By Henry Howard	Apr. 7
*Circuits. By Henry Howard	May 12
*Circuits. By Henry Howard	June 11
*Circuits. By Henry Howard	July 3
*Circuits. By Henry Howard	Sept. 5
*Circuits. By Henry Howard	Oct. 6
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*Circuits. By Henry Howard	Dec. 12
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*Communications Receiver (Hallcrafters SX25). By Holmes Webster	Jan. 23
*Communications Receiver (Hallcrafters SX28). By Holmes Webster	July 14
*Communications Receiver (Hammarlund HQ120X)	Apr. 15
*Communications Receivers (Howard Progressive Series)	Mar. 14
*Communications Receiver (National NC200)	Feb. 12
*Communications Receiver (RCA AR77)	May 15
*Communications Receiver (RME99)	Aug. 16
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*Expanding Service Opportunities. By Alfred A. Ghirardi	Dec. 5
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*Gain Measurements and Signal Tracing. By John H. Potts	Mar. 5
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*Killing the Hum-Bug. By Mark & Edward M. Glaser	Jan. 5
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National Defense and Radio. By Lewis Winner	July 3
National Defense and Radio. By Lewis Winner	Aug. 18
Nineteen Forty One Sound. By Robert G. Herzog	Feb. 3
*Permeability Tuning. By H. I. Danziger	Oct. 3
Permeability Tuning Alignment Procedure	Dec. 19
Personal Portables. By Henry Howard	May 5
*Phase Inverters. By Robert G. Herzog	Sept. 14
*Phono Pickup Connections. By Mark & Edward M. Glaser	June 5
*Pilot Lights Will Get You. By Walter R. Jones and Frank D. Langstroth	Aug. 7
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Radio and National Defense. By Lewis Winner	June 22
Radio and National Defense. By Lewis Winner	Sept. 12
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Reallocation. By Lynne Smeby	Feb. 17
*Recorder Adaptor (Airline 14WG-499)	Dec. 22
*Remote Level Controls for Sound Systems. By Robert G. Herzog	Aug. 10
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Replacement Batteries for Portables (Charts)	July 8
Service Benches	Apr. 18
Service Men's Equipment Directory	Sept. 23
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*Short-Wave Adapter for Auto Sets (Philco SW1)	May 12
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*Solving Shortage Problems in Input R-F Circuits. By Robert G. Herzog	Nov. 5
*Solving Shortage Problems in R-F Interstage Circuits. By Robert G. Herzog	Dec. 9
*Sound Ideas	May 18
*Sound Ideas. By S. Gordon Taylor	Jan. 10
*Sound Ideas. By Robert G. Herzog	Mar. 18
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*Speakers. By Henry Howard	Aug. 5
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*Tuning Indicators. By M. Heller	Feb. 6
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*Volume Controls. By Edward M. and Mark Glaser	Mar. 8
*Volume Expanders. By Robert G. Herzog	Oct. 11
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*Wireless Output Indicator. By H. J. McCveary	May 30

An asterisk preceding a listing indicates that a partial or complete circuit accompanies the text.

Your Equipment. <i>By Robert G. Herzog</i>	Oct.	16
Your Jobber. <i>By Arthur Moss</i>	Jan.	20
*Zenith 10H551, 10H571 (Chas. 10A3), Cascade Limiter and Discriminator	Apr.	7

FREQUENCY MODULATION

<i>Issue Page</i>		
*Espy 1141, 1150 F-M, A-M Receivers	Nov.	12
F-M Broadcasting. <i>By Ray D. Rettenmeyer</i>	Apr.	14
F-M Broadcasting Stations (Chart)	Apr.	14
*Meissner 9-1023, 9-1037 (Chas. 9-1041)	Apr.	7
*Pilot 12 Series F-M, A-M, I-F.. Test Equipment for F-M Station Maintenance	July	5
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*Zenith 10H551, 10H571 (Chas. 10A3), Cascade Limiter and Discriminator	Apr.	7
*Zenith 12H678, 12H679 (Chas. 12A6) F-M, A-M Receivers	Nov.	13

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<i>Issue Page</i>		
*Choke Input Filter	Jan.	5
*Emerson ES374, ES397 Hum Neutralizing Circuit	May	12
*Emerson EX386 Hum Neutralizing Circuits	June	12
Filaments and Heaters	Jan.	6
*Hum Bucking	Oct.	31
*Hum Bucking Circuits	Jan.	6
*Hum Neutralization Circuits	Jan.	6
Hum with 6AD7G	Dec.	15
Induction Hum	Jan.	29
*Killing the Hum-Bug. <i>By Mark & Edward M. Glaser</i>	Jan.	5
RCA 25BT3	Dec.	30
RCA 28X, 28X5	Dec.	22
RCA R98	Feb.	29
*Resistance Capacity Filters	Jan.	5
Tuned Filters	Jan.	6
Tunable Hum	Jan.	29
Wells Gardner 6A43-1, 6A43-3, 619, 621, 621NI, O4WG613	Jan.	9
Wilcox-Gay A89, A91, A92, A93, A94, A101	March	20

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<i>Issue Page</i>		
*Airline 14WG499 Recorder Adaptor	Dec.	22
General Industries Home Recorder Home Recording	June	20
Manufacturers of Motors (<i>Buyer's Guide</i>)	June	20
*Philco Phonograph Motor Circuits	Nov.	31
*Philco HR1 Recorder	Nov.	16
RCA Magic Brain Automatic Recorder Changer	June	20
RCA U40, U42, U46, etc.	Sept.	18
*Recorder Adaptor (Airline 14WG-499)	Aug.	32
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Ignition Noise	Aug.	15
Noisy Amplifiers. <i>By D. Bee</i>	Jan.	12
RCA 1941 Receivers	Feb.	10
RCA 98YG. <i>By Willard Moody</i>	Aug.	22
DeWald 44. <i>By Willard Moody</i>	Aug.	22

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Button Base Tubes	June	24
*External Antenna Coupler	Nov.	25
*Hum Bucking	Oct.	31
Industrial Application for R-F	Dec.	15
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Modernize Your Shop	Aug.	34
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*Pilot Lights Will Get You. <i>By Walter R. Jones and Frank D. Langstroth</i>	Aug.	7
R-F Rotates Steel Balls	Dec.	15
Radio Locator	Aug.	25
Refinishing Leather Covered Cabinets	April	27
Set Provides Code Practice	June	32
*Speaker Phase Checker	Nov.	23

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*Checking Condensers. <i>By Lewis Winner</i>	Jan.	14
*External Antenna Coupler	Nov.	25
Iron Core Coils	Oct.	3
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*Permeability Tuning	Nov.	35
*Permeability Tuning. <i>By H. I. Danziger</i>	Oct.	3
*Pilot Lights Will Get You. <i>By Walter R. Jones and Frank D. Langstroth</i>	Aug.	7
Sockets. <i>By John H. Potts</i>	Sept.	10
*Solving Shortage Problems in Input R-F Circuits. <i>By Robert G. Herzog</i>	Nov.	5
*Solving Shortage Problems in R-F Interstage Circuits. <i>By Robert G. Herzog</i>	Dec.	9
*Speaker Field Connections. Substitutes	Aug.	5
Trends	July	3
*Volume Controls. <i>By Edward M. and Mark Glaser</i>	Dec.	12
Mar.	8	

PHONOGRAPHS, PICKUPS, RECORD PLAYERS, ETC.

*Airline 14WG499 Recorder Adaptor	Dec.	22
Airline 04JP399D	Jan.	8
*Airline 14WG1203W Phonograph Combination	Dec.	14
*Ansley D24A, D25A	June	14
*Crosley Auto Expressionator	Oct.	12
*Emerson Symphonizer	Oct.	12
*Emerson ES374, ES397	May	14
Manufacturers of Record Players (<i>Buyer's Guide</i>)	Nov.	31
*Motorola 22A Wireless Record Player	Jan.	8
*Philco Phonograph Motor Circuits	Nov.	16
Philco Record Changer	Nov.	16
*Philco 41-620 Light Beam Phonograph Amplifier	May	14
*Philco 41-623, 41-624, 41-625 Phono Combinations	Apr.	9
*Philco 42-355, 42-390 F-M, A-M Receiver	Oct.	7
*Phono Equalizer Circuits	June	6
*Phono Pickup Connections. <i>By Mark & Edward M. Glaser</i>	June	5
RCA Automatic Record Player	Aug.	27
RCA "Magic Brain" Automatic Record Changer	Sept.	18
RCA Phonograph Motors	Mar.	20
*RCA 27K (Chas. RC576) Combination Tone Control Phono-Radio Switch	Oct.	9
RCA O-50, U50	Mar.	12
RCA U40, U42, U46, etc.	Aug.	32
*RCA R99 Volume Expander	Oct.	13
RCA RP158, RP160, RP162	Nov.	30
*RCA MI-4288 Volume Compander	Oct.	11
*Radio-Phono-Recorder Switching (Stewart Warner)	Feb.	8
*Recorder Adaptor (Airline 14WG-499)	Dec.	22
*Scratch Filter Circuits	June	6
Servicing the RCA "Magic Brain" Automatic Record Changer	Sept.	18
*Silvertone 6336, 6436	Feb.	29
*Sonora KWU 79 Phonograph Amplifier	Nov.	14
*Sparton Volume Expander	Oct.	12
*Volume Expanders. <i>By Robert G. Herzog</i>	Oct.	11
Wilcox-Gay A93, A94	May	14

PUBLIC ADDRESS
(See Sound)

PUSH-BUTTON TUNING

G. E. GD 62. <i>By Willard Moody</i>	Aug.	22
*Air Castle 2122 (Chas. BP12) Power Supply	Aug.	22
RCA U10. <i>By Willard Moody</i>	Jan.	31
RCA 16K, 16T3, 16T4, 17K, 18T, 19K, 110K, 111K	Mar.	12
RCA 96T. <i>By Willard Moody</i>	Aug.	22
Reallocation. <i>By Lynne Smeby</i>	Feb.	17
Stewart-Warner Hudson SA40	Nov.	29
Stewart-Warner Hudson SA40	Dec.	21

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*Admiral 29G5 Personal Portable	May	6
*Air Castle 2122 (Chas. BP12) Power Supply	June	11
*Air Castle CP5120, CP 5121 Antenna Input	Apr.	9
*Air Castle CP5120, CP5121 Input R-F	Nov.	8
*Air Castle 5122, T40 Personal Portable	May	8
*Air Chief S7397-2 Battery to Line Switching	Apr.	8
*Air Chief S7405-9 I-F Stage	Sept.	8
*Airline O4WG614	Jan.	7
*Airline 14BR525A, 14BR526A	Sept.	7
*Airline 14WG499	Dec.	22
*Airline 14BR573 Converter	Sept.	6
*Airline 14BR629A Output	Oct.	9
*Airline 14WG680 Input R-F	Nov.	8
*Airline 14WG680 Antenna Input	July	5
*Airline 14BR742A	Oct.	10
*Airline 14WG756, 14WG757	Dec.	15
*Airline 14WG807 Band Spread	Nov.	14
*Airline 14BR911A Antenna Input	Dec.	12
*Airline 14BR912A	Nov.	15
*Airline 14WG1203W Phonograph Combination	Dec.	14
*Ansley D24A, D25A Power Supply Circuits	June	12
*Automatic Tom Thumb	July	6
*Belmont 11AE2	May	13
Belmont 590	June	12
*Circuits. <i>By Henry Howard</i>	Jan.	7
*Circuits. <i>By Henry Howard</i>	Feb.	8
*Circuits. <i>By Henry Howard</i>	Mar.	10
*Circuits. <i>By Henry Howard</i>	Apr.	7
*Circuits. <i>By Henry Howard</i>	May	12
*Circuits. <i>By Henry Howard</i>	June	11
*Circuits. <i>By Henry Howard</i>	July	3
*Circuits. <i>By Henry Howard</i>	Sept.	5
*Circuits. <i>By Henry Howard</i>	Oct.	36
*Circuits. <i>By Henry Howard</i>	Nov.	12
*Circuits. <i>By Henry Howard</i>	Dec.	12
*Clarion WS1-56	June	12
*Clarion 1-61C	Jan.	8
*Coronado C5D14 Plate Supply Filter	Dec.	12
*Crosley 45 Personal Receiver	Mar.	11
*Crosley 49BZ Loop Input	Feb.	10
*DeWald 410 Personal Portable	May	8
*DeWald 568 Power Supply	June	14
*DeWald 563 Output Bias Arrangement	Dec.	13
*DeWald 670, 707	Mar.	10
*Echophone EC3 Communications Receiver. <i>By Holmes Webster</i>	Sept.	20
*Emerson DS365, DS372	Dec.	13
*Emerson ER369, ER370	Feb.	10
*Emerson ES374, ES397 Hum Neutralizing Circuit	May	12
*Emerson FT383	Nov.	16
*Emerson EX386 Hum Neutralizing Circuits	June	12
*Emerson FF411 Personal Portable	May	6
*Emerson FJ412	July	7
*Espy 1141, 1150 F-M, A-M Receivers	Nov.	12
*Fada C33 Oscillator and Power Tube Bias Circuit	June	14
*Fada 137 Mixer	Oct.	6
*Farnsworth BT52, BT53, BT54, BT55, BT58	Mar.	6
*Farnsworth CT59 Personal Portable	May	8
*Farnsworth BT70, BT71, BT73, BT77, BT78 Oscillator and Converter	Mar.	12
*Farnsworth BK85, BK87, BK88, BK89, R-F and Oscillator	Mar.	10
*G. E. J51, J52, J54, J54W	Mar.	5
*G. E. LB412 Personal Portable	May	5
*G. E. LB530 Power Supply and Filament Circuit	June	11
*G. E. J629	Jan.	7

An asterisk preceding a listing indicates that a partial or complete circuit accompanies the text.

*G. E. L630 Tone Control.....	Nov.	12
*G. E. LC638, LC649.....	Oct.	8
*G. E. LB700, LB701, LB702, LB703.....	Oct.	6
*Garod BP20 Personal Portable..	May	9
*Hallicrafters SX25 Communica- tions Receiver.....	Jan.	24
*Hallicrafters SX28 Communica- tions Receiver.....	July	14
*Hallicrafters SX28 Communica- tions Receiver.....	Dec.	6
*Hallicrafters S29 Beat Oscillator and Noise Silencer.....	Mar.	12
*Hallicrafters S31.....	June	28
*Hammarlund HQ120X Communica- tions Receiver.....	Apr.	15
*Howard 302R, 302RA, 302RT....	June	12
*Howard 437A Communications Re- ceiver.....	Mar.	14
*Lafayette C125.....	July	5
*Lafayette E193.....	July	17
*Meissner 9-1023, 9-1037 (Chas. 9-1041).....	Apr.	7
*Motorola A1 Personal Portable...	May	9
*Motorola 40-60W.....	Mar.	5
*Motorola 61L11, 61L12 Loop Connections. (See correction Dec. p. 29).....	Oct.	8
*National NC200 Communications Receiver.....	Feb.	12
*Packard Bell 65A.....	Sept.	9
*Packard Bell 67B.....	Oct.	9
*Personal Portables. By Henry Howard.....	May	5
*Permeability Tuned Superhetero- dyne.....	Nov.	35
*Philco PT2, PT6 Antenna Input and Loop.....	Feb.	8
*Philco 41-250. Audio Circuit....	June	14
*Philco 41-620 Light Beam Phono- graph Amplifier.....	May	14
*Philco 41-623, 41-624, 41-625 Phono Combinations.....	Apr.	9
*Philco 42PT87, 42PT88 Battery to Power Supply Switching.....	Oct.	6
*Philco 42-355, 42-390 F-M, A-M Receiver.....	Oct.	7
*Philco 42-842, 42-843, 42-844....	Sept.	8
*Pilot 12 Series F-M, A-M, I-F....	July	5
*RCA Alert Receiver.....	Aug.	20
*RCA 9TX31, 9TX32, 9TX33....	Jan.	34
*RCA BP10 Personal Portable....	May	6
*RCA 11X1.....	Mar.	6
*RCA 15BF Filament Circuit....	Apr.	8
*RCA 24BT1, 24BT2, I-F Stage....	Sept.	7
*RCA 25BK, 25BT5.....	Dec.	30
*RCA 25BT3.....	Dec.	30
*RCA 26X4 (Chas. RC1014B)....	Sept.	6
*RCA 27K (Chas. RC576) Combi- nation Tone Control Phono- Radio Switch.....	Oct.	9
*RCA 28X5 (Chas. 1002A).....	Sept.	7
*RCA CV42 Electrifier.....	Sept.	9
*RCA U45, K105, V205.....	Dec.	30
*RCA AR77 Communications Re- ceiver.....	May	15
*RCA CV112X Converter.....	Dec.	30
*RCA 135 Voltage Doubler.....	Dec.	12
*RCA 211K (Chas. RC571) Double Push-Pull.....	Oct.	8
*RME 99 Communications Receiver	Aug.	16
*Sea Pal Battery Portable and Di- rection Finder.....	May	12
*Sea Pal 6P21.....	May	13
*Silvertone 771, 1771 Antenna, Os- cillator and Converter.....	Apr.	7
*Silvertone 1591.....	Feb.	10
*Silvertone 2011, 2051, 2411, 2511	June	12
*Silvertone 5731, 5761.....	Jan.	9
*Silvertone 6336, 6436 Tone Filter	Feb.	29
*Silvertone 6641.....	Feb.	9
*Silvertone 6911, 6951 Power Sup- ply and Battery Switching....	Apr.	8
*Sonora KWU79 Phonograph Amplifier.....	Nov.	14
*Sparton 672-6X Power Supply Circuits.....	Oct.	6
*Stewart-Warner 11-5W Loop Cir- cuit.....	Feb.	8
*Stewart-Warner 11-8R8, 11-8R9 Output and Power Circuits....	Feb.	8
*Stewart-Warner 206B-206C Series First Detector.....	Oct.	6
*Stewart-Warner Series 207B Band Spread.....	Nov.	12
*Stewart-Warner Series 207C Dry Battery Charging and Power Supply Circuits.....	Nov.	14

*Stromberg Carlson 500 Input R-F and Mixer.....	Feb.	10
*Stromberg Carlson 520.....	Jan.	9
*Truetone D1090.....	Jan.	8
*Truetone D1124.....	Sept.	5
*Truetone D1175 Band Spread....	Oct.	9
*Well-Gardner 6B10.....	Jan.	9
*Wells-Gardner 8A51.....	July	7
*Wilcox Gay A100 Recordio Jr....	Apr.	7
*Zenith 4K600 Personal Portable..	May	6
*Zenith 4B639 (Chas. 4B04) 6-V Vibrator Power Supply and Filament Circuits.....	Nov.	12
*Zenith 5G504 (Chas. 5A03) I-F..	Apr.	9
*Zenith 6D612, 6D612W (Chas. 6B04 R-F to Converter).....	Oct.	8
*Zenith 6R631 (Chas. 6B02)....	Sept.	5
*Zenith 6G638.....	Nov.	15
*Zenith 7S681, 7S682, 7S685 (Chas. 7B02).....	Sept.	5
*Zenith 8F593, 8F594 (Chas. 8A04).....	Mar.	7
*Zenith 10H551, 10H571, 10H573 (Chas. 10A3) Cascade Limiter and Discriminator.....	Apr.	7
*Zenith 12H678, 12H679 (Chas. 12A6) F-M, A-M Receivers....	Nov.	13

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*Airline 14WG499 Recorder Adap- tor.....	Dec.	22
General Industries Recorder Me- chanism.....	June	20
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*Howard 302R, 302RA, 302RT....	June	12
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*Radio-Phono Recorder Switching (Stewart-Warner).....	Feb.	8
*Silvertone 5731, 5761.....	Jan.	8
*Recorder Adaptor (Airline 14WG- 499).....	Dec.	22
*Wilcox Gay A100 Recordio Jr....	Apr.	7

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Aerial Tramway Sound.....	Feb.	23
*Airline 14WG499.....	Dec.	22
*Airlines Terminal Sound System. By L. C. Stong.....	May	20
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*Bogen P-A Remote Level Control. Church Sound.....	Aug.	11
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*Clarion (TCA) P-A Remote Level Control.....	Aug.	14
*Courthouse Sound System. By R. McElquaine.....	May	22
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Dollars in Music Boxes.....	Jan.	12
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*Industrial Sound Speaker Dis- tribution.....	Jan.	10
Industrial Sound System. By Harry Paro.....	May	18
Legislative Halls.....	Feb.	5
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Night Club Sound.....	Mar.	20
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Oil Yard Sound.....	Apr.	11
Outdoor Sound.....	Feb.	3
*Phase Inverters. By Robert G. Herzog.....	Sept.	14
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*RCA P-A Remote Level Control. Recorder Adaptor (Airline 14WG- 499).....	Aug.	10
*Remote Level Controls for Sound Systems. By Robert G. Herzog	Dec.	22
*Sound Ideas.....	Aug.	10
*Sound Ideas. By S. Gordon Taylor.....	May	18
*Sound Ideas. By Robert G. Herzog.....	Jan.	10
Sound Ideas. By R. McElquaine. Sound Ideas. By Jay Allen....	Mar.	18
*Speakers. By Henry Howard....	Apr.	10
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Two-Way Teaching Device. By Robert G. Herzog.....	Mar.	18
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*Volume Expanders. By Robert G. Herzog.....	Oct.	11
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*A-F Circuit Tester. By Willard Moody.....	Dec.	16
*Capacity and Inductance Measure- ment. By J. E. Wilson.....	Aug.	12
*Capacity and Inductance Measur- ing Circuits.....	Aug.	12
*Checking Condensers. By Lewis Winner.....	Jan.	14
*G. E. TC2 Tube Tester.....	May	34
*G. E. TC2 Tube Tester.....	June	35
*Gain Measurements and Signal Tracing. By John H. Potts....	Mar.	5
*General Pen-Oscil-Lite.....	Feb.	15
*Hickok 202 Electronic Volt-Ohm- Milliammeter.....	July	18
*Insulation Test.....	Jan.	15
*Leakage Test.....	Jan.	15
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*RCA 171 Station Allocator.....	Apr.	32
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*Radio City 417 Appliance Tester. Service Benches (Photos)....	Mar.	29
*Solar OCA Condenser Checker...	Apr.	18
*Supreme 549 Electronic Volt- Ohmmeter.....	Jan.	14
Test Equipment for F-M Station Maintenance.....	Oct.	32
*Triplett 1632 Signal Generator...	Dec.	27
*Weston 777 Tube Tester.....	Feb.	30
*Wien Bridge.....	Mar.	16
*Wireless Output Indicator. By H. J. McCreary.....	Jan.	15
Your Equipment. By Robert G. Herzog.....	May	30
.....	Oct.	16

TUBES

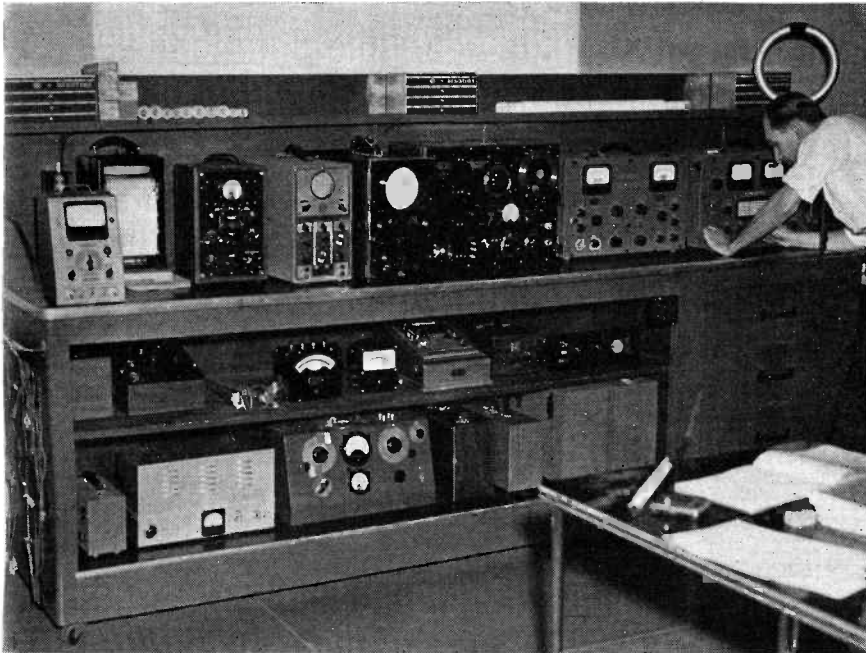
Button Base Tubes.....	June	24
*G. E. TC2 Tube Tester.....	May	34
*G. E. TC2 Tube Tester.....	June	35
Hum with 6AD7G.....	Dec.	15
Metals for Tubes. By Lewis Winner.....	Nov.	21
Mutual Conductance. By J. R. Barnhart.....	Feb.	32
*Phase Inverters. By Robert G. Herzog.....	Sept.	14
Sockets. By John H. Potts....	Sept.	10
*Weston 777 Tube Tester.....	Mar.	16

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(See also Push-Button Tuning)

*Colorama Tuning.....	Feb.	7
*Dimlight Tuning Indicator.....	Feb.	6
Dual Tuning Indicator.....	Feb.	7
Early Tuning Indicators.....	Feb.	6
*G. E. G61. By Willard Moody..	Nov.	30
*Neon Tuning Indicator.....	Feb.	6
*Permeability Tuning Dial Mechan- ism.....	Nov.	35
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*Pilot Lamp Tuning Indicators...	Feb.	6, 7
*Relay Type Tuning Indicators...	Feb.	7
Shadowgraph Tuning Indicator...	Feb.	6
Stewart-Warner 02-4C1, 02-5T1, 02-428, 12-4D1, 205CA, 205CK..	Aug.	31
Stewart-Warner Hudson SA40...	Nov.	29
Stewart-Warner Hudson SA40...	Dec.	21
Stromberg Carlson 231R. By Willard Moody.....	Nov.	30
Truetone D1124 Tuning Mechan- ism.....	Sept.	5
*Tuning Indicators. By M. Heller	Feb.	6

TEST EQUIPMENT for f-m station maintenance



THE PHOTO shown above was taken at dedication ceremonies of WOR's new 10,000-watt f-m transmitter for

their station W71NY on Sunday, November 30. It shows the test equipment used to maintain station at its peak operating efficiency. From left to right on top of bench can be seen the following: RCA Rider Voltohmyst; Easterline 0 to 5 ma d-c recording milliammeter; General Radio 715A d-c amplifier; RCA 155 three-inch cathode-ray oscilloscope; DuMont 208 five-inch cathode-ray oscilloscope; General Radio 605B all-wave signal generator; RCA 301A h-f and 308A field intensity meter set (with B-supply units at right on lowest shelf). Engineer tuning the 308A set is John J. Keel. On the upper shelf under the bench can be seen the following: Industrial Instruments megabridge; General Radio 726A vacuum-tube voltmeter; Hickok portable voltmeter; Jewell wattmeter; Weston 773 tube tester; General Radio 727A a-c vacuum-tube voltmeter; control panel for the General Radio 605B signal generator. On lower shelf: RCA TMV128A motor driven frequency modulator; a special converter unit; Boonton Q meter; Cornell-Dubilier BF50 capacity bridge; Weston 772 20,000-ohm-per-volt multimeter; and RCA Vibrator type B power units for storage battery operation of field intensity measuring sets mentioned above.

BIG BOY



Performance . . . Eye Appeal . . . Value . . . Sensationally Priced at \$19.65, Dealer Net Price.

Here is an AC-DC Volt-Ohm-Milliammeter with all the ranges you want . . . easily readable on the large 7" instrument with extra-long 6" scale, in a new up-to-the-minute three-tone case. DC Volts 0-10-50-250-500-1000 at 5000 Ohms per volt DC; 1000 ohms per volt AC. AC Volts 0-10-50-250-1000 at 400 ohms per volt; DC Ma. 0-1-10-100; Resistance ranges: 0-1500 Low Ohms; 0-150,000 Ohms and 0-7.5 and 0-15 Megohms. Maroon case with red and silver panel, attached handle.

Dealer Net Price, \$19.65

For Catalog Write — Section 1217, College Drive

READRITE METER WORKS, Bluffton, Ohio



PRONG-BASE

ELECTROLYTICS

- Even without that well-known yellow-and-black label, you could still pick out an Aerovox prong-base electrolytic. Just try to wiggle its soldering lugs; they don't budge! Also note square can shoulder eliminating danger of shearing cathode tabs. Lastly, note rubber sleeves sealing in lugs passing through bakelite disc. These Aerovox design features mean better, non-leaking, non-corroding prong-base electrolytics.

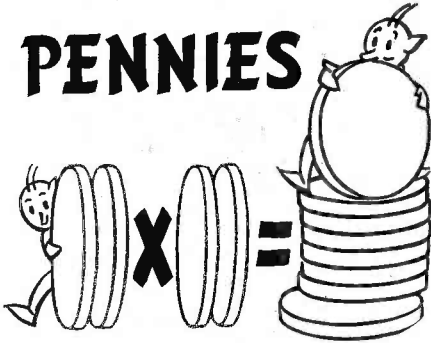
Type	Aerovox Type F Cap. & Vol.	Size
F2J	10x450	
F4J	20x450	1x2"
F8J	40x450	1x2
F22J	10-10x450	1x3
F44J	20-20x450	1x2
F222J	10-10-10x450	1x3
F16H	80x400	1x3
F22F	10-10x250	1 3/8x2
F44F	20-20x250	1x2
F6D	30x150	1x2
F44D	20-20x150	1x2
F66D	30-30x150	1x2
F64D4A	30-20x150	1x2
F33F4A	+ 20x25	
	15-15x250	1x2
F22J4A	+ 20x25	
	10-10x450	1x2
	+ 20x25	1x3

• Ask Your Jobber . . .

He can supply you with Aerovox prong-base electrolytics either for initial equipment or as replacements. Ask for latest catalog—or write us direct.



Mystery OF THE MULTIPLYING PENNIES



Benjamin Franklin said, "Take care of the pennies and the dollars will take care of themselves." But in a case like this he would no doubt have said something like this—use your pennies wisely and watch them multiply into dollars.

The entire story is told in the new folder, entitled "Mystery of the Multiplying Pennies," published by Sylvania and distributed by Sylvania Jobbers. Your jobber has this folder. Ask him for it.

For here is a complete showing of all the many, many sales helps which Sylvania has produced at considerable expense for your benefit. Some are FREE and some cost only a modest price.

Order from the illustrated folder or from the list below. Get full information and samples either from your jobber or by writing Hygrade Sylvania Corporation, Dept. S-12, Emporium, Pennsylvania. Order now so that these helps will start working for you at once.

Sylvania Helps You Sell—See Below

- | | |
|---|--|
| 1. Miss America Football Window Display | 15. Service hints booklets |
| 2. Counter displays | 16. Technical manual |
| 3. Electric Clock signs | 17. Tube base charts |
| 4. Electric Window signs | 18. Price cards |
| 5. Outdoor metal signs | 19. Sylvania News Characteristics Sheets |
| 6. Window cards | 20. Interchangeable tube charts |
| 7. Personalized postal cards | 21. Tube complement books |
| 8. Imprinted match books | 22. Floor model cabinet |
| 9. Imprinted tube stickers | 23. Large and small service carrying kits |
| 10. Business cards | 24. Customer card index files |
| 11. Doorknob hangers | 25. Service Garments |
| 12. Newspaper mats | 26. 3-in-1 business forms |
| 13. Store stationery | 27. Job record cards (with customer receipt) |
| 14. Billheads | |

SYLVANIA

SET-TESTED RADIO TUBES
EMPORIUM, PENNA.

Also makers of Hygrade Lamp Bulbs,
Hygrade Fluorescent Lamps, and
Miralume Fluorescent Light Fixtures

Catalogs, Bulletins, etc. . . .

Copies of the catalogs and bulletins discussed below may be obtained directly from the respective manufacturers mentioned. Write for them today!

• • • • Facts, figures and curves dealing with the electrical and mechanical characteristics of various high-frequency powdered iron materials and cores have been released by Henry L. Crowley & Co., Inc., 1 Central Ave., West Orange, N. J. The information is in loose-leaf form so that additions may be made as new powdered iron materials and new core shapes are made available. Due to the highly technical and specialized nature of the data, the information is available only to engineers engaged in professional radio or allied work, writing in on their business stationery.

• • • • Ghirardi's newly revised and expanded "Radio Troubleshooter's Handbook" is described and a detailed listing of its 66 chapter titles given in a circular in color issued by the Radio & Technical Publishing Co., 45 Astor Pl., New York City.

• • • • Solar Manufacturing Corp., Bayonne, N. J., have issued two new catalogs,



12F and 12G which illustrate and describe Solar Elim-O-Stats and Capacitor Analyzers.

Expansion . . .

• • • • Arthur E. Akeroyd, manager of replacement sales for the Raytheon Production Corp., 420 Lexington Ave., New York City, announces that the company has moved to new quarters at the same address. The new office is located in Suite 2628. L. K. Marshall, president of Raytheon; David T. Schultz, vice president and treasurer and E. R. Haines, sales promotion manager also have offices at this address.

• • • • Terminal Radio Corp., distributors of radio parts and electronic equipment, announce that the parts departments of their two stores will be consolidated at new and larger quarters at 85 Cortlandt St., New York.

At 70 W. 45th Street, Terminal's radio and record department, under the management of Jack Haizen, will continue to function in enlarged quarters. Radio parts and equipment sales will be discontinued at this address, however.

Personnel . . .

• • • • Paul S. Ellison was elected to membership on the board of directors, Association of National Advertisers, at the annual fall meeting held in Hot Springs, Va., last week. He has been constantly active in the ANA ever since he became advertising manager of the Brunswick-Balke Collendar Co., in 1926.

Recently Mr. Ellison was promoted to position of director of advertising of the Hygrade Sylvania Corp. At the present time he also is acting chairman of the ANA membership committee and a member of the ANA display committee.

Displays . . .

• • • • Much has been written recently about the radio service profession in general and in particular of the practices prevalent among some Service Men. Regardless of whether or not the charges are legitimate, the public has had most of the weaknesses brought very forcibly to its attention. In an effort to aid Service Men to constructively counteract any ill effects, National Union Radio Corp., 57 State St., Newark, N. J., has had a series of four cards prepared as follows:

1) A reprint of the Reader's Digest article. The purpose of this card is to build up in the mind of the prospective customer the fact that the service man realizes some of the troubles obtaining in the industry and that knowing them strives to overcome these malpractices.

2) An individually embossed sign attesting to the fact that the shop was inspected by a National Union representative and found to contain all essential testing equipment.

3) & 4) Reserve the right to charge for testing all tubes where replacements for the defective items are not purchased and a nominal service charge for all inspecting of sets.

• • • • Shure Brothers, 225 W. Huron St., Chicago, have released a display card and streamer on the Shure "Hi-Lo" 1-ounce crystal phonograph pickup—for jobbers' coun-



ters and windows. In brown, gray and black, with a large photo of the pickup, these display pieces tell the "Hi-Lo" story. They point out the combination of high voltage and low pressure (1.4 volts output at 1000 cps with 1-ounce needle pressure).

"We Quote"

"VICTORY IS OUR ONLY OBJECTIVE..."

AT THE SUMMONS of Vice President Wallace, the Supply Priorities and Allocations Board held a special meeting December 9 in the Vice President's office and adopted the following declaration:

"FROM NOW ON, every action by this Board and by the related civilian agencies of the Government must be keyed to one goal—complete victory in this war which has been thrust upon us.

"FROM THIS MOMENT we are engaged in a victory program. We can talk and act no longer in terms of a defense program. Victory is our one and only objective, and everything else is subordinate to it.

"IT IS CLEAR that a vastly expanded national effort is imperative. Production schedules for all manner of military items must be stepped up at once. Every activity of our national life and our civilian economy must be immediately adjusted to that change. To attain victory we aim at the greatest production which is physically possible; we call for the greatest national effort that can possibly be made.

"THIS POLICY applies all down the line—in the agencies of Government, in industry, in agriculture, in commerce, in labor, in every phase of national life. There is but one standard for activities in all of these fields—the simple question, 'Is this the utmost that can be done to bring victory?' Policies and actions which meet that test must be adopted; those which do not must be rejected.

"A UNITED PEOPLE will harness the unparalleled might of the United States to one word and one slogan—VICTORY."

from the OEM publication DEFENSE

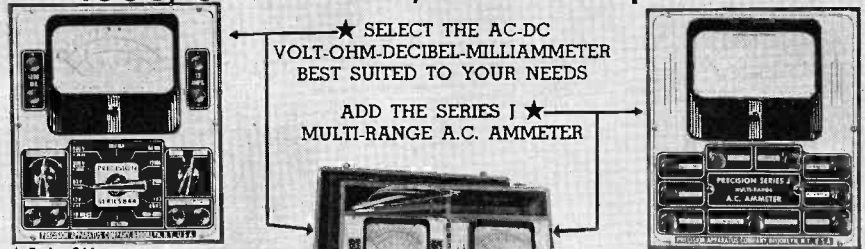
CORRECTION NOTICE

WE HAVE received a notice from Galvin Manufacturing Corporation that their Service Manual, Form S18G, covers their Models 61L11 and 61L12 instead of Models 62L11 and 62L12 as indicated on the form. Page 10 of the October issue of SERVICE included a novel circuit feature, contained in these receivers, under the latter subtitle. The diagram illustrating this feature appeared on page 8. The caption on page 8 and the subtitle on page 10 should read "Motorola 61L11, 61L12." Please make the proper corrections in your October copy.

RADIO? COMMUNICATIONS? ELECTRIC POWER?

There is a PRECISION INDUSTRIAL CIRCUIT TESTER to meet your INDIVIDUAL SENSITIVITY REQUIREMENTS

Ranges to 6000 Volts—60 Amps—10, 20 or 60 Megs—70 DB
1000, 5000 or 20,000 ohms per volt!



★ Series 844 (illustrated above)

1000 ohms/volt AC and DC

★ Series 845 5000 ohms/volt DC
Plus 1000 ohms/volt AC and DC,

★ Series 856 20,000 ohms/volt DC
Plus 1000 ohms/volt AC and DC

★ Series J (illustrated above). Eight AC ammeter ranges, 300 MA full scale to 60 AMPS. Available individually or as companion unit to Series 844, 845 or 856.

★ Series 844-J Combination AC-DC Industrial Circuit Tester (center illustration). Complete with ohmmeter batteries and high voltage test leads. Furnished in walnut finished hardwood portable case, size 11 x 15 x 6" \$48.95

★ Series 845-J Combination AC-DC Industrial Circuit Tester. Complete as above \$52.95

★ Series 856-J Combination AC-DC Industrial Circuit Tester. Complete as above \$59.95

WRITE FOR NEW PRECISION INDUSTRIAL TEST INSTRUMENTS CATALOG No. 42-E

PRECISION TEST EQUIPMENT
INDUSTRIAL · LABORATORY · RADIO · TELEVISION

PRECISION APPARATUS COMPANY • 647 KENT AVENUE • BROOKLYN, N. Y.
Export Division: 458 Broadway, New York City, U. S. A. Cable Address: Morhanex

RCA INVITES SUB-CONTRACTING

The RCA Manufacturing Company has indicated its willingness to extend to other manufacturers of tubes technical assistance in making special tube types developed by RCA. These special types of tubes have been developed at a cost of many thousands of dollars, and such information is normally regarded as a commercial secret. The offer was made by means of the following letter, dated November 3, 1941, and addressed to the other manufacturing organizations by L. W. Teegarden, Manager of RCA's Radio and Tube Divisions.

"The rapid increase in our requirements to meet the needs of the National Defense Program necessitates the manufacture and delivery of tubes at rates which are considerably greater than any production which has been obtained up to this time.

"In view of this situation, therefore, we desire to consider subcontracting for certain quantities of these tubes and to place other members of the tube industry in a position to serve equipment manufacturers having defense contracts.

"We have set up at our Camden, N. J., plant a department with responsibility for administering sub-contract work for our entire company. This department is under the supervision of Mr. H. L. Sommerer, Manager.

"If you are in a position to participate in the overall Defense Program by undertaking any portion of this production on a subcontract basis or otherwise, we invite you to write to Mr. Sommerer indicating the facilities and capacity you have for this type of work, after which we will arrange for a detailed discussion as promptly as possible."



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RIDER BOOKS

as evidenced by your unprecedented demand for established Rider publications and the many new books released during the past twelve months. For the coming year we are planning important new additions to our list. We promise you every effort to produce Rider Books

and

RIDER MANUALS

that will make your work easier, faster and more profitable in 1942.

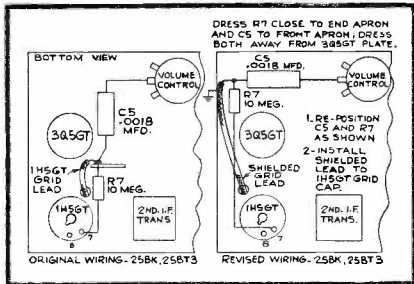
JOHN F. RIDER PUBLISHER, Inc.
404 FOURTH AVENUE, NEW YORK CITY
Export Div.: Rocke Int. Elec. Corp., 100 Varick St., N.Y.C., Cable: ARLAB

SERVICE, DECEMBER, 1941 • 29

CASE HISTORIES

RCA 25BK, 25BT3

Reducing minimum volume: When these models are used near strong local stations, the minimum volume may be too high. This can be remedied by



RCA 25BK, 25BT3.

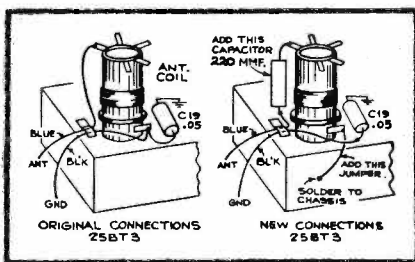
re-positioning the 1H5-GT first audio grid capacitor (C5) and grid resistor (R7), and installing a shielded lead to the grid cap of the 1H5-GT tube. These changes are shown in the accompanying drawing.

Distortion on locals: In Models 25BK and 25BT3, distortion on strong local stations (even with volume control turned low) may be caused by "front-end" overloading due to excessive signal strength. This can be corrected by using a shorter antenna, or by connecting a small capacitor (about 50 mmfd) in series with the antenna.

RCA 25BT3

Hum modulation with CV42: The

RCA 25BT3 (below).



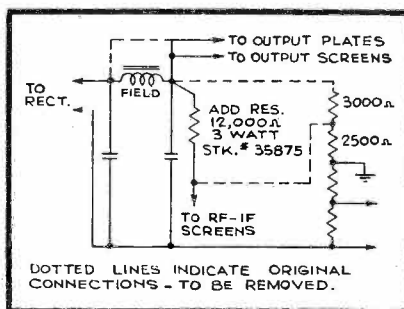
changes shown in the accompanying sketch are recommended to eliminate hum modulation when using Model 25BT3 with CV42 "Electrofier." These changes may be made without removing the chassis from the cabinet, and require the addition of only one part, a 220-mmfd mica molded capacitor.

RCA U45, K105, V205

Defective bleeder resistor: If bleeder resistor becomes defective, the set can be repaired, without replacing the bleeder, by changing the circuit as shown in the accompanying diagram.

This change requires only one part,

RCA U45, K105, V205 (below).



a 10,000 or 12,000 ohm, 2 or 3 watt resistor.

Procedure:

(a) Disconnect leads attached to 3,000 and 2,500 ohm sections (leave ground connection intact).

(b) Change output stage plate supply from the filter input (rectifier side of speaker field, + 350 volts) to the filter output (load side of speaker field, + 250 volts). This can be done at the speaker plug. Leave the output stage screen lead connected to this same point.

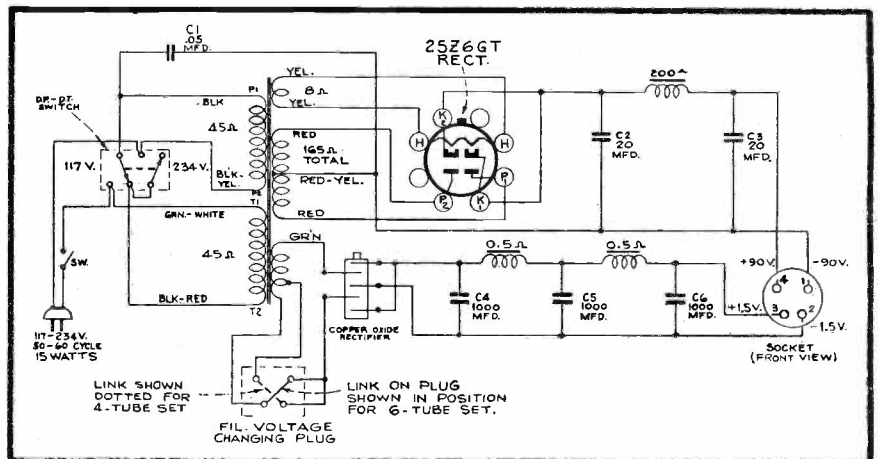
(c) Install a 10,000 or 12,000 ohm, 2 or 3 watt resistor in series between the r-f, i-f screen supply lead and the filter output, being sure that the existing 16-mmfd capacitor is connected to the screen side of the resistor.

This modification slightly lowers the reserve of power output.

RCA CV-112X CONVERTER UNIT

AC power unit for QB2, QB5, QB6: The CV-112X is designed to convert Models QB2, QB5, and QB6 from battery to a-c operation. It differs from the CV-112 in that it has a tapped filament winding to provide correct filament voltage with 4- and 5-tube, or 6-tube receivers. A plug, which fits in a socket on the side of the unit, is used to select the correct tap, as shown in accompanying diagram.

RCA CV112X converter.



FREE Your Fortune for 1942

We're not crystal-gazers but (with Defense cutting receiver production) we predict a bigger repair and maintenance business for you in 1942 than you've ever dreamed! Be prepared with RCP Dependable Test Equipment. All non-essentials are trimmed to make RCP the finest instruments for your purpose at rock-bottom prices. See the many improved tube and set testers in our new, big 1942 Catalog No. 125. Write today!

RADIO CITY PRODUCTS CO., Inc.
88 PARK PLACE • NEW YORK CITY

★ HERE'S A PROFIT TIP: Make yourself the local expert on FM receivers. Get aboard this 1942 Radio Bandwagon EARLY with RCP Test Equipment.



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.

Sound News...

Additional information and prices of the equipment described below may be obtained, without obligation, from the respective manufacturers.

PHONOGRAPH NEEDLE

The Emerson Radio and Phonograph Corp., 111 Eighth Ave., New York City, has introduced a long-life phonograph needle. Each needle is packed individually in a sealed container and is guaranteed for 4,000 playings without the necessity for changing. Features of this new Emerson "Miracle Tone Long-Life" needle are the flexible shank and the platinum metal tip.

To promote the sale of these needles, Emerson has provided a full-colored self-merchandiser that effectively displays twelve sealed containers. Under each container appears a sales message which becomes visible to the consumer as a container is sold.

DYNAMIC MICROPHONE

The Turner Co., Cedar Rapids, Iowa, offer a new Dynamic microphone, Model 211, for radio stations, loudspeaker systems, bands, and others. The 211 dynamic utilizes a new type magnet structure and acoustic network, offering outstanding performance characteristics, it is said. The



salt-shaker type is dictated by these two features and style and streamlining has been added.

The high-frequency range, and the extreme lows have been raised 2 to 4 decibels, to compensate for over-all deficiencies in loudspeaker systems, it is said. Turner 211 is equipped with tilting head, balanced line output connection and 25 feet of heavy duty cable. It is finished in rich satin chrome.

15-WATT AMPLIFIER

A new 15-watt amplifier, Model MI-1222, has been announced by George Ewald, manager of the Commercial Sound Division of the RCA Manufacturing Co., Camden, N. J. The unit is capable of 21 watts of output as a maximum. At its rated output, distortion is said to be less than 3½%. Provision is made for microphone and phonograph inputs, the former at 560,000 ohms, and latter at 500,000 ohms. A terminal

board is provided for making output connections. Separate volume controls are supplied for the microphone and phonograph inputs. A continuously variable tone control and voice-music switch are also incorporated in this amplifier. Gain of 125 db is provided for the microphone input, 85 db for phonograph. Frequency response is from 30 to 10,000 cycles. Dual control intro-tube mixing is another feature of the new unit.

A good, well equipped service bench is vital to successful servicing. Read SERVICE each month for the latest developments.

New Products...

Additional information and prices of the equipment described below may be obtained, without obligation, from the respective manufacturers.

OIL-FILLED PLUG-IN CAPACITOR

Aerovox Corp., New Bedford, Mass., announce Series -72 oil-impregnated oil-filled capacitor, with four-pin base that fits into a standard UX socket, as distinguished from the octal base of other plug-in units.

The aluminum-sprayed tin-plate round can comes in 2, 2½ and 3 inch diameter sizes, and from 2½ to 4¾ inches high. It is provided with a mounting ring with lugs, so as to be held securely in place and in accordance with Underwriters requirements. These oil-filled plug-ins are available in single-section units up to 16 mfd, and up to 4-4-4 mfd in multiple-section units, in both the 400 and 600 v. d-c-w ratings.

HAMMER FINISH KIT

General Cement Manufacturing Co., 919 Taylor Ave., Rockford, Ill., have announced their No. 1820 Complete Hammer Finish Kit. The finish is a two coat process, and



the kit contains the necessary materials including a handy spray. Colors of blue green, silver green, silver, silver blue, blue and copper bronze are available.

SOLDERING DEVICE

Jiggers, Inc., 215 W. Illinois St., Chicago, have introduced a device called "Jiggers" designed as a self-contained soldering unit which includes a proper amount of 50-50 solder and flux in a sealed shell. To obtain a soldered joint, it is said that all that is necessary is to push the wire splice into a Jigger and touch a lighted match to the combination. The burnt shell may then be removed to reveal the joint. Samples are available directly from the manufacturer.

Standard, nationally known parts and accessories are guaranteed for quality and performance. It pays to use them—and only them—in your work.

RADIART

*in wishing you
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and a Prosperous
New Year,*

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the year 1942
will bring to you
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lasting peace
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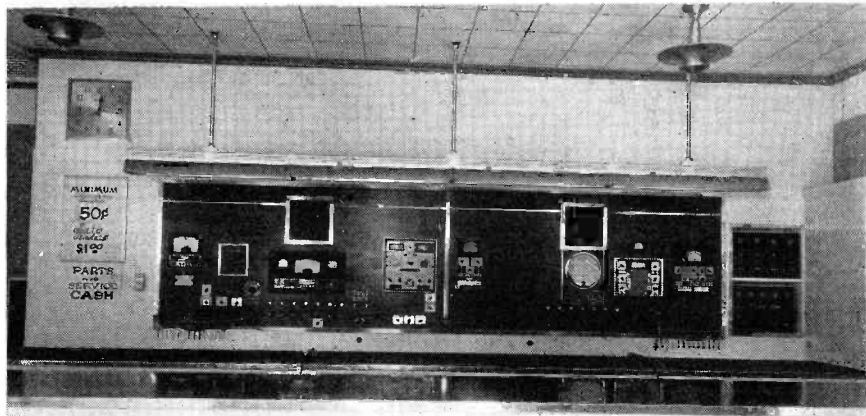
5 DAYS AT OUR RISK—GO TO YOUR DEALER OR MAIL THIS COUPON NOW

DELUXE SERVICE

THE FOLLOWING are a few features of the Wilcox Radio Service, 1423 N. W. Twenty-third St., Oklahoma City, Okla., shown in the accompanying photographs. The building faces south on one of the busiest streets of the city. It is sound proof insulated, fully heated in winter and air conditioned in summer. Fluorescent lighting throughout, including the display windows. Intercommunicating system, connected at convenient points, increases efficiency.

Wilcox policy: no fee estimates; minimum charge for shop inspection 50c; for inspection at customers home, \$1.00. Customer is informed of the charges so that there is no misunderstanding when the time comes for her to pay up.

Clifford C. Wilcox, proprietor, says: "In my thirteen years of experience in the radio service business I find I lose less and gain more, both in customer confidence and in actual cash, by this method than by any other that I have tried."



IN SERVICE



Here we are again—with replacements for the many manufacturers that used Ken-Rad better tubes for initial equipment last year. Stock us for quick turnover and added profits. For we assure you completely satisfied customers. As one writes: "I know that your tubes will give me full satisfaction as I have been using them in my sets for some time and do not believe that there are better tubes on the market."

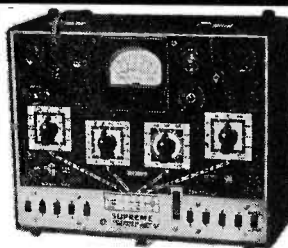
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FCC SEEKS MONITORING OFFICERS

Within the past year there has been considerable expansion of the radio monitoring activities of the Federal Communications Commission. Even further expansion is anticipated in connection with national defense. To secure qualified people to do this work, the U. S. Civil Service Commission has just announced an examination under the title "Radio Monitoring Officer." The positions pay \$2,600 and \$3,200 a year.

Radio monitoring officers are assigned to monitoring and direction-finding stations of the FCC where they stand watches at any time of the day or night, including Sundays and holidays. They provide surveillance of all communication channels by listening to and recording transmissions. Copying radio-telegraphic transmissions is also a part of the work. Monitoring officers investigate complaints alleging subversive uses of radio and secure evidence leading to the prosecution of operators of unlicensed stations. They are required to travel a great deal and to drive direction-finder cars.

No written test will be given for these positions. To qualify for the full-grade position (\$3,200 a year), applicants must have at least 2 years of responsible supervisory experience in installation, testing, inspection, laboratory development, or responsible maintenance of commercial or Government radio transmitters. In addition they must have either similar experience, not necessarily supervisory, or have completed appropriate college or technical study. Applicants for the assistant grade (\$2,600 a year), may qualify on appropriate study or experience such as that of studio engineer supervising high-fidelity recording of aural programs and their reproduction. For some positions, applicants must also meet certain license and code receiving and transmitting requirements.

Applications may be filed with the U. S. Civil Service Commission, Washington, D. C., until June 30, 1942. However, interested persons are urged to secure a copy of the announcement and application forms at once from the Commission's representative at any first- or second-class post office or from the Commission's central office in Washington, D. C.

HIGH-SPEED OPERATORS NEEDED

There is a continuing and urgent need for High-Speed Radio Equipment Operators in the Signal Service of the War Department. Over 200 positions paying \$1,620 a year are now open at various Army posts throughout the United States and its Territories. In an effort to secure men for these positions, the experience and operating requirements of the *Junior Communications Operator, High-Speed Equipment examination* (Announcement No. 20), issued by the Civil Service Commission, January 20, 1941, have been amended to read as follows:

"Experience.—Applicants must have had at least 1 year of experience as a radio-telegraph operator in commercial or government communications system, which must have included at least 3 months' ex-



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perience in the operation of high-speed radio communication equipment.

"Operating Requirements.—

(a) Reading and transcribing to typewriter syphon recorder tape in continental Morse code at a sustained speed of 40 words per minute.

(b) Operating transmitting perforator at a speed of 40 words per minute.

(c) Copying audio English to typewriter at a speed of 30 words per minute and audio code groups at a speed of 20 words per minute.

"Substitution.—Training in radio operation at a service school may be substituted month for month for the required radio operator experience except that in any case applicants must have had the 3 months' experience in the operation of high-speed radio communication equipment as described in (a), (b), (c), and (d)."

Further information regarding the examination is contained in Announcement No. 20, available at any first- or second-class post office of the Civil Service Commission in Washington, D. C. Proper application forms Nos. 6 and 4006-ABCD and Supplemental Form 3629 may also be obtained from these offices. Qualified persons are urged to file their applications at once with the Civil Service Commission.

Auto radio and sound—Two phases of this business that should be especially profitable during the coming months. Are you getting your share?

DR. CONRAD DIES

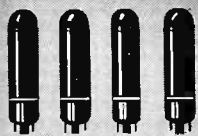
Dr. Frank Conrad, Assistant Chief Engineer of Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa., died Wednesday night, December 10, at his home



in Miami, Florida. He was sixty-seven years old.

It was Dr. Conrad's experiments in radio broadcasting in the fall of 1919, that attracted widespread attention and led to the establishing of Station KDKA at East Pittsburgh by Westinghouse, where Dr. Conrad was general engineer at that time.

A number of developments in radio and other fields are attributable to Dr. Conrad and he held more than 200 patents. Among his developments are watt-hour meters, pantagraph trolleys, electric clocks and ignition apparatus. He pioneered in the early development of broadcasting equipment as well as in broadcasting itself.



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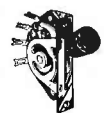
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Proper signal reproduction is the basic function of radio and communication equipment.

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Instead of depending upon the interpretation of secondary effects, RCA Instruments go right to the source of the trouble. By picking up the signal where it is present in any circuit they quickly indicate the exact point in the circuit sequence where the signal ceases, weakens or becomes distorted. Once this point has been found, the trouble can quickly be isolated by using one of the RCA Electronic Measuring Instruments. These instruments make it possible to measure voltages with-

out loading the circuit sufficiently to appreciably disturb its normal functioning. Here again, the basic conditions of signal operation are maintained.

RCA Signal Generators are designed to give signals at r-f, i-f or audio frequencies. Sufficient controls and adjustments are available so that a signal can be reproduced which will approximate closely the normal signal encountered in the particular circuit being tested.

Thus, Signal Tracing is the keynote behind all RCA Test Equipment. Because RCA has recognized the basic servicing idea that "The Signal's the Thing," instruments like the RCA-Rider Chanalyst, VoltOhmyst, Signalyst and various others have set new high standards in radio and communication servicing.



Test Equipment

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