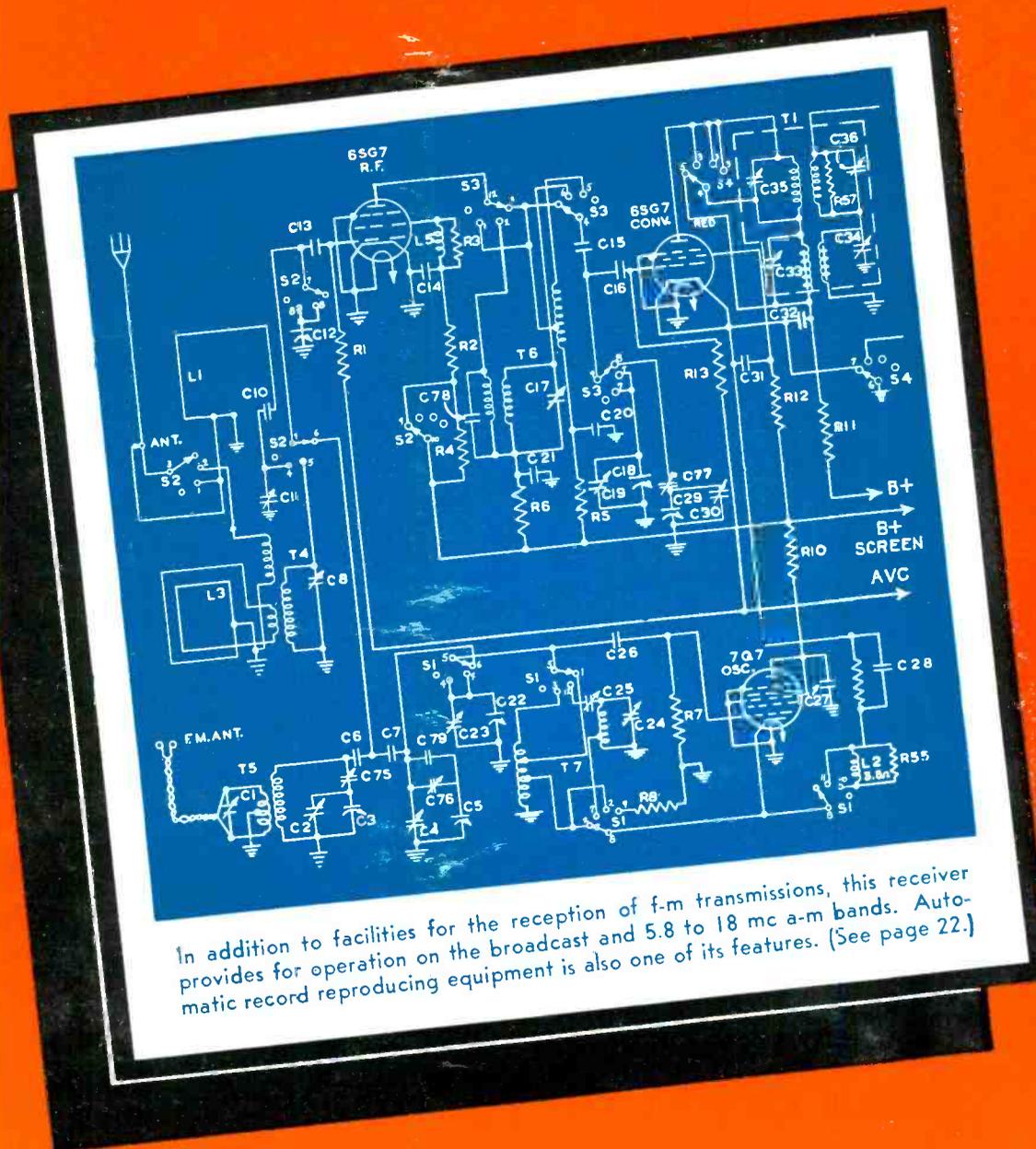


# SERVICE



In addition to facilities for the reception of f-m transmissions, this receiver provides for operation on the broadcast and 5.8 to 18 mc a-m bands. Automatic record reproducing equipment is also one of its features. (See page 22.)

**JUNE  
1942**



## Institutional?... *and How!*

Whadd'ye mean—institutional?

Well, it's this way. Mallory is an institution with the radio service fraternity; studying your problems, working out new helps for you, bringing new ideas to you, to make your work more effective and more profitable.

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Remember, that in the Mallory laboratories are experts in almost every branch of radio, electrical and metallurgical engineering. We repeat—they're here to help. They're making Mallory a live, progressive aid to industry. You can bet your life it's an outfit that you can depend on.

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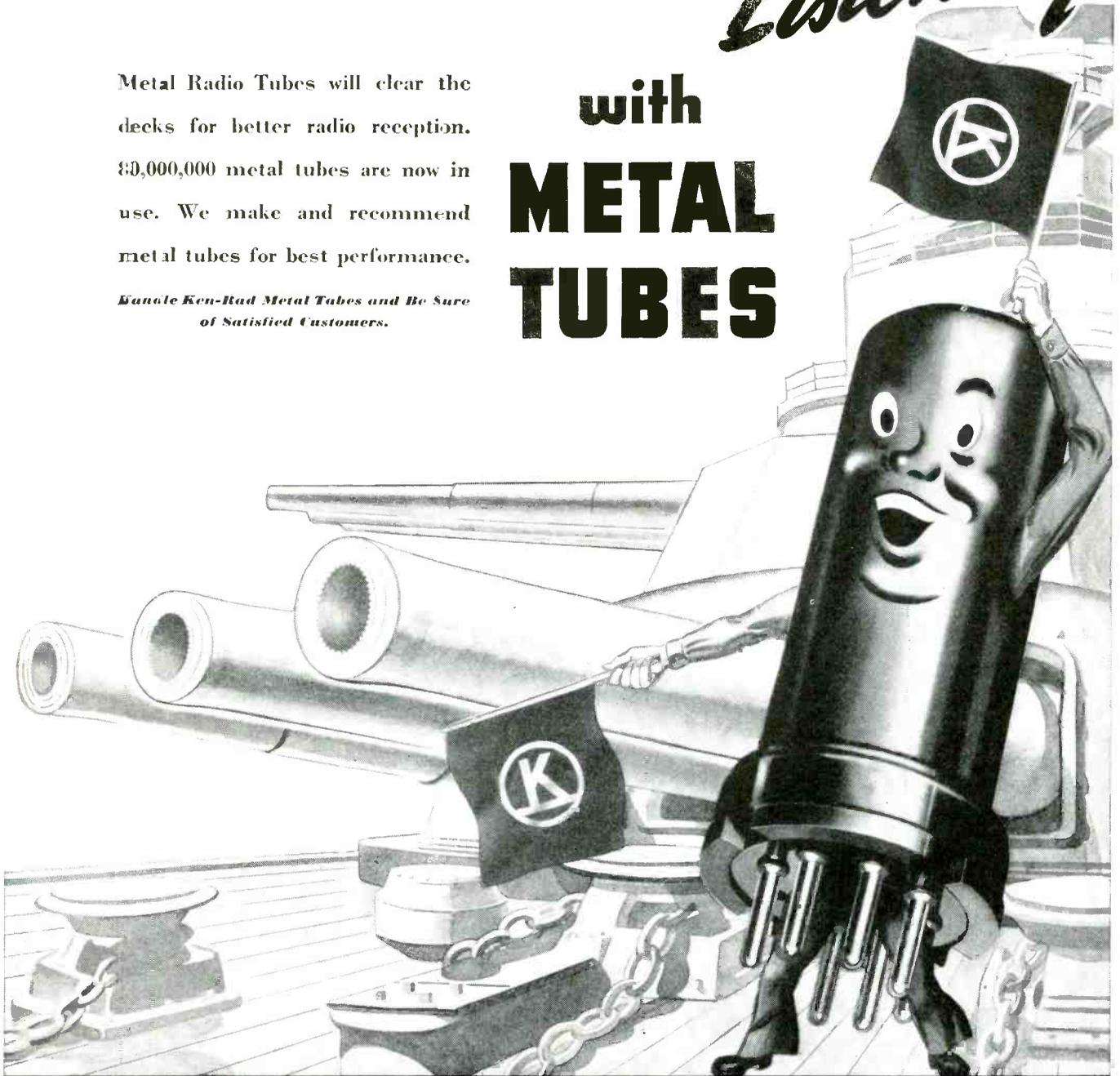


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*Handle Ken-Rad Metal Tubes and Be Sure of Satisfied Customers.*

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**METAL  
TUBES**



# KEN-RAD

## *Metal Radio Tubes*



**KEN-RAD TUBE & LAMP CORPORATION, Owensboro, Kentucky**



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

**B**ECAUSE OF the suspension of the Trade Show we have promised to discuss The State of the Industry in this issue. We hope we have not overdone ourselves in this respect. With but a single exception each of the authors this month has given space to a discussion of the status and trends of a particular phase of the industry. In our feature article Mr. Ghirardi tells about the service shop itself. On page 8, Henry Howard briefly paints the picture of the progress of the receiver manufacturers. Charlie Farrell tells us about price regulation, among other things, on page 11. The replacement parts and tube situation is outlined on page 25. All of the material presented is accurate and authoritative and comes from such governmental agencies as the War Production Board, the Office of Emergency Management, the Office of Price Administration and from the Radio Manufacturers Association.

In addition, on pages 13 and 14, we present brief excerpts from well known leaders in the industry to give their side of the picture.

With authentic information concerning happenings in the industry of which you are a part, you will be better equipped to meet the problems that confront you while keeping the country's receivers operating. We all know that keeping the public listening plays an important part in the war effort.

**F**ROM OUR advertising department comes the timely and helpful advice that you take exceptionally good care of the shop and window display material which you now have on hand. It is extremely doubtful that the parts and accessory manufacturers will produce much in the way of new or additional displays for the duration of the war. Unless your present material is kept bright and clean you will be put to the unpatriotic and costly necessity of producing your own in the future.

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## U. S. War Savings Bonds

This space is a contribution to America's all-out war program by SERVICE

# SERVICE

A Monthly Digest of Radio  
and Allied Maintenance

ROBERT G. HERZOG, EDITOR

## Running Your Service Shop FOR THE DURATION

By ALFRED A. GHIRARDI

WITH THE COUNTRY at war even the most remotely located radio service shop operator has felt the repercussions in his business. Problems never before felt—today's gargantuan radio industry has come into being since the last war—are crowding in.

Radio service work has increased tremendously, almost beyond calculation, the burden now carried by many repair shops is already severe. When the dealers' present stock of new sets is exhausted the full force of receiver production curtailment will be felt, and that day is not far distant. Service shops the country over will know then, many for the first time, what it means to be swamped with repair work. Belatedly, they will experience the situation of radio shops in England, where many have been forced to keep their doors locked to customers several days a week, simply to get enough uninterrupted time to clear away the unprecedented accumulation of service jobs.

Will this sudden flood of service work prove to be a bonanza to all service shops? No, it will not be a matter of just opening the doors and raking in money. The tables (of too little work) have been turned, but innumerable servicing difficulties have turned up with them. Managing a radio shop "for the duration" will not be easy. The most profitable shop will be, as always, that which *sells* its services most widely, *performs* its repair work most efficiently, and plans ahead most cleverly to meet all present and future obstacles bound to come, even more carefully than in normal times. The successful shops "for the duration" will be those managed by alert, adaptable men, constantly on guard against every "monkey wrench thrown into the works," able to change tactics frequently to outwit each new threat, de-

termined to carry on, come hell or high water.

Shop owners and service managers will encounter greater and greater difficulty in finding, training and holding competent Service Men against competitive bidders, both inside and out-

parts and supplies threaten to become still more serious because, among many reasons, of impending transportation restrictions. The increased volume of service work will have to be handled with practically the same old test equipment and tools; new units cannot be



With the country at war every radio shop has already felt the repercussions. Barron's Radio Service Laboratory, 309 South Penn Avenue, in Shawnee, Oklahoma, is no exception.

side the industry. Skilled radio men by the thousands are going into the Army, Navy and war industries. There is a real shortage of experienced help, with every indication that it will become more widespread.

Acutely needed, vital replacement parts now have to be left indefinitely "on order." Delays and shortages of

had. (Greater efficiency in troubleshooting and repairing is the only answer to this.) The threat of more severe nation-wide gas rationing after July 15 may prevent altogether the use of the shop car for pickup and delivery of sets. Higher taxes will be levied to meet the soaring cost of the national emergency. All these difficulties, and more to come, *must somehow be solved*, we might say, below deck. On deck, remains the necessity of attracting customers, winning their good will and confidence and persuading them to pay

fair prices willingly for essential work. Relationship with the customer is of utmost importance if a shop is to operate *profitably*, even during ordinary times. It becomes inestimably more so when a radio shop must be run successfully and profitably in a world turned upside down by war—with daily increasing uncertainty concerning almost every matter vital to the shop's very existence. Only skillful planning and expert steering of the business ship can keep it safe from rocks and disaster.

Every Service Man must come to grips with the situation clearly and realistically. He must immediately formulate workable plans to cope with the adverse conditions besetting his particular business; by such plans only can he operate a successful and profitable shop "for the duration."

#### "Fixing" Faulty Parts

Once upon a time, before manufactured parts for radio sets became available almost at an instant's notice, there flourished in the radio servicing business a unique kind of Service Man whose motto was, "Don't replace it if you can fix it." He was a combination magician-mechanic with nimble, skillful fingers; he could do anything from the rewinding of any coil in a set to repairing a broken resistor element in a rheostat.

"Fixing" faulty parts in radio sets was given up as a general practice some years ago because replacement parts became reliable, inexpensive and easily obtainable. It did not pay to fix most faulty parts—it was cheaper and more satisfactory in the long run to replace them with new, factory-made ones. But now that those are becoming increasingly unprocurable on short notice, a modern version of the old-time "fix it" Service Man may become more than welcome to the service shops of the country. We did not bemoan the passing of the "fix it" days. There were too many abortions passed as repair jobs to permit any illusions about how satis-

factory most of that work was. But the war may force a return of the ingenuity, resourcefulness, individual skill and initiative of the old-time "fixers." A Service Man who can plunge in, "fix" a faulty part and get the set "perking," who is not hopelessly helpless if a new part is not available, may find himself suddenly in great demand. More time will undoubtedly have to be spent per job, substitutes and alternates will have to be resorted to, if the "fix it" days return full force, but the ability somehow to get the set to work by hook or crook will be at a high premium.

#### Trade-Ins for Parts

The possibility of salvaging perfectly good parts from discarded or trade-in sets—or even from a few new ones on your shelves, set aside for this purpose—should be seriously considered. When you take in a discarded or trade-in set, go over it carefully to determine what parts in it can be used to advantage and profit as replacements in other sets. Reference to your *Rider Manual* will usually give you the electrical constants of the various components in the receiver, if necessary. Naturally, be very careful with condensers and certain other components transferred from one set to another. For example, the working voltages of condensers must always be duplicated; the suitability of an electrolytic, paper or mica condenser for various circuits positions, etc., must be watched.

This suggestion that salvaged parts be so used for replacement purposes is made very reluctantly; if the impending situation were not so acute, it would not be made at all. The writer fully realizes what dynamite this practice can be if pursued by unscrupulous or unskilled Service Men. However, in the hands of Service Men who know their stuff, using suitable parts (recondi-

L. A. Mayberry, proprietor of Mayberry Radio Company, 226 North Broadway Street, Shawnee, Oklahoma, will share in the increased work because he operates his shop efficiently.

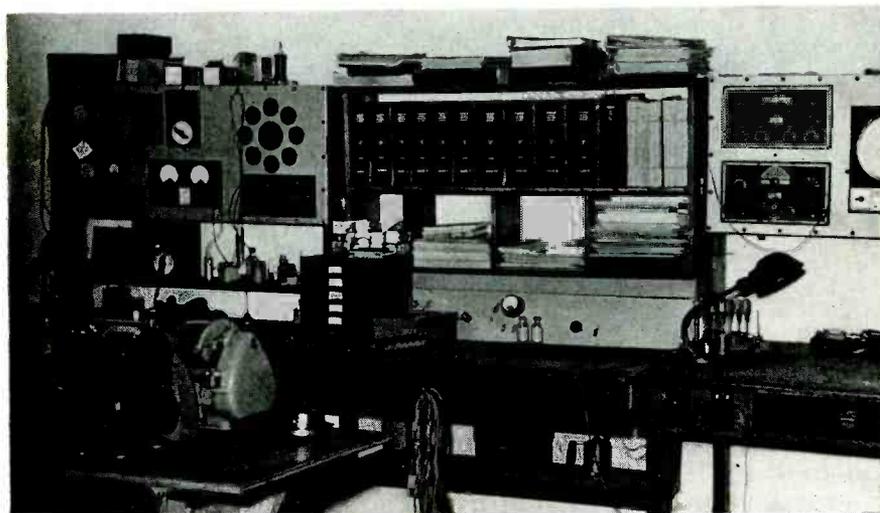
tioned when advisable) from such sets can well be the salvation of their servicing business. This has been a limited practice for years in many of our service shops; it has been a life-saver in the service shops of England and probably is in other countries which have been at war for some time. Under extremely difficult circumstances, customers are tolerant and do not expect perfection. They are already accepting many makeshifts with good grace. When you use parts from another set for replacement, tell your customer so frankly; tell him, too, that it was only by your willingness to do it and your knowledge of *how* to do it that it was possible to get his set to working again at all. This gives your prestige a perfectly honest and legitimate boost, and at the same time, protects you against comebacks.

It is not too pessimistic, it is rather realistic, to expect the time to come when Service Men may even be forced to go out among their customers and buy up all available used sets—merely for the value of their disassembled parts as replacements.

#### Your Test Equipment

The shortage of new test equipment, the virtual impossibility of getting any faulty or damaged test equipment repaired by competent instrument men, is growing serious. Shops that employ several repair men at the bench are fortunate these days if they have test equipment made up of several independent units. These independent units permit a flexible distribution of test instruments among several men, and so speed work. They even make practical the employment of beginners to do certain test or repair jobs, as we shall explain later.

Alleviating the critical shortage of test instruments by using each and every possible test of which it is capable, is a measure that has not had the attention it deserves. Every test instrument manufacturer could certainly do his former customers and the entire servicing industry a good turn by devoting all his trade advertising "for the duration" to teaching the Service Men who own his instruments how to care for them and how to make the most and best use of them. It is a curious fact that the advertising agencies of these manufacturers are at present lying awake nights trying to cook up institutional advertising that has some semblance of an excuse for its existence (and expense) at this time, completely ignoring the finest and most helpful institutional advertising they could possibly devise for their clients during this war period. The stuff some of them now turn out does nothing for either the



manufacturer or the Service Man. Instrument manufacturers need not become inarticulate suddenly, because they have nothing to sell to the civilian Service Man. They now have their greatest opportunity for usefully serving their former customers, and at the same time cementing bonds of friendship and good-will with them, bonds which will endure long after the war is over.

The intelligent use of modern radio test equipment to its fullest capabilities is just so much more cash in the register. Service Men burdened with more repair work than they have ever had must study short cuts and learn new ways to use their test instruments to get work done faster.\* With skilled Service Men becoming more and more scarce, it is the only solution.

#### Stop Free Service

Many repair shops have always given too much free service, believing this generosity would certainly result in increased customer good will and accelerated business. Ordinary, run-of-the-day helpfulness and courtesy to your customers is one thing—*giving away* valuable services is quite another. Too often it wins slight contempt from your customers, rather than their good will; almost always it ends in your being exploited.

With Service Men's wages and other expenses generally higher, with idle time no longer existent, shops simply cannot afford to continue free service. Ingenious, realistic managers can form new business policies that combine these small services, formerly free, with other services justly charged for, thereby collecting fair compensation for their "contributions."

#### Pay Help Well

During the depression, Service Men's wages sank to low levels in many communities, partly because often-idle shops could pay no more, partly because jobs were scarce and men accepted almost any compensation. That period is past. Service business competitors, defense industries, radio manufacturing plants and other agencies are constantly bidding for skilled radio men. Only decent working conditions, fair treatment and full-time work at wages in keeping with their skill, will hold them. Smart shop managers are paying their men attractive rates, whether on an hourly or a flat-rate weekly basis. They are meeting these increased rates wholly, or in part, by giving less free service, permitting fewer unproductive hours, insisting on more and efficient use of the shop's testing and repairing facilities,

\*The author has in preparation a series of practical articles on this subject, to appear in early issues of SERVICE.



Radio service work has increased for all shops as it has for Emil J. Giara, 1704 Dunn Avenue, Corbin, Kentucky.

reducing waste and raising formerly under-priced jobs to a proper, somewhat higher charge level.

#### Train Additional Men

One of the most important single things service shops can do now is to launch a definite plan for training additional Service Men—even in small shops. A practical plan seems to be to add one or two suitable men, interested in radio (perhaps with some electrical or radio training), above or below draft age, or definitely subject to deferment. These may be ambitious youngsters or older men who are moving into the radio field from other industries disrupted by the present emergency. Start them on beginner's work—simple, useful jobs on which they can quickly become efficient and on which they will naturally and gradually begin to watch and help the experienced men. Eventually, they can tackle small jobs under the direct and almost constant supervision of an experienced man.

Together with this direct shop experience should go an after-work-hours educational program. Encourage the new man to study good radio texts and to subscribe to the better, more helpful trade magazines. If evening courses in radio are available, by all means encourage him to attend. If such courses are not available, advise him to sign up for a good correspondence course. Institute weekly evening sessions at which some competent member of the staff can make practical demonstrations and step-

by-step explanations of certain jobs done in the shop. It may be necessary to pay overtime wages to both instructor and learners. If so, increased shop receipts will help to pay the bill, which may better be met gracefully than to let the business suffer reduced volume or, at worst, be forced to close for lack of competent men. This kind of training cannot make the new man the world's expert Service Man, but it will make him a useful asset in your shop.

It is not surprising that many men in the servicing business throw up their hands at the suggestion of training others. Usually, nobody on the regular staff likes to teach or feels confident that he can do so. Fortunately, some good radio text or correspondence course can very well supply required knowledge of basic fundamentals; the new man can clinch his studies very effectively if he is permitted to apply them practically under supervision in the shop.

Various working conditions and circumstances best dictate what methods shop operators can apply in improving the skill of their men. The cold fact which cannot be evaded is that something *must be done* to fill the depleted ranks of Service Men. From now on they will have to be "made" and service shops will have to do the "making". That radio manufacturers have awakened to the problem and are doing something about it is clearly shown by the fact that almost every important manufacturer now maintains, after hours, training classes for improving the skill of new, inexperienced em-

(Continued on page 22)

# SER-CUITS:

By HENRY HOWARD

ADVICES FROM the War Production Board tell us that 30 of the 55 companies producing civilian radio sets stopped putting sets into production before the original WPB April 22 deadline was reached. RCA and Philco shut off civilian production before April 22 in plants representing more than 80 per cent of their total production. These 32 companies already have war contracts totalling over \$780,000,000, representing approximately 87 per cent of all the war contracts let so far to the home receiver industry.

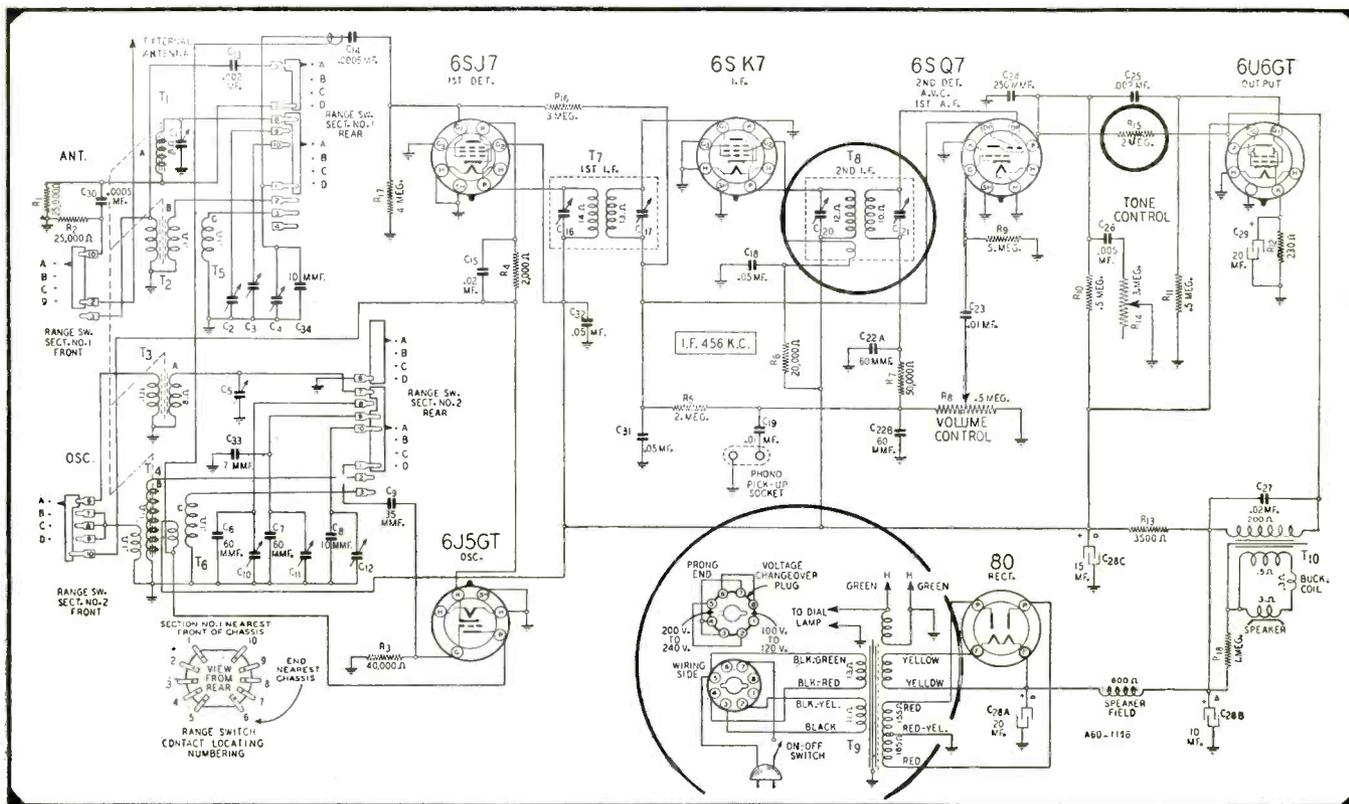
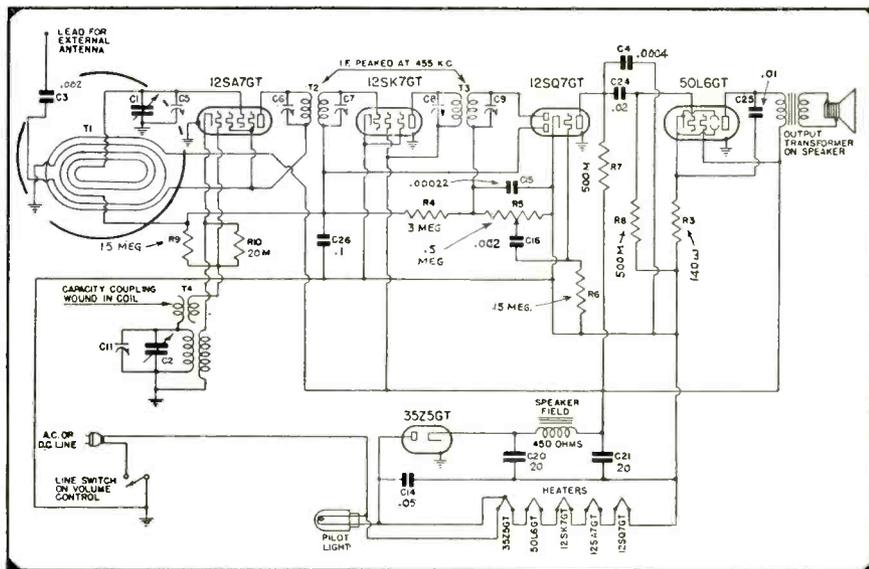
The remaining 25 set manufacturing companies were given additional time, ranging from one to six weeks to produce additional sets in order to facilitate the program of conversion to war work. By this writing all radio production in this country will be concentrated on war purposes alone.

Half of the approximately 410,000 re-

ceivers which were produced after the original April 22 shut-off date will be reserved for export to friendly nations, as requested by the coordinator of Inter-American affairs and lend-lease.

The plants discontinuing civilian production by April 22 produced approximately 57 per cent of all the civilian sets, on a dollar basis, sold in 1941. Their sales accounted for approximate-

Fig. 1 (below), Westinghouse M108, and Fig. 2 (right), Emerson EL360 and EP367 Series.



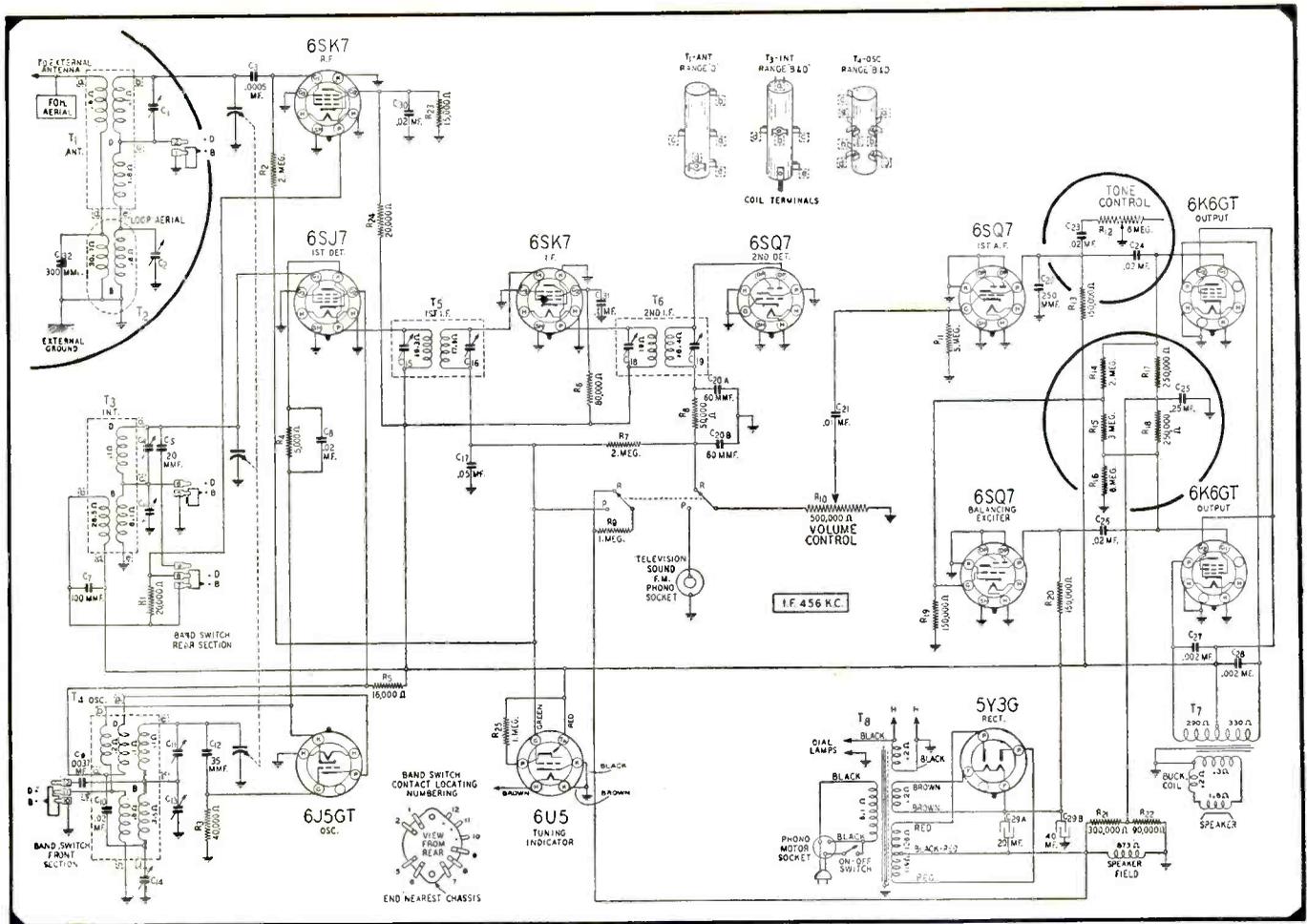
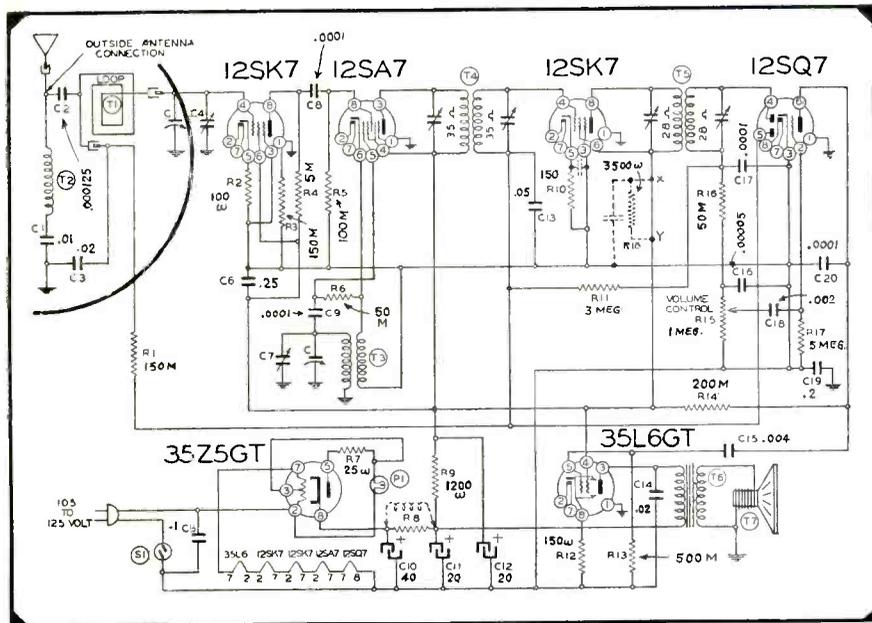


Fig. 3 (left), Coronado C6D18, and Fig. 5 (above), Wells Gardner IA63.



equipment used to detect airplanes and ships, and a variety of receiving and transmitting sets for use in airplanes, tanks, trucks, and other military equipment.

In spite of the complete cessation of civilian receiver production there are many thousands of receivers, mostly new models, in the hands of distributors and dealers. We are able, therefore, to present our regular feature giving new circuit kinks for at least this month and next.

#### Westinghouse M108

The Westinghouse Model M108, 4-range, 6-tube, a-c receiver, has a split primary power transformer allowing a parallel connection for 110 volt use and a series connection for 220 volts or so. A slotted plug is used for the changeover. See Fig. 1. This receiver also uses i-f regeneration of the screen grid tickler type and plate-to-plate inverted feedback obtained by a 2-meg resistor from output a-f plate to first a-f plate. Note also that the output transformer core and voice coil are tied down—not to ground—but to the "B plus" through a 1-meg resistor.

The data in this set gives the sensitivity values for 0.5-watt output on all

ly \$151,000,000 worth of the \$263,000,000 total receiver production for 1941. By the end of 1942 the industry will be producing at a rate six times as great as their best year.

It is felt by the WPB that the conversion order (L-44-a) greatly expedited a changeover to war work. This is true not only of the 55 receiver manufacturers but of the 15 or 20 manufacturers of phonographs and some 250

manufacturers of radio components. In fact, the parts companies began conversion almost immediately after the issuance of the original order. This is indicated because the receiver manufacturers, faced with the stop-production order and stop-purchase order, cancelled their outstanding orders for parts and issued no new ones.

War work to which the industry is being converted includes all sorts of

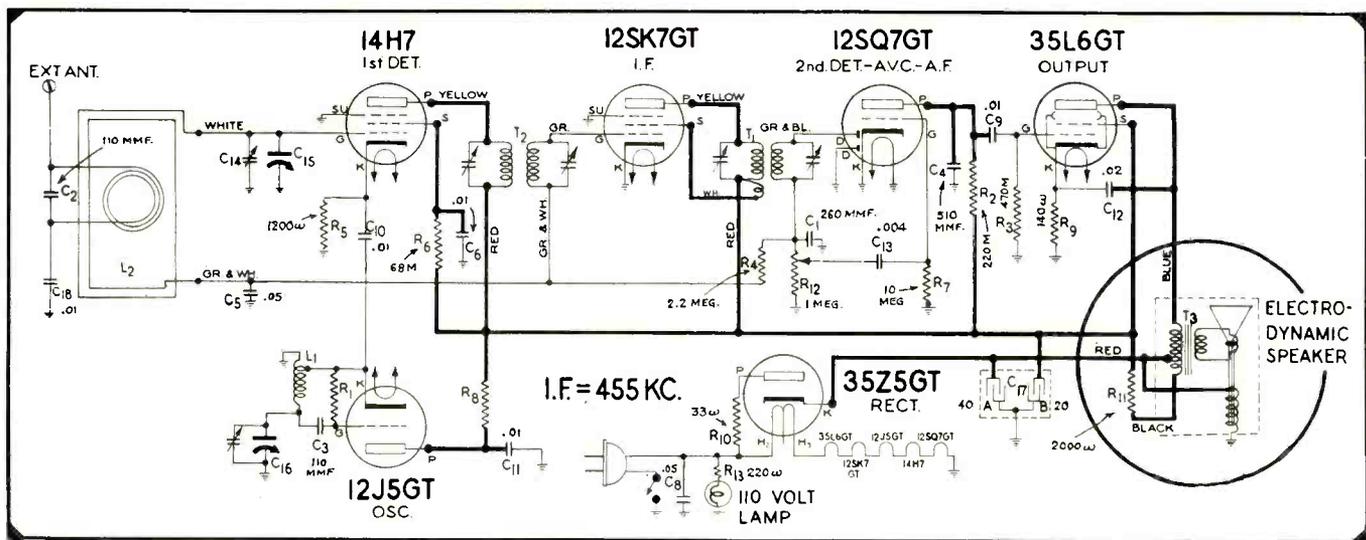


Fig. 4 (right), Belmont 579, and Fig. 6 (above), Silvertone 7010.

four ranges as follows: broadcast—10 microvolts; 3.2 to 7.4 mc—12 microvolts; 8.32 to 12.05 mc—12 microvolts; 15.0 to 22.0 mc—18 microvolts.

#### Silvertone 7900

Sears Roebuck Silvertone Model 7900 also features a split primary power transformer for 110 or 220 volts. The output stage is a 6K6 with an unby-passed 680-ohm cathode resistor.

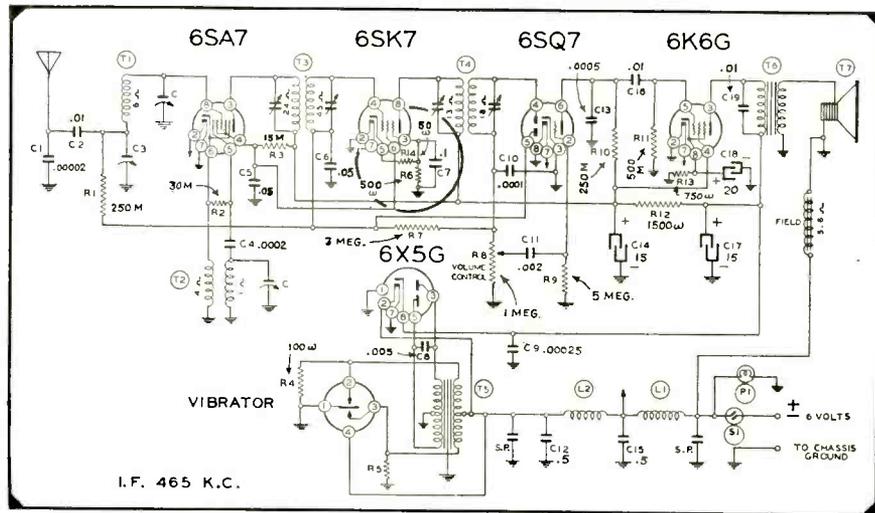
#### Emerson EL360, EP367 Series

Emerson a-c-d-c models EL360 and EP367 have a feedback arrangement in conjunction with the loop antenna. See Fig. 2. The "B plus" runs through a turn around the loop to the screen of the converter and low side of the first i-f transformer.

#### Coronado C6D18

Many manufacturers have had to make changes in models while the production line was running due to shortages and new regulations. Several small changes are sometimes necessary, for example, when making the changeover from metal to glass tubes. Fig. 3 shows model C6D18 of Coronado, a 6 tube, a-c/d-c model of many features. Where glass tubes are used, an additional decoupling filter is inserted in the i-f plate supply to counteract the additional capacity coupling because the glass tubes are not being shielded. On other sets, the p-m speaker is replaced by an electro in which case the resistor in the first section filter is replaced by the speaker field and the second section filter is eliminated.

Note the outside antenna coupling to the loop—through a 0.000125-mfd. condenser to a low-impedance tap on the loop. The small condenser prevents excessive loading and the consequent



detuning that may occur when a large aerial is connected. A shunt wavetrap is also employed. In these days of maximum conservation, it is becoming very popular to eliminate the cathode by-pass condensers in both r-f and a-f amplifiers. Many have been pointed out. In this Coronado, the r-f stage has a lonely 100-ohm cathode resistor; the 35L6 output tube—a 150-ohm resistor. A reduction in amplification always results but stability or quality is enhanced. Note the second diode of the 12SQ7 detector which is tied directly to the avc bus, giving an initial negative bias due to normal cathode emission.

#### Belmont 579

Belmont Model 579, 5-tube auto receiver of conventional design has an interesting kink for increasing stability which servicemen should note. Fig. 4 shows the i-f stage where a 50-ohm degenerative cathode resistor is connected between cathode and suppressor and the latter is connected to ground through a 500-ohm bias resistor. The bias resistor is by-passed by a 0.1 mfd. This set uses the popular capacity coupled an-

tenna fed to the low end of the antenna coil across the antenna trimmer condenser. For equalizing, a shunt condenser of 20 mmfd is connected between aerial and ground.

#### Truetone D4240

Speaking of auto aerials, Truetone 6 tube, Model D4240 has a similar coupling system and, when the receiver is to be used with a high-capacity antenna (70 to 500 mmfd including the shielded cable) a 24-inch shielded adapter extension cable is necessary. The adapter has fittings to take the aerial at one end and to plug into the set at the other. Under-car and over-the-roof aerials on metal tops are not recommended as a proper match cannot be secured and the signal noise ratio will be inadequate for good reception.

#### Airline 14BR574A

Wards Airline Model 14BR574A, 5-tube battery set has a novel push-button design which requires no tool to set. The push button is pulled all the way out, the desired station is tuned in

(Continued on page 27)

# Farrell Says:

By C. H. FARRELL

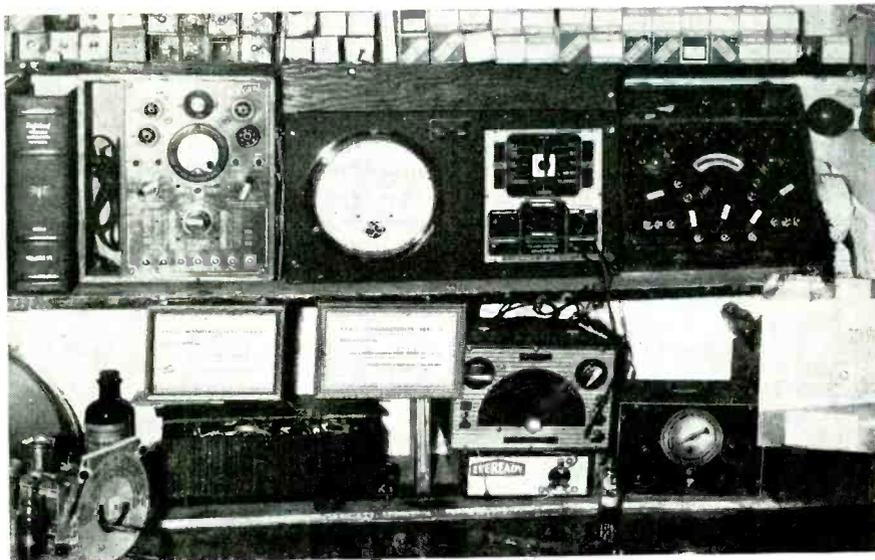
WHEN A MAN with an avocation changes it into a vocation, as most of those engaged in the servicing of radio receivers have done, one of the missing ingredients in the transition is business acumen. Perhaps "acumen" is not the word. But it will be conceded that too few servicers in the past have operated their businesses along lines which would be approved by the School of Business Administration.

It has been said of the radio servicing fraternity that as far as the keeping of business records is concerned, they are most lax. To one who knows the modus operandi of the servicer's mind, this occasions little or no surprise. In fact, I think that there is something to be said in favor of the artist who is more interested in doing his work than in collecting the proper commercial fees for it. But, however much the lack of proper business methods may be lauded, it still does not furnish ham and eggs for the family breakfast table. As I have pointed out in these dissertations several times, the present emergency furnishes an opportunity for Service Men to climb out of the underpaid and overworked class and begin to get the fees which are his due. And I hope that some of you have heeded these suggestions and have, previous to March 1942 established fair standards of service charges. For the highest rates you charged for jobs in March are the highest rates you will be permitted to charge for the same types of jobs during the time the OPA price ceilings are in effect.

## One, Two Three

Geographical considerations, competition, local living costs have served to govern rates charged by Service Men. The rent of a store in a small town, the cost of living, the cost of entertainment will be lower, in most instances, than the same factors in a large city in the same general geographic locality. It follows that the cost of radio repair jobs will follow the general trend. Where the Service Man in the small town might be able to get by and possibly show a profit at year's end with a standard labor rate of \$1.00 per hour, it is likely that the service organization

in the larger community would not be able to eke out a bare existence by charging \$2.00 per hour. There are



With the advent of price fixing the service shop must put his house in order and above all must go in for more adequate bookkeeping.

as many methods of figuring the cost of service jobs as there are stars in the heavenly firmament. But most service shops attempt to figure their charges on a "time consumed" basis. This is possibly the most practical way of assessing the true value of a repair job and it is a method which I advocate. Obviously, however, it would not do for everybody to charge the same basic hourly rate for labor. I know of service shops which must charge \$3.00 per hour for labor if they are to meet their overall costs and show a profit. Conversely, I have encountered servicers in smaller communities who are happy to get \$1.00 per hour for their labor and skill, and who do very well indeed at this rate.

But whatever rate you have charged during March, that is the basis you must use in figuring your ceiling price. Many Service Men have written me in perplexity. They cannot fathom the rules and regulations laid down by Mr. Henderson's "General Maximum Price Regulation." It is really simple if one

approaches it from the proper angle and does not attempt to interpret it the hard way.

For instance, one servicer writes that the highest price he charged for repairing a Stromberg Carlson in March was \$2.50. He wants to know whether or not he is restricted to a charge of \$2.50 for repairing Stromberg Carlsons! The answer was, of course, that he did not make a flat charge on a Stromberg. He charged at the rate of \$2.00 per hour for his labor with parts extra. He found some difficulty in explaining to a lady who

brought in a Stromberg Carlson the other day that the ceiling prices did not apply to trade marks. They applied to the cost of his services. Many misunderstandings will arise, you will probably have a hard time explaining why one Emerson can be repaired for \$3.50 while another might require a charge of \$7.00. The best thing to do is acquaint yourself with the provisions of the "General Maximum Price Regulation." You may obtain a booklet called Bulletin No. 2—"What every retailer should know about the Regulation" from your State or local OPA office. It is free. You can hardly go wrong if you quote flat rates. Just recently I saw a helpful booklet which is copyrighted by the Radio Equipment Co. of Minneapolis, Minn. It is called "Flat Rates for Radio Service" and is put out in three editions. No. 1 is based on \$1.00 per hour labor charges; No. 2 is based on \$2.00 per hour service charges and No. 3 is based on \$3.00 per hour service charges. This is the best compilation I have seen.

## Flat Rate Charges

Here are some of the flat rates based on \$2.00 an hour labor charges. How



## Only the BIG SHOW matters now!

**T**HIS season, for the first time in many years, there'll be no Radio Show. With the entire industry absorbed in the nation's war program, even this traditional event may seem like small potatoes now.

Nevertheless, we of Sylvania shall miss the get-together at Chicago, with its renewal of old friendships, its cementing of new ones.

And we'd like to offer the trade this assurance: Like you, we are convinced that radio is a vital weapon of home defense, and we'll do what we can to keep radios working on the civilian front.

Today the tubes we are building are stouter, better, longer-lasting than any we've ever turned out. Moreover, our laboratories, working for war, are making discoveries that hold promise—once the peace is won—of a new and even brighter era in radio.

# SYLVANIA

RADIO TUBE DIVISION

HYGRADE SYLVANIA CORPORATION

do they compare with your charges?

Compensating By-pass Unit Installation for Philcos, material included .....	\$3.00
Complete B Voltage correction, material included .....	4.25
Complete By-pass replacement for Maj., 90, 130, GE Century Box Models, Clarion 60, 80, 90, Philco 20, 70, 77, 90, material included .....	6.50
Conversion of 25B5 to 43.....	\$3.50
Tube extra at list price.....	1.05
Dial-Drive Repair (Fric. Type) material extra .....	\$4.55
	1.75

There can be little doubt that the Service Man who has gone to the trouble of making up a flat rate chart on every possible job will find the public easier to deal with, since he has, in effect, filed a record of his ceiling prices on these jobs. But, lacking that, it is suggested that ceiling prices be posted on labor charges and, in the absence of other records, this will probably be accepted by OPA shoppers and inspectors.

### Keen Competition Coming

The Army and Navy and Air Force and Marines are training many thousands of radio technicians and "hams." For the greater part, these men will not go into the business of servicing radios. Many new "hams" will be CQing all over the aerial lot, however. The angle which should concern the servicer in the post war days, however, is the electronic angle. Have you been keeping up with the newest electronic theories? Have you investigated industrial electronic installations in factories located all around you? There is an unprecedented increase in electronic control devices in American factories. These devices have had a tremendous influence in increasing production efficiency. It is a safe wager that American industry will be more conscious of electronic production controls than in the pre-war days. Many of the war time developments of the electronic tube will find their way into peace time pursuits. And on a scale which is well nigh incomprehensible today.

Service Men have had this theme dinned into their ears for more than a year now, and if they have availed themselves of the opportunities presented to them, they will be in on the "ground floor" when the products of the laboratories of Mars are released for civilian uses. Those who have not begun to delve into the industrial aspects of the electron are urged to do so now. Tomorrow may be too late, for, as I pointed out previously, many a good industrial electronic maintenance man is coming out of the armed services when the bird of Victory finally

perches on the banners of the United Nations.

### Shortage of Parts?

Wherever I may roam, one question is always shot at me: "Is the OPM going to clamp down on the manufacture of replacement parts and tubes?" The only answer is: "I don't know what the OPM is going to do!" But a fellow can dream, can't he? And here is the way I dope it out:

At this writing the OPM is dallying with an order permitting the production of 40 million tubes in 1942. This compares with 33 million replacement tubes produced in 1941. There are, according to the best estimates I've seen, about 60 million sets in the United States now. The best information I have been able to obtain shows that two-thirds of a replacement tube per set in operation per year has been the average demand in years past. There is little reason to believe that the 1942 demand will exceed this figure greatly, although some authorities are inclined to the belief that with increased listening, due to news bulletins, etc., the demand in 1942-43 will be close to one tube per set per year. If OPM does give the green light to tube manufacturers, it naturally follows in logical sequence that they will also give the go

(Continued on page 15)

# BIG BOY



MODEL  
860

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

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**RANGER**

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

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# "WE QUOTE!"

## Important Leaders on THE STATE OF THE INDUSTRY

"As a radio Service Man, you have a very definite responsibility during these trying times. Your job is to 'keep 'em listening'. You must carry on somehow in spite of the difficulty of securing replacement parts.

"I know of no one better qualified and willing to give you assistance than the radio parts jobber. Go to him with your troubles! He knows your problems. He has some of his own—who hasn't these days!

"If you buy guaranteed standard replacement parts recommended by your jobber and guaranteed by the manufacturer, your troubles will be fewer.

"The close cooperation of the Service Man, the jobber and the manufacturer is a big factor in maintaining the high morale of the American public by guaranteeing them entertainment and up-to-the-minute news during this great emergency."

*R. T. Schottenberg, Sales Manager*  
THE ASTATIC CORP.

"The M-9-c order limiting the use of copper to strictly military purposes means a temporary (?) shutdown on the manufacture of replacement parts. If this order is either rescinded, or modified, within a reasonable period, it will not mean a shutdown on the part of the radio jobber. The present manufacturers' and jobbers' stock should hold the fort for a little while.

"However, exact duplicates are automatically washed up. It will no longer be possible for the manufacturer to produce a single exact duplicate for special orders. The radio jobber in the past has done much to relieve the headaches caused by exact duplicate demands. However, with many of the experienced Service Men going into the military and with new men coming into the field, the demand for exact duplicates has in recent months been on the increase. Again it is up to the jobber to educate the new Service Men on the principles of using general purpose parts in lieu of the now-impossible-to-get exact duplicates. It is now extremely important for the jobber to take pains to instruct these new men. Otherwise, the embryo Service Man may take the easy way out by advising the customer, 'Sorry, I can't get the parts for the repair of your set'. Now, as never before, every receiver in the country must be kept in good operating condition."

*G. V. Rockey, Vice President*  
MEISSNER MANUFACTURING CO.

"Practically every individual and business associated with the radio industry either already has or very shortly will feel directly the effects of the war. There is no logical reason why all of us should not feel the effect of it and there is no sound argument why we should not adapt ourselves to the new situation in order that our efforts will be most beneficial to our victory as well as to our individual selves.

"The status quo has been entirely upset with regard to the production of test



**Dependable!**

That word "Dependable" is very closely associated with Meissner products; in fact, they are inseparable companions. Today, as never before, we are guarding Meissner quality, knowing as we do that throughout the world Meissner products are being called upon to give extra performance and bear a heavier burden. We know they have the stamina to carry through.

Perhaps it is largely because of their dependability that Meissner products have become so widely accepted.

**Meissner**

MOUNT CARMEL, ILLINOIS

"PRECISION-BUILT PRODUCTS"

instruments for servicing civilian radios. This means that the best equipment manufacturer is unable to obtain materials or supplies for such equipment, although he is authorized to obtain all that he needs to produce the tremendous amount of test equipment that is needed for the war. Of course, even with the official authorization and with the highest of priorities, conditions are so critical that it frequently takes as long as six months to get deliveries with A-1-a preference ratings.

"You can readily understand that it is relatively hopeless to expect that there will be any new instruments available for servicing civilian radios. What then is the Service Man to do?

"The instrument manufacturers had to ask the similar question as applying to themselves. The only satisfactory and pa-

triotic answer is to fit into the war picture. The need for radio Service Men and radio mechanics in civilian status by the Army and Navy is so great that every individual can be placed to advantage. Capable men today are being paid in many instances more than they earned in their every day status.

"Manufacturers have not forgotten their obligation to the Service Man and have kept their lines intact in so far as it is possible. Moreover, we are constantly developing better methods of production as well as improved performance and circuit design. One excellent result of these conditions is that all manufacturers have had to comply to a strict high standard of performance and quality that was not necessary in ordinary commercial production. These new standards will become



Standard types in 10- and 20-watt fixed, with pigtail terminals; and in adjustable up to 200-watt, with lug terminals and sturdy, removable mounting brackets.

★ Those green-colored cement-coated power resistors now found in quality receivers, amplifiers, power packs, oscillographs and other fine assemblies, are Greenohms. They are the toughest thing in power resistors. Comparative tests prove this statement over and over again. So, use them for your initial equipment. Use them for your best grade servicing. Remember, they cost no more.

★ **See Our Jobber . . .**

He'll gladly show you these quality power resistors. Ask for latest listings. And be sure to order Greenohms if you want the smug satisfaction of using the toughest power resistors to be had.



**CLAROSTAT MFG. CO., Inc.**  
285-7 N. 6th St., Brooklyn, N. Y.



commonplace so that instruments of the future will be of a much finer quality than ever before.

"Laboratory development is expanding and progressing at a very rapid pace. The Service Man of the future can rightfully expect testing apparatus that will be far better in performance and quality than anything he has anticipated. We at RCP are striving to the utmost to hold every inch that we have gained."

*Milton Reiner, President*  
RADIO CITY PRODUCTS CO., INC.

"Service Men are lucky fellows these days. They've got a bigger job to do than ever before. It's a job that holds bigger opportunities for profit. Above all, it is one that holds tremendous opportunity for emergency service to the nation in seeing to it that at least one radio is kept working in every American radio-equipped home.

"But it isn't going to be easy. The man who can fill it must be far more than a tinkerer. He must be a real mechanic. If war priorities are such that certain types of parts are unobtainable, he must learn how to make parts that are obtainable fill the bill. If new test equipment is missing, he must know how to keep his old equipment in good repair. As other Service Men are called into military service, and as still others take essential defense jobs, he must learn to work faster and more accurately to fill the gap.

"Personally, I have no qualms in the matter. I've been around the industry for a long time, and I know a lot of Service Men personally. I believe they are fully capable of meeting any emergency they may be called upon to meet. They'll keep the nation's radios working—if not with exact duplicate parts, then with the best the market affords. If need be, they'll work their ingenuity overtime in finding ways around any difficulties that arise.

"Meanwhile, every Service Man worth his salt will realize that it is in times like these that the old-reliable, well-known trade names mean more to him than ever before. Even though war demands necessitate delays, changes in product design, possible elimination of certain types of parts, or substitution of universal units for exact duplicates, he will know that the trade names that have proved their dependability in the past will not fail him today—for the simple reason that these same trade names are looking forward to his continued patronage in the Peace-time days of the tomorrow."

*Harry Kalker*  
SPRAGUE PRODUCTS CO.

"Never before in the history of radio has it been so important to have receivers in working order as it is today. War news and information about its prosecution uses more and more radio broadcasting hours. Radio will continue to be the one important source of information for all present day happenings in virtually every American home for the war duration and thereafter. Essentially radio receivers must be kept in working order. Service Men today find their time at a premium and in addition are experiencing difficulty in obtaining needed repair parts, but American ingenuity will save the day on the home front as well as on the battlefield. Testers now in use must be carefully handled and preserved during the emergency because of

delays experienced in obtaining new equipment."

*R. L. Triplett, President*  
TRIPLETT ELECTRICAL INSTRUMENT CO.

"Alert Service Men will find a vast new market awaiting them when the war is over. This new market is aviation communications.

"Tremendous strides are being made by aviation during this war. Mass production is turning out planes by the thousands. New developments are giving America faster planes, more powerful planes and safer planes.

"Thousands of Army and Navy pilots will definitely continue to fly when the war is over. There will be sport planes, family planes, and business planes. These planes are all going to have two-way communication equipment. Most of it will probably be installed by the manufacturer of the plane, but a great deal will be installed by communications shops.

"Repairs will all be made by special radio communications service shops. These shops will be located at or near airports and there will be many more airports, more convenient and better equipped.

"Keep your eyes open for a location for a service shop near an airport. Study the types of communication equipment that will be used in planes. Above all, keep in touch with these new markets and take advantage of this new profitable field."

*J. A. Berman, Sales Manager*  
SHURE BROTHERS

**BUY WAR SAVINGS BONDS & STAMPS**

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is in the air  
WITH  
**POLYMET**

We are now supplying the Army and Navy contractors with POLYMET Condensers. Uncle Sam comes first with us. However, expansion of our facilities enables us to fill regular requirements with very little delay.

**POLYMET CONDENSER CO.**  
699 E. 135th St.  
NEW YORK, N. Y.

## TRADE JOTTINGS

**C**ONGRATULATIONS to Sam Cole, Charlie Golenpaul and other Aerovox officials in commemoration of the company's 20th anniversary. . . . new and larger quarters for University Labs, at 225 Varick St., New York City. . . . Sherman Pate, sales head of Permo Products, is in the Army. . . . John Meck Industries now located in a new plant in Plymouth, Indiana. . . . Both Stromberg-Carlson and Allied Radio report 100% employee enrollment in War Bond Buying Plan. . . . have you bought your quota this week . . . better had . . . General Electric training Signal Corps men in latest radio developments. . . . General Cement Mfg. Co. of Rockford, Ill., announces new "Victory" catalog . . . write for your copy. . . . Don F. Jay appointed export manager by Lafayette Radio of New York. . . . Spokane Radio celebrating 15th anniversary . . . congratulations. . . . R. C. James, Sr., retiring from Seattle Radio Supply after 22 years in radio . . . he is succeeded by Ed. O. Mickelson . . . newsy house organ is "The Clipper" offered by Mueller Electric of Cleveland. . . . congratulations to Stancor for their efforts in behalf of the radio parts field . . . read about it elsewhere in this issue. . . . Mallory's monthly messages to Service Men are "must" reading . . . strongly support those manufacturers who are continuing to support you despite their "all out" war production efforts . . . are you saving your scrap metal for contribution to the war effort . . . if you have any suggestions as to how SERVICE can better serve you during these hectic times, shoot 'em in to us . . . congratulations to Bob Herr—just elected vice-president in charge of service at Philco.

### FARRELL SAYS:

(Continued from page 12)

ahead signal to replacement parts manufacturers, for any reasonable person can see the fallacy of furnishing tubes and not furnishing parts.

My guess is that while many replacement parts (exact duplicates for old sets, for instance) will be difficult to obtain, there will be no actual famine of replacement parts.

I bank on a radio conscious and propagandist War Time Administration seeing to it that the American public is fully informed as to developments and is ever in a position to absorb whatever publicity is handed out by various Governmental agencies. And I cannot visualize Mr. Roosevelt ever being content with an audience of less than 100% of the American listeners when he airs one of his Fireside Chats.

# I'M MEETING MY RESPONSIBILITIES

## ARE YOU?



There was a time when a serviceman would have been justified in turning down some of the jobs that are now being brought to him in increasing volume. Today, however, it is your duty and responsibility as an American Serviceman to "keep 'em playing" regardless of the age or condition of the set—regardless of how overworked you may be.

True, there are only a certain number of hours a day that a man can work—so you must work more efficiently. One sure, easy way to do that is to use your Rider Manuals before you get started on each job. Stop wasting time trying to guess-out the servicing facts that are readily available in Rider Manuals. And be sure you have all thirteen volumes, for many of the sets you will get will be six, eight, or even ten years old.

### RIDER MANUALS

Volumes XIII to VII . . . \$11.00 each  
 Volumes VI to III . . . 8.25 each  
 Abridged Volumes I to V . . . \$12.50  
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*This photo taken in action in Bataan by U. S. Army Signal Corps*

## The War isn't fought in Fox Holes alone

**I**T'S fought in the mind. It's fought with a will to win. It's fought with a belief in a cause worth dying for.

That will, that belief, is known as *morale*.

Our enemies have had years of indoctrination. They have been conditioned to believe themselves part of a "new order" . . . to which the contribution of their lives is small but all-important. They believe themselves cogs in a vast machine.

Our soldiers do not fight that way—because they do not live that way. They believe in the sanctity of the individual.

They must be treated as persons.

To maintain their morale in the American way, the USO has devoted all its time and energy since practically the beginning of conscription.

It has done this by staffing and maintaining club houses near all training camps and in outlying possessions of the United States.

Today its work is far greater than ever, its need for funds to carry on more than doubled.

*The USO needs your help more than ever before!*

High government and military offi-

cial— including General MacArthur— have praised the work done by the USO and recognized its importance in the war effort.

But it needs recognition from *you*— recognition in the way of dollars and cents. For the six national agencies which comprise the USO are publicly supported.

Now above all times, to make your dollars count, give to the USO!

Send your contribution to your local USO Committee or to National Headquarters, USO, Empire State Building, New York, N. Y.

# Give to the USO

# ELECTRONICS IN INDUSTRY

By JAY ALLEN

WITH THE Radio Service Man up to his ears maintaining the country's receivers it might seem out of place to recommend that he look to allied fields for added revenue. It is advisable, however, that he investigate industrial electronics for several good reasons. Chief among these reasons is the fact that no one else capable of installing and maintaining such equipment is available. Since electronic equipment is used to speed up and improve production it is very essential to our war effort and any help given toward its maintenance thus helps the war effort.

Another reason why the Radio Service Man should consider electronic equipment looks forward to conditions after the present conflict. There can be no doubt but that a demand for electronic equipment will exist after this war is finally won. A corresponding demand will exist for experts on the subject. The logical time to learn all about the equipment is right now when you can get in on the so-called "ground floor."

Many industrial processes are made to order for electronic devices. General

applications. Several typical instruments are described on these pages.

## Pin Hole Detector

Most uses for sheet metal do not permit holes, even of the minutest size. Sheet metal manufacturers who can offer their material without holes are therefore in a favored position commercially. Then too, a device which

has had units in operation since July 1938—a hole detector capable of detecting holes  $1/64''$  and even smaller in diameter in tin-mill strip at strip speeds of between 100 and 1,000 ft per minute. (See Fig. 1.)

The hole detector consists of a light source, a phototube housing and a control unit. The light source shown in Fig. 2 is mounted above the strip and

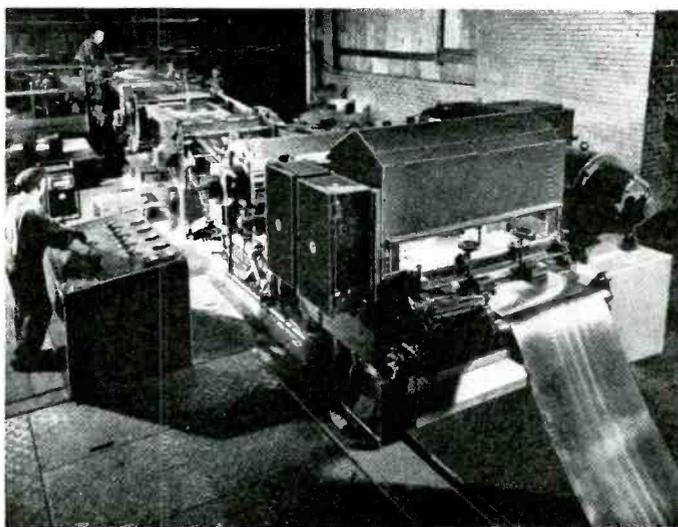
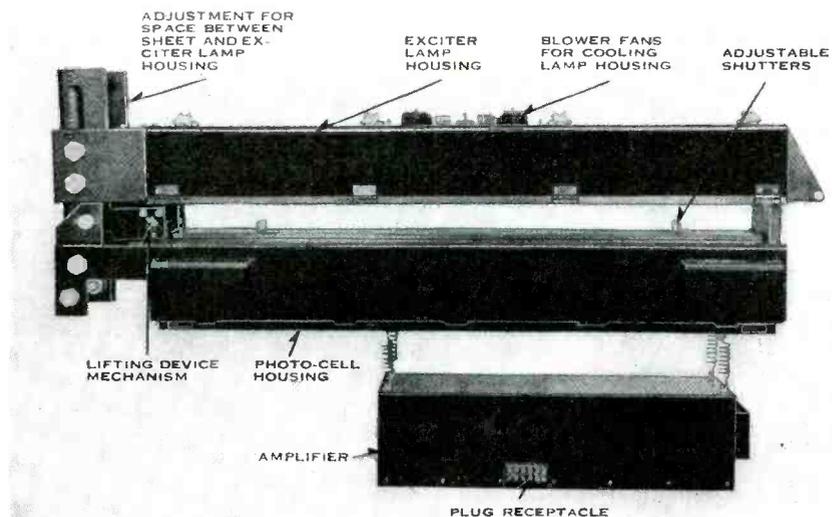


Fig. 1. (Above) The pinhole detector is a comparatively simple electronic device which employs photocells and an appropriate amplifying device to detect and mark or classify minute holes in sheet metal. In operation the sheet metal is drawn between the exciter lamps and the photocells. With the sheets travelling at a rate of 1,000 ft. per minute, every hole can be detected and marked. A typical installation of the instrument is shown in Fig. 2 at the left.

provides intense illumination over the full width of the strip by means of 10-volt exciter lamps which are wired in series parallel. The light source is provided with series relays which show whether all lamps are burning or not without having to open the cover for inspection.

The lamps are operated at reduced voltage furnished by a separately mounted transformer so that a life of several thousand hours should be obtained. This long life insures less frequent interference with operation.

The light source is cooled by twin blowers (115 volts, 60 cycle) which may be connected so that they will run continuously or cut off when the lamps are cut off by the sheet interlock.

A heavy, dust-tight, welded sheet housing contains the photo-tubes. The anodes of these photo-tubes are connected in parallel to a 4 ft. shielded cable.

The phototubes are mounted on a

Electric, RCA, Westinghouse, Worner, Allied Control and others have investigated the possibilities and are manufacturing devices to suit specific ap-

promptly shows up defects keeps everyone in the plant on his toes with a resultant better product all around.

Westinghouse has developed—and

removable frame which is accessible for inspection and test by the removal of a side plate. The phototube cathodes are connected in parallel and are grounded to the phototube box. The top cover of the box is equipped with a lens for each phototube to focus the light to it. The phototube housing may be mounted directly on the mill structure underneath the strip, keeping approximately 1/2 in. from the sheet to the top of the shutter guide on the housing.

The amplifier is contained in a separate cabinet which is spring suspended from the bottom of the phototube housing. This amplifier serves to magnify the small current impulse passing through the phototube caused by light shining through a hole in the strip. The first stage of the amplifier is non-microphonic to prevent reduction of sensitivity because of instability caused by mechanical motion. A sensitivity adjustment is provided. The amplifier assembly is especially designed for industrial (24-hour per day) service.

The impulse output of the amplifier goes to a thyatron panel and is impressed upon a thyatron tube which functions as an instantaneous locking relay to detect the impulses lasting only approximately 0.005 of a second at 1,000 ft. per minute strip speed. This lock-in tube operates an SG relay to give indication of a hole and is reset by a thyatron time delay relay on the same panel. The latter relay is adjustable from 0.05 to 1.5 seconds.

There are three methods of removing holes after detection: visual indication or stopping of mill, marking of strip for later removal, and automatic operation of a classifier or sorting machine located immediately following the shear.

Visual indication or stopping the mill is not as commonly used as marking and classifying. However, when the

strip is sold in coils, it may be necessary to remove a hole where found, as for instance, in copper coils. For these cases the SG relay can be used to operate a signal light or bell, or can stop the mill. The detector can then be reset automatically by the thyatron time delay or manually as desired.

Many mills now have a classifier to sort out "light" and "heavy" sheets as they come from the shear. It may be satisfactory to use a two-pocket classifier by routing all off gauge sheets, whether "light" or "heavy" into one pocket, and the sheets having holes into the other pocket. Sheets with holes may also be routed into one of the pockets with "light" or "heavy" sheets. If it is desired to prevent resorting of rejected sheets a three-pocket classifier is necessary.

Use of the hole detector to operate a classifier requires some form of a memory device, which is operated by the hole detector as soon as the hole appears at the phototube housing and which memory device remains in the operated condition until time has been allowed for the hole to reach the classifier which may be 30 to 50 feet further on. The hole detector is immediately reset and is ready for another detection, even though the previous hole has not yet been sent into the classifier and rejected.

Depending on the type of classifier, the lock-in thyatron can be reset by a contact on the classifier or the reset thyatron time delay can still be used. The classifier memory device may be operated from the marking device when used.

When a classifier is not used it is usually desirable to mark the strip so

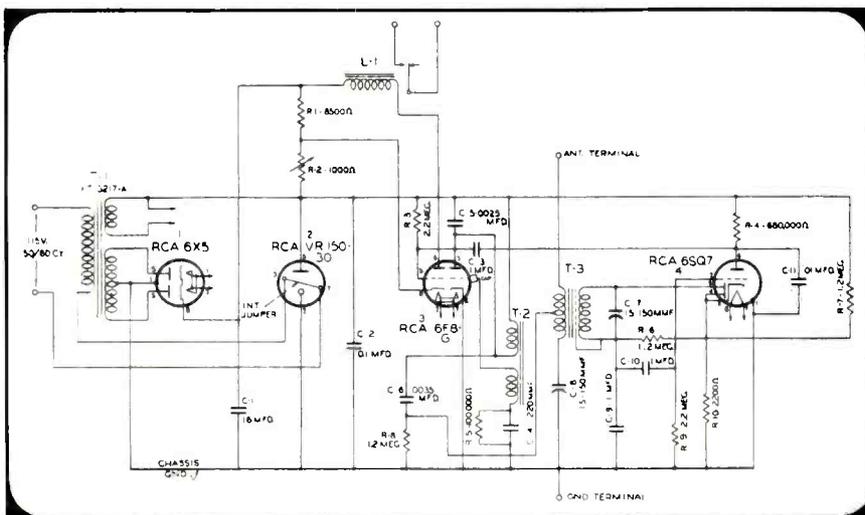
as to leave a permanent visible indication of hole position. The defective sheet is then removed at a suitable inspection station after shearing or at final inspection after plating. The marking equipment for this purpose is readily connected to the hole detector. It is mounted in a separate dust-tight cabinet with separate pilot generator and a solenoid to operate the marking system. A pilot generator is geared to the mill to provide an indication of mill speed which the marking device control translates into a time control of the stylus solenoid so as to give an approximately constant length of mark regardless of mill speed over a ratio of 10 to 1 in speed. The length of mark is adjustable from about 10 to 20 inches by means of a potentiometer on the panel. The mark is thus constant at 10 to 20 inches instead of varying as much as from 10 to 100 inches during threading or slow operation as would occur without speed compensation. When the marking device is used it resets the lock-in thyatron in the hole detector at the proper time and the thyatron time delay relay reset is not used.

### Electronic Control

The RCA Stock No. 41903 electronic control (See Fig. 3) is a capacity operated relay of the momentary contact type, designed to control the operation of other electrical or mechanical devices through the change of capacity due to the approach of a person (or other conducting object of comparable size) to within several feet of an antenna connected to the control. A simple example of such an application is the use of the control to turn on a group of lights in a show case when a person approaches the case. (See Fig. 4.) The control has a great many other useful applications such as: operating display signs; controlling electric motors, opening doors, and sounding alarms.

Unlike other capacity operated devices, the electronic control is designed to be responsive to capacity increases exceeding a predetermined rate of change. In other words, it will operate only on changes of capacity which occur within a predetermined short interval of time. The device will not operate because of slow changes in capacity, such as those caused by temperature and humidity. It is, however, continually balancing itself against changes in antenna capacity whether or not these changes are rapid or large enough to operate the relay. For this reason, even though the relay of the device has been operated due to a rapid and sufficient change in antenna capacity, it will, in a short time (about 10

Fig. 3. RCA's No. 41903 electronic relay can be used wherever an automatic switch is required to actuate a relay upon the approach of a person or object.



or 20 seconds, depending on the adjustment). balance itself against this rapid capacity change, and restore its relay. It may then be reoperated in the same manner as before. Because of this automatic restoring action, the device is termed a capacity-operated relay-momentary contact type.

From the above description it will be seen that the device can be used to control auxiliary equipment, but will not by itself hold the auxiliary equipment in operation for a long period of time. For example, the device could serve as an automatic door opener if the door opener circuit is arranged to recognize a momentary contact from the electronic control, and thereby lock its own cycle of operation. On completion of the cycle, the door opener operating circuit would automatically release and then be ready for the reception of another starting impulse from the electronic control.

Non-selfcycling devices, such as burglar alarms, etc., could be of the self-locking type and arranged to operate continuously, once they have been impelled from the momentary contact of the control. A device of this latter type when operated would, of course, remain in operation until relieved manually (or otherwise) regardless of the condition of the electronic control.

The electronic control is essentially a capacity bridge with the antenna to ground capacity as the unknown capacity. A person approaching the antenna increases its capacity causing the bridge to become unbalanced. The increase in bridge output is rectified and amplified to operate the relay.

The capacity bridge consists of the balanced transformer T-3 (see Fig. 2), the antenna, and the balancing condenser C-8. The primary of transformer T-3 is balanced, with the oscillator connected to the mid-tap. If C-8 is adjusted equal to the antenna capacity, the current in the two halves of the primary will be equal in magnitude, but opposite in direction so that no voltage is induced in the secondary. An increase in antenna capacity will unbalance the current and a voltage will appear across the secondary. This voltage is rectified by the 6SQ7, and a voltage is impressed across the resistor R6 (See Fig. 3). Thus an increase in antenna capacity results in an increase in the voltage across R6.

A two-stage amplifier consisting of the 6SQ7 and part of the 6F8G amplifies the voltage across R6 sufficiently to operate the relay. The oscillator is of the tuned plate type, utilizing for the oscillator tube one-half of the 6F8G, and for the transformer, T2, which has

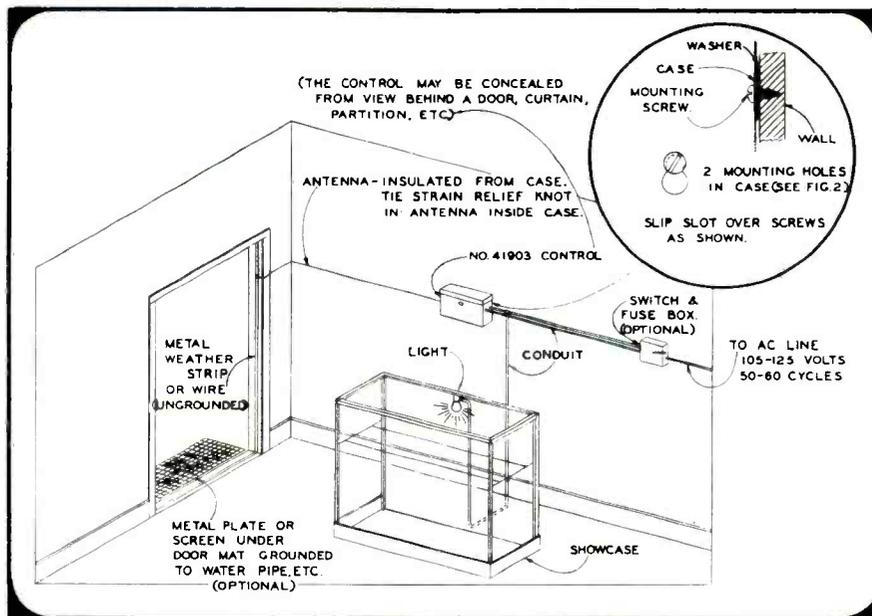


Fig. 4. In this application of the RCA electronic relay the approach of a person will turn on lights in the showcase. It has numerous other applications.

a magnetite core. The power supply includes a VR150-30 voltage regulator tube. The electronic control is designed so that it is unaffected by normal or severe line voltage fluctuations.

The antenna may consist of a bare or insulated wire, a metal plate, or any metallic object having a capacity to ground (when installed) of between 15 and 150 mfd. If the capacity is greater than 150 mfd, it will be impossible to balance the antenna capacity within the range of the balancing condenser C8. In that case, a capacitor of 100 or 150 mfd should be connected between the antenna and the antenna terminal indicated in Fig. 3. A single wire about 20 feet long will come within a range of the balance control. Spacing the antenna away from grounded objects permits a larger, or longer, antenna.

The antenna should be located where its capacity will be most readily affected by the approach of the bodies intended to affect it. Care must be taken to insulate the antenna from the case of the control, or any other grounded object.

Since the device functions on antenna capacity changes, the approach of a person to a concentrated or lumped antenna will have greater effect on the device than the change caused by a person approaching only a small part of a distributed or long single wire type antenna. Furthermore, the closer to actual ground potential the approaching person is, the larger will be the capacity of this person to ground and, therefore, the greater will be his effect in altering the antenna capacity. Where greater capacity is required, a metallic plate,

copper screen, metal screen, etc., may be grounded and placed on the floor, and may be concealed from view if desired by placing under a rug, or mat, etc.

A knot should be tied in the antenna wire just inside the case. This knot will serve as a strain relief to prevent damage to the antenna coil.

Two adjustments are provided: a sensitivity adjustment, and an antenna adjustment. The sensitivity adjustment is the variable resistor R2. The antenna capacity balancing adjustment is the variable condenser C8.

#### Speed Regulator

The Westinghouse Type DT3 speed regulator may be used to control the speed of a motor as shown in Fig. 5. A pilot generator is geared to the motor, and the regulator (through exciter No. 2 and the generator) controls the voltage across the motor armature so that the speed of the pilot generator is maintained at a definite value to give a constant voltage across regulator terminals 6 and 7. Since the pilot generator voltage is proportional to the pilot generator speed, the equipment will regulate the speed of the motor at a value determined by the adjustment of rheostat R1.

The regulator consists of three KU628 tubes connected to supply current to the No. 2 exciter field winding, and two RJ571 tubes which control the KU628 tubes. The pilot generator is connected to terminals 6 and 7, and a 45-volt battery is connected in the grid circuit of the RJ571 tubes to oppose the pilot generator voltage so that the RJ571 grid voltage becomes more negative when the pilot generator voltage is decreased. The RJ571 tube grid-control circuit may be traced from the cathode

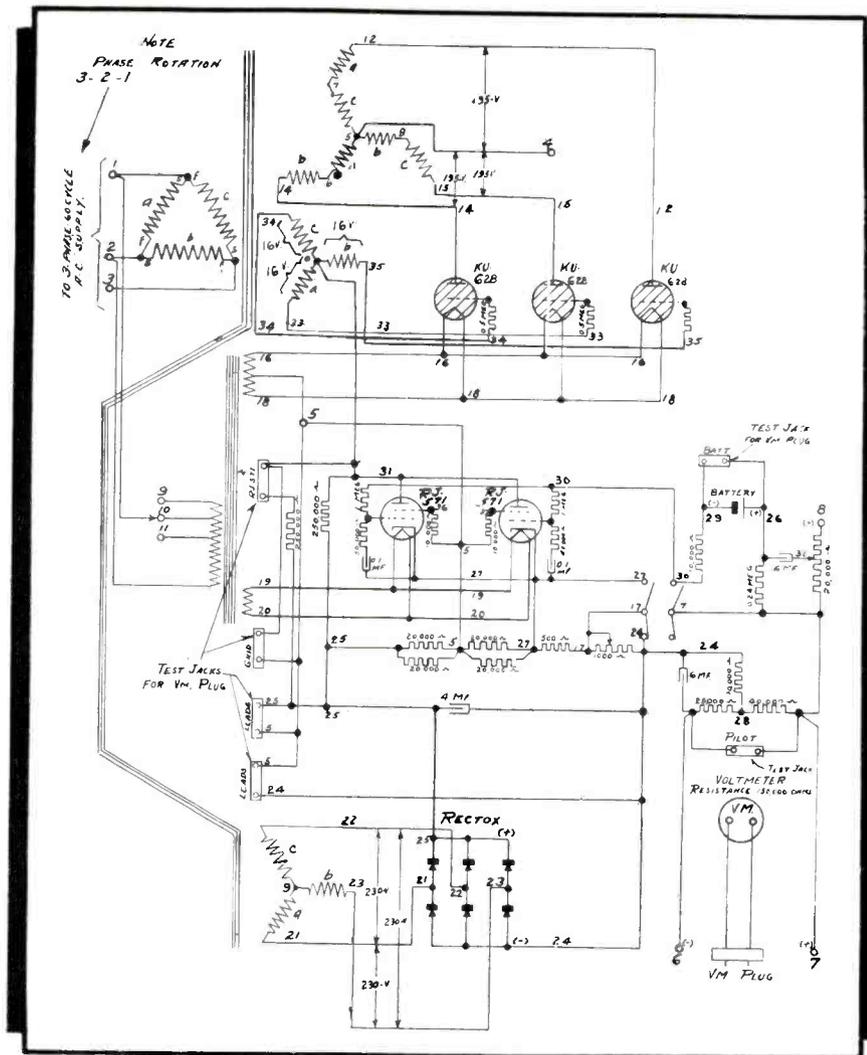


Fig. 5. The Westinghouse DT3 speed regulator is an electronic device which may be used to control the speed of an electric motor.

27 of Fig. 5 to 17-24-28-7-26-29-30 grid. The resistor 24-28 in connection with capacitor 24-6 gives quick response action. When the pilot generator voltage 6-7 is changing a charging current is flowing through resistor 24-28 to capacitor 6-24. This charging current produces a voltage drop across resistor 24-28 with a polarity so that the voltage across 24-7 will be higher than voltage 28-7.

Resistor 26-7 and capacitor 26-32 produce the required anti-hunting action. The exciter armature voltage is connected to terminals 7-8, and when the exciter voltage is varying as a result of regulator action, a voltage drop will appear across resistor 26-7. The polarity of this voltage drop is such that the variation in RJ-571 grid voltage which caused the regulator action will be opposed and stable regulator action is therefore obtained.

Assuming that the motor speed is too low, the voltage across 6-7 will be low and the grid voltage between 30 and 27 will become more negative. This increased negative voltage decreases the current through the RJ571 tubes, and

the voltage across resistor 31-25 is decreased. Since the grids of the KU628 tubes are connected through leads 33-34-35 to the star winding of the transformer and the neutral of the transformer is connected to 5, the KU628 grid voltage becomes more positive when the voltage across resistor 25-31 is decreased. The No. 2 exciter field winding is connected to terminals 4 and 5, and is therefore supplied with rectified current from the three KU628 tubes. The exciter field current is increased when the KU628 grid voltage is made more positive. For this reason, the exciter field current is increased when the voltage across 6-7 is decreased.

The grid control of the KU628 tubes is obtained as a combination of a-c and d-c voltage control. The a-c grid voltage which is 16 volts, obtained from transformer winding 31-33, -34, -35 is displaced 90 degrees relative to the KU628 anode voltage supplied by trans-

former winding 4-12, -14, -15. The d-c grid voltage component is obtained from 5-31. By varying this d-c voltage the point on the a-c anode voltage wave, at which the KU628 tubes will break down may be shifted, and the average current through the KU628 tubes may be varied correspondingly. Due to the application of three KU628 tubes and two RJ571 tubes the regulation will not be affected if one KU628 tube and one RJ571 tube should fail.

## HIGH-SPEED LIMIT BRIDGE

Production testing of capacitors and resistors and inspection for conformance with tolerance specifications are possible with a high-speed limit bridge just announced by Industrial Instruments, Inc., 156 Culver Ave., Jersey City, N. J.

For checking capacitors, the model LB-1 is used in conjunction with the DK-2A Decade Capacitor, having a range of 0.001 to 1.1 mfd. in 0.001 mfd. steps. However, the bridge can be used with decades of other ranges, or with independent capacitance standards. For checking resistors, Model LB-2 is used and supplied with a resistance standard having a range of 1000 ohms to 1.11 megohms.

For production testing, all that is necessary is to set the instrument's high-low dials for the desired plus-minus limits. The closing of the corresponding cathode-ray null indicator or "magic eye" gives immediate warning when limits are exceeded.

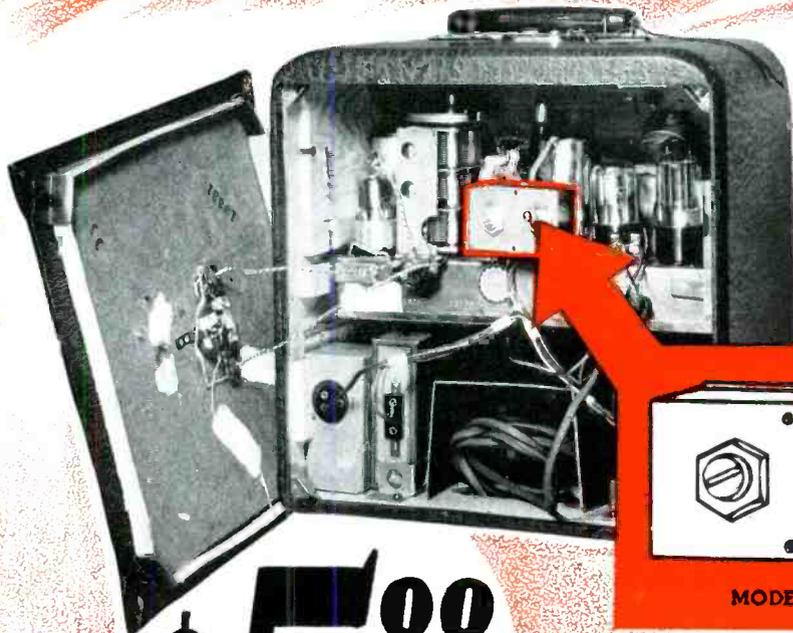


The Industrial Electronics limit bridge is used for production testing of resistors and condensers.

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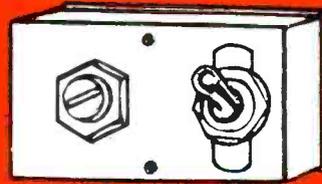
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### *What It Does . . .*

Because a radio signal can be used as a direction guide, your key radio broadcasting station will go off the air promptly at the very first warning of attack. During normal day or evening hours when you are listening to your radio, you would immediately know this; but during the hours that you are asleep or not listening to your radio set, your radio would be off. National Union Air Raid Alarm hooked into your radio set and left on in accordance with the operating instructions will set up a loud and intensive howl whenever the station to which it is tuned goes off the air.

During one of the early air raid alarms in Los Angeles, owners of radio sets equipped with this device had notice

from six to ten minutes before the alarm sirens sounded in the city.

This device used on your radio set will insure hearing in your home where, because of weather or other local conditions, noise of sirens might not be noticeable.

### *Easily Installed by Your Service Dealer . . .*

Your radio service dealer connects four wires. These wires are in each case joined to easily accessible circuit terminal points in your radio set. No change is made in the circuit of your radio set.

Full operating instructions are furnished with each unit and should be placed by customer where they can be readily observed and followed.

After installation it is extremely simple to check. Simply tune in a station, throw the switch to alarm at which time it should remain silent. Then tune the station out so no station is being received and the device should sound a loud siren-like tone. To stop this alarm, throw the air raid alarm switch to the silent position.

### *Low Cost . . .*

The primary object of the National Union Air Raid Alarm has been to give an automatic alarm of utmost dependability at a cost within the reach of all.

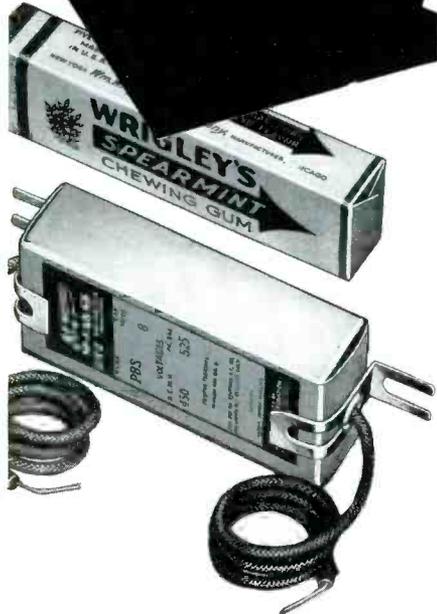
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Type PBS250—250 v. D.C.W.  
Single Section: 2 to 30 mfd.  
Double Section: 4-4 to 16-16 mfd.  
Triple Section: 8-8-8 to 8-8-16 mfd.  
Type PBS100—100 v. D.C.W.  
Single Section: 5 and 10 mfd.  
Type PBS50—50 v. D.C.W.  
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**F-M / A-M COMBINATION**

(See Front Cover)

**T**HE INPUT AND BAND switching circuit shown on the front cover is that of the General Electric Model 40, an 11 tube, f-m/a-m phono-radio combination with one short-wave band (5.8 to 18.0 mc). When switched for a-m reception this set operates in a conventional manner with a single tuned r-f stage using a 6SG7 tube. For f-m operation the receiver functions as a double superheterodyne. In this mode the r-f stage is used as the first converter. The General Electric engineers have found this system capable of delivering considerable extra gain so that a single r-f stage is all that is required for the 4.3 mc intermediate frequency. This system is also well adapted to pass the wide band required for f-m.

A separate 3-gang tuning condenser is used for f-m. The antenna tuning circuit consists of T5 and C3 which tunes the f-m band from 42 to 50 mc. The second converter tuned circuit consists of a portion of T6 and C29 and tunes from 23.15 to 27.15 mc. The oscillator tuning circuit consists of a portion of T7 and C5 and tunes from 18.85 to 22.85 mc. The condenser C7 couples the oscillator to the grid of the first converter. This beats with the incoming signal in the usual manner to produce

an i-f signal in the plate circuit. The first converter tube also passes the oscillator frequency with a gain of unity, thereby applying the same oscillator to the second converter to produce the second i-f of 4.3 mc which appears in the plate circuit of the second converter. The signal is then sent through the i-f stage and two limiter stages, discriminator and audio to a 12-inch speaker.

To clarify the double superhet action, here's an example using a 42 mc signal. When the set is tuned to 42 mc, the oscillator will tune to 18.85 mc causing both the sum and difference frequencies to appear in the converter tube. The plate circuit is tuned to the difference frequency (23.15 mc). Then this signal, in turn, beats with the same oscillator frequency in the second converter to produce the 4.3 mc i-f signal. The i-f amplifier operates on two frequencies (as do many ordinary f-m jobs) without the need for switching except at the first i-f primary.

For pickup, two loops are built-in for broadcast and short wave, but an external f-m antenna must be used for best results, binding posts being provided. Note that the f-m input circuit is entirely separate from the a-m.

**RUNNING SERVICE SHOP FOR DURATION**

(Continued from page 7)

ployees they have been forced to take on "for the duration".

Any service shop proprietor who fails to provide for the continuance of adequate, efficient help in his shop, who neglects to provide for it by his own efforts, is just plain dumb!

**Selling Is Still Necessary**

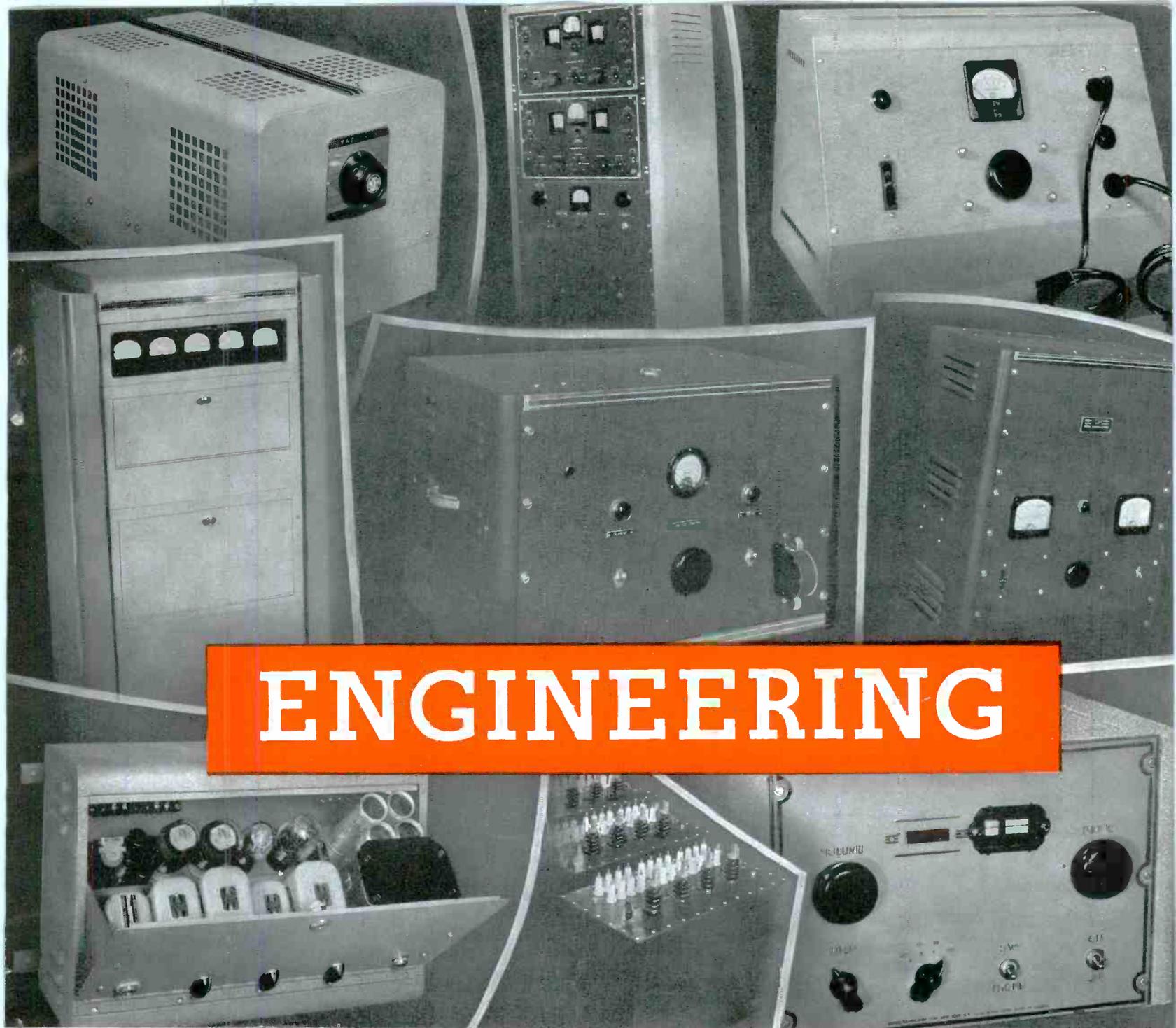
A service shop without competent Service Men cannot hold customers; just as truly, a shop with too small a business volume cannot meet the increased costs of doing business today. You must be prepared to give expert service on every job, you must charge a reasonable price for your services, *but* business will not come to you merely because your doors are open. Despite the general, tremendous increase in repair business, it will not come your way unless you go after it and direct it there.

In boom, as well as bad times, you have to *sell* your services. Word-of-mouth cultivation of customers, mail and phone follow-ups are just as necessary to a shop's continued life now as they always have been. Service Men who find their new set business diminishing, because of lack of sets to

sell, can now profitably devote a part of their sales planning experience and ability to selling service. They can, too, very well lend a hand to the management problems now acute because of difficulties in obtaining labor and materials.

The "boss" should now spend more time with customers to keep them coming back. He should assume the job of smoothing over their misunderstandings and complaints, thereby saving the Service Man's precious time. Work on "prospects" to make them customers; no expenditure of money is needed to move them from one status to another. Once they are customers, make them "repeat" customers, the most profitable in any business; their idiosyncrasies are known, their sets are known, they have confidence in your business. Once you have made them "repeat" customers, keep them "repeating" by your friendliness and good service—and go after new ones.

***Our country is at war. On the home-front, it is your obligation, small enough surely, to keep your industry functioning smoothly "for the duration."***



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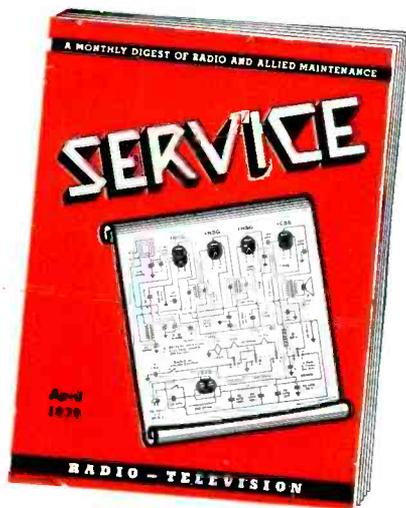
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## REPLACEMENT PARTS AND TUBES

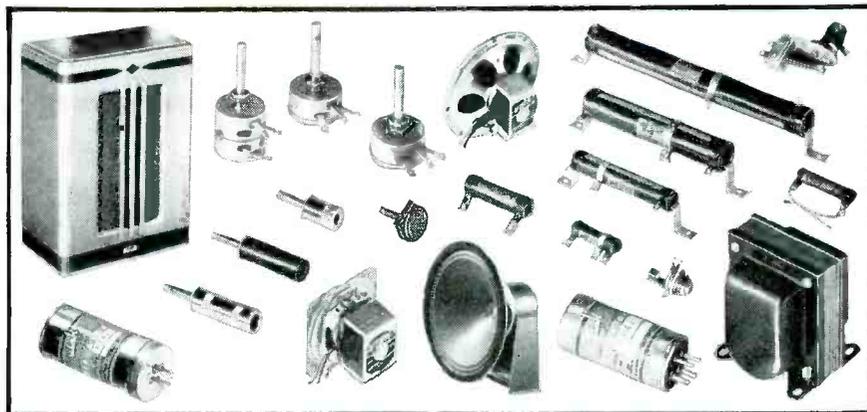
**R**ECEIVING tube manufacturers have received a 30-day stay from the drastic Copper Conservation Order, M-9-c, prohibiting virtually all civilian use of copper, including production of replacement parts after May 31. Extension of the copper order for replacement tube production until June 30 has been granted by the WPB Copper Section.

A 30-day extension from the copper order was secured for tube manufacturers in order to develop a definite 1942 program of replacement tube production. A total of 40 million replacement tubes in 1942, compared with about 33 million replacement tubes in 1941, is now under consideration. An official limitation or L order is in prospect authorizing the 40 million replacement tube program for this year, with quotas equitably divided, by the WPB Radio Section under Chief F. H. McIntosh, among the seven tube manufacturers.

The question of a definite replacement parts program and possibly similar relief for parts manufacturers under the copper order will now be taken up following the 30-day stay secured on replacement tube manufacture. Pending action on replacement parts, parts manufacturers are no longer permitted under the copper order to use their copper inventory for further production of replacements. A number of parts manufacturers have filed their appeals (on form 167 revised) with WPB from the drastic copper order, but WPB Copper Section officials advised that relief action to parts manufacturers was "practically nil." Virtually all radio manufacturers' appeals, except for the 30-day stay given tube manufacturers, are being denied, officials stated. Relief from the copper order for replacement parts production is not expected until after the WPB Radio Section, under Chief McIntosh, conducts further negotiations with the WPB Copper Section officials and until progress is made on a replacement parts production program, to the replacement tube program.

While the copper order, M-9-c, exempts use of copper on military radio and other war contracts, there is not a similar exemption on Lend-Lease contracts. WPB approval for use of copper on such Lend-Lease contracts is required.

The WPB Communications Branch under Chief Leighton H. Peebles, and the Radio Section, under Chief McIntosh, are developing procedure for specific allocations of copper and other materials for replacement parts. Detailed requests for copper for tube replacements already have been filed by the Radio Section with the Copper



## Utah Engineering Skill Is On The Alert For Today and TOMORROW!

On the war front and on the home "listening front" Utah's skill and knowledge stand ready to keep the air waves open. Utah has had years of experience in making speakers, vibrators, transformers, resistors and many other key radio parts. Today, Utah technicians and ace production men are actively engaged in supporting the war effort.

In the Utah laboratories, engineers are constantly at work to help meet the demands of the Victory program and provide the solution to the important problems of civilian communication. Here, Utah's ingenuity and ability to meet changing requirements are meeting the test. New products are being developed; substitutes are being found to replace products in which materials important to Victory are used—substitutes that are equal in performance and reliability to the products they are replacing.

Utah's advanced production facilities are maintaining quality and dependability—so long associated with Utah products—and at the same time producing them with the speed necessary to Victory.

Today, Utah engineering and production stand together to meet emergency needs—with their eyes also on tomorrow. Utah Radio Products Company, 816 Orleans Street, Chicago, Illinois. Canadian Office: 560 King Street, W., Toronto. In Argentina: UCOA Radio Products Company, SRL, Buenos Aires. Cable Address: UTARADIO, Chicago.



**SPEAKERS, VIBRATORS  
TRANSFORMERS, UTAH-CARTER PARTS**

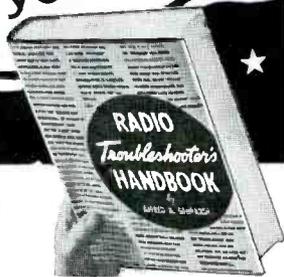
Branch for tube production from June 1 to December 31. As about 20 million replacement tubes have already been manufactured, the proposed 1942 replacement tube program of 40 million tubes will contemplate production of an additional 20 million tubes from June 1 to December 31. Similar procedure for replacement parts also is being worked out by the WPB Radio Section. A questionnaire is now being prepared for transmission to all radio parts manufacturers, to secure necessary data on which to base the prospective replacement parts and material allocation program.

**CATALOGS,  
BULLETINS ETC.**



• • • • A 24-page technical manual on General Electric radio receiving tubes, prepared to assist those who work or experiment with vacuum tube circuits, has been released by the General Electric Radio, Television and Electronics Dept., Bridgeport, Conn. Copies are available without cost to readers of SERVICE.

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**SUPREME**

INSTRUMENTS CORP.

GREENWOOD, MISSISSIPPI, U. S. A.

## 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.

## PERSONNEL

Appointment of Robert P. Almy as manager of Renewal Tube Sales was announced by C. W. Shaw, general sales manager of the Radio Tube Division of the Hygrade Sylvania Corp. Announcement was made at the same time of the appointment of A. R. Oliver as field sales manager of the Renewal Tube Sales Division.

Mr. Almy will headquarter his radio tube renewal sales work at Emporium, Pa., while Mr. Oliver will operate from Chicago.

Ralph S. Merkle, commercial engineer for Hygrade Sylvania Corp., was recently commissioned First Lieutenant in the coordination branch of the U. S. Army Signal Corps. He has been stationed in Washington, D. C.

best efforts to be certain that radio replacements parts continue to be manufactured so that home radio receivers can be kept in good repair. . . ." The petitions are designed for distribution

RADIO KEEPS THE  
PUBLIC INFORMED

*Keep 'em  
playing*

IF YOU AGREE, WILL YOU PLEASE  
COME IN AND SIGN A PETITION?

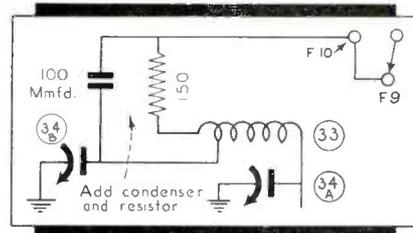
to service shops throughout the country where listeners may come in and sign in an effort to keep their receivers operating. Copies of the poster and petitions are available to readers of SERVICE directly from Standard Transformer Corp., 1500 N. Halsted St., Chicago.

### PHILCO 42-124, CODE 121

*Improving power output:* To improve the audio power output the 800-ohm resistor (50) was changed to 680 ohms.

### PHILCO 42-788, CODE 121

*Trouble in padding:* If trouble is experienced in padding the 22-mc, normal tuning range (compensator 38A), the



installation of a 150-ohm resistor and a 100-mmfd condenser will improve the operation. These parts are installed in the circuit as shown in the accompanying sketch.

*"In these days of material shortages and production restrictions, the radio service engineer has his big opportunity to 'keep 'em listening', no matter what the obstacles. "It is a time when ingenuity counts—a time to make good use of experience."*

from P. R. Mallory & Co. advertising

## DISPLAYS

From Standard Transformer Corp., Chicago, comes the poster illustrated herewith, in patriotic red, white and blue, together with a petition urging every congressman "to exert his

## SER-CUITS

(Continued from page 10)

accurately and then the button is pushed in (with gusto) to lock it in place. The buttons may be reset easily when desired. This system would come in handy in auto sets and portables when traveling or vacationing. Some buttons are so difficult to set (as far as the layman is concerned) that the set owner doesn't bother about them when they go out of adjustment and it is not until the set really quits completely that a Service Man is called. However, some service calls may be attributed directly to push buttons going out.

Wells Gardner IA63

Next, we have a dual-range, 11-tube, a-c combination of Wells Gardner, series IA63, which has a neat switching system—shown in Fig. 5. On the broadcast band the loop antenna is connected in series with a loading coil and short-wave antenna transformer. On switching to short-wave, the loop and loading coil are shorted out. A foil aerial is permanently connected to the primary of the short-wave transformer and through a loop coupling coil, shunted by 300 mmfd to ground. The foil adds some signal, though probably of small magnitude, to the loop in the broadcast range. On the short-wave band, the condenser effectively bypasses the signal around the loop primary so as to conserve the weak signal voltage. In many locations, of course, the foil antenna is simply ineffective on short-waves.

In the first detector circuit, the short-wave and broadcast coils are also in series, the broadcast coil being shorted when switching to short-wave. While the broadcast transformer is conventional, capacity coupling is used in the short-wave position. A 20,000-ohm plate-load resistor is cut in the circuit

and the broadcast primary is shunted with 100 mmfd, making a sort of impedance coupled transformer. The coupling condenser is low, 20 mmfd, so as to preserve reasonably sharp tuning.

The oscillator switching is accomplished similarly to the converter. In the broadcast position, the two grid coils and the two tickler coils are in series. Switching to short-wave shorts out the cathode tickler and grid coil of the high inductance transformer. Cathode to cathode oscillator coupling is employed through a 5,000-ohm bias resistor shunted by a 0.02 mfd. The sensitivity on the broadcast range is 2 microvolts average; on short-wave, 4 microvolts average. Note also the inverter circuit which uses a high impedance voltage divider: 2, 3, and 6 megohms.

Silvertone 7010, 7034

Silvertone models 7010 and 7034 are further examples of changes brought about by shortages. Here, again, it's changing from a p-m to electro speaker. Fig. 6 shows the output circuit of these a-c/d-c 6-tube models. Note the neutralizing tap on the primary of the output transformer formerly seen only on p-ms. This takes some d-c flux out of the core, similar to the balanced system obtained with push-pull operation, and, hence, increases the inductance value and improves the low-frequency output. The 2,000-ohm resistor acts as part of a filter section for the B supply and it also acts as a resistance load on the output transformer, taking a little power in exchange for improved fidelity.

*Help beat the Axis by buying United States War Bonds and Stamps every pay day.*

# STANCOR TRANSFORMERS

**First Choice of Servicemen!**



## STANDARD TRANSFORMER

• CORPORATION •

1500 NORTH HALSTED STREET . . . CHICAGO

# 2 Handy Aids for Resistance Problems Today!

**New OHMITE Quick Reference Catalog 18 FREE**

Gives up-to-date information on the wide range of Ohmite stock resistors, rheostats, chokes and switches used in all types of applications. Helps you select the right units for each job easily, quickly. Send for Catalog 18 now — it's Free.

## Handy OHMITE Ohm's Law CALCULATOR

Figures ohms, watts, volts, amperes — quickly, easily. Solves any Ohm's Law problem with one setting of the slide. All values are direct reading. No slide rule knowledge necessary. Size 4 1/8" x 9".

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OHMITE MANUFACTURING CO.  
4879 Flournoy St., Chicago, U.S.A.

Send Free Catalog 18.  
 10c in coin enclosed. Send Ohm's Law Calculator.

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City \_\_\_\_\_ State \_\_\_\_\_ Service—June, '42

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RHEOSTATS • RESISTORS • TAP SWITCHES



**Old Man Centralab**  
reminds you to always "specify  
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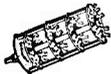
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MILWAUKEE, WIS.

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*for*  
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**VIPOWERS**

**THE RADIART CORP.**  
**CLEVELAND, OHIO**

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power of the radio re-  
placement parts field.  
Not a bit of waste cir-  
culation.

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JULY 10TH**

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War  
Bonds  
and  
Stamps  
Regularly**  
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in times  
of stress...

**SOLAR**  
SERVES THE SERVICES



**IN THE AIR**  
special Solar capacitors function down to -40°C. or at 50,000 feet altitude, under severe vibration.



**ON THE SEA**  
are Solar capacitors which have passed saltwater immersion tests, and are corrosion-proof and stabilized.



**MOBILE FORCES**  
Solar capacitors of compact special design can take punishment from extremes of heat and cold and have passed exacting vibration tests.



**ARTILLERY**  
directed from aircraft — or controlled electrically from the ground — gains certainty of action from reliable electrical equipment — including Solar capacitors.

Solar reliability is built into all types of electrical condensers for industrial, radio and service applications.

**SOLAR MFG. CORP. BAYONNE, N. J.**

today,  
as always...



SERVES THE SERVICE-ENGINEER

Naturally, War Efforts come first! Nevertheless, we have not lost sight of our highly valued radio-service clientele. Thanks to SOLAR ingenuity and resourcefulness in adapting *available* raw materials to the demands of the day... hard-pressed service-engineers still can obtain "Quality Above All" Dependable Capacitors.

To simplify your replacement problem... ask your Solar distributor about "Aluminum-Saver" Universal Replacements

C A P A C I T O R S

**SOLAR MFG. CORP., Bayonne, N. J.**

# General Electric advertising will direct the public to **YOUR STORE** for **RADIO SERVICE**



### ON THE AIR!

On Coast-to-Coast CBS Network, people needing radio service will be told time and time again, on the G-E Radio News Program, to go to qualified service dealers who display the emblem of the G-E Electronic Radio Tube.



### IN MAGAZINES!

The public will be directed to dealers displaying the Pledge Plaque of the G-E Electronic Radio Tube as qualified to give radio service.



### THROUGH THE MAIL!

Dealers qualifying under the sign of the G-E Electronic Radio Tube will be supplied with envelope enclosures for mailing to customers and prospects.



### AT POINT-OF-SERVICE IDENTIFICATION

To closely identify your store with G-E's powerful national advertising program, General Electric offers dealers an attractive Pledge Plaque and a Window or Door Decalcomania featuring G-E Electronic Radio Tubes.



### IN THE CLASSIFIED TELEPHONE DIRECTORY

In towns of 50,000 population and over, G-E offers you the opportunity of listing your name under G-E's nationally advertised emblem heading — The Sign of the G-E Electronic Radio Tube.



The Public Will be Directed  
to the Sign of  
G-E Electronic Radio Tube  
for Qualified Service



**USE RADIO SERVICE TO KEEP YOUR RADIO IDENTITY**



Now that no new radios are being manufactured for the duration of the war, you soon will no longer be able to advertise radios for sale.

After you have sold your last radio—what then? The answer is—Radio Servicing.

Every radio owner will want to keep his radio operating at peak efficiency—will want it to see him through the wartime emergency.

Radio dealers and servicemen will want to carry on with the all-important job of keeping America's radio sets playing.

Radio servicing, with its increasing volume sales of replacement tubes and parts, will become increasingly important as radio sales dwindle. The service business

offers dealers the opportunity to keep their identity in radio and earn a good profit besides.

So General Electric steps in with a great national advertising program specifically designed to direct people to your place of business for radio servicing.

To you as a radio dealer who must face these business wartime conditions, this General Electric Radio Service Plan is important. Phone, wire, or write your G-E Radio Distributor for complete information.

**SO TIE UP WITH  
THE G-E RADIO  
SERVICE PLAN**

**GENERAL  ELECTRIC**

**RADIO, TELEVISION AND ELECTRONICS DEPARTMENT  
BRIDGEPORT, CONNECTICUT**