december, 1943
25 cents

Radio SERVICE DEALER

to which is added –

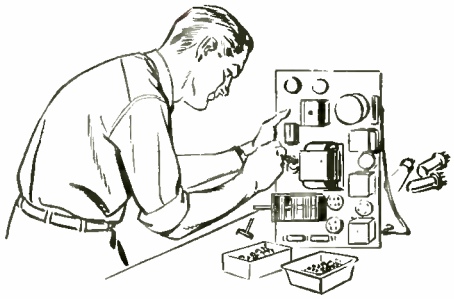
ELECTRICAL APPLIANCE Retailing

In This Issue . . .

PORTRAIT of a POST WAR RADIO SET . . . . .

Donate Your Scrap

To The War Effort



Donate or sell your metal scrap for the War effort. Those unused parts will help make planes, tanks and guns to beat the Axis.

But donate *wisely*. If you do not have a reasonable stock of nuts, lock washers, screws, solder lugs and similar items, strip your junk of these parts. Radio hardware will become increasingly hard to secure—but more important is the necessity of eliminating purchases of small parts which are fabricated by automatic screw machines.

The automatic screw machines of our nation are working overtime, turning out parts for War use. Don't add to this burden by discarding parts which must be repurchased in the near future. Your good common sense will tell you what to save and what to scrap.

But act now! Take apart discarded apparatus. Don't hold on to that old receiver or other assembly because it has some part you may need later. Remove the parts and sub-assemblies that have immediate definite replacement value—junk the rest to help junk the Japs.

Large quantities of bulk metal are needed immediately. Do your part!

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

P.R. MALLORY & CO. Inc.
MALLORY

ARMY E NAVY

Approved Precision Products

Radio SERVICE-DEALER

Registered U. S. Patent Office

Devoted exclusively to the problems of Dealers, Soundmen, Servicemen & Jobbers.

VOL. 4, NO. 12

CONTENTS—DECEMBER 1943

Cover, "Planning the Peacetime Set", by Henry F. Kroeger, Jr.

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with the editor . . . . . .

SOMETHING NEW HAS BEEN ADDED!

A COMPLETE SECTION has been added to RADIO SERVICE-DEALER. Called ELECTRIC APPLIANCE RETAILING and almost a little magazine by itself, it will serve to bring to the radio dealer a better appreciation of the problems (and their solution) which confront those in the appliance game. By the same token the appliance man will want to meet and understand the radio dealer. All this, because this war has again created strange bed fellows. What were before bitter enemies, are now friends,—nay, even doing each other's business and work. Since the scarcity of parts in both trades as well as the lack of new units to sell has made each business a service only proposition, the public has been bringing its radio sets to be repaired by the appliance man, while the radio jobber-serviceman has struggled with a mangle.

We believe that the Peace will see these two fields even more closely allied, perhaps so tightly that they may never be separated. To the better understanding, then, between these two industries, ELECTRICAL APPLIANCE RETAILING along with RADIO SERVICE-DEALER is dedicated.

HOARDING DOESN'T PAY!

SURVEYS PROVE THAT a few radio and appliance dealers still have large inventories of pre-war produced radios, refrigerators, washing machines, fans, etc., most of which are practically obsolete, all of which have deteriorated somewhat because of non-use or display handling. Most appliances still on hand are of the higher-priced types or of the slow-moving variety.

The dealers who own stocks of appliances alluded to above are in most cases asking ceiling prices, or prices out of proportion to the merchandise's true value. These dealers are doing themselves and the public a disservice by not trying to move their stocks quickly, at reasonable markups. Idle commodities are useless to the all-out war effort. Nothing should be done to deter one wit from winning the war, Sell whatever items can be sold now when they can do some good. Cash obtained through sales consummated now should be invested in War Bonds . . . so funds will be available to purchase fresh new stocks when same become obtainable. None of us know just now when civilian commodity production will be resumed, but let's prepare for that happy day. In the meantime, Keep 'Em Playing — keep servicing 'em!

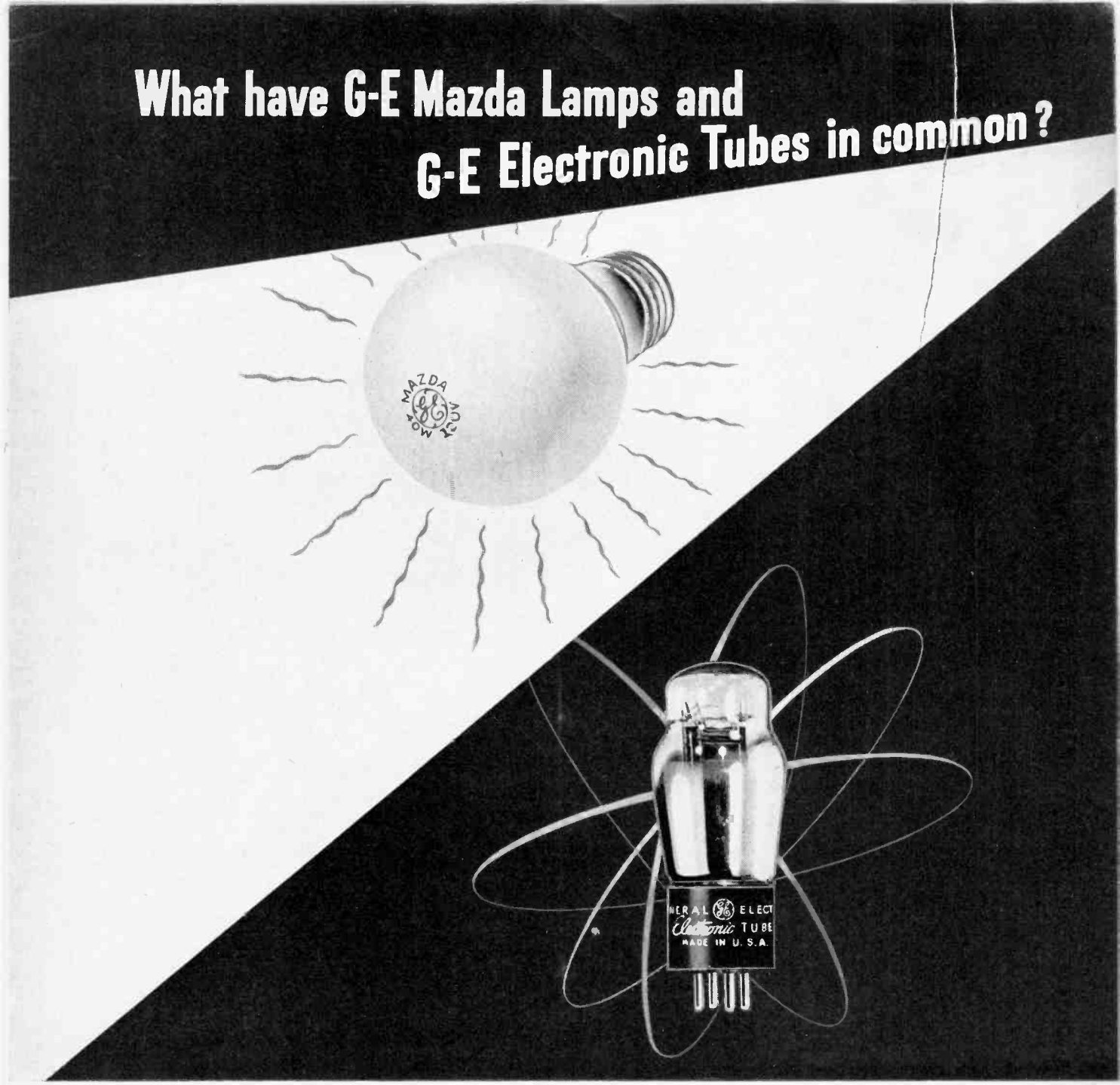
PICK YOUR LINE CAREFULLY—PLAN NOW!

ALL SERVICE DEALERS, radio and electrical appliance, should now be planning for the Post War era. Now is the time to study the many and various brands of merchandise on the market— even if there are no 1943 or 1944 sets or units available. Distributors can be contacted and sales plans looked over. No wide-awake, conscientious dealer can afford to wait any longer insofar as *planning* is concerned. A franchise for a good line of radios or electrical appliances contracted for *now*, may prove invaluable later. Business indices indicate that dealer mortality has tapered off; and it is quite likely that all service-dealers who have survived so far will last for the duration.

To assist them in making up their minds that there are some real honest-to-goodness facts available, we have included a number of "post-war" articles in this issue. It will pay all to read them carefully; they are full of real meat —and hard-to-get facts.

S. R. Lorain

What have G-E Mazda Lamps and G-E Electronic Tubes in common?



THE General Electric Mazda Lamp and the General Electric Electronic Tube have a lot more in common than meets the eye!

But radio service men and service dealers should recognize the important similarities. Both lamp and tube bear the same G-E symbol that the public has long shown its respect for by buying countless millions of electric lamp bulbs for its homes, stores, farms, factories.

Both are durable. Both are efficient. Both bring a fair profit to the retailer. Both are as American as Chevrolets, Plymouths, Fords. Both give much more service than their cash value indicates.

The history and development of both are closely tied in with General Electric's history and development. Both are being widely and currently advertised to consumers through the nation's most effective advertising media.

As a result, the G-E Electronic Tube is earning the same complete consumer confidence now given to the famous G-E Mazda Lamp.

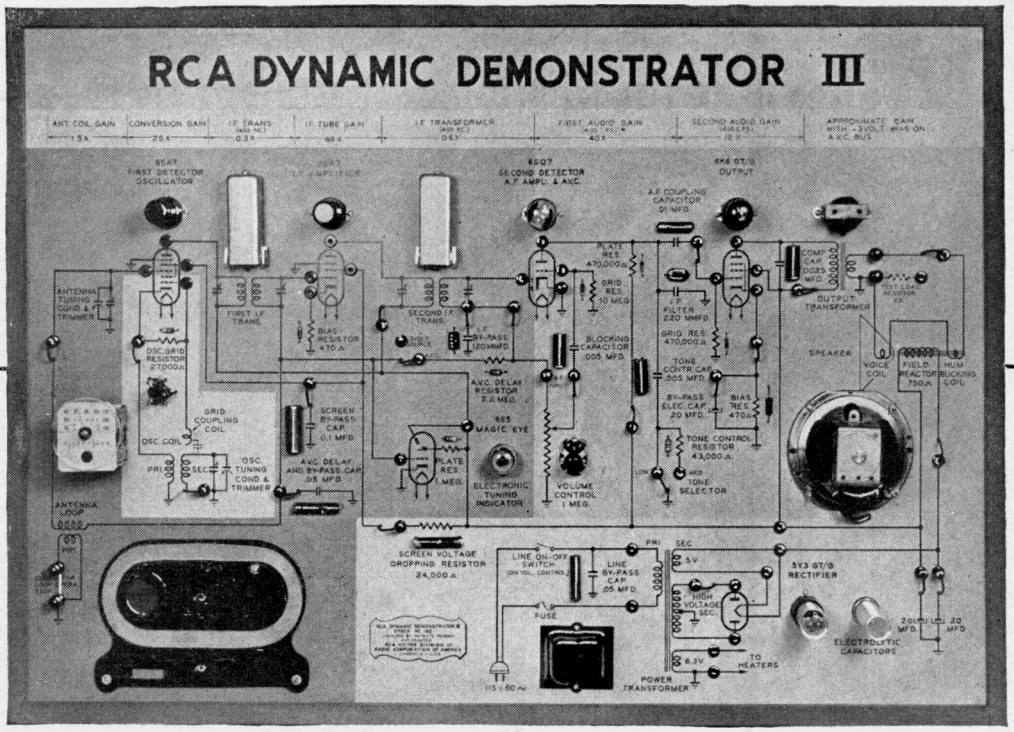
There is already an increased demand for G-E Electronic Tubes. And when peace is restored, General Electric Electronic Tubes will be in greater public demand for replacements than they ever were before. Insistent General Electric advertising and promotion are carefully planned to make them your fastest moving radio tubes. *Electronics Department, General Electric, Schenectady, New York.*

Tune in **"THE WORLD TODAY"** *and hear the news direct from the men who see it happen, every evening except Sunday at 6:45 E.W.T. over CBS. . . . On Sunday listen to "The Hour of Charm" at 10 P. M. E.W.T. over NBC.*

GENERAL ELECTRIC

176-84

LEADER IN RADIO, TELEVISION, AND ELECTRONIC RESEARCH



The Working Schematic Circuit Diagram that has helped thousands to learn radio principles, circuits, and servicing

The RCA Dynamic Demonstrator is a complete schematic diagram of a modern six-tube superheterodyne radio receiver; all circuits clearly visible; all operating parts mounted in their proper places in the circuits; the correct symbol representing each respective part in plain sight beside that part; and the whole hook-up arranged in perfect working order.

Each Circuit Section in Different Color—Large color-blocks differentiate each circuit section: the power section is blue; audio frequency, green; intermediate frequency, orange; oscillator, yellow; radio frequency, red.

Pin Jacks and Switches—At all important measuring points there are pin jacks for instrument connections, or insertion of jumpers. All types of part or circuit failures can easily be simulated to facilitate effective methods of location and correction. Other types of simulated failure can be realistically produced by operating switches provided on the back of the Demonstrator.

Typical Applications—A specially prepared RCA Instruction Manual is supplied to help teachers and students use the RCA Dynamic Demonstrator to best advantage. This instruction booklet contains many well-illustrated suggestions for helpful experiments, with adequate explanations of the nature, purpose, and significance of each experiment.

Write for Data—A large number of RCA Dynamic Demonstrators are now being used in schools and colleges and for radio instruction of the armed forces. For complete information regarding this interesting and valuable radio teaching aid, write to Test & Measuring Equipment Section, Radio Corporation of America, Camden, New Jersey.

★ *BUY MORE WAR BONDS* ★

RCA TEST & MEASURING EQUIPMENT

RCA Victor Division • RADIO CORPORATION OF AMERICA • Camden, N. J.

IN and AROUND the TRADE . . .

Being a condensed digest of some of the happenings in and around the radio trade as compiled by the Editors . . . .

Welcome Out On Mat For Visiting Reps.

R. Edward Stemm, Secretary-Treasurer of the Chicagoland Chapter of "The Representatives" whose office is at 21 East Van Buren St. (Phone WEBster 4840) has put out a hearty welcome on the mat of the organization for all visiting reps to call up and join the luncheons which are held the first Monday of each month.

Stemm advises that from time to time they have meetings of a special character, sometimes even a dinner, at which worthwhile matters are discussed. Not only are the meetings known for the good that generates among the Reps, but also because of the problems that get settled. Any visiting Reps who are in the vicinity around the first Monday of the month are urged to telephone him, Stemm said, and attend.

Ohmite Prexy Elected Trustee of Ill. I. of T.

David T. Segal, founder and president of Ohmite Manufacturing Co. of Chicago, was elected to the board of Trustees of the Illinois Institute of Technology at the annual meeting.

As a member of the board, Segal will help formulate the governing policies of Illinois Tech, one of the nation's largest engineering colleges which was formed by the merger, in 1940, of Armour and Lewis Institutes.

Cheap Telly Set To Make Network Possible

That network television programs would be commonplace things within 5 years after resumption of commercial television, was forecast by Thomas F. Joyce, Manager of the Radio, Phonograph & Television Dept. of RCA. It only awaits the advent of a cheap receiver to cost around $200, he stated.

Mr. Joyce believed that such a receiver was possible based on labor and material costs (and assuming no excise taxes) of 1940. And, of course, assuming that there would be no postwar inflation of prices in general.

In fact the only real post war problem, Mr. Joyce said, was to develop this cheap receiver. If this obstacle could be surmounted, television would be a billion dollar industry within 10 years after its start.

OCR To Count Noses

A nationwide consumer survey will be conducted for the Office of Civilian Requirements by the Bureau of the Census, it was announced.

Census enumerators will visit 7,000 households to ask civilians about the availability of 115 types of goods and services used in homes and on farms.

The survey is designed as a scientific cross-section of the entire United States, embracing, in proportion, every geographic area, every income group and every type of worker. The farm survey will include not only every sized farm operation and every income group, but will be divided by crops according to relative size.

This national sample, is the culmination of a series of "spot check" surveys OCR has conducted in various sections of the country to determine conditions in specific areas and about specific products. The information obtained in the national survey will be collected and analyzed to find the answers to these questions:

1. To what extent are shortages (of radios—excluding auto radio sets) and other consumer problems causing actual hardship?
2. What products now in short supply are most needed by the civilian population, and is the lack of any specific item so seriously affecting health and morale as to interfere with the productive efficiency of war workers, farmers and other civilians?
3. Is the available supply of consumer goods being distributed fairly?

As a result of these studies, OCR will have factual information from consumers for use in carrying out its function of maintaining an adequate supply of necessary civilian goods and services within the limit set by the war demand for manpower, manufacturing facilities and materials.

New Reps Appointed

M. F. Klicpera, Houston, Texas, by Universal Microphone Co., Inglewood, Cal. for territory Texas, Louisiana, Arkansas and Oklahoma . . . .

Ben Miller, Chicago, by Radio Essentials, Inc., New York City, N. Y. for territory Southern Wisconsin and Illinois . . . .

J. E. McKinley, Philadelphia, Pa., by Solar Capacitor Sales Corporation for territory of Eastern Pennsylvania, Maryland & District of Columbia . . . .

Wiggin Leaves W.D. to Return to Sears-Roebuck

Parker E. Wiggin, who for the past nineteen months has been connected with the War Department, as chief business adviser, Procurement and Distribution Service, U. S. Signal Corps, has returned to Sears, Roebuck and Co. with headquarters in Chicago to resume charge of the Parent Radio and Musical Instrument buying organization.

Fritschel & Mandernach Upped to Sales Managers

Mr. G. E. Nevin, Division Manager of General Electric Company has announced that E. H. Fritschel and H. J. Mandernach have been named sales managers of Transmitting Tubes and Receiving Tubes, respectively, of the company's Tube Division.

Fritchel has been with the company since 1926, coming directly from Iowa State College from which he graduated with a BS in electrical engineering.

Mandernach, formerly sales manager of the Replacement Tube Section of the G.E. Electronics Dept. at Bridgeport, is a native of Chicago. He came with G.E. in 1936, becoming radio representative in the central west, with headquarters in Chicago. Later he was transferred to Bridgeport, from whence he has just been promoted.

Crosley Plans Keeping 8000 & Reemploying 1250

Entering the field of room coolers, which it is claimed was just coming into its own in 1941, The Crosley Corporation of Cincinnati plans to keep the greater part of its 8000 employees on the job, and also re-employ the 1250 which have gone to serve the colors.

This was the program outlined by J. H. Rasmussen, commercial manager, when he addressed delegates of the Hardware Association recently.

"We will manufacture first those items which we formerly produced. We will add new items, one at a time, as we are sure they are ready for production, and when we know our distributors are ready to absorb them into their own programs. We believe that we can maintain our employment during the transition period when we are still producing war materials and are getting back on civilian production."

5-Million Salesmen: Postwar View of S-C Sec'y Lee McCanne

A post-war opportunity for 5,000,000 salesmen was predicted yesterday by Lee McCanne, secretary and assistant general manager of the Stromberg-Carlson Company, who said that will represent enough jobs to absorb one-half of the men who will be released from the armed forces.

Mr. McCanne said "these veterans will make splendid salesmen if they can be induced to try the profession of selling and are given a proper start."

He estimated that 8,000,000 of the 43,000,000 civilian jobs in 1940 were sales jobs, in part at least. This figure has been reduced to less than 3,000,000 today, and it will be necessary, he declared, to restore selling forces to their full pre-war status. He added that, if the aim of the Committee for Economic Development of 9,000,000 extra jobs over 1940 is to be accomplished, industry must take on at least 2,000,000 additional salesmen.

In the post-war period the "big customer" taking 60 per cent of output today will be replaced by millions of little customers, and the slogan "Produce for Victory" will be replaced by "Sell for Prosperity."

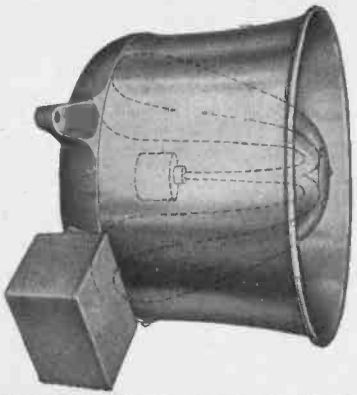
General Electric Announces "Lectrofilm"

Lectrofilm, a new synthetic dielectric material for capacitors, developed after several years of GE laboratory research, and made of materials available

(Continued on page 37)

MORE SPEAKER FOR THE MONEY -LESS MONEY FOR REPAIRS!

RACON

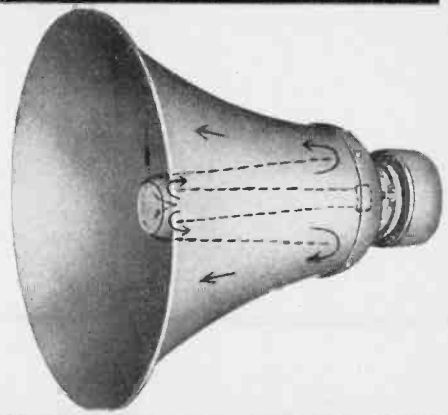


RACON loudspeakers and driving units generally cost less than competitive brands because a low power-rated (and lower priced) RACON will outperform higher power-rated units of other manufacture. In other words, catalog list prices are meaningless in comparing loudspeaker values.

RACONS are the finest that money can buy, afford greater operating efficiency, require less repairs. Receiver units are supplied with either metal or plastic diaphragms. There is a RACON horn, speaker, driver or trumpet for every conceivable sound application. *Send for our catalog.*

RACON is the world's largest manufacturer of air-column horns and speakers.

RACON ELECTRIC CO., 52 E. 19th St., New York, N. Y.



ACME PHOTO

A *Motorola* "Handie-Talkie" in Sicily

Portrait of a Post-War Radio Set

by

karl a. kopetzky

Most post war talk has been in vague generalities, but here are some very hard facts from a big manufacturer

IT'S *anyone's guess! . . . .*"
—"*We can't say for sure,—except that our radio sets will have everything from electronic soup to radionic nuts! . . . .*"

—"*Postwar? Sure! Our radio line will be the only one to bzz, bzz . . bzz . . . . bzz.*"

That has been the sort of talk with which the dealer and jobber has had to put up. Nothing very definite has been told him. That many a firm is thinking and doing something about postwar, every dealer knows from the ever-busy manufacturer's publicity department and from the distributor. But the term, "Post War," has been so loosely used, that like an OPA edict, it has come to cover almost everything that is *not* war work. Which is far from the truth! The dealer is tired of being ladled vague pap; he wants facts!

And here they are; at least insofar as one big manufacturer is concerned.

The *Galvin Manufacturing Corporation,* better known to thousands of radiomen and dealers by its trade name of "*Motorola,*" sprawls out over more than a whole square block of western Chicago. Long and low are the buildings flanked by small watch-towers manned by burly, pistol-packin' men who maintain a 'round-the-clock guard over the premises, and, while coldly courteous, stop all who want *in* until properly identified! Surely you know the picture. A big factory heavily engaged in war work; running on a 24-hour a day schedule turning out *hush-hush* radio equipment for Uncle Sam and the United Nations; pouring its every energy in getting "there fustest with the mostest!" Apparently not one thought is being given to postwar, its problems, nor the conversion to Peacetime radio . . . .

But it is only,—apparently. Every morning the top-flight executives are meeting with but one thought on their table of discussion, "What shall it be for 'PostWar'?" And they have the answer ready even now . . .

The first great truth to come out of these meetings is that the postwar radio set will improve by *evolution* and not *revolution.* This means that there will not be any sudden great change in the radio sets as we have known them up to date. Whatever improvements have been wrought by electronic advance due to war, will be added slowly.

The reason behind this is simple. No one can revolutionize an industry overnight. To tool up for that, too, would be well nigh impossible in the short period between the advent of Peace and the production of the first postwar radio set. This period, *Motorola* says, will be short. Also the postwar sets, even the first, must be good; and *Motorola* promises they will be the finest possible.

So don't expect a radically different set right after Peace; don't even expect it for some time afterwards. The radio set will change slowly, evenly,—but not over night!

From the War and Navy Departments experience (which have taught the radio set manufacturer

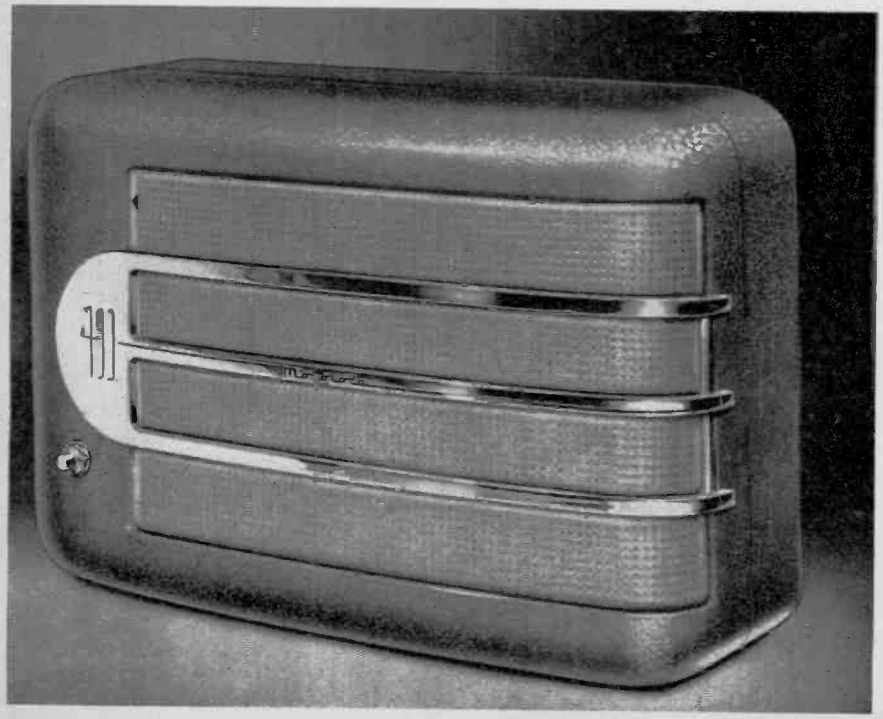
A Command car radio installation in New Guinea SIGNAL CORPS PHOTO

how to build the receivers so that they can "take it"), will come a much finer-built unit. That means less repair on the part of the dealer —and less returns for inoperation. There will be more of the nicer things available: (1) high fidelity reception due to the improvements in loud speaker construction, (2) more compact sets so that, for instance, phonograph-recording-radio sets will not take up a whole wall, (3) specialty sets for almost every condition, which will make the public want to own at least three sets per home, not counting its car radios. As an example of the third division, there will be special sets for the traveling man, the air-traveler, the sportsman and the office worker. Some of these sets will be *pre*-tunable. Of course, improvements which are applied to the battery rigs, will be found, perhaps somewhat expanded, in all "line-operated" radios. All this will be the direct result of applying war intelligence and "know-how" to the 1941 radio unit.

▲ THIS INTO THAT? ▼

— OR —

The commercial *Motorola* "400" set



What will the console look like? Pretty much as it did before. It is unreasonable to suppose that the radio industry will, or can upset the furniture trade. What about the some 35-million homes with all their furnishings? Surely they cannot be emptied just to make way for some new type of radio console; neither is it smart to expect that people will buy the "odd" or "different" looking model only to find that it does not blend in with their furniture, and stands out like a sore thumb. So one may expect that the "improved" radio console externally will resemble its predecessors. For a while the changes will be chiefly internal—to the chassis and its components—not on the outside in the cabinet. However, there will always be some "modern" sets, mostly for the table-top, made up of startling combinations of plastic, which will not look like that which has been on the market before. But this type of radio will probably be in the minority.

Bi-aural delivery, i.e., sets using two speakers, will be improved and

become more commonplace. Their advantage is that the sound will seem to have more depth and more fidelity, since it will reach *both* of the hearer's ears at once.

What about the *hush-hush* radio developments? Well, *Motorola* cannot talk any more than any other radio set manufacturer. But it seems logical that new methods are available for tuning units, for turning radios on and off automatically, for getting great distance reception without cumbersome equipment, and for some of the things which have only been "dreamed" of before.

There is no doubt that eventually battery radio sets will be sharply, perhaps drastically revamped to accommodate the new tubes developed for war work. That means that the sets will work for much longer periods on the same batteries than ever before; and that multi-tube sets—even with up to 8 tubes will be available for battery use.

Following up the fact *that radio sets will evolve* slowly rather than be the subject of a rapid revolution,

Electronic Ack-ack battery director

PERHAPS THIS INTO THAT!

Motorola will start its post war radio sets somewhat ahead of the place where it left off with its 1942 models, and *will bring out this line*, whether it be in 1944 or later, so long as it is after Peace, perhaps *within 90 days after Victory, — or "V-day."* What will the line look like? Modern and up-to-date with some real improvements, but not radical ones. Plans are to produce only the "best-selling" units until the first "market" after Peace.

It will probably be at the first "market", in the months of April-June, as has been the custom in the trade, that *Motorola* will bring out its first "newly designed" models. If the first "market" period comes too close after Victory, then *Motorola*, as well as the radio industry, will probably have to wait for the second April-June period after Peace.

What about the newcomers to the trade; the manufacturers who have only recently discovered the electron and the radio set, and who have only during this war come into the radio industry? The question is

(Continued on page 38)

A well-known commercial RCA receiver

THE ADJUSTMENT OF

Automatic Frequency Control Systems

By JOHN H. POTTS

The automatic frequency control system of receiver tuning which started in 1935 will, it is believed, become more popular in postwar sets. That is why this is timely

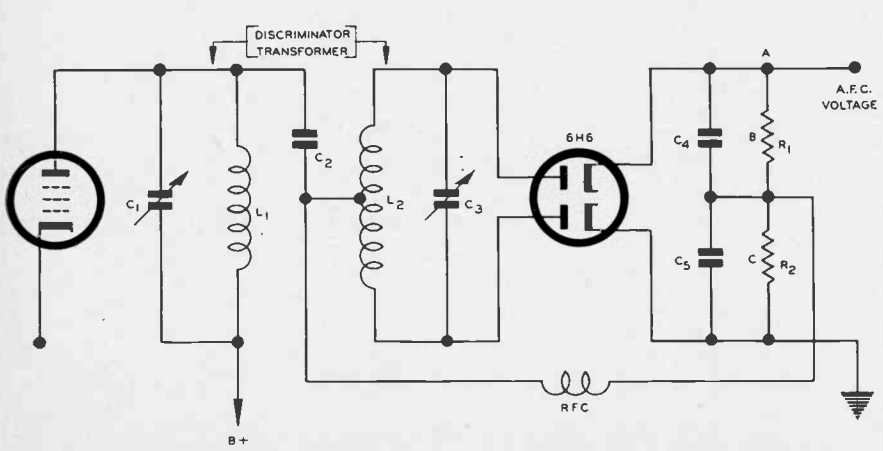
METHODS of tuning, automatically and electronic means, a superheterodyne oscillator to a predetermined frequency were first described in 1935. These systems, termed automatic frequency controls, or afc, were primarily intended to simplify the manufacture of receivers employing some sort of mechanical or electrical automatic station-selecting system. To tune the desired station in automatically "right on the nose," particularly on short-wave bands, requires a high degree of precision from the station-selecting mechanism. By having some automatic means of compensating for minor variations in the accuracy of the tuning adjustment, it is possible to employ less expensive automatic tuning mechanisms. Because afc systems do just that, they were hailed with considerable enthusiasm as soon as they were introduced, and many manufacturers marketed receivers employing afc circuits. However, the enthusiasm diminished rapidly once the receivers got into the field.

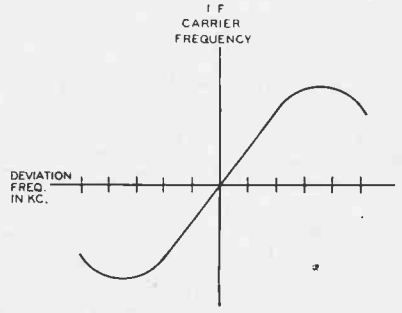
This was particularly true where afc systems were employed on short-wave bands, where they were most needed. A properly adjusted afc system can pull in a station which has been mistuned as much as 7 kc to within 100 cycles of the proper frequency. But this is true only when the system is perfectly adjusted—and all too often it is not. Thus the possessor of such a receiver who aimed for a *BBC* station on some short-wave band was likely to become the unwilling recipient of a discourse in German, Italian or what-not, depending upon the degree of maladjustment of the tuning mechanism, the afc system, and the receiver alignment.

While the afc system has been shelved for some years insofar as its application to most home receivers is concerned, its development has gone forward and unquestionably will be incorporated in some form in postwar receivers. Many of the faults which were blamed on the afc system were due to other causes, some having to do with the necessity to produce receivers cheaply during the depression. Now that consumers are becoming able to pay a fair price, and buy apparatus, which is not cheap to produce, in large quantities, we may expect a corresponding improvement in the quality of postwar equipment. For this reason, and because there are so many receivers still in the field which employ it, the serviceman should become thoroughly familiar with afc systems.

Automatic frequency control functions by varying the reactance shunted across the superheterodyne oscillator circuit. This is done electronically by using a tube (called a reactance tube), which can be made to act electrically in the same manner as a coil or a condenser. We know that if we shunt additional capacity across a tuned circuit comprising at least a capacity and an inductance, we will lower the frequency of the circuit; also, if we shunt a coil across the oscillator tuning coil, we shall reduce the effective inductance in the circuit and accordingly the frequency will be raised. The reactance tube itself is not any special type; usually being a 6J7, or similar sharp-cutoff type. The manner in which it functions as a reactance is determined by its circuit design, and by the method of varying its grid bias as the intermediate frequency is changed.

Since the functioning of the reactance tube is entirely dependent upon the variation in its grid bias, let us discuss first just how this is accomplished. In *Figure 1* is shown a typical discriminator circuit, just as it is used in f-m receivers of modern design. This type of circuit is identical to that employed in afc circuits to vary the bias of the reactance tube. It is so designed that when the circuits are precisely in tune with the intermediate frequency employed in the receiver, the voltage





Left is Figure 1. It is a typical A-F-C Discriminator circuit in full

■

Above: Figure 2. The output voltage varies with deviation in frequency

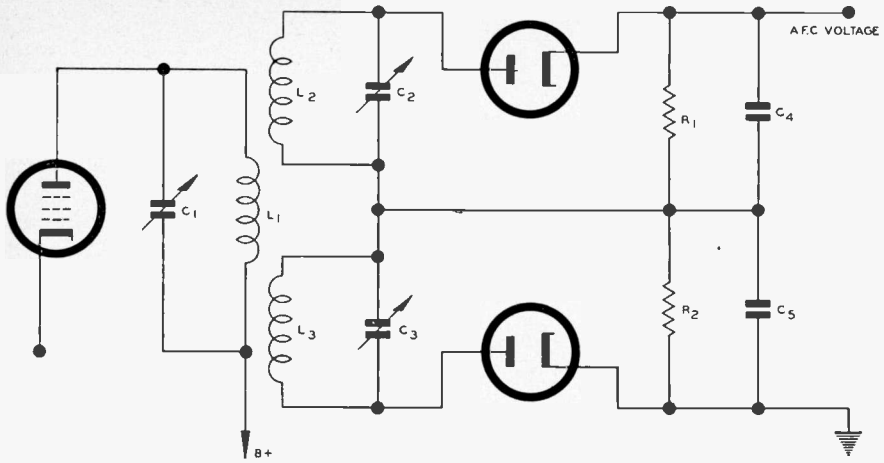


Figure 3. Split discriminator circuit; tuning above and below i.f. freq.

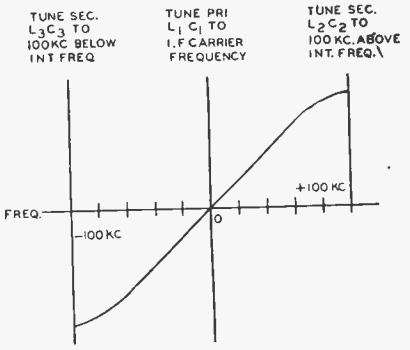


Figure 4. FM discriminator is similar to figure 3; is tuned the same

across the discriminator load resistance, from point (A) to ground, will be zero, provided that the incoming i-f signal is precisely the frequency to which the discriminator is tuned. This condition is reached when the receiver oscillator circuit is so adjusted that it beats with the incoming r-f signal to produce exactly the proper i-f frequency.

When we tune the receiver manually, we can adjust the tuning until the proper frequency difference between the set oscillator and the incoming signal is such that the resulting signal is the correct i-f frequency. Some set owners, we know, do have trouble when they attempt to do this by ear, and the tuning indicator has helped a lot in making certain that proper adjustment has been made. But in mechanically or electrically controlled tuning systems which function automatically, the tuning must be done without the help of the operator.

This is where the discriminator enters the picture. For, if the receiver is mistuned, the voltage from point (A) to ground becomes either positive or negative, depending upon the direction of change in the incoming i-f frequency. Thus, if the set oscillator frequency is too low, the resulting i-f frequency will be too high and the voltage across the discriminator load resistors from point (A) to ground will be positive. On the other hand, if the oscillator frequency is tuned too high, then the i-f will be too low and the resulting discriminator load voltage will become negative with respect to ground. This voltage is used to control the bias of the reactance tube, which usually functions as a variable condenser, so that the oscillator circuit capacity is increased when the i-f is too low and decreased when too high, and thus the set oscillator is brought to the proper frequency. Actually, the oscillator is never precisely tuned to the proper frequency when the afc is acting, because the discriminator cannot act until the oscillator becomes mistuned. In properly adjusted circuits, though, the set oscillator can be brought, through afc action, to within 100 cycles of the exact adjustment even when the tuning adjustment is 7 kc off frequency.

The discriminator circuit shown in Fig. 1 is known as the *Foster-Seeley* circuit, and is the most widely used and the simplest to adjust. Although it is shown working out of a limiter, this is not required when used merely as an afc discriminator. For this purpose it may work out of the final i-f tube. The primary coil is loosely coupled to the secondary, so that there is normally a 90° phase difference between the primary and secondary voltages. A split secondary is employed, feeding two diode plates in much the same manner as a full-wave rectifier. The secondary voltages applied to each diode plate are 180° out of phase, but, because the center-tap, rather than one of the secondary is connected to the primary (through C2), when the resonant frequency is applied, two output potentials result, one of which reaches a maximum above the resonant frequency and the other with a maximum below the resonant frequency.

This is demonstrated in Figure 2. Here we see that one circuit produces a maximum voltage at about 80 kc above the resonant, or i-f, frequency while the other reaches a maximum at the same frequency deviation below the resonant frequency. When the discriminator circuit is properly tuned, these voltages are equal and opposite in polarity with respect to ground (point (C) in *Figure 1*). Therefore, points (A) and (C) are at the same potential and the voltage difference is zero. This is convenient to remember because, in aligning the secondary, all we have to do is to tune it until the voltage from point (A) to point (C) is zero, when it will be perfectly aligned to the incoming frequency. It is usual to use a zero-center high-resistance voltmeter for this operation, since the voltage will vary in either a positive or negative direction as the tuning

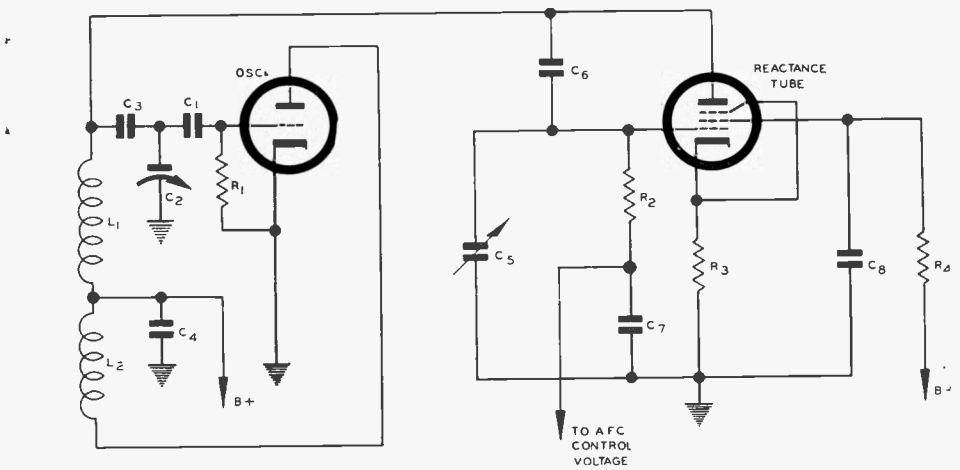


Figure 6. Reactance tube circuit and oscillator it controls

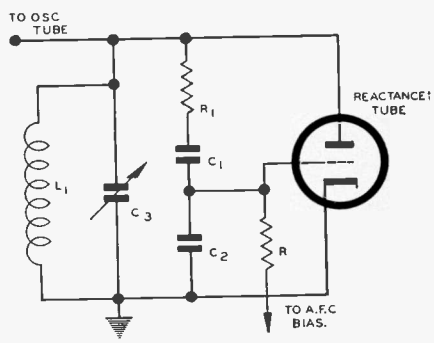


Figure 5. Fundamental reactance tube circuit used in AFC system

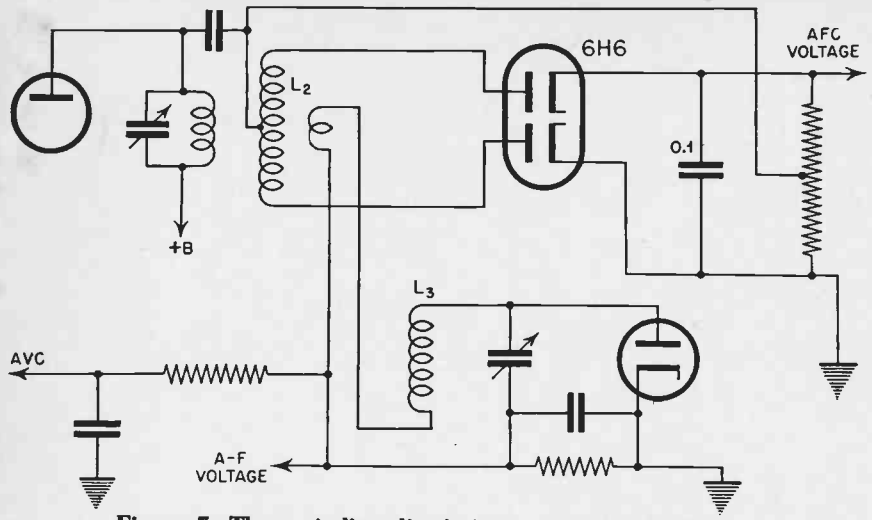


Figure 7. Three-winding discriminator for high-fidelity sets

capacity is increased or decreased when the i-f frequency is fed to the transformer.

Although the circuit of *Figure 1* is most commonly employed, some receivers did make use of the earlier circuit shown in *Figure 3*; and while the resulting action is the same, the adjustment of the circuit is much more difficult than the former. Whereas in *Figure 1*, we had but one secondary trimmer to adjust, and that was simply adjusted to resonate the secondary to the intermediate frequency, in the circuit of *Figure 3* we have two such trimmers, C2 and C3, one of which must be adjusted to 100 kc above the carrier frequency and the other to the same frequency deviation below the carrier frequency. When each has been adjusted to produce a maximum reading across its load resistor, the secondary circuit is properly tuned.

The specification for the tuning of the circuit of *Figure 3*, and the resulting discriminator curve, are shown in *Figure 4*. In practice, the tuning adjustments may be simplified by first adjusting C3 until a *maximum* voltage reading is obtained when connecting the voltmeter from the junction of R1 and R2 to ground. Then the high side of the voltmeter is connected to the junction of R1 and the diode cathode and the trimmer C2 is adjusted until the resulting voltage across both R1 and R2 in series, thus indicated, is zero. It is well to use an electronic voltmeter when making these adjustments, although a 20,000 ohms-per-volt type may be used.

A diagram of the elements of the reactance tube and oscillator circuit is shown in *Figure 5*. Here C3 and L1 are the conventional oscillator tuning capacity and inductance. These are shunted by the plate-to-cathode circuit of the reactance tube, which has been drawn as a triode for simplicity, but which is generally, as mentioned previously, a pentode of the 6J7 variety. Note that the oscillator voltage is fed directly to the reactance tube plate and also, through R1 and C1, to the grid. This resistance-capacity network, R1-C1, serves as a phase-shifting network, so that the grid voltage of the reactance tube is 90° out of phase with the oscillator voltage applied to the plate. Under these conditions the reactance of the plate-cathode circuit, which is in shunt with the oscillator tuning circuit, varies as the mutual conductance of the reactance tube is varied. Because the mutual conductance of the reactance tube may be varied by simply changing its grid bias, we have a means of varying the oscillator frequency. The discriminator, in turn, serves as the voltage source from which the variations in grid bias of the reactance tube (and consequently its change in reactance), are derived.

A complete circuit of a reactance tube with its associated superheterodyne receiver oscillator is shown in *Figure 6*. In this circuit R1 and C1 are, respectively, the oscillator grid leak and grid condenser, C2 and L1, with the padder C3, serve as the oscillator tuning components, and L2 is the tickler coil in the oscillator circuit. In the reactance tube circuit, R2 and C6 form the phase-splitting network we mentioned above, C7 is a by-pass condenser for any i-f components which may be present in the afc biasing voltage, C5 is a trimmer condenser, R3 and C8 are the cathode bias resistor and its associated by-pass condenser. The resistor R4 feeds the screen and helps to provide a semi-fixed bias on the cathode because of the voltage-divider network which it forms with R3. The afc voltage is applied directly to the control grid of the reactance tube.

In these reactance tube circuits, only capacitive elements are shown. Actually, an inductance could be used just as well, insofar as theoretical considerations are concerned. But it is easier to make a stable condenser, and less costly, so practically this works out better.

In discussing alignment, we have mentioned only the discriminator secondary circuits. These circuits are far more critical in adjustment than the primary. However, the primary should first be adjusted to resonance. This is done by feeding a signal at the exact i-f frequency to the i-f amplifier input, in order to provide a good, healthy signal for aligning purposes. The output meter for aligning purposes is a high-resistance voltmeter, as has been mentioned, and should remain connected across the high side of the diode load resistors and ground for both primary and secondary alignment of the discriminator transformer.

In aligning the primary, the secondary should be slightly detuned so that some small indication appears on the meter, either a positive or negative voltage, it does not matter. Usually the secondary will be slightly out of adjustment, so it will ordinarily be unnecessary purposely to detune the secondary. Now the primary tuning condenser, C1 in *Figure 1*, is adjusted until the indication on the output meter is a maximum. Don't be alarmed if this adjustment is broad; this is characteristic of commercially used discriminator transformers. Also, don't be sur-

(*Continued on page 35*)

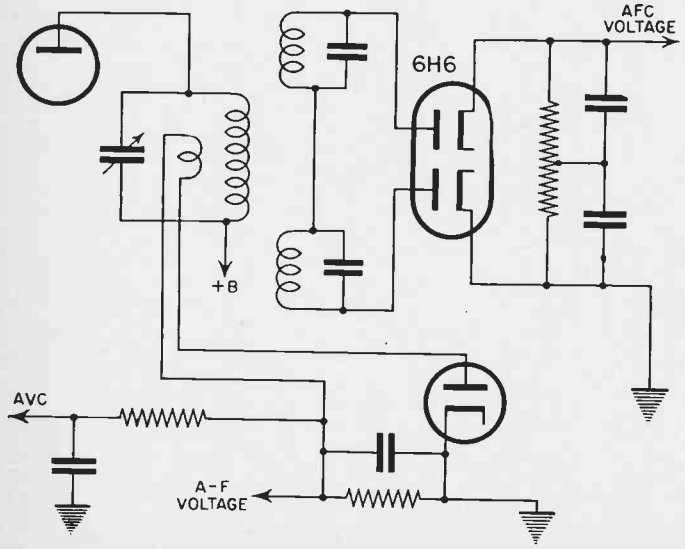
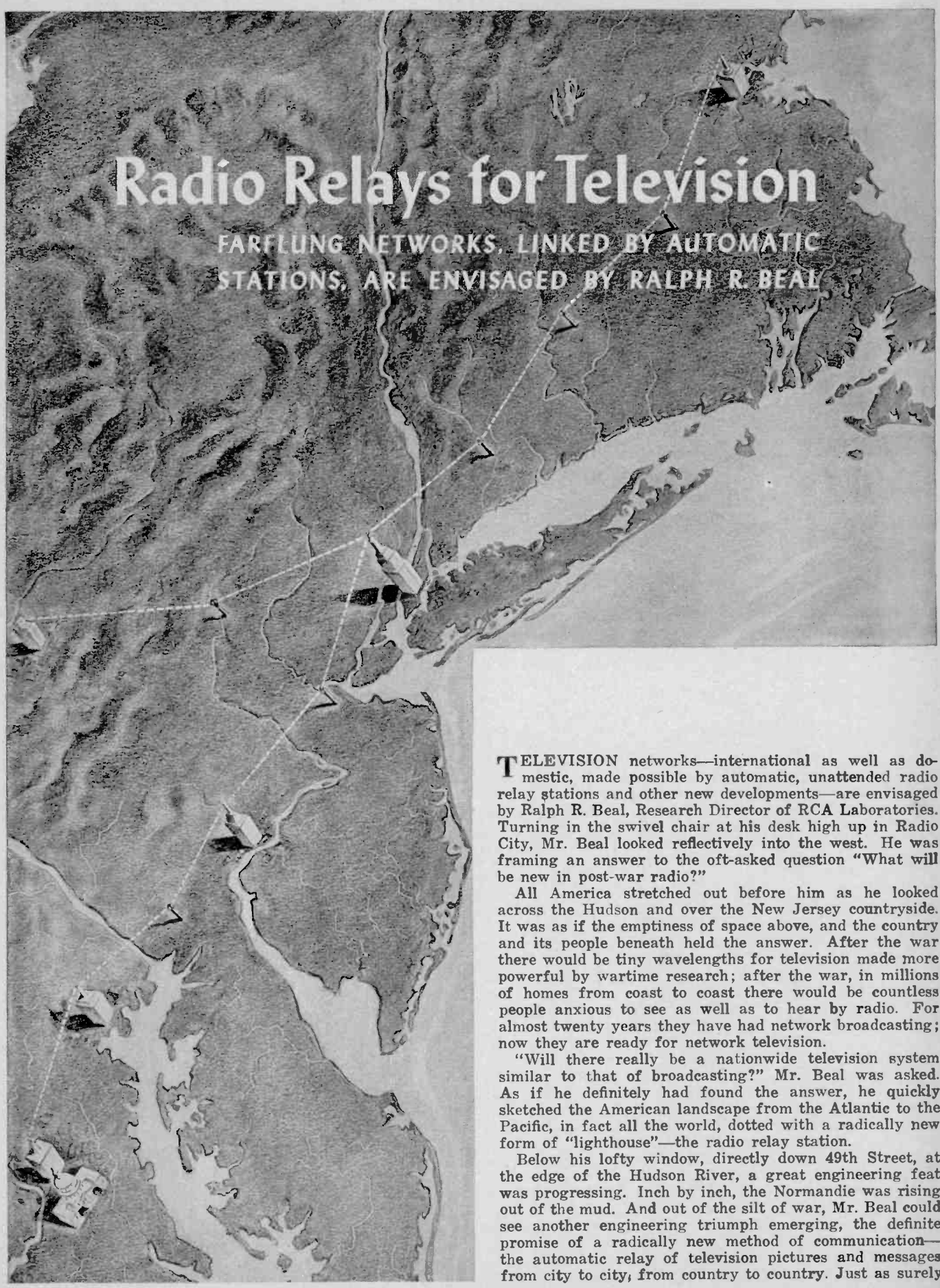


Figure 8.

A different three-winding discriminator. The detector-AVC diode is coupled to primary



Radio Relays for Television

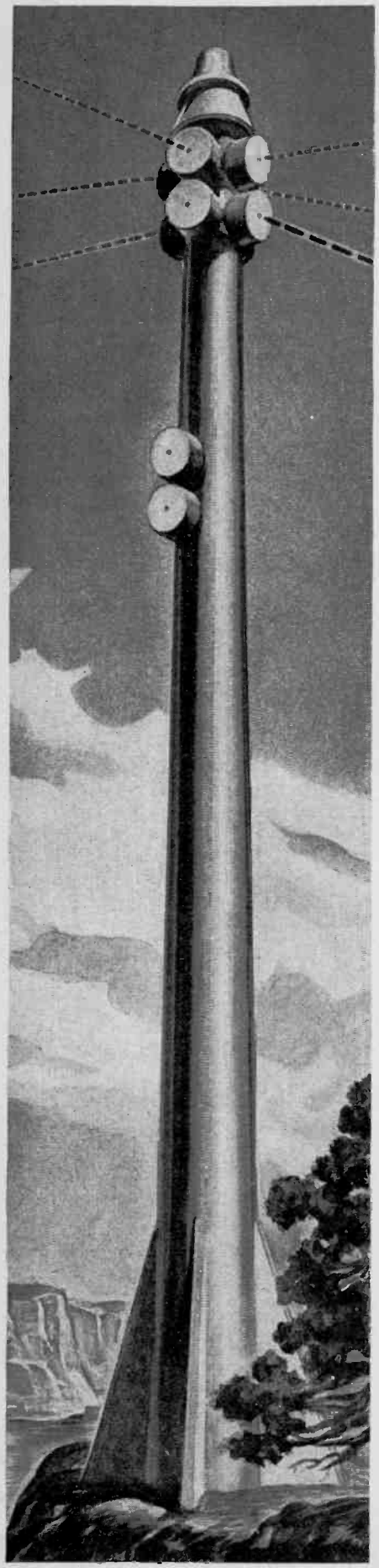
FARFLUNG NETWORKS, LINKED BY AUTOMATIC STATIONS, ARE ENVISAGED BY RALPH R. BEAL

TELEVISION networks—international as well as domestic, made possible by automatic, unattended radio relay stations and other new developments—are envisaged by Ralph R. Beal, Research Director of RCA Laboratories. Turning in the swivel chair at his desk high up in Radio City, Mr. Beal looked reflectively into the west. He was framing an answer to the oft-asked question "What will be new in post-war radio?"

All America stretched out before him as he looked across the Hudson and over the New Jersey countryside. It was as if the emptiness of space above, and the country and its people beneath held the answer. After the war there would be tiny wavelengths for television made more powerful by wartime research; after the war, in millions of homes from coast to coast there would be countless people anxious to see as well as to hear by radio. For almost twenty years they have had network broadcasting; now they are ready for network television.

"Will there really be a nationwide television system similar to that of broadcasting?" Mr. Beal was asked. As if he definitely had found the answer, he quickly sketched the American landscape from the Atlantic to the Pacific, in fact all the world, dotted with a radically new form of "lighthouse"—the radio relay station.

Below his lofty window, directly down 49th Street, at the edge of the Hudson River, a great engineering feat was progressing. Inch by inch, the Normandie was rising out of the mud. And out of the silt of war, Mr. Beal could see another engineering triumph emerging, the definite promise of a radically new method of communication—the automatic relay of television pictures and messages from city to city, from country to country. Just as surely



as the Normandie was rising, so was the dawn breaking on a new era in radio.

"Are radio relays sufficiently developed so that television can depend upon them for distribution of its pictures from city to city?" Mr. Beal was asked.

"Yes, indeed," he said. "Radio can serve itself. Doing so would introduce a new form, or a new branch of radio communication. It will have to be less expensive, of course, than other methods, but there are encouraging indications that this will be possible and practical. Had radio relaying descended upon us at the advent of wireless, we would have looked upon it as a miracle rather than a new artery of communication. Automatic, unattended radio relay stations, located 20 to 50 miles apart, will link television stations into national chains. But the scope of this new development goes much further afield in communication than merely to hook up television transmitters, some of 50-kilowatt power.

"Think what these unattended radio relay stations promise to such vast areas as China, Russia and Africa; think what they will mean for countries which haven't enjoyed the splendid trunk line communication services as found in the United States and the British Isles. It is my belief that in the post-war era other regions will also have extensive trunk line systems of communication made possible by radio relays of telegraph messages, telephone calls, sound broadcasting and television. The routes of these radio relays will extend to any part of the world. They can go through the jungles, from island to island, across mountains and the polar wastes. Neither tropical heat, nor arctic snow, neither fog nor hurricane will 'cut' these global lines. They can be built to be practical, efficient, and foolproof."

Opening a drawer in his desk, Mr. Beal brought out a picture of a radio relay station as the engineers have envisaged it and made it part of their plans. It looks like a streamlined lighthouse with little bulging eye-like windows at the top facing to the four winds. Behind each of these windows is a highly directive centrimeter wave antenna.

The radio relay system is to be no one-way ethereal street, as Mr. Beal charts it. Multiple channels make it all the more promising in efficiency, flexibility and service. The relay towers will handle numerous circuits, for example, down and back from New York to Washington. Furthermore, the circuits can be multiplied to any reasonable extent, not only to carry one television program but several simultaneously, as well as "FM" sound broadcasts, telegraphic traffic and facsimile. In fact, relay circuits should be among the busiest in the air.

The main relay system, envisaged by Mr. Beal, will be like a great intercity spine, becoming interstate and eventually transcontinental. The ribs will spread to television stations. To illustrate its possibilities, he describes it as it is likely to function between New York and Washington: While the NBC television program is being broadcast from the aerial on top of the Empire State Building, a different program will be originating in Washington. Both programs will be fed simultaneously into the relay system leading from Manhattan Island through Philadelphia to the Nation's capital. One Philadelphia station can elect to broadcast the program from New York, while another taps the relay channel carrying the program staged in Washington.

Also, if a New York station, aside from the NBC transmitter, desires to broadcast the Washington program, it can do so by tapping the relay channel. In this way, the relay system becomes a trunk line that can be tapped at will by the television stations, thereby affording greater freedom of program selection and operation. The relay enhances variety in programming, because there may be four or five relay channels simultaneously carrying different programs, which can be selected by the main television stations.

In addition to this main system, there are supplementary methods of operation. In the simplest form the relay stations might serve as links in a chain of stations. For example, if one of these 'radio lighthouses" were located atop the Orange Mountains in New Jersey, its eastern "eye" might intercept pictures from the NBC station on the Empire State Building in New York, and "bounce" them along to the stations in other directions within a 50-mile radius.

Standard television stations within that area would intercept the pictures and re-broadcast them to homes. Simultaneously, these standard stations, as well as the relay stations within the 50-mile circle, would toss the pictures beyond the horizon to be picked up by other stations and relayers. Already telecasts from New York have been intercepted 129 miles away, at the Helderberg Mountains, near Schenectady, without intervening relays in the Catskill Mountains. Philadelphia also has re-broadcast the New York programs without intervening relays. Nevertheless, it has been found that by use of relays, the picture quality is near perfect, while without relays, a degrading effect is inherent, and it is more noticeable as the distance between stations increases.

Radio relaying will be comparatively simple, Mr. Beal explained. The relay transmitters will operate on microwaves with the energy concentrated almost in a beeline. Practically all the power is made to serve a useful purpose; it is not scattered as in broadcasting. Therefore, relatively small amounts of power will operate the relay transmitters. The apparatus is neither cumbersome nor complicated. It is simple and compact. It could not

be otherwise and still perform in the domain of tiny wavelengths which bring radio men so close to the frontiers of light, he said.

"We know, of course," continued Mr. Beal, "that ultra-short waves and centimeter waves travel in a straight line and leave the earth on a tangent at the horizon. The area of the earth's surface touched by such waves, is much like that touched by a stick held against a basketball. Obviously, if we use high towers or antennas on lofty buildings or mountain peaks, we capture and retransmit the waves at higher levels, and therefore their effective range is lengthened. With the use of radio relay stations, the average range is about 30 miles, depending upon the terrain and various other factors. It is interesting to recall that an airplane over Washington, D. C., carrying a television receiver intercepted the pictures from the NBC aerial on the dome of the Empire State Building 200 miles away. But for such long distance reception of the ultra-short waves, the plane had to go up 20,000 feet."

"It is to be expected," continued Mr. Beal, "that television stations will first go on the air in such broadcasting centers as New York, Chicago and Los Angeles. But there is every indication that alert broadcasters will keep pace with them in such localities as Boston, Philadelphia, Washington, Pittsburgh, Cleveland, Detroit, St. Louis, Kansas City, Omaha, Denver, and San Francisco. It seems logical to assume that the first television network linked by radio relay stations, will be formed along the Atlantic Seaboard.

"But television will not be limited to the larger cities. The radio map will be dotted with stations in cities like Schenectady, Utica, Syracuse, Minneapolis, Erie, Buffalo, Louisville and many others. By the use of radio relays, these too will become outlets for the television network which before many years pass after the war, will weave from the east across the Mississippi and the midwest plains to meet a Pacific Coast link striking eastward across the Rockies. A relay station atop Pike's Peak might well be the key station to complete a transcontinental television chain.

'It seems clear that the tree of radio development is about to spread new branches extending in many directions," said Mr. Beal. "The roots of post-war radio television are in the soil of wartime research. They are being cultivated by radically new electron tubes. Radio is being prepared for vision. All America will go radio sight-seeing, for science is equipping the United States with a new optic nerve."

Responding to Mr. Beal's enthusiasm and confidence in nation-wide television, the interviewer asked whether international television would some day be possible. If the ultra-short waves leap into space at the curvature of the earth, how could they ever be made to encircle the globe.

"I firmly believe that we shall find the key to world-wide television," said Mr. Beal. "Radio history will repeat itself. Broadcasting started locally in big cities and rapidly extended to smaller towns encompassing a vast audience. Gradually, east and west coast networks were formed, and in 1927 their wire tentacles met in the Rockies and we had the first transcontinental hook-up."

"Then, before many years, short-wave stations linked the continents and international broadcasting was achieved. The pattern for television will be much the same. The post-war world will be ready for it; television promises to be one of the great contributions of science to the new world. It symbolizes the spirit of the United Nations by bringing new vision to all people regardless of race, color, or creed.

"Just think what television trunk lines will mean to China," continued Mr. Beal. "I have been there and I feel that I know how welcome the new art of radio relaying will be to the millions of Chinese, for it will bring them communications, entertainment, and education on a scale they have never known. What a gigantic task it would be to wire all China and its great open spaces for sound. But how much easier it will be to do the job by 'wireless,' to dot the countryside with relatively inexpensive radio relay transmitters that will give to China a trunk line system of communication, radio, telephone and telegraph. Even the Himalayas will be no barrier to such radio relaying. Their high mountain peaks will speed the process, for relay stations at such altitudes can reach far beyond the horizons of the valleys. China will then have a new Burma Road—a road of television.

"Of course, you will understand," said Mr. Beal in concluding the interview, "that I have spoken of these technical developments from the standpoint of the engineer. I realize, as do others, that it will take money to establish such a radio relay system as I have described. Indeed, it will take more than money. It will require a sympathetic and helpful attitude on the part of Governmental agencies concerned with licensing and regulation and the daring spirit of the American industrial pioneers who have led the way in so many new developments."

The Editors wish to thank RADIO AGE for permission to reprint this article.

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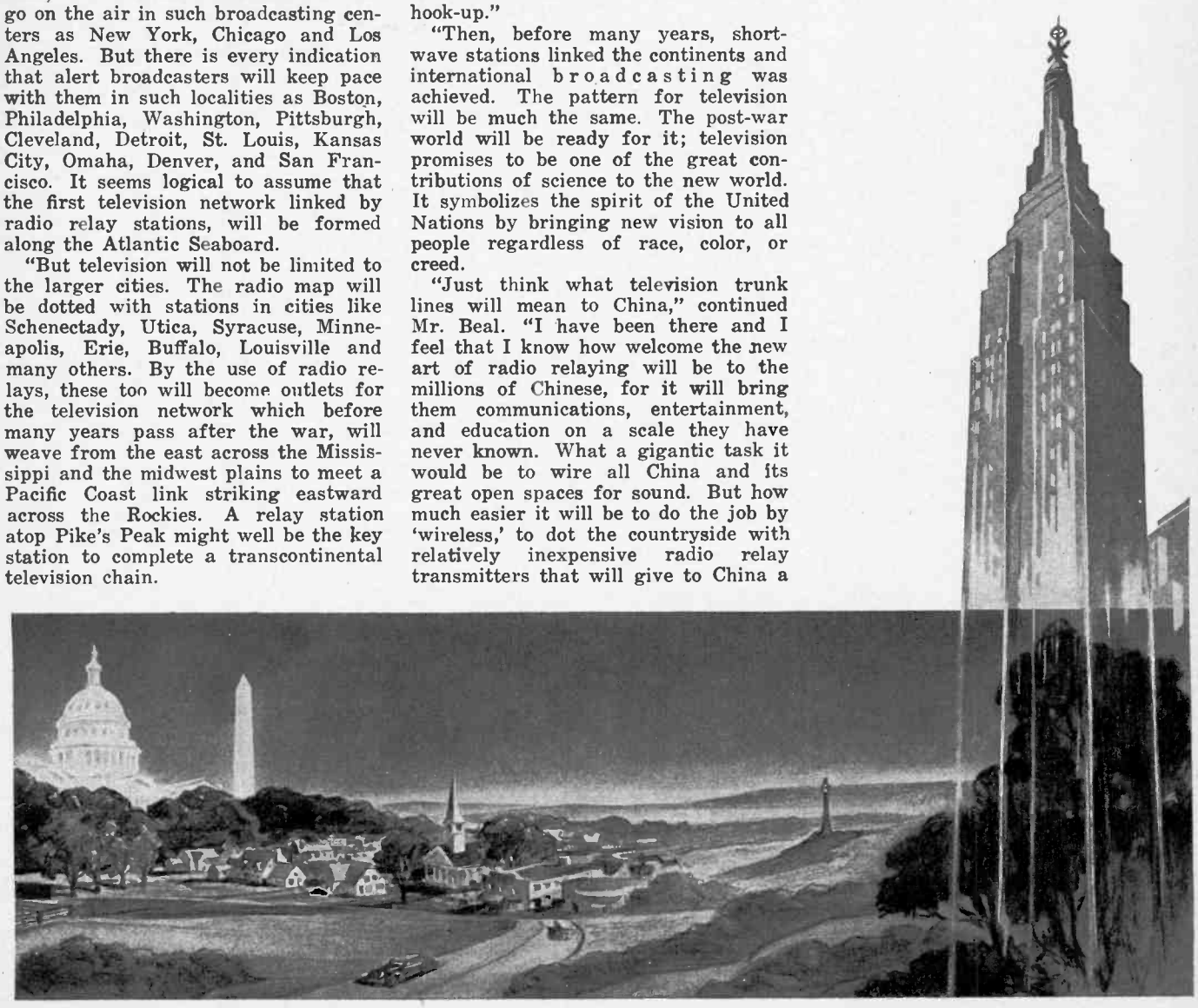


"SPECIALTIES" SAVE THE RADIO DEALER'S STORE!

No. 1 of a series

by

ERICH DUMKE

Prop., Dumke Radio Co.

At first it was only a novelty; but the war made paints the salvation of this dealer's business

BEFORE December 7th, 1941 when radio was going great guns, we had a few items other than radio for sale. These consisted of a small amount of sheet music to please the young people of our neighborhood, a tiny amount of paint (which we hid—and only brought out on demand) and a few appliances of the smaller variety.

We had two servicemen whose only work was to repair radios; and we bid actively for the business. These two men are still with us, having served us and our customers each for 15 years. That is something of a record, we believe.

Now things are greatly changed. To bring in customers, and to bring in, too, a small amount of income, we have become agents for the paying of Gas and Electric bills. This brings us from 20 to 50 persons a day, some of whom also buy an odd thing here and there.

Naturally, we still have our repair business divided between the radios and the electric appliances; only we don't bid on this any more. We have, like many radiomen on the street, more repairs than we can handle. And our two men are kept busy day and night. The story of repairs is too familiar with all radio stores to bear repetition here.

What is most amazing of all is the tremendous increase in our paint business. We carry *NuEnamel*, manufactured by the *NuEnamel Corporation* of Chicago, and it certainly has been a God-send to us. It seems that what with gasoline rationing, and the high salaries, men and women are trying to keep what they have in good repair, by painting. We recently sold as much as $35 worth of *NuEnamel* to one customer who had decided to repaint his house. Since the type of enamel we sell can be used for almost anything from a kitchen table to a car, we do not lack for customers. Our sales of this paint have averaged up to $120 per week. With no new radios and few parts available this has been really the backbone of our store income.

Also we have installed, of all things, pens and pencils of the repeater type. While we could sell many more than we have, and we have had the usual trouble in geting the merchandise, nevertheless we have been successful in disposing of between $10 to $15 per week. This small sum has also been effective in bringing new persons into our store.

We do a fair sized business in appliances and in second-hand radio sets. We would rather rebuild a set which we have purchased, than to repair the customer's set. We find that we have much more latitude in this work and accordingly try to buy

(Continued on page 40)

TECHNICAL SERVICE PORTFOLIO

SECTION XXXXIV

MECHANICAL RECEIVER CONSIDERATIONS

Not all the trouble with sets the serviceman gets lies in the electronic circuit. Some of the best repair jobs can be done on purely mechanical layouts

IN THE foregoing articles of this series, we discussed the selection of tools and equipment for the radio service shop and suggestions regarding their application.

Let us now consider a few of the *mechanical* problems involved in the repair of radio receivers. One of these concerns the reduction in the effects of vibration and shock which are frequent causes of unsatisfactory receiver performance. Sometimes, sets which originally showed no evidence of inadequate protection against the effects of vibration, suddenly develop a microphonic howl which cannot be corrected by the substitution of new tubes. In some cases, of course, this may be due to the present-day tubes which are not as free from microphonic trouble as those of the pre-war variety; but more often the trouble is traced either to incorrect design of the vibration mounting, or to a gradual deterioration in the rubber used for suspension. In any event, something must be done about it.

Fundamentals of Vibration

An understanding of some of the fundamentals of the vibration problem is needed. Every portion of the assembly of the receiver has a natural "period" of mechanical oscillation, depending, among other things, upon its mass and weight. A termal mechanical vibration can be transferred to a portion of the receiver. If this occurs at some frequency differing widely from the natural frequency of the unit which is being subjected to vibration, a resistance to this vibration will be offered so that its effects are minimized. However, if the vibration is the same as the natural frequency of the unit, mechanical oscillation results, causing a more violet vibration than that which was originally impressed upon the unit.

Boomy Cabinets

We see instances of the effects of the natural period of vibration in the "boominess" which results when the natural period of the radio cabinet itself falls within the low-frequency range of the loud speaker. Another common effect is due to vibration of the gang condenser rotor plates (generally at relatively higher frequencies) caused by sound transmission from the speaker to the chassis. Because of this, a bar, occasionally loaded with a rubber strip, in addition to the rotor, is often used to join the rotor plates. These modifications change the period of vibration of the plates to some other (usually lower) frequency which is not so readily transmitted and thus reduce the tendency toward mechanical oscillation, which expresses itself as an acoustic howl.

While the boomy cabinet and the vibrating condenser plates are common illustrations of the effects of vibration, there are others not so well known, which often cause

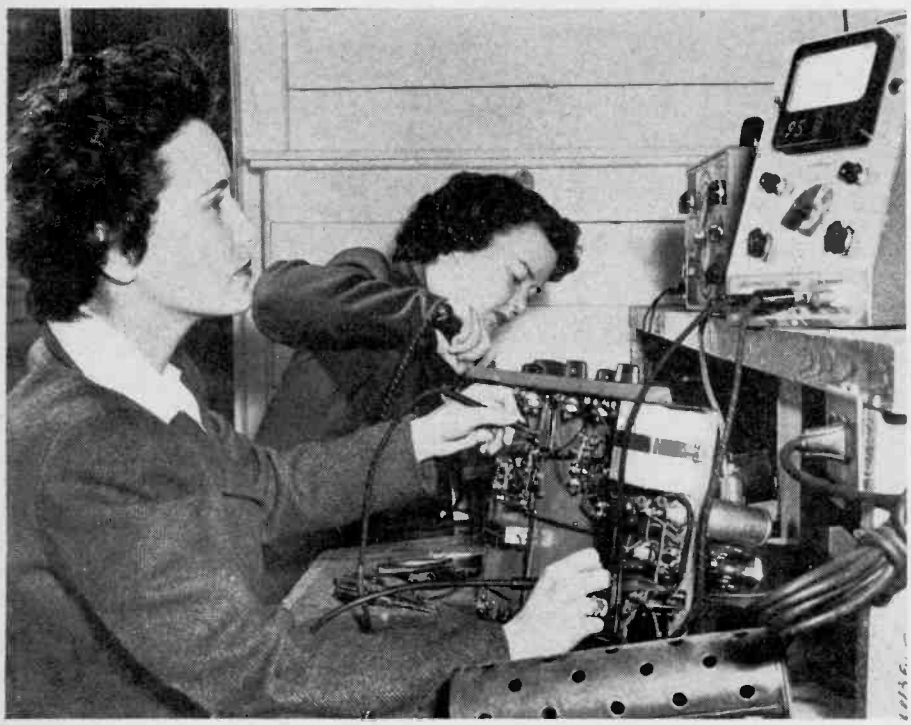
Postwar test sets may be like this one which contains in a single cabinet a tube tester, AC-DC volt-mil-meter & ohmmeter

trouble in servicing. Occasionally, for example, repairs are made in the oscillator circuit of a converter tube or separate oscillator which involve the replacement of a coil, or even of a lead to a coil. If this lead is so placed, or the coil is so mounted, that vibration will change its position with respect to ground or surrounding objects at ground potential, the result is a change in capacity in the circuit, and a consequent variation in signal frequency which takes place at the vibration frequency. This in turn causes frequency modulation of the signal, which seriously affects reproduction. Often a condition such as this results also when shield cans are insecurely mounted after repair work has been done, and any attempts to correct the effects of vibration should therefore start with a good mechanical inspection.

In many cases, howl due to vibration can be overcome by simply readjusting the vibration absorber material or blocks into which the chassis generally fits. Due to excessive heat or drying out of the rubber, these mountings may become tight or hard, thus minimizing their vibration-absorbing characteristics. Sometimes the whole chassis is put in askew, so the mountings likewise become ineffective. By making certain that the mountings are in good condition and properly placed, the trouble may be eliminated without further investigation.

Vibration may occur in any direction; therefore a good vibration mount must permit the unit which it suspends to move freely in any direction. In replacing the tuning condenser and coil assemblies which are usually separately vibration-insulated from the rest of the chassis, we may draw up the mounting screws which pass through the vibration mounts too tightly; or the mountings may not be properly centered. The result is that the effectiveness of the vibration suspension is reduced, many times to the point where mechanical oscillation occurs and howl results.

There may be cases where we know that the vibration mounts are defective, due to deterioration or damage, yet we find it impossible to obtain replacements. In such cases, it is a good idea to tackle the problem of eliminating the trouble at its source, which is usually the loudspeaker. It is often possible to eliminate stubborn cases of acoustic howl by renewing the ring on the speaker dishpan and inserting a felt ring, against which the speaker presses. In other cases, where this method does not do the trick, simply inserting small spacers between the speaker and its baffle, so that the speaker is moved away from the baffle not to exceed a quarter inch, will often correct the trouble. This treatment will affect the bass response, but usually not to a noticeable degree.



ACME

A postwar possibility! These WACS will become the nucleus of radio service personnel and a trade problem

While rubber is pretty scarce these days, it is possible to improvise suitable substitutes. A coiled spring, for example, with a piece of felt added on each end if necessary, can pinch-hit for a rubber suspension. The spring in turn can be made from music wire (for small springs). Felt alone may serve the purpose when it is desired merely to supplement the present mounting.

Appearance Counts, Too

Let us now consider some allied problems along the lines of improving the appearance of the apparatus being repaired. Cabinets, particularly of small receivers, frequently get scratched or chipped. It is a good idea to carry the materials necessary to remove such scratches, in stock. If there is a piano store in your neighborhood, drop in and pay the piano refinisher a visit. He will show you his palette knife which he uses, like an artist, to mix colors to match the color of the part to be repaired. He will also show you the stick shellac which, when heated, is used to fill in such dents. Watch him handle a couple of jobs; it will come in handy in your own work.

For the molded bakelite cabinets used on midget receivers, which so often break, do not use the common cements or glue. From the Bakelite Corporation, or one of its representatives, you can obtain a special cement designed particularly for this purpose. You'll find plenty of opportunities to use it for repairing many bakelite parts. Remember, a good repair job means something more than correcting just the technical deficiencies of the apparatus. To the customer, all too often the relatively minor operations of repairing broken or damaged cabinets are more appreciated than the correction of an obscure performance difficulty.

Refinishing Finishes

Enamels and lacquers will often be required in refinishing articles after repair. Synthetic lacquers which are baked on will, in general, prove to be superior to the air-drying type in that a harder surface finish results, which is therefore more durable. Because a special oven is necessary for this sort of work, it means that the job cannot be handled in the service shop. But the results are so superior when a professionally applied coating is used that it pays to send the work out.

However, a sprayed-on air-dry paint or lacquer far exceeds one applied with a brush. For greatest protection a zinc chromate primer should be used over the bare metal,

(*Continued on page 33*)

ELECTRICAL APPLIANCE Retailing

POST-WAR APPLIANCES.

A PREVIEW OF WHAT'S TO COME

Not without fault has been the electronic writer in conjuring up sometimes vague—and more often wild "dreams" on the Post-War appliance market. Not satisfied with the fact that these United States have by far the greatest preponderance of appliances per capita distribution, and therefore the greatest comfort afforded by these instruments of modern civilization, the "dreamers" have apparently placed such extraordinary units at the beck and call of the public after the war is over, that ELECTRICAL APPLIANCE RETAILING made a short survey of the situation to discover what could be justifiably expected.

"Electric ranges which will include in a single unit: pressure cooker, broiler, toaster, grill and oven; with electronic temperature control for each" is soberly forecast by the Radio Corporation of America in its booklet, "Industrial Science Looks Ahead." Furthermore, the same firm says, "Ceramic stoves which can be made in any desired color" will be available. Also "New types of dishwashers which automatically perform all operations necessary in washing and drying dishes."

In the matter of refrigerators, RCA predicts that there will be a "Refrigerator with compartments of varying degrees of temperature, including super-cold for home freezing."

In the kitchen, we may expect kitchen tables with heat-proof and acid-proof plastic or non-breakable glass tops, also plastic dishes and utensils of any color or design. These will neither break nor chip.

Going into the Post-War bathroom, there will be "Automatic electronic regulation of temperature of the shower bath and basin water." Of course the towel racks will be heated to dry the towels.

The appliance salesman can be expected to offer house windows, electronically operated, which function as ventilators!

The use of centralized vacuum-cleaner systems with intake ducts in each room of the house will be installed, and sold by appliance dealers.

There are a score of manufacturers in the air conditioning business making units which will filter dirt, dust and most important—pollen—from the air. Every hay-fever addict should be a prospect! Then there will be lamps which eliminate bacteria for use in homes having new-born babies and young children!

A new one for the appliance salesman: Fluorescent discs plus electronic spot lights of definite type for remote and cheaper lighting systems!

On the shelf of electronic appliance dealer in items for the present house-owner, one should find: Electronic—

Burglar alarms,

Window shade regulators,

Rectifiers for conversion of AC to DC and vice-versa.

Clocks without moving parts, but with lamps which tick off the seconds and indicate the time in minutes and hours,

Recording of messages by embossing phonograph records, automatically or on motion picture film.

These are what a conservative firm, of national reputation has set forth to be expected in the appliance and allied fields. While no mention is made of the time element as to when after Peace the units will make their appearance on the market, nor who will be the manufacturers, it is to be supposed that since the statements are being made, that they are within the realm of possibility and that the units will be available rapidly after Victory.

What will be the best way for the appliance dealer to be assured that his store will have its share of these wonderful developments? It seems that the best bet is to stick tight and wait for the firms to come to him. Yes, and tying up with a few leaders at this

(Continued on page 38)

This is the unimposing store front of the place which made us $50,000

Smart DEALER BEATS APPLIANCE SHORTAGE

YES, SIR, WE have electric irons! In fact we have almost everything a customer could wish for in electrical appliances. This year, in spite of the scarcity of appliances, we expect to gross well over $50,000.00 from our small store which fronts 15 feet on the avenue and is 45 feet deep. With that we also have a cellar which we call our "bank."

9210 S. Wabash-avenue.

ELECTRIC APPLIANCE MART

Electric irons, all types. Electric heaters; small A. C. and D. C. portable radio-phonograph-recorder combination. Intercom. system, master unit with four stations. Small electric dry cleaning machine with fluid. Portable electric table mangle; adjustable heat control; toaster; waffle baker; broiler; hot plates; Mixmaster attach.; Kitchenaid heavy duty mixer with food grinder attach.; electric percolator; pressure cooker; 36x54 inch electric heating blankets; electric fans; sewing machines; de luxe T. T. electric range with 5 automatic features; kitchen fluorescent light units; quartz ultra-violet treatment lamp, built-in timer with carrying case. Also available on rental basis.

OPEN SUNDAY, 10 TO 5.

Kimbark Electric Appliance.

1309 E. 53D-ST. PLAZA 2700.

HEINEKE for cleaning tumbler—Motor driven; druggist's scale; jeweler's scale; exercises with

This is the small advertisement which weekly brought us buyers

And we grossed every one of those fifty thousand dollars the hard way!

Long ago, we decided that there really was no reason why we could not pass our competitors. We believed that we had the key to their one weakness; it was, "Wait for the other fellow."

We proposed to wait for nobody!

We have consistently done our thinking and planning well in advance of taking any action. That, too is a fault of most dealers: they do not indulge in enough skull practice. So they miss their opportunities, even though they are all around each one of us. For example, while this is being written the winter season is just starting. Yet we are buying up fans! But heavily! Not for now,—no,—for next summer when almost anybody will be more than happy to pay a fair price for a nice breeze on hot Chicago nights!

It will surprise the dealer who looks into our windows or showcases to discover that we have not a single, solitary *new* article for sale. Except for some small appliance replacement parts such as cords, plugs, elements, tubes, and the like,—we simply have *nothing new* in the house! How then, are we able to make a turnover of roughly a thousand dollars per week?

Here is the secret. It is an air-gun and a lot of cream-colored, fireproof air-drying enamel! Sometimes, in peace-times this was known as "eye-appeal." Well, it's still eye-appeal that sells the appliance. Yes, sir, eye-appeal backed by a well-working unit does the trick! And here is how the store is kept full to overflowing with appliances *(and no black market stuff for us!)* and the cash register keeps up its merry ding-dinging!

One of our two employees,—the other is a part time bookkeeper,—goes out at least three times a week with his pockets crammed full of cash. He goes appliance-hunting! You will find him at auctions, answering ads from the classified sections of all the papers, at second-hand dealers, at pawn shops and wherever he thinks he can root out an old stove, a broken-down iron or a beaten mangle. He has a fine "nose" for appliances; once said that he could smell a washing machine which was for sale at least a mile away. Judging by his good purchases, we think he's dead right.

Well, whenever he finds the appliance, he buys it then and there. Gradually he loads the car to the roof top—even sometimes comes back with a stray appliance tied on the radiator. The units usually are both old and "junky." None

by

harold e. wollenhaupt

Owner, Kimbark Electric Appliance Co.

By careful planning, and excellent foresight this appliance dealer has found that there is no shortage in merchandise for him

These well-filled shelves have not even one single new item on them. They're all reconditioned units

would think that they had a dollar left in them. We store them in the cellar. That's why we call it our "bank."

As business demands we take the units from our "bank" and put each through the same routine. First we diagnose what is wrong, then we repair it mechanically and electrically. Next we give the machine a rigid test, because we guarantee all of our units for one year after sale! Next we apply the "magic"—several coats of air-dry, cream-colored enamel.

And what looked like a dirty, chipped, impossible-to-sell stove or washing machine turns out as a respectable, eye-filling, "new-looking" appliance for which we have more customers than we have units.

It is as simple as that!

The same routine is applied to old radio sets. Have any of you dealers thought that it was the dirty cloth grille and the chipped wood that prevented your getting rid of those old midgets? Well, take it from us, it is!

What we do with old radios is to repair them first, using whatever substitutions we have to make the set operate. Then the rigid test because we also guarantee our radio sets for a year. Next we replace the old, worn-out, dirty grille cloth with a swell piece of *shimmering, silver cloth*—and do the customers go for silver—and finish the cabinet with an air-gun applied coat of mahogany varnish, lacquer or color, depending whether the set is a table-top unit or a "midget." Our sets look better than new, if that were possible; and the customers never have failed to empty our showcases.

We have never made any claim that we were selling new equipment; it is sold as "rebuilt, reconditioned and guaranteed," or *RR&G*, as we say it. We guarantee everything we do except the electric cords which were not guaranteed in the first place when the unit was new.

That is all there is to the secret of our success; we have had the courage to go out and do a bit on our own account without waiting for the other fellow.

Furthermore, our selling is not confined to the neighborhood where the store is located. That would be too narrow a market for our operations. So we have taken to placing a classified ad, similar to the one which is illustrated herewith, on the front page of the classified section of Chicago's largest newspaper. It has brought us customers from all parts of the city and suburbs. Also we have had other dealers as our customers; we sell them at a ten percent discount from list! But we only do that when they are short, because we really haven't enough for our own customers.

In the matter of purchases of staple replacement items, we have done our thinking "on our feet." That is, when Pearl Harbor came up and war was declared, we saw at once that radio replacement parts would become as scarce as hen's teeth. So we stocked up moderately on what we thought we could sell and what we believed we would need for repairs. As a result of that policy we actually have been able to furnish *50L6's* when they were needed!

One other policy has been successful with us. That has been our offer to the customer to exchange his broken radio for one RR&G which closely approximated his. In other words, *we have not had to repair anything other than our own sets!* Naturally, under those circumstances we have been able to make substitutions which would have been impossible if the customer retained his own set. Well, if not impossible, it would have taken a lot of sales talk and *time*. And *time* is what we have the least of!

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SEEN, HEARD, PROPOSED & PRODUCED

On this page the Editors plan to keep the dealers well informed on what is going on in the appliance & allied fields

Movies Appliance Minded

Silex Automatic Electric Steam Iron is seen stealing the scene from no less a personality than Veronica Byrnes, popular Ziegfeld Follies showgirl. Among other improvements over ordinary steam irons this iron spreads steam over the entire ironing surface instead of concentrating the steam at one point. This protective steam-cushion makes the *Silex Automatic Electric Steam Iron* especially effective for the ironing of synthetic fabrics, like that used in Miss Byrnes' costume. This is a proven product which will be available for Post War Delivery.

Crosley to Expand Household Appliances

To keep employed after the war the greater part of its peak force of 8,000 employees and to re-employ its 1,250 former employees now in the armed forces, *The Crosley Corporation*, of Cincinnati, plans to enter into new production fields, when victory comes, and to expand its pre-war major household appliance operations.

This program was outlined by James H. Rasmussen, commercial manager of The Crosley Corporation.

"We agree with those who believe that there is a great pent-up demand for appliances," Mr. Rasmussen said. "We believe that the volume of sales will be even larger, for at least a short time after unlimited production starts, than it was in 1941.

"Like practically every other major manufacturer, we propose to do more business on the products we formerly sold for two reasons: (1) Because the market will be larger; and (2) because we are preparing to secure a larger percentage of the total business.

"We have come to the conclusion that, if we are to keep our peak force of 8,000 persons employed after the flush of the pent-up demand has been satisfied that we must develop markets we haven't formerly been in and that means we must produce new products.

"Some of these products which will be new to us will also be new to industry, or practically new, because the market had hardly been scratched.

"We will continue to produce electric refrigerators and, being in the refrigerator business, it is logical that we enter the room-cooler field, which was just beginning to come into its own in 1941.

"There will be a big demand for frozen food cabinets. Again, that's a field we fit into, because we are in the refrigerator business.

"We plan on enlarged activity in the gas and electric range business, as well as in the washer and ironer business, including an automatic washer.

"We are very much interested in the electric dish-washer. We think that's going to be a big field when we can develop one that really does the job and at a price that people will pay. A housewife spends three times as much time each week in washing dishes as she does in washing clothes.

"These are some of the products we are studying carefully — there are others.

"This diversified product program is not an over-night program. We will not start production on all these products the day the war ends. It may be a five-year or ten-year program.

"We will manufacture first those items which we formerly produced. We will add new items, one at a time, as we are sure they are ready for production, and when we know that our distributors are ready to absorb them into their programs.

"Distribution costs in our industry have been reduced considerably during the past ten years. They are low now; much lower than in many other industries. However, if working together, we can learn how to make a fair profit at a reduced cost of distribution from the factory, from the distributor and from the dealer, and still give efficient service—then we will be prepared to make a still further contribution to industry and consumers alike.

"Distributor profits are not too large; costs must be reduced before we can start talking about reducing margins.

"Some manufacturers have decided to handle all or a substantial part of their distribution through factory branches. Some time ago, we announced that there would be no change in our program—that we believe in the independent distributor.

"This is not a subject which is new to The Crosley Corporation. We have operated branches in several sections of the country, some for more than twelve years. We have been actively studying this phase of our business in our post-war planning program for more than a year.

"Our considered opinion is that independently-owned and operated distributorships will deliver a better over-all service to the trade and to the consumers alike, because:

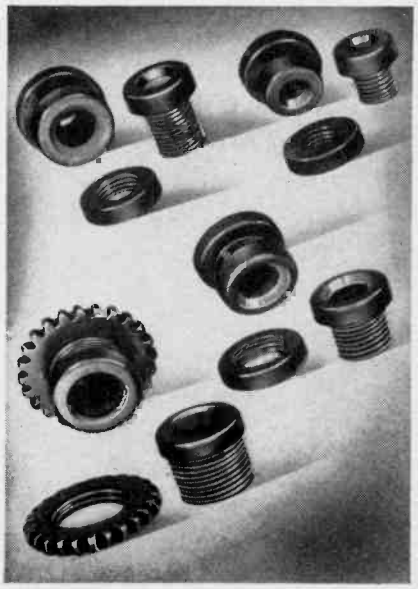
(1) Small business is the basis for the American system of free enterprise.

(2) Distributors, with their own money invested in the business, will give better service, as they have more at stake.

(3) An independent distributor knows more about local conditions in his home town and can be of more direct help to dealers.

(4) Factory managers are inclined to "yes" the factory, while independent

(Continued on page 39)



The Fundamentals of

CLASS A AMPLIFIERS

Since almost all driver-amplifiers are of the Class A type, this article should be a welcome bit of valuable information for the serviceman

by

oscar e. carlson

★ A Class A amplifier is defined as an amplifier in which the grid bias and alternating grid voltages are such that plate current in a specific tube flows at all times. This type of amplifier circuit finds its greatest use in radio receivers. The radio frequency, intermediate frequency, and first audio amplifiers of a receiver are invariably operated as class A amplifiers. It is safe to state, therefore, that this is the most important type of amplifier that the radio technician encounters. Consequently, a thorough knowledge of the principles of operation of such an amplifier stage is essential.

Voltage Amplifiers

In the above-mentioned stages of a receiver the design is such that the stages operate as voltage amplifiers. It is to be remembered that in the r-f and i-f stages the r-f voltage to be amplified is modulated by the audio signal at the transmitter so that we have in the receiver a minute voltage at radio frequency that varies in amplitude as does the modulating voltage at the studio and whose "frequency intelligence" is a function of the sideband frequencies accompanying the carrier. The sole function of a radio receiver is to strengthen these minute r-f signals and then convert them again to frequency and amplitude variations in exact accordance with the modulating signal at the transmitter. A tremendous amplification of that minute r-f voltage is necessary before it is to be demodulated and raised to a power value sufficient to drive the loudspeaker or headphones of our receiver. We must therefore of necessity amplify this modulated waveform to a true but enlarged reproduction of its original. The class A amplifier is by definition the only amplifier which will reproduce in the output circuit a reproduction of the full alternating input voltage using only one tube to the stage.

Since the output voltage is desired to be a true reproduction of the input voltage, the average plate current, *Ip*, should be the same between conditions of no input voltage and full input voltage. This is an ideal condition which if attainable would result in distortionless reproduction of the input signal. This is impossible of achievement since the mutual characteristic, or *Eg-Ip* curve, would have to be a perfectly straight line over the entire operating range of *Eg-Ip* as shown in *Fig. 1* to achieve such a result.

This curve never has a true straight line function over any large portion of its length. The procedure is to operate the tube over only the "straightest" portion of such a curve. *Figure 2* illustrates an exaggerated form of *Eg-Ip* curve, showing the signal voltage on the tube's grid and also the distorted plate current variation that results. Since the output voltage is merely a function of that varying plate current through a load resistance, or impedance, the output voltage would show that same distortion. This distortion would be passed on to the input of the next stage and amplified.

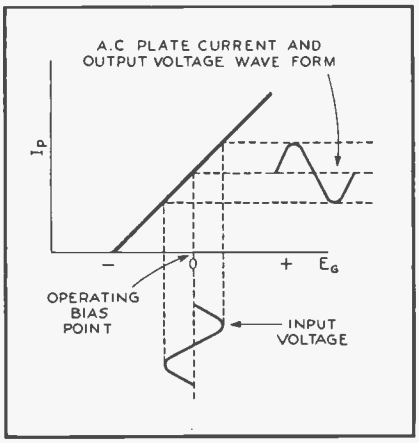


Figure 1

From *Fig. 1* we can readily see that for distortionless reproduction the d.c. value of plate current is the same under no-signal input conditions as with signal input. This

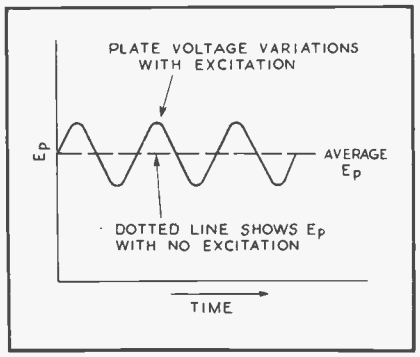


Figure 3

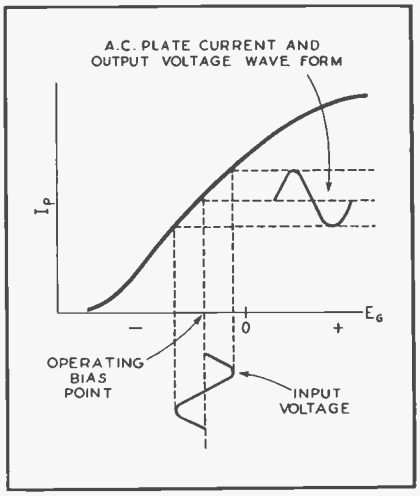
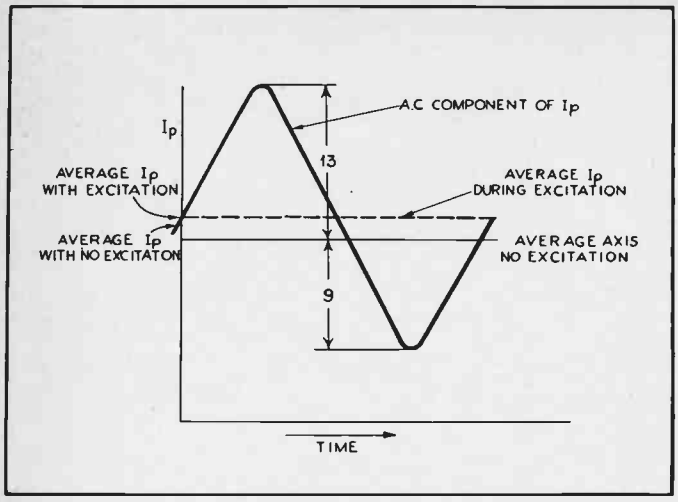


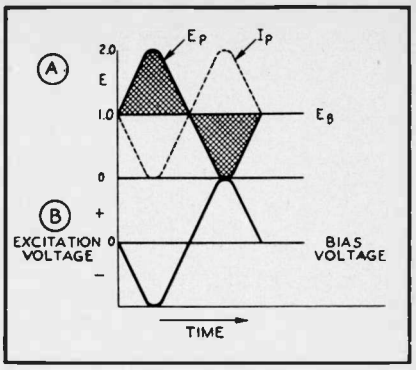
Figure 2



Left: Figure 4

Right: Figure 6

Below: Figure 5



would be true due to the fact that the reproduced output waveform caused by sinusoidal input would be purely sinusoidal and its average value would thus equal zero. *Figure 3* illustrates the plate voltage variations over three cycles of sine wave input, assuming a straight line mutual characteristic. The solid line sine curve illustrates how the plate voltage varies. The average voltage change for one complete cycle would then be zero volts as mentioned above. The average, or d.c. plate current would then remain the same as for no excitation.

Figure 4 illustrates the practical attainment. Here it is seen that the variation of *Ip* and *Ep* above the quiescent, or average, axis is not equal to the variation below that axis. It may then be considered that rectification takes place due to the mutual characteristic non-linearity and the d.c. plate current drawn by the tube is greater with excitation than without. The output voltage waveform is now slightly different from the input voltage waveform. This distortion from the original is caused by the addition of harmonic content and is a result of the addition of all the harmonics present plus the fundamental waveform. Since this distortion is a function of the displacement of the plate current axis of *Fig. 4* we may state that that displacement is equal to the integration of the harmonic distortion. If the alternating component of plate current for an amplifier tube operated class A is 4 milliamperes and the d.c. displacement is .5 milliamperes we have then 12.5% harmonic distortion.

The major offender is the second harmonic and fortunately the ear can notice little if any distortion below about 10%. It is practical to design and construct class A amplifiers having less than five (5) per cent distortion once a thorough knowledge of the amplifier theory is attained and utilized. *Figure 5* shows effects tied together on one diagram. For those readers who wish a more rigorous and mathematical treatment of this harmonic generation, a bibliography is appended to the end of this article. We can now draw the conclusion that distortion can be greatly minimized by utilizing as little grid excitation voltage as possible thus assuring operation over a fairly straight portion of the mutual characteristic, and by using a bias and plate voltage of such value that the operating point of the tube is selected at the center of the straightest portion of that mutual characteristic curve.

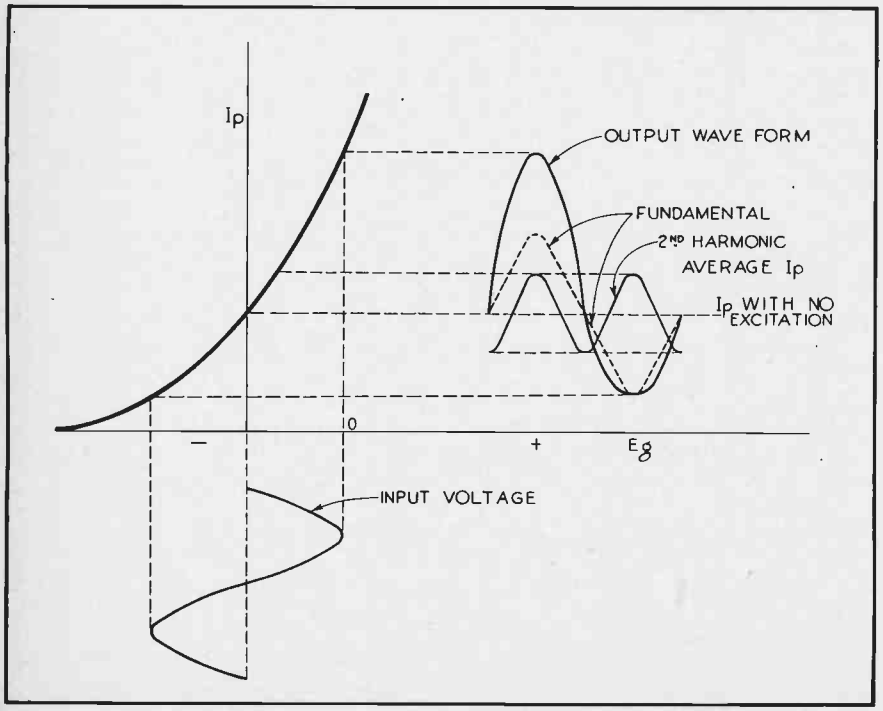


Plate Efficiency

Since plate current flows at all times thus causing a continuous expenditure of power within the tube the efficiency will be low. Maximum attainable efficiency would under conditions of minimum plate current necessitate an *Ep* equal to twice the normal *Ep* without excitation and consequently maximum *Ip* would result in no *Ep*. Sufficient excitation would be needed to accomplish that. To do so the mutual characteristic would be a straight line from zero *Ip* to maximum *Ip* as shown in *Figure 1.*

Figure 6 illustrates the necessary variation of *Ep* for maximum plate efficiency. The plate efficiency, being power efficiency, is then equal to:

$$Efficiency = \frac{Power\ input}{Power\ output} = \frac{DC\ Power}{AC\ Power} \times 100\%$$

In *Fig. 6* for ease of explanation we have set *Eb*, the plate voltage with

(*Continued on page 26*)

SPRAGUE TRADING POST

A FREE Buy-Exchange-Sell Service for Radio Men

FOR SALE AT ONCE — Best stocked radio shop in central Missouri. 2000 tubes, many scarce types, transformers, etc. Compl. test and sound eqpt. Doing $150 weekly labor. Must sell quickly—called to Navy Jan. 15th. Address: Radio Service, P. O. Box 606, Lebanon, Mo.

WANTED—Meissner hi-fidelity P.A. tuner. Also want "Servicing by Signal Tracing," "The Oscillator at Work" and other Rider books, also "Radio Operating Questions and Answers" by Wilson and Hornung. Edward E. Materski, 1950 Trowbridge St., Hamtramck 12, Mich.

WANTED — O-1 Milliammeter of good, std. make. Also want 50L6, 25L6, 43, and 6SQ7 tubes; small converter (vibrator) for changing 110 V. DC to 110 V. AC, or what have you? Bela B. Paine, 1186 Lexington Ave., New York 28, N. Y.

WANTED—RCA bound volume service manuals, 1937-1939-1941 and 1942. Also need 2 each 50Z7G and 50Y6G or GT tubes. Will pay cash. What do you need? Louis J. Long, 652 E. 19th St., Indianapolis, Ind.

WANTED—Dependable model 411 universal supertester, and AC-DC V-O-M, pocket type for 110 V. AC-DC. Norbert Levandosky, 2631 Yorkway, Apt. B., Baltimore 22, Md.

FOR SALE—Philco model 42-PT87. What do you offer? Will trade for Echophone EC-1. Sgt. Don Mushrush, 431st S.E.F.T. Sqdn., Napier Field, Ala.

FOR SALE—One Webster SB7 amplifier with complete set of new tubes. In 1st class condition. Uses 2-56, 2-A3, and 1-5Z3 tubes. Make offer. A. B. Smith, Box 173, Mandeville, La.

FOR SALE—Unused Rider's manuals vols. 1-13 complete. $120. M. Okin, 915 Bryant Ave, New York, N. Y.

FOR SALE—One Clough-Brengle CRA 3" scope; one model 81A frequency modulator unit. Used very little. $100 for the two. Herman McMasters, 1800 So. 26th St., Terre Haute, Ind.

WANTED—One portable tube tester, emission type preferred. Cash. Charles L. Bryant, 619 McAlpine St., Talladega, Ala.

TUBES TO SELL OR TRADE—Write for list. Sikking's Radio Service, 116 No. 6th St., Springfield, Ill.

WANTED—Selective analyzer, also any number of following tubes: 12SA7; 12SK7; 12SQ7; 50L6; 35Z5 and 25L6. Name price and quantity. Roy Kappresser, 4233 W. San Francisco Ave., St. Louis, Mo.

FOR SALE—Complete set of Sickles video and audio I-F transformers for television receiver. Also RCA magnetic scanning transformers, kinescope yoke, 1852, 1853, and 879 tubes. Phillip Rosenblatt, P.O. Box 905, Hoboken, N. J.

WANTED—RCA-Rider chanalyst and RCA signalyst and V-O-M. Good cash price for A-1 units. Don Y. Yen, Rockford, Mich.

WANTED—Readrite #710A set tester for repairs, or octal plug-in to fit same. Albert Ratcliffe, Box 148, Hilda, Alta., Canada.

FOR SALE—Sound eqpt., test eqpt., and radio parts. Send for list. Fox Sound Eqpt. Co., 435 S. Fifth St., Richmond, Ind.

FOR SALE — Triplett Voltohmmeter a-c and d-c, and signal generator combination portable, $25. Also, one Tobe condenser tester, $10. Both like new. Home Radio Service, Plymouth, Wisc.

WANTED—Thordarson output transformer #T-15S93 or T-17S15. No others will do. Urgently needed! Evanshire Radio Shop, 520 Main St., Evanston, Ill.

WANTED—Solar capacitor checker model QCA; also Triplett 1232 a-c signal generator or Philco #077. Will pay $30 for either unit in good condition. Chas. Becker, 1833 Bathgate Ave., Bronx, New York, N. Y.

WANTED AT ONCE—V.O.M. in good condition—any type. Will consider combined tube tester and V-O-M. Floyd Howard, Hodge, Ia.

FOR SALE—Clough-Brengle OM-A r-f signal generator and oscillator—or will trade for a tube and set tester. C. W. Thompson, 6326 Repton St., Los Angeles 42, Calif.

WANTED—A good oscilloscope for cash. B. W. Jones, Delta, Pa.

WANTED—RCA voltohmyst, Jr. in A-1 condition. Also need tuning condenser for Belmont model 636. McKerral Radio Service, 211 Garfield, Laramie, Wyo.

FOR SALE—Radio tubes, parts, etc. special brands, slightly used or salvaged items. Send list for quotations. J. C. Thimijan, 715 N. 7th St., Lake City, Minn.

WANTED FOR WAR RESEARCH —Supreme 561 or Hickok 180 service oscillator; Supreme 562 audolyzer or equivalent signal tracer; Supreme 504 or equiv. tube tester, condenser analyzer. Prefer 110 v. 25-cycle, but can use 110-volt, 60-cycle. Give full details. Canadian Research Institute, 463 Spadina Ave., Toronto 4, Canada.

FOR SALE—Large quantity Signal Corps #18 gauge wire. Will send sample. Geo. A. Hutchins, c/o New Mertens Hotel, Grand Rapids, Mich.

WANTED—A signal generator a-c operated unit; tube tester not more than 2 years old; a multi-meter with ohmmeter range at least 10,000,000 ohms and obtained from self-contained battery, operating instructions, test leads, adapters, and all eqpt. included, all in good operating condition. Thomas C. Knight, 2400 Amherst St., Brunswick, Ga.

WANTED—Will pay cash for V-O-M with a-c and d-c ranges, in good condition. Also want late type tube tester. Richard Grabowski, 183 Columbia Ave., Irvington, N. J.

WANTED—Riders manuals, multitester (such as Precision EV-10 or equivalent). Also want signal generator and tube tester. Must be late models. Vernon Prunyi, Undercliff Sanatorium, Meriden, Conn.

FOR SALE—Full-wave dry selenium rectifiers. Input 50 V. AC. Output approx. 25 V. DC at 1.5 amp. Will withstand short duration overloads and have long life when properly used. May be rebuilt easily to suit your requirements. E. R. Dietz, Route #5, Jackson, Mich.

WANTED—Good cash price for Hickok test eqpt.: #530 tube tester; #155 tracemeter; #145 appliance tester; #177x or 188x generator; #110 vac. tube voltmeter. Also want Solar #CE-Exam-eter analyzer; Sprague Telohmike; Sprague #MA-1 Interference Analyzer; Sprague #IL-2 Interference Locater; and Cornell capacitor analyzer #BF-50. Roxy Radio Repair, Mitchell, S. D.

FOR SALE—Thordarson 6-tube hi-fidelity 2A3 amplifier; Miller 10-tube F-M tuner. Both with std. panels for rack mtg. Jensen hi-fidelity 12" PM speaker in bass reflex cabinet. Precision 2-panel test inst. rack with light. Want 2" 'scope or larger, cash, or what have you? John Repa, Jr., Richlandtown, Pa.

FOR SALE—One 40-watt P.A. system. Two new Wright Decoster "Donut" speakers. One Astatic crystal mike. One 110 V. 60-cycle 350-watt light plant. One Philco signal generator with batteries. One Superior analyzer, 5 megs. A-C operated. All in perfect condition. Send cash offer. W. S. Frank, R.R. #3, Chippewa Falls, Wisc..

FOR SALE—Rider's manuals vols. 1-4-5-6 in perfect condition. First offer of $27.50 takes them. J. L. Roberts, Howard, Kans.

WILL SELL—National HRO Sr. in perfect condition. Complete with power supply and six sets of coils covering short-waves and broadcast spectrums. Make offer. Also have Supreme analyzer #551 in excellent condition. Edward E. Materski, 1950 Trowbridge, Hamtramck 12, Mich.

FOR SALE—¼h.p. motor; 1/3 h.p. also ½ h.p., also 1000-w 40 v. DC generator. Two fans $8 each. Write for details. Hastings Electric Supply Co., Hastings, Mich.

CASH WAITING

for your unused parts and equipment

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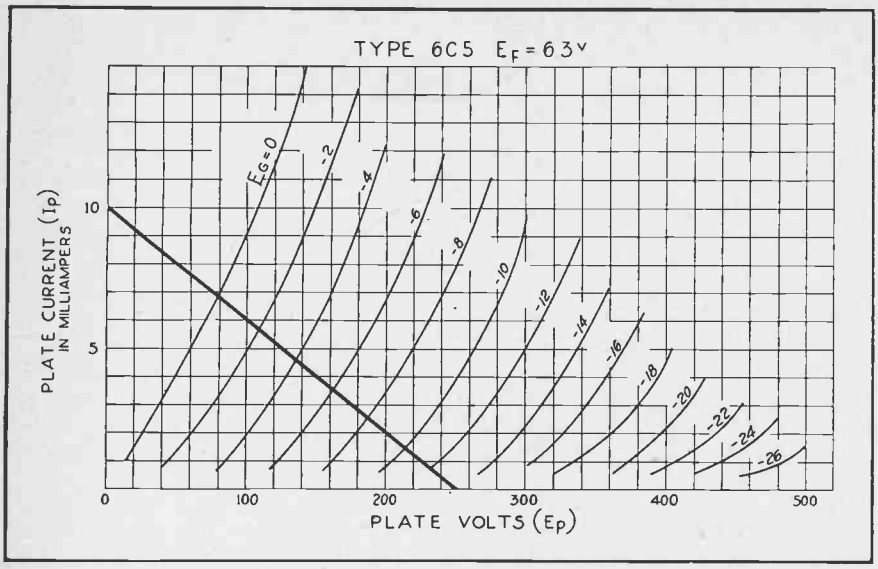
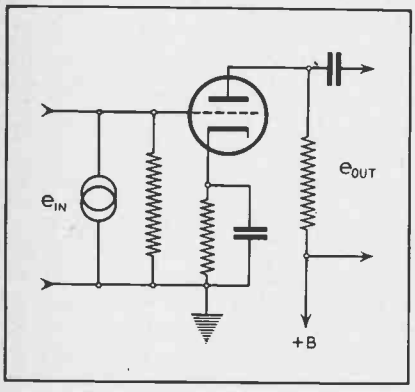
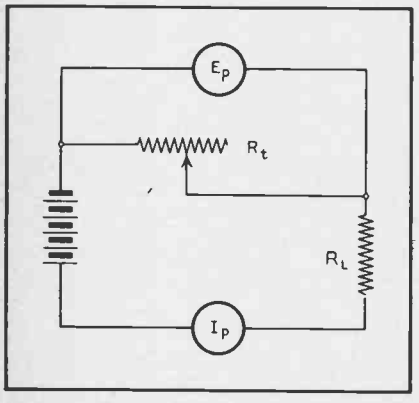


Below: Figure 8

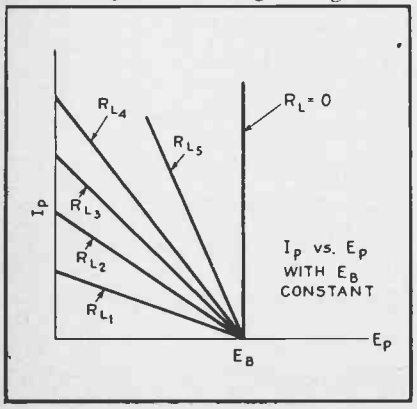
Above: Figure 7



Below: Figure 9



Below: Figure 10



Right: Figure 11

no excitation, equal to unity, or 1; *Ep* varies as the sine wave input and the output voltage, being a.c., is that portion of the figure that is shaded. The peak output voltage by our above explanation is then also unity. The r.m.s. output voltage will then be .707. This should be familiar to all readers as it is merely the r.m.s. value of a sine wave as referred to its peak value. A very thorough solution of the integration that gives this answer is to be found in *"The Calculus for the Practical Man"* by Thompson, on page 251. The d.c., or input voltage, is given as one volt. Since the load resistance is not a variable, the power varies as E^2. The d.c. power is 1^2, or 1. The a.c. power is $.707^2$, or .5. The plate efficiency is then .5/1 × 100%, or 50%.

In practice an efficiency of from 15% to 20% is quite good due to the fact that high excitation cannot be used. A high ratio of power amplification may be achieved since low excitation voltages are used and the power requirements for excitation are not high.

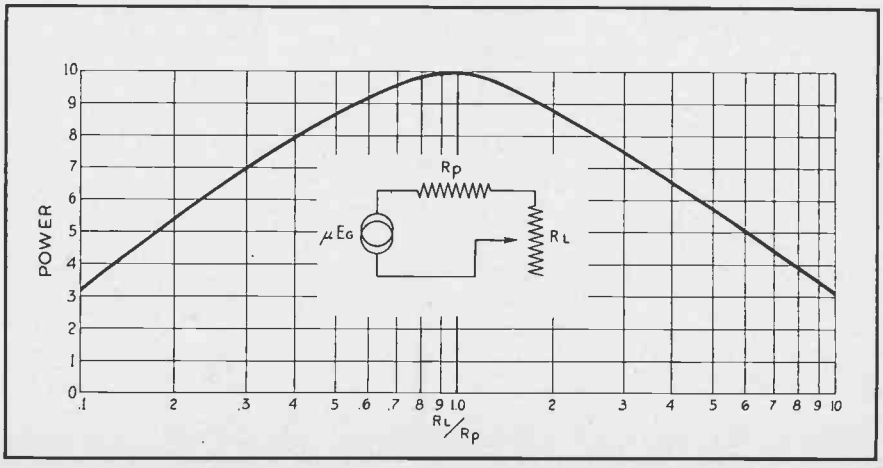
Analyzing Tube Performance

The Mutual Characteristic curves as used herein are of little value in design applications. The plate characteristic, or *Ep-Ip*, curve is more adaptable to design work and is found in most tube manuals as published by various tube manufacturers. A family of such curves for a 6C5 is found in *Fig. 7*. Each curve is known as a "constant control grid voltage plot" and represents variation of *Ip* with varying *Ep* and the control grid voltage fixed.

Any one of such a family of curves is a graphical representation of a very complex algebraic equation that is beyond the scope of this article.

Let us take a typical triode resistance capacitance-coupled amplifier as shown in *Fig. 8*. *Fig. 7* is then a graphical representation of the operating characteristic of the tube we use in *Fig. 8*. From that we must determine the operating characteristics of the circuit in which the tube is to be used. Since the tube manufacturer has furnished us with the graphic representation of the tube performance we must now provide similar representation of the circuit performance. We might call this the "Circuit Characteristic Curve." Such a curve is found as follows. We can replace the vacuum tube of *Fig. 8* with an adjustable resistor as shown in *Fig. 9*. We can do this for the very elementary reason that the vacuum tube functions as a variable impedance. When biased to the plate current cut-off point, the tube then offers an infinite impedance to the flow of current through it. The value of that impedance is a variable, and depends upon the anode voltages which permit varying currents to flow. Each

(*Continued on page 28*)



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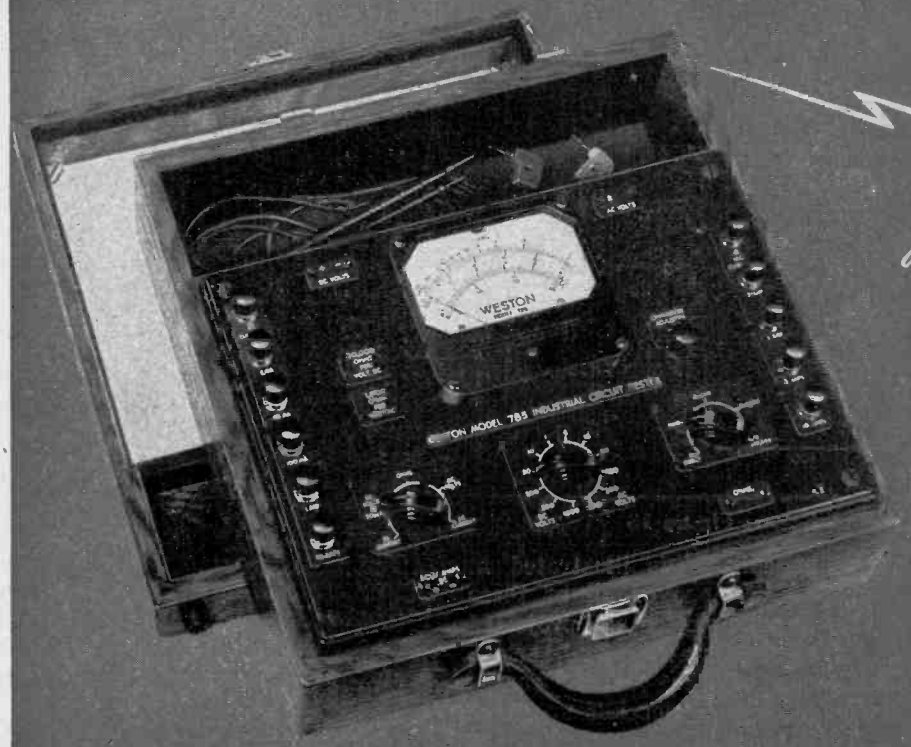

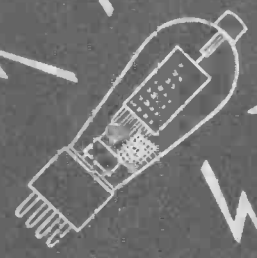

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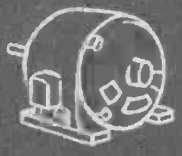

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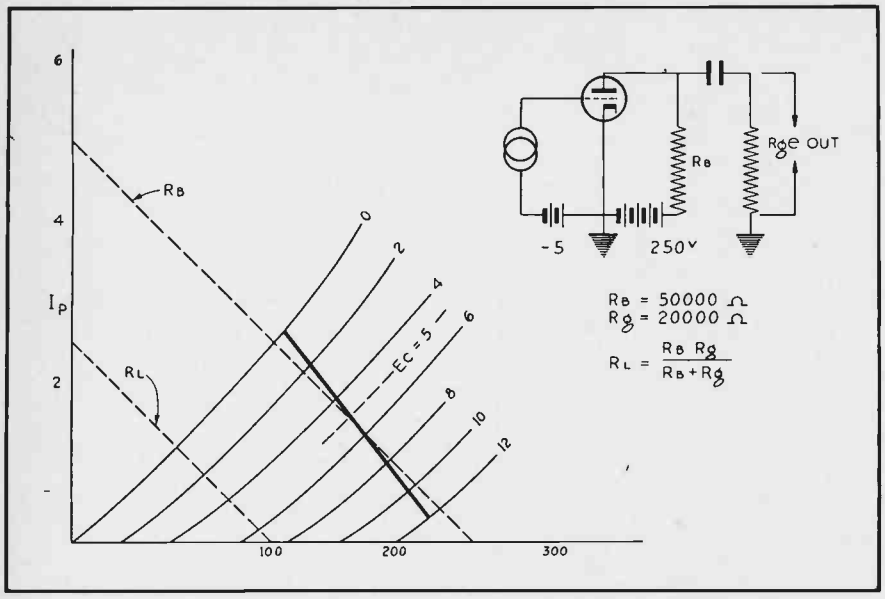


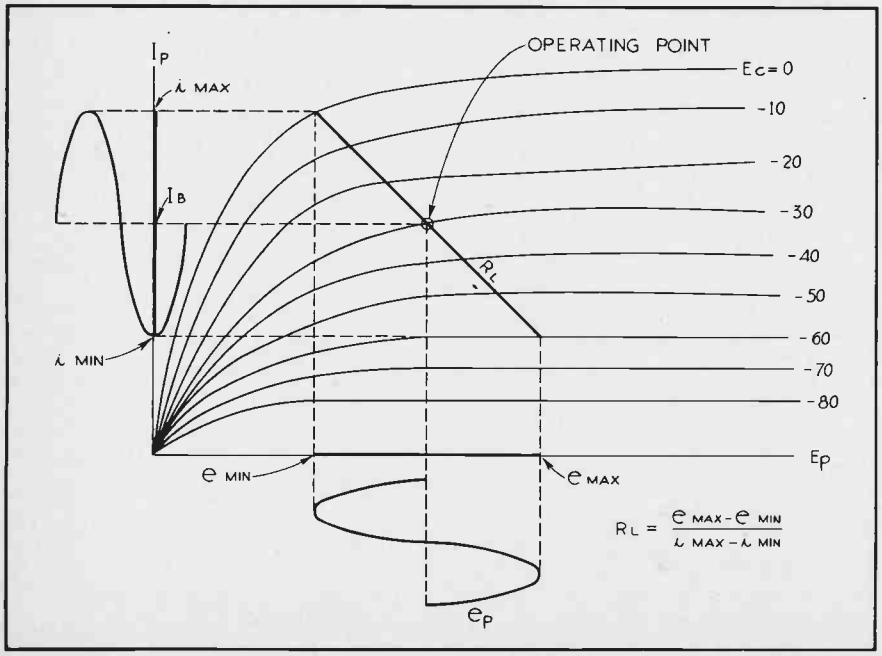
Above: Figure 12

Below: Figure 13

different value of *Ip* for the same plate supply voltage represents then a different value of impedance and is controlled by the grid potential.

In *Fig. 9 Ep* is the voltage that would appear between the cathode and the plate of the tube. With a constant plate supply voltage and constant load resistance, R_L, only one curve will result. We may, however, hold *Eb* constant and plot curves for varying values of R_L. The current *Ip* is the plate current that would flow through the tube in the actual circuit when the tube bias was such as to render its impedance the same as the variable resistance at that particular point. A family of such curves for various values of R_L, keeping *Ep* fixed, and varying the "tube impedance" is illustrated in *Fig. 10*. Any one or all of these curves may be plotted and projected on the same axis as the *Ep-Ip* curve. The slope of the various curves shown in *Fig. 10* depends upon the load resistance. The lower we make R_L, the steeper the slope of the curve until for 0 R_L the curve is perpendicular to the *Ep* axis. These curves are most often termed the "load lines" and for a given value of R_L the load line superimposed on the *Ep-Ip* curve appears as shown in *Fig. 7*.

The design of a class A amplifier using the above data is relatively simple. The plate supply voltage is usually known. This known plate voltage determines the position of the zero current end of the load line. A straightedge should then be laid on the tube curves and held so that it passes through this point and the center of the straightest portion of the *Ep-Ip* curve for the bias voltage chosen to allow some definite peak alternating excitation voltage without the grid going positive. It will intersect the *Ip* axis where $Ip = Eb/R_L$. R_L then equals *Eb/Ip*, when *Ip* is the plate current at the intersection of the load line with the zero voltage axis.



When this procedure has been tried and a tentative value of load resistance chosen, a check should be made to determine whether the maximum *Ip* exceeds the value recommended for that particular tube. If it does, the plate voltage may be lowered or a higher value of R_L may be used.

The parallel resonant circuit so universally used in radio receivers appears as a very high resistance at resonance. The frequency range over which that circuit appears as a nearly pure resistance is a function of the circuit *Q*. In r-f and i-f stages, this circuit provides the load resistance for the vacuum tube amplifiers. Under conditions of no signal, the tuned plate circuit is essentially a short circuit for the d.c. plate voltage and a vertical load line is the result. With signal input the circuit resistance to the a.c. component of plate current is equal to the resistance value of the parallel circuit at resonance in conjunction with the reflected load on the secondary of that r-f or i-f transformer supplying the grid circuit of the next tube.

In audio amplifiers, the audio transformer offers practically zero d.c. resistance, but here we do not depend on the effect of resonance. On the contrary, it is to be avoided since it would result in uneven gain due to the increased gain at resonance where the R_L would be very high. We depend in the transformer coupled amplifier upon the essentially flat impedance curve of that unit for the range of frequencies that we wish to amplify. The a.c. resistance of the transformer plate winding is equal to the turns ratio squared times the actual secondary load resistance. The value of the lead resistance to be used is a function of the amplifier tube type and usage. *Figure 11* illustrates the relationship between power developed in a varying load resistance across a generator having an internal impedance

(Continued on page 31)

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CLASS A AMPLIFIERS

Continued from page 28

Rp. This makes a very easy example and illustrates the action for a vacuum circuit since we may consider the tube as a voltage generator with an internal resistance. As may be seen from that figure, the power output to the load resistance is highest when the load resistance is equal to the internal generator impedance. The voltage output will, however, continue to increase with an increase of load resistance and approaches maximum as the load resistance approaches infinity. For a power amplifier then we would require a load resistance equal to the plate impedance of the tube for maximum power output. This, however, tends to allow considerable distortion and it is found that for a triode a load resistance equal to twice the value of the plate impedance gives low distortion with approximately a 13% decrease in power output from the maximum attainable. Consequently, when we use an audio transformer in an audio power amplifier, the matching that we refer to is not truly matching of the impedances. We "match" for best results and that is accomplished with the above mentioned 2 to 1 ratio. The transformer primary when loaded down by the secondary circuit should offer a resistance equal to twice the plate impedance of the tube whose plate circuit it is in.

In voltage amplifiers where a resonant circuit is the load, the resistance is very high and maximum voltage is induced across that circuit. The circuit may be loaded with an ohmic resistance to lower the coil *Q* and the load impedance thus affording better frequency response at the expense of gain and a smaller voltage output.

In a resistance-capacitance-coupled audio voltage amplifier, the value of plate load resistance is limited in maximum resistance by the permissible d.c. voltage drop across it. This resistor cannot be allowed to be so large that the plate voltage of the tube will fall below the rated value for proper operation. The plate load resistance is usually made to be from 2 to 5 times the *Rp* of the tube depending upon the gain and frequency response desired.

The plate load of a capacitance resistance-coupled amplifier is a complex impedance which is a function at intermediate frequency, where coupling capacitor reactance may be neglected, of the parallel plate load

resistor, *Rb*, and the input, or grid, impedance of the following stage. *Figure 12* shows such an amplifier. R_L is then at those frequencies lower than *Rb* which means that the effective load resistance must be achieved by having *Rb* higher than at first estimated.

$$R_L \text{ is equal to } \frac{Rb\ Rg}{Rb + Rg} = 40{,}000 \text{ ohms}$$

Pentodes

Due to the fact that pentodes provide greater gain and have better power sensitivity than triodes, they have come into nearly universal use for both r-f and audio amplifiers of both voltage and power type. *The choice of load resistance for a pentode is fundamentally the same as for a triode. Pentodes may be efficiently operated with values of load resistance equal to only a fraction of the plate impedance and still give large gain figures. For low distortion in a pentode power amplifier the load resistance must be several times smaller than the plate impedance.* As we learned from the triode, the gain is a function of the plate load resistance. *The pentode has such large Gm that sufficient gain is achieved without gain approaching the maximum gain capabilities of the tube.*

When used as a power amplifier, large grid excitation is used and the voltage gain must be limited so that the plate voltage will swing as far positive as it will negative, assuming sinusoidal input. This is necessary for undistorted class A amplification. Since the slope of the *Ep-Ip* curve of a pentode tends to flatten off very abruptly above the knee of the curve the choice of a proper load is fairly critical. This is illustrated in *Fig. 13*. There is only one optimum load line for a given maximum excitation and

$$R_L = \frac{e\,max - e\,min}{i\,max - i\,min}$$

In pentode voltage amplifiers the excitation is small and nearly any value of R_L will give low distortion. However the gain is a function of the load impedance which varies with excitation frequency. The gain over the middle frequency range is equal to GmR_L while the gain at the higher frequencies where the tube shunt capacities must be considered = GmZ_L. At the frequency where the distributed $Xc = R_L$ the gain is 70% of the mid frequency, or maximum, gain. The low frequency gain equal to 70% of mid frequency gain will occur when the *Xc* of the coupling capacitor is equal to the grid leak resistance. We can see that gain is equal to GmR_L only when $Rg + Rp$ is much greater than R_L. At lower and higher frequencies than where that is true the load impedance is lower than at the mid frequency and is not purely resistive.

The gain of other circuits having complex load impedances was discussed in the *May, 1943* issue of "RADIO SERVICE-DEALER" in an article by the author entitled *"Superheterodyne Receivers"* and will not be repeated here.

Bibliography—

Books—

Principles of Electron Tubes—Reich
Applied Electronics—M.I.T.
Radio Fundamentals—Ballou
Electrical Fundamentals of Communications—Albert
Fundamentals of Vacuum Tubes—Eastman

(Continued from page 18)

followed by two coats of the lacquer. This finish may be applied to any metal. However, if magnesium is being treated, the zinc chromate has a tendency to eat into the metal slightly, thus changing the fit of mating parts. Special primers are available for magnesium, or the places where dimensional tolerances must be maintained may be masked off, applying the zinc chromate to all other surfaces. Ordinarily, of course, mating surfaces are not painted or lacquered.

When You Can't Solder

In re-assembling appliances or radio apparatus after repair, there are some points which should be especially emphasized. In appliances, such as toasters, irons, etc., in which the connections are subject to extreme heat, ordinary soldered joints won't stand up. For these, either a brazed or welded connection is used, or, more simply from the service angle, a special solderless terminal is employed. The latter, incidentally, is quite a useful gadget, widely used in aircraft radio and is bound to become a factor in the repair of home radios after the war. Think what it means, when working in a customer's home, to be able to make all connections to terminal lugs without having to bother dragging out the soldering iron and waiting an interminable period for it to come up to soldering temperature! The solderless lug, a simple crimping tool, resembling somewhat a large pair of pliers, makes the joint swiftly and securely.

Tropical Wire Repairs

In rewiring high-grade equipment which is used in tropical climates the ordinary cotton-insulated, wax-impregnated hookup wire is not satisfactory. The wax has an irresistible attraction to the appetites of tropical insects, and there is a greater tendency for insulation of this type to support a luxuriant growth of fungus. In emergencies, this wire may be used if sprayed with lacquer after all wiring is finished but, at best, this is a makeshift job.

There are many new plastic insulations which, extruded over wire, are superior both to the wax-impregnated types or even to the rubber coatings formerly used. Plastics, such as vinlite, form a wire insulation which is almost impervious to moisture, with the result that leakage in high-impedance circuits is obviated. Leakage trouble has been prevalent with much manufactured test equipment when used in damp places. Most of us have already experienced this difficulty, and have found it necessary to "dry out" apparatus occasionally, by heating, before it is in usable condition. A limitation of this new plastic is that it does not withstand high temperatures very well; care must be taken that it does not touch metal parts, such as metal rectifier tubes, which become very hot. Also, the soldering iron must be handled more carefully. Whereas, with ordinary wire, a misplaced poke of the iron may result only in a bit of scorched insulation, with vinlite-insulated wire, the hot iron will strike through to the bare wire. Vinlite has its advantages, though, in that ends may be readily cleaned for connections by simply running the hot iron over the insulation.

As a measure of mechanical protection, the vinlite insulation is often supplemented with a serving of cotton, silk, or nylon. When this is done, the dangers resulting from careless handling of the soldering iron, and proximity to hot spots in the apparatus are greatly minimized. Another point to remember in connection with plain, vinlite-insulated wire: in cabling, the lacing should not be drawn too tightly. If this is done, and the cable is

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then bent to form it into position, the lace may cut into the relatively soft insulation. This difficulty, too, is eliminated when a fabric covering is used over the vinlite. It is to be noted that such a covering, when employed, is always lacquered to prevent or minimize moisture absorption.

Glass insulation over fabric and plastic-insulated wire is rather now commonly used. The glass braid serves as the outer covering for the other insulations, and permits the use of a wide variety of color codes, because the colors are readily distinguishable through the glass outer braid. The glass prevents moisture absorption through its surface, though such wires may be subject to trouble from moisture absorption when the fabric insulation under the glass braid acts like a wick so that moisture travels along from exposed terminals under the outer coating.

A. F. SYSTEMS

(Continued from page 12)

prised if you find it impossible to align the primary to precisely the proper frequency (but make sure your oscillator frequency is correct!); there are a few receivers on the market which have too many turns on the primary, so it can't be tuned to resonance. You probably won't be able to get a replacement, but you can peel off a few turns until it does work properly—that's usually the trouble.

The alignment of the secondary is more critical, and should not be undertaken unless an insulated screwdriver is used and not until the set has had several minutes to warm up. Although we have discussed only the voltmeter method of alignment, it is of course possible to use the cathode ray oscilloscope for the same purpose. In such cases, it is recommended that the manufacturer's service notes for the particular receiver being aligned be followed. In general, the result will be either an X-shaped image, if a double-image type of aligning circuit is employed, or a single image corresponding to the curve shown in *Figure 2*, if a suppressed return sweep is employed.

The audio and avc voltages developed in the discriminator circuit are taken off R2 at the point (B) in *Figure 1*, and at the corresponding point in the circuit of *Figure 3*. Some distortion at higher frequencies and high modulation percentages results from this form of connection, so that more complicated circuits are employed in high-fidelity receivers. Some of these involve capacitive coupling to separate detector diodes, which removes the objection to the previous circuit; others employ three-winding discriminator transformers.

A typical three-winding discrimina-

tor circuit is shown in *Figure 7*. Here a triple-tuned circuit is employed, the detector diode being fed by the tuned circuit L3-C3. The rectified audio voltage is developed across the diode load resistor R1 in the same manner as other conventional diode detectors. The coupling to L2 is effected by winding a few turns of wire at the center of L2 and precautions are taken to make certain that the connecting leads to L3 are kept well away from L2. In fact, this is as good a time as any to emphasize the importance of keeping all discriminator, and particularly reactance tube, leads in proper position. Many obscure troubles arise from reckless manhandling of such leads and, in case you start to develop a headache when servicing such circuits, it's well worthwhile checking the wiring layout against that shown in the manufacturer's diagram—it may save sending the set back to the manufacturer or jobber for more expert attention.

Another three-winding discriminator transformer circuit, representing an expansion of the circuit of *Figure 3*, is shown in *Figure 8*. In this diagram the detector-avc diode is coupled to the primary, instead of the secondary circuit. The link coupling method shown in *Figure 7* is not employed. Actually, the link coupling is often omitted in the circuit of *Figure 7*, also.

Note that the detector diode circuit is not tuned in *Figure 8*. This results in somewhat reduced sensitivity, as compared with the circuit of *Figure 7*, but is considerably simpler from the manufacturing viewpoint.

Of course, it should be remembered that even under the best conditions, when all adjustment have been properly made, etc., all is not always going to be sweet and lovely where afc is involved. We have mentioned the fact that there is bound to be a slight amount of mistuning because the discriminator won't function to correct mistuning until this fault develops. And naturally, since a control voltage is necessary to correct the condition, and no control voltage is produced until maladjustment is present, we've just got to grin and bear it. But, as we emphasized before, this is usually a very minor defect which will be noticed only by perfectionists.

More important, and not so highly theoretical, are the troubles which arise from voltage variations and changes in tube characteristics, particularly the reactance tube. Since the effectiveness of the control is dependent upon the change in mutual conductance of the reactance tube, it stands to reason that a tube which has fallen off in transconductance cannot be as effective in its frequency-control action as one which is right up to normal. Further, we are going to find that conditions which vary the voltages applied to the reactance tube, particularly the control-grid voltage, are going to affect its performance. If the receiver is used in an area where large variations in line voltage are common, and no volt-

age regulator is employed in the receiver circuit, it is natural that variations in the mutual conductance of the reactance tube, with corresponding frequency changes in the oscillator circuit, will take place without benefit of the voltage derived from the discriminator circuit. This will not permanently detune the circuits, of course, because the discriminator will go into action to correct for these conditions as well as any others which affect the oscillator frequency stability. But the result may be that the degree of correction is not so great as is attained under normal operating conditions. In such cases, more distortion will result.

IN AND AROUND THE TRADE

(Continued from page 5)

in the United States, has been announced by the Company.

The development of this material was hastened by the growing shortage of high-grade mica; and can be best applied to the manufacture of most radio-frequency-blocking and by-pass, fixed capacitors used in communications and other electronic equipment. The new product has a greater combination of desirable properties than was previously available in any one dielectric material. It is available in both rolls and sheets and can be used in present capacitor production lines with very little change in equipment or method of manufacture.

Gadget Counts Thunderbolts

An electric gadget that writes with lightning on a plastic slate was reported today as one of the latest developments in the never-ending campaign to protect power lines from damage by thunderbolts.

The device itself offers no protection —but it does enable power company engineers to get an accurate record of the lightning strokes that hit their lines, thus showing the spots where protective devices are needed.

When lightning strikes a power line, a small part of the current is sidetracked into the counter and sent into the saw-toothed foil strip. The current must jump from the saw-toothed strip to the straight-edged piece of foil to get to the ground. The current always picks out the easiest path—the tooth whose tip is closest to the straight-edged strip. As the current leaps across this gap, it makes a tiny spark which scorches a black spot on the clear plastic and burns away the tip of the tooth, so that the next discharge will choose another path.

WANTED FOR CASH!

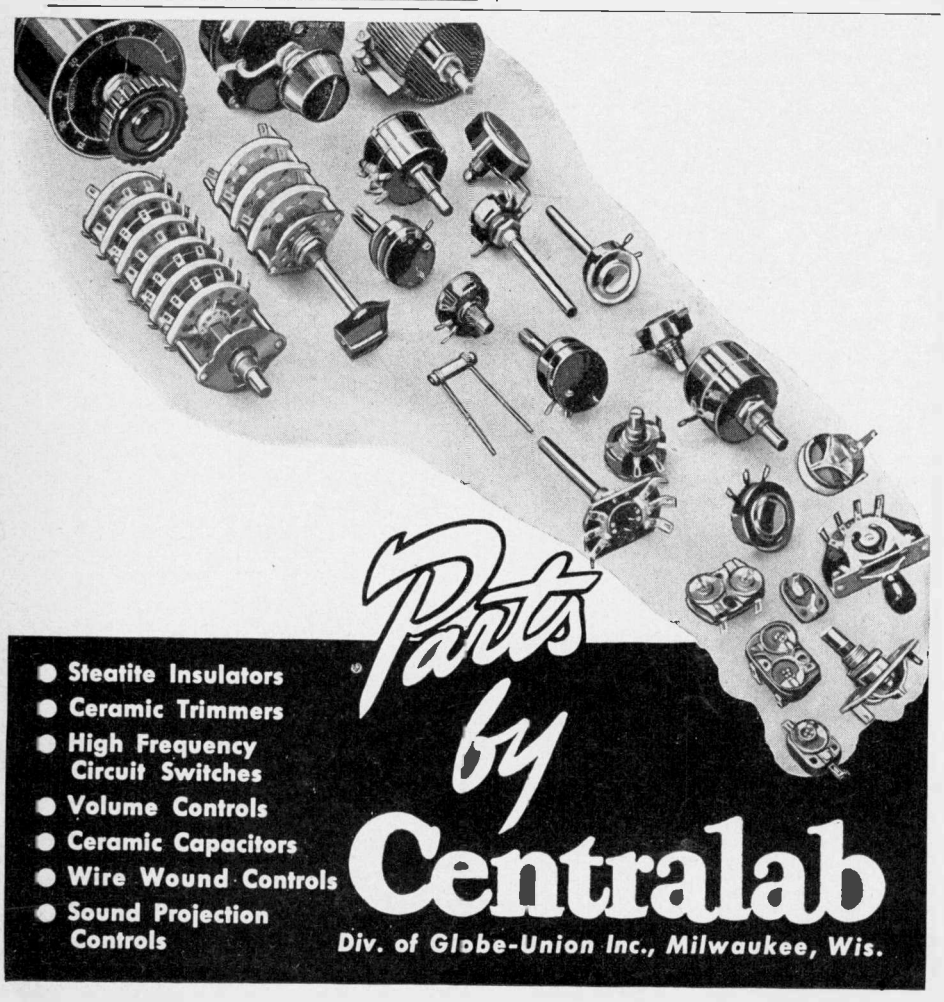
Photographs of radio and electrical appliance retailing establishments wanted. Interior and outside views—also musical instrument and record departments acceptable. Photos must be suitable for reproduction in RADIO SERVICE-DEALER. Submit glossy prints to News Editor, Cowan Pub. Corp., 132 W. 43 St., N. Y. 18, N. Y.

POST WAR APPLIANCES

(Continued from page 19)

time. The "mainline" and oldtime application firms, will, after they finish making War stuff for the United Nations, probably be the first to convert to turning out these electronic marvels for Peace. It will be best to wait for them.

Whatever else may be said of this war, it will bring to the home owner—and hence to the appliance dealer—a new era. So new as to be as entirely different from the old as the horse-and-buggy is from a P-39 plane!



POST WAR RADIO SETS

(Continued from page 9)

asked as to whether these firms will be able to use their "know-how" to jump the gun, bringing out their lines in advance of the "old-line" manufacturers. It is hard to believe that the newcomers will try to upset the traditions and good business precepts established over a long period of time by the radio industry. Further, most war sets cannot be directly converted into Peacetime consoles. It will take more than that. And also there is the matter of distribution—a gigantic problem for the uninitiated. Right now these war plants have but one buyer — Uncle Sam. In the open trade they will have many customers, which are only reached via some established system of distribution. Here the "old-line" manufacturer has a distinct edge on the new fellow, and the oldtimer intends to follow it up.

But to get back to the "improved" radio sets. What will they be like at the first "market"? Let us look at the record. It is only natural that *Motorola* will convert to peacetime operation as fast as possible. They will utilize as much of their war-work equipment as they can because that is the most economical thing to do. So it is logical that the war manufacturing methods will influence the peacetime set.

Motorola is one of the big manufacturers of mobile FM equipment. And following up their advantage in FM, it is reasonable to expect that *FM phono-oscillators* will make their appearance on the "new" market. They will be used with the FM receiver, and to extend the audio range beyond that which has been possible with the old style AM oscillators. Since *Motorola* already has enjoyed having a phono-oscillator (wireless record player) in their line, it is supposed that FM may be added to their AM oscillators, giving the public its choice of either.

Will Motorola do everything that has been set down here? That would be an unfair question for them to answer right out. Not only are such plans a jealously guarded secret even in peacetime, but no concern is subscribing to the idea of revealing *exactly* what its plans are for postwar. Suffice it to say that *Motorola may* do some, *might* do a lot, and *can* do *all* the things which have been here suggested. «««««

Due to paper restrictions, we cannot accept many more new subscriptions—so, be sure to send us your order today. See page 34, RADIO SERVICE-DEALER.

ELECTRICAL APPLIANCE RETAILING

(Continued from page 24)

distributors are more free to criticize, constructively.

(5) An independent distributor's employees render better service because final authority is in the local operation.

New Plastic Insulating Grommets Developed by Creative

Of special interest to production engineers seeking to cut down assembly time operations, *Creative's* new line of 100% phenolic plastic insulating grommets offers many important advantages. These new grommets, available in four standardized sizes, have been developed especially for use by appliance manufacturers and dealers. Holes are concentric, with all corners chamfered, avoiding wire chafing. All threads are clean and lubricated. To promote easy gripping and conservation of assembly time, all parts are matte finished.

Available from *Creative Plastics Corp.*, New York.

Universal Announces "U" Plan to Help Dealers in 1944

Launching one of the most dynamic campaigns ever offered to support the nation's dealers, *Landers, Frary & Clark* today heralded its approach to post war dealer planning with its *U Plan For V Day.*

Based on a scientific approach to the dealers post war distribution problems, the plan is the result of a coast to coast survey of dealer thinking in 48 states and is molded to fit the needs of dealers everywhere, yet flexible enough to be adapted to any degree the dealer wishes to promote it.

The *U Plan* is the first national orderly approach to the problem of post war appliance distribution in the opinion of its writers. It involves five easy steps that will enable any consumer to plan now for post war appliance needs, have the money available for their purchase after the war and be registered with their local dealer on a first come first serve basis before appliances are available.

All dealers are invited to participate and use the plan not only in their appliance departments but they may apply it to all departments in their merchandising if they desire.

The consumer is urged to survey her post war appliance wants today using a specially devised *U Plan* check list which indicates the entire range of *Universal* housewares lines. It includes 25 types of appliances and housewares manufactured by the concern. In addition the check list indicates the 1941 price range of each item which the consumer can use as an easy guide in developing a rough estimate of appliance costs. All the consumer has to do is check off the appliances she will need after the war in one column, estimate using the price guide their approximate cost in another column, then add up the total. This enables her in one easy step to plan her purchases from a toaster to a complete electric kitchen.

The plan suggests that she purchase U. S. War Bonds to equal the required cost of her appliance purchase.

It asks her to tear out the check list and take it to her nearest *Universal* dealers to discuss her appliance needs with him and to suggest that he register her for the appliance she needs to be demonstrated to her as soon as he receives merchandise of that description after the war.

In the plan it is suggested to the dealer that he set up a customer file on appliances registering each customer for her appliance needs on a first-come-first-served basis. If he desires, he may further give the consumer a special priority number for each appliance she needs in the order of consumer demand for the appliance; then stamp this number on a dealer-consumer registry form which is provided in the point of sale material.

The plan suggests that the dealer call his customers as soon as appliances are available following the war in order of their priority for merchandise as established by his registry records.

Book Review

BOOK REVIEW: Tube substitution made easy. That would be a short descriptive title for the recent publication, "RADIO TUBE SUBSTITUTION & CHANGE-OVER MANUAL." To assist the serviceman and dealer to find the proper tube when he is unable to get the one he wants, this manual will advise what to do. Not only is the proper substitute indicated, but the method of re-connecting the new tube is shown. Divided by tube functions (oscillators, RF Amplifiers, Diode Detectors, etc.) the manual is easy to follow and the information is simple to locate. Excellently bound in paper cover. 20 pp. Price $1.00. Author *Robert T. Oelrich.* Publisher: *Oelrich Publications,* Chicago.

«««««

$1.00 PAID FOR SHOP NOTES

Write up any "kinks" or "tricks-of-the-trade" on radio set or electrical appliance servicing that you have discovered. We will pay $1 in Defense Stamps for such previously unpublished "SHOP NOTES" found acceptable. Send your data to "Shop Notes Editor," RADIO-SERVICE DEALER, 132 W. 43rd St., New York 18, N. Y. Unused manuscripts cannot be returned unless accompanied by stamped and addressed return envelope.

SPECIALTIES SAVE DEALER

(Continued from page 16)

up everything in the used radio set line which we can. Unfortunately, the public is not in a selling mood at the present time.

We do not expect to keep on with our paints, (which exceed the largest Chicago department store in variety of colors), after Peace and radio comes back into its own. We were always interested in radio, and —while we have had to deflect some of our "love" to another sales item, it is not our intention to desert the most fascinating field, radio. ««««

AD INDEX

What happens when a Shadow meets an RCA Electron Tube

JUST by itself, it's hard enough to measure to an accuracy of 1/10,000 of an inch. But on a production line, where tens of thousands of wires have to measure up to this accuracy, it's next to impossible —unless you want to spend more time measuring than producing.

However, with a simple electronic device, built around an RCA Electron Tube, thousands of small lead wires for radio tubes are now being checked for such accuracy at the rate of 5 to 8 a minute!

How is it done? Like this . . .

The wire passes before a light. As it does, it casts an enlarged shadow on a sensitive phototube whose output is measured on a meter. If the wire is 1/10,000 of an inch off, the difference is recorded on the meter and the offending wire can be rejected. If desired, the wire can be rotated to measure out-of-roundness.

This is electronics — the so-called "dream science" of tomorrow—in action *today* at RCA!

Many of you Distributors and Servicemen can remember when radio, too, was just a "dream." But *you* helped that dream "come true."

Much of the electronic equipment you may be helping to sell, install, or service tomorrow will be built around tubes, circuits, and parts already familiar to you from your radio days! ***Yes, the magic brain of all electronic equipment is a tube... and the fountain-head of modern tube development is RCA!***

TUNE IN "WHAT'S NEW?"

RCA's great new show, Saturday nights, 7 to 8, Eastern War Time, Blue Network.

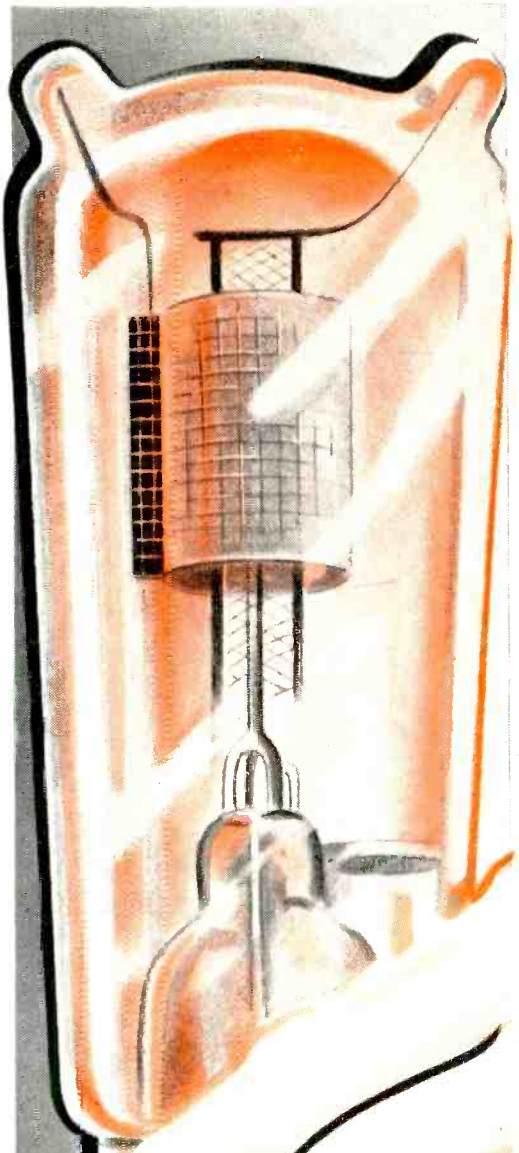
This machine, while used at RCA to measure the diameter of tungsten wires by an electronic method, embodies a basic principle for measuring any critical dimension of any component that can be made to cast a shadow directly proportional to the dimension to be checked.

RADIO CORPORATION OF AMERICA

ASK ABOUT... RCA INDUSTRIAL MUSIC SERVICE

Over 12,000 highly skilled Raytheon employees are producing for the military . . . when we again return to peace time pursuit of normal business, the Raytheon jobber dealer and servicemen will have the additional advantages of all of Raytheon's war time engineering development and production of electronic tubes for the enormous number of new applications.

The new peace time Raytheon tubes will be in the front line of the new electronic era, and greatly expand Raytheon jobbers' possibilities for tubes not only in commercial radio receivers but the new industrial electronic devices as well.



THE RAYTHEON JOBBER HAS A NEW JOB!

RAYTHEON TUBES
RADIO & TRANSMITTING

FOUR "E" AWARDS
Each Division of Raytheon has been awarded the Army and Navy "E"

RAYTHEON PRODUCTION CORPORATION

NEWTON, MASS.; LOS ANGELES, NEW YORK, CHICAGO, ATLANTA

DEVOTED TO RESEARCH AND THE MANUFACTURE OF TUBES FOR THE NEW ERA OF ELECTRONICS