

AUGUST

1941

*Radio*

# SERVICE DEALER

*This Month*

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THE TOP VIA BRITAIN

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MESSERSCHMITT RIG

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*Radio*

# SERVICE-DEALER

**SOUNDMAN AND JOBBER**

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## Ad Index

<b>Aerovox Corporation</b> .....	18
Auto Radio Condensers	
<b>Brach Mfg. Corp., L. S.</b> .....	23
Home & Auto Antennas	
<b>Burgess Battery Co.</b> .....	19
Battery Replacement Guide	
<b>Centralab</b> .....	3rd Cover
Radiohms	
<b>International Resistance Co.</b> .....	4
Volume Control Manual	
<b>Paramount Products Co.</b> .....	19
"Whiz" Electric Tool	
<b>Racon Electric Co.</b> .....	2
Horn & Speaker Units	
<b>Radio Servicemen of America, Inc.</b> ..	24
Membership	
<b>Radolek Company</b> .....	23
Radio Profit Guide	
<b>Raytheon Production Corp.</b> .....	2nd Cover
Tubes & American Airlines	
<b>RCA Mfg. Co., Inc.</b> .....	4th Cover
Radiola Receivers	
<b>Rider, John F.</b> .....	15
Abridged Manual	
<b>Shure Brothers</b> .....	22
Hi-Lo Crystal Pickup	
<b>Solar Mfg. Corp.</b> .....	22
Quick-Check Analyzer	
<b>Sundt Engineering Co.</b> .....	23
Carillons, Musical Towers	
<b>Supreme Instruments Corp.</b> .....	18
Model 504-A Tester	
<b>Triplett Elec. Inst. Co.</b> .....	23
"What of Tomorrow?"	
<b>Turner Co., The</b> .....	22
Cardioid Microphone	
<b>Utah Radio Products Co.</b> .....	17
Sound Improvements	

## Contents

<b>Transients (Editorial)</b>	
The "Digest" Survey	
<b>Messerschmitt Radio Obsolete</b> .....	5
<b>Performance Ratings, Part I</b> .....	6
By John F. Rider	
<b>Britain Calling</b> .....	8
<b>Book Reviews:</b>	
Rider's Manual, Vol. XII .....	8
Aligning Philco Receivers, Vol. 2 .....	19
The Business Helper .....	22
<b>Technical Service Portfolio, Sec. XIII:</b>	
Replacement Parts Problems .....	9
<b>Circuit Court:</b>	
High-Voltage Pilot .....	12
Frequency Correction .....	12
"Electrifier" .....	12
<b>The RadioFront</b> .....	13
By Karl Kopetzky	
<b>Shop Notes:</b>	
Hum reduction in ac-dc sets with pm's ..	14
Microphonics in portables .....	14
RCA 6SL7-GT tube .....	14
RCA 1631, 1632, 1633, 1634 tubes ...	14
RCA RP-158; replacing sapphire .....	14
RCA battery sets; low output .....	14
RCA QB3 condenser change .....	14
RCA RP-153 motor hum .....	14
RCA Station Allocator; changing ranges ..	14
Stewart-Warner 1941 Series;	
repairing on-off indicator .....	14
<b>RSA News</b> .....	20
<b>New Literature</b> .....	24
<b>Appointments</b> .....	24
<b>National Defense Front</b> .....	24

## Cover Photo



★ Lear Avia engineers removing the radio equipment from the Messerschmitt 109 plane shipped here by Britain. For dope on the tests made on this equipment in the Lear Avia laboratory, see page 5

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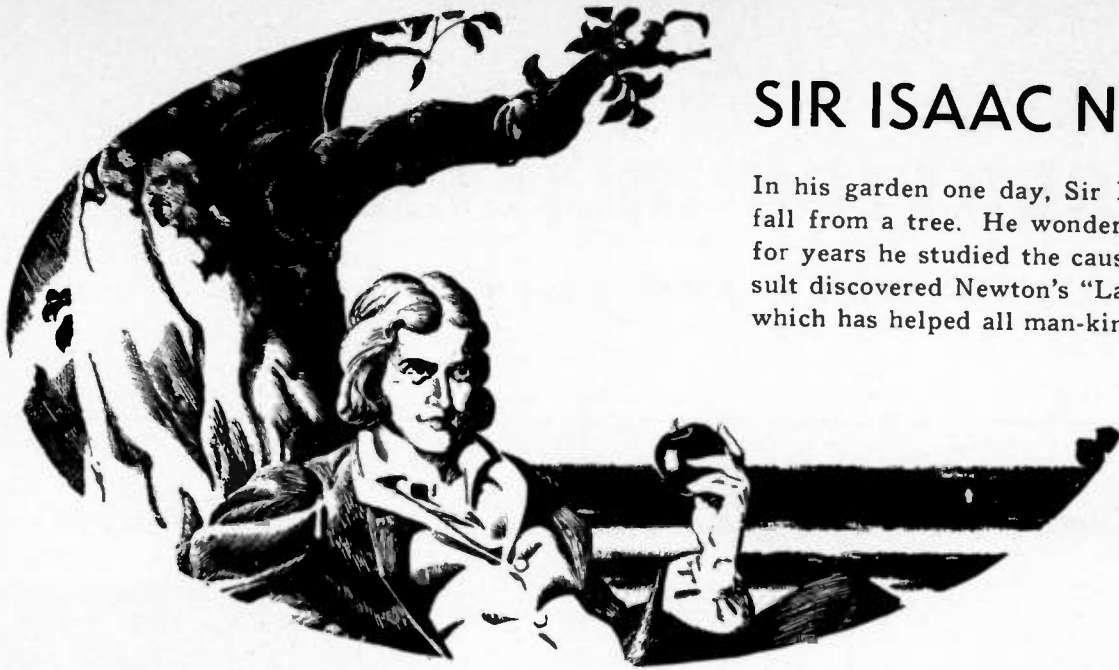
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**M. L. MUHLEMAN, EDITOR**

**S. R. COWAN, ADV. MANAGER**

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VOL. 2 No. 8 ★ AUGUST, 1941



## SIR ISAAC NEWTON

In his garden one day, Sir Isaac saw an apple fall from a tree. He wondered why it fell . . . for years he studied the causes . . . and as a result discovered Newton's "Law of Gravitation," which has helped all man-kind.

Sir Isaac Newton became famous because he could learn from apparently unimportant everyday happenings and put such knowledge into practical use. In like manner, RACON, pioneer in manufacturing sound reproducing devices, through constant research and development, has accounted for almost every worth-while advance in the art of improved sound distributors and reproducers.

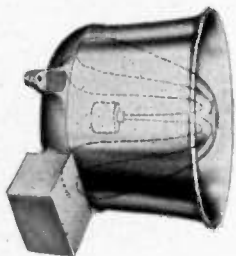
Though RACON's name is pre-eminent and RACON reproducers are preferred by all leading soundmen, RACON Products are competitively priced. There is a RACON Horn, Speaker or Driving Unit for every purpose. Each will outperform, with more dependability and efficiency, any similar competitive unit. Thus RACON Products are more profitable to use in every type of sound installation.

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RACON speakers alone can afford peak efficiency regardless of changing climatic and atmospheric conditions. They were designed to do just that and the patented materials used in their construction are contributing factors.

### MARINE HORN SPEAKERS



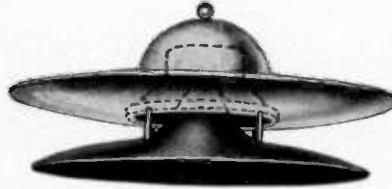
Re-entrant type speakers using horn type units for marine and general P-A applications — may be used as loud-speaker or as a microphone. Miniature and regular sizes approved by the

Bureau of Marine Inspection and Navigation, Department of Commerce, for marine work. In all sizes, miniature, midget, regular and bull, handling from 5 to 50 watts.



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Types for high fidelity, giving even intensity sound projection over a circumference of 360° radially. Upper deflector made of heavy gauge aluminum, cone covering of steel, and lower deflector of RACON ACOUSTIC material storm-proofed for all weather conditions. Models for 5"—6"—10"—12" cone speakers.

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**RACON ELECTRIC CO. 52 EAST 19th ST. NEW YORK, N. Y.**

NOT CONTENT WITH having grown fat on (and by the grace of) other publications, *The Reader's Digest* has recently gone in for the "sensational" type of article as a means of snaring new readers. The first (of a series) points out what a sly fellow the auto repair man is; the second article, appearing in their August issue and titled, "The Radio Repair Man Will Gyp You If You Don't Watch Out," portrays, with considerable relish on the part of the authors, what a perfect heel the average radio serviceman is.

The better magazines, such as *Time*, for instance, never publish material that has not first been reasonably substantiated; the editors seeking the opinion of authorities where that is deemed essential to the cause of authenticity. But *The Reader's Digest* subscribes to no such flimflam, and accepts without question and with no sense of responsibility, an article based on a "survey" made by two roaming reporters with no knowledge of radio but an acute appreciation of smear tactics.

The result is what one might expect under the circumstances: The authors were happy to find, by their own methods, that the average American set owner will be cheated 64 out of every 100 times by radio repair men; that signal generators, set analyzers, signal tracers, vacuum-tube voltmeters, etc., though not mentioned by name, are "Rube Goldberg" contraptions designed to make any diagnosis seem plausible; that tube testers are evil devices for hoodwinking the public; that, presumably, all a good and "honest" serviceman requires to test a modern receiver is "a voltmeter and a few other little things." And, that the chief hope of the set owner, if he wishes to avoid being gyped, is to acquire an *elementary knowledge* (italics ours) of how a radio works! We ask you—of what service would an *elementary* knowledge of radio be to a man with a receiver having an unbalanced discriminator, an open or grounded AVC line, or a case of hum? He'd be as befuddled as the man with an elementary knowledge of medicine trying to diagnose a pain in his joints.

# TRANSIENTS ☆

## Customer Reaction

CONSIDERING THE circulation of *The Reader's Digest*, a large number of people will be influenced by the article in question, and that makes it a serious matter. Though we have protested to the editors, there seems little chance that they will make any move to rectify the matter. Hence, the eye of suspicion will be cast on the serviceman who has spent a thousand dollars or more on test equipment that he knows and we know and all radio authorities know is absolutely essential in servicing modern receivers.

Insofar as the matter of dishonesty is concerned, neither we nor *The Reader's Digest* know what the percentage may be, but it is probably no greater than in any other field of endeavor.

## Truth of Matter

(Your Clients Should Read This)

WHAT THE PUBLIC may not know and what *The Reader's Digest* does not care to know is, that were it not for the radio serviceman's investment in "Rube Goldberg" equipment, *the cost of testing and repairing the average receiver would be almost prohibitive*, for the complexity of modern radios is such that the horse and buggy method of testing with "a voltmeter and a few other little things" would consume more charged-for time in working hours than many receivers are worth in cash.

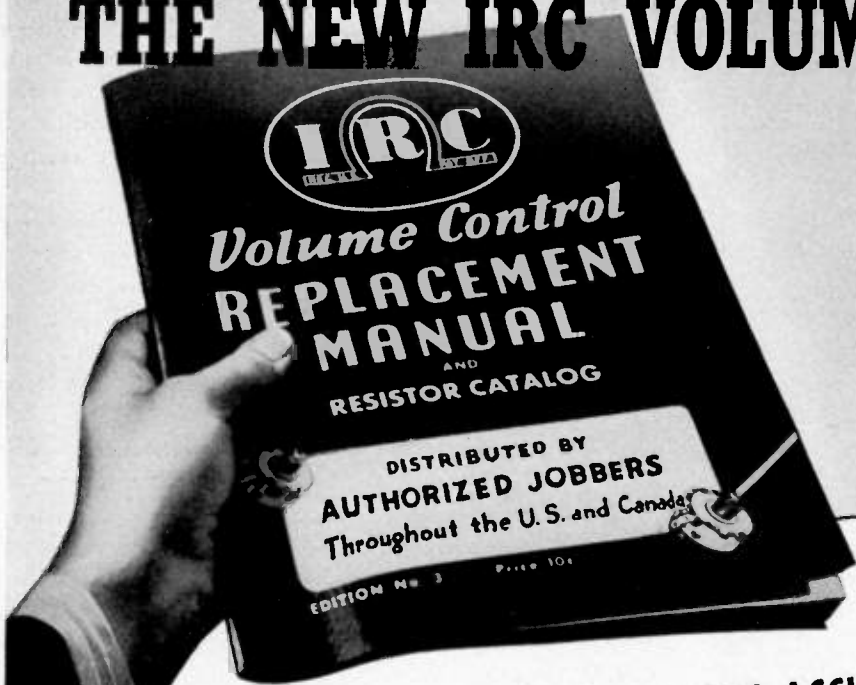
As to the replacement of parts, *only a trained radioman is able to judge whether replacements should be made*, just as only a dentist is competent to judge whether an apparently sound tooth should be removed and replaced by a false tooth.

It has been our experience that the people who are gyped are the ones who want something for nothing. The serviceman has as much right as the doctor to charge for a diagnosis. If a customer prefers to patronize a shop where no fee is charged, then he may be sure that it will be made up for in some other manner.

Believe it or not—even radio servicemen have to live.

# THE NEW IRC VOLUME CONTROL MANUAL IS HERE!

(3rd Edition)



## 35% MORE LISTINGS—MORE ACCURATE—EASIER TO USE

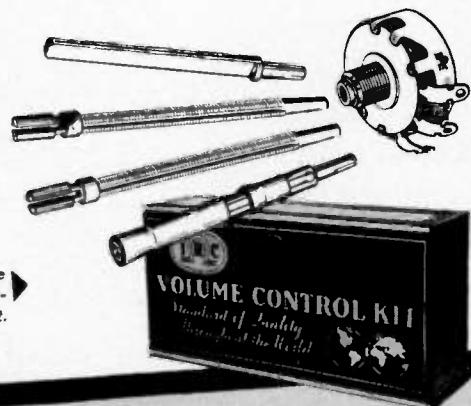
- ★ The finest, most complete manual of its kind ever published. Unexcelled in its helpfulness to every serviceman who makes control replacements.
- ★ Lists correct controls for over one-third more radio receiver models than ever before.
- ★ Every replacement recommendation checked and double-checked against manufacturers' drawings, revised specifications or latest engineering data, etc.
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## INTERNATIONAL RESISTANCE CO.

401 N. Broad Street • Philadelphia, Pa.

# Messerschmitt Radio Obsolete

EVIDENCE of obsolescence and ersatz in German aircraft radio equipment removed from a Messerschmitt 109 fighter plane was disclosed by William P. Lear, designer and builder of aircraft radio for the United States air services and the Allies, following completion of exhaustive test of the radio apparatus found in the Nazi pursuit now being displayed in this country by Bundles for Britain, Inc.

The equipment tested was installed in a German Messerschmitt 109 shot down over the Thames estuary. The plane was shipped to the United States through arrangements made by Mrs. Winston Churchill, honorary sponsor of Bundles for Britain. Upon its arrival in this country, Lear engineers removed the radio apparatus, and the equipment was thoroughly tested by Mr. Lear in his laboratories at Lear Avia, Inc., Piqua, Ohio.

Mr. Lear's report on the German radio equipment stressed four points:

(1.) The Germans have apparently "frozen" their military radio design since 1933, and standardized their tubes and components for ease of mass production servicing.

(2.) Shortages of war materials are indicated by the use of ceramics instead of plastics, fiber instead of rubber and special alloys instead of aluminum.

(3.) The extremely limited range of the transmitter (around 5 miles), and the provision for higher power output, indicate that most German warplanes in a given squadron can talk only to one another, while the leader only can communicate with his base.

(4.) German aircraft radio apparatus found in the Messerschmitt cannot pass U. S. Government test for even commercial radio equipment, and weighs more than comparable American apparatus.

## OLD DESIGN

Examination of the radio equipment from the Messerschmitt indicates very definitely that it is intended primarily for communication over very limited ranges. The equipment is comprised of a low-power transmitter sufficient for interplane communication; a receiver, and a power supply unit. The receiver is relatively insensitive, and the transmitter output is so limited that it cannot be picked up by the enemy at a distant location. The fre-



William P. Lear, of Lear Avia, testing the Messerschmitt 109 radio equipment.

quency range of the equipment is from 2500 to 3700 kilocycles which in itself represents a very narrow band for communication purposes. Both the receiver and the transmitter are tunable in this range of frequencies.

The equipment weighs in the neighborhood of sixty pounds and is comparatively bulky.

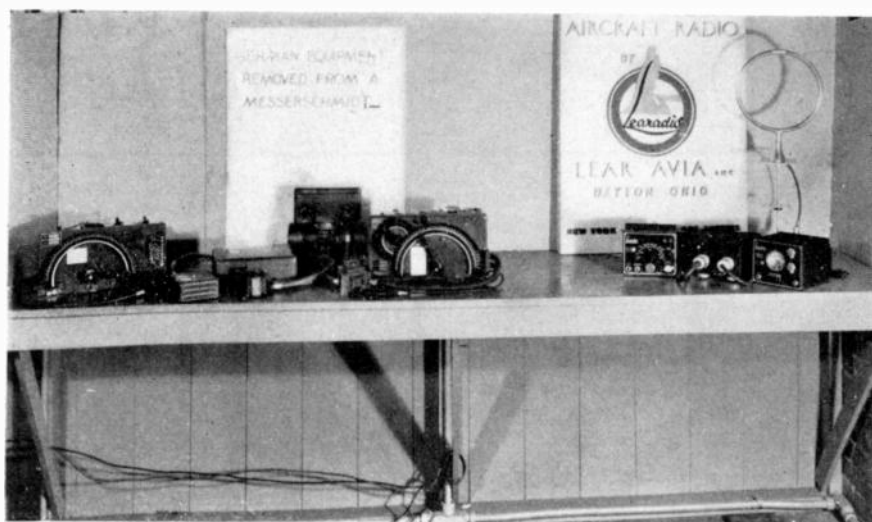
As far as the size and weight of the Messerschmitt radio equipment is concerned, it should be mentioned that it is possible to obtain commercial equipment in this country which will give much better performance and yet be

considerably lighter and take up much less space.

## THE RECEIVER

The receiver has a single band, tunable over the frequency range of 2500-3700 kilocycles. It employs a superheterodyne circuit and contains five shielded Telefunken RENS 1264 tubes used as follows: first r.f., detector-oscillator, first i.f., second detector, and audio output. The filament voltage on these tubes is 4 volts, and the plate lead is brought out at the top of the tube. *These tubes are the equivalent of our types 24 or 35; their design is at least ten years old.* The detector-oscillator uses an old type autodyne circuit which is not at all suitable for high frequency operation and has been radically revised through the use of newer types of tubes.

Ceramics are used extensively in the equipment for terminal boards, coil forms and tube sockets. The coils in every case are air-tuned and no iron-core coils are used except in the second i-f transformer. This is significant because Germany pioneered in the development and application of iron core coils. The receiver sensitivity is approximately 10 microvolts at the high frequency end of the band, and varies up to 60 microvolts at the low end of the band. The i-f frequency of the receiver is 520 kc, and the first i-f transformer is double-tuned, whereas the second i-f transformer has only one tuned circuit.



Comparison of Messerschmitt equipment with comparable gear manufactured in this country shows size and complexity of two-way rig frozen by Nazis, as against the small three-way job, with direction finder, made by Learadio.

# RIDER on Gain Data

## Performance Ratings—Part I

John F. Rider

THE development of various brands of signal-tracing apparatus has brought the subject of gain-per-stage information into the servicing limelight. True, it is not as yet as prominent as it could be or as abundantly available as it should be, but we can say upon fairly reliable authority that, whereas only five manufacturers have so far furnished such information, at least five additional prominent receiver manufacturers intend including gain data in future service literature.

### IMPORTANCE OF GAIN DATA

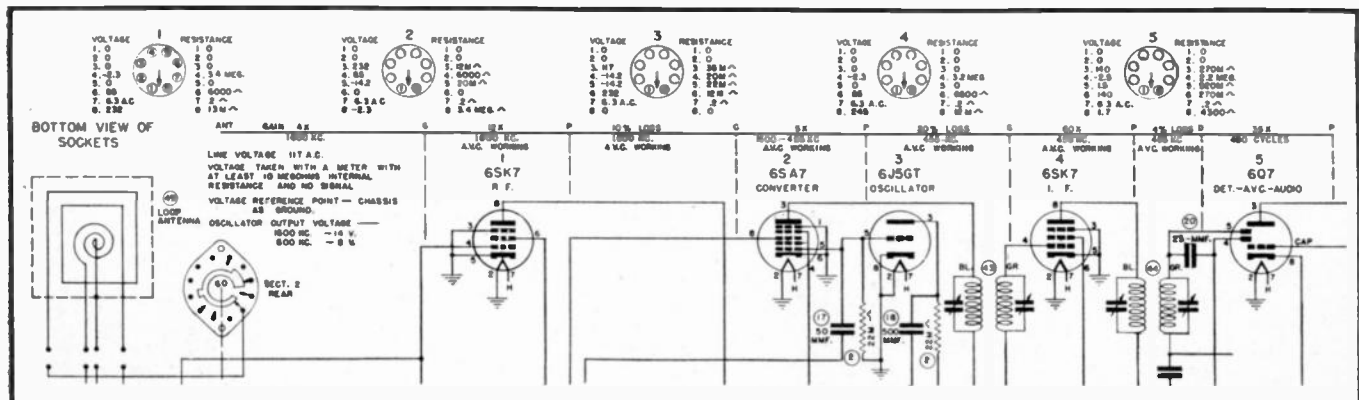
The subject of gain-per-stage data, which, in the final analysis, are the equivalent of sensitivity data, can be viewed from two angles; that of the receiver manufacturer and that of the serviceman. Appreciating the significance of the information for the serviceman, it nevertheless is necessary to see the receiver manufacturer's side and in that way understand why such information has been so scarce in the past and why the manufacturer hopes and trusts such data will be used. We mention this phase if only to enlighten those who may feel that it was signal tracing which raised gain-per-stage or sensitivity data to its prominence and if signal tracing is not used, then such data is of no value.

To entertain ideas of that kind is wrong, for such is not the case. Grant-

ing that signal tracing did bring gain-per-stage data into the realm of desired information among servicemen, it should be realized that it always was of value to the man who was in a position to use it. Not only because it enabled rapid determination of such defects as influenced the overall sensitivity of a radio receiver or any kindred apparatus, but also because it furnished the individual with the facts which he needed to be able to determine if the receiver or amplifier was functioning as intended. This latter accomplishment is, to say the least, just as important as the former, for it removes the many errors in judgment which crop up when checks of sensitivity are based upon "air" tests, general experience of what a radio receiver should be able to do at the location of the shop, and comparison of relative performances of different receivers. In this respect, the servicing industry has been woefully wanting, despite the fifteen or more years of its existence. We say this without any desire to criticize, for it is a plain fact that very few servicemen have been in a position to state definitely whether a receiver was living up to the manufacturer's performance figures. Some men may resent this statement, but it

will have to stand, for, after all, neither the means of measurement nor the required comparative data have been available until about three years ago. And even since that time, service equipment capable of such measurement is to be found in but a few thousand shops and the information has been furnished by comparatively few manufacturers.

The fact that the required apparatus has not been generally available was instrumental in keeping gain-per-stage data out of manufacturer's service manuals. Inasmuch as the information is of great value and furnishes definite identification of performance, incorrect methods of measurement, carried out with apparatus which is not suitable for such work, can create not only hopeless confusion, but also very misleading and erroneous conclusions, which, as some manufacturer's service managers have stated, may react to the manufacturer's disadvantage—and unfairly so. Hence, many manufacturers were afraid that if they released gain-per-stage information to the servicing industry before it was prepared to accept it, servicemen would compare receivers on the basis of amplification only; and also imagine the existence of certain kinds of de-



Typical gain data as given on a schematic, this one being a portion of the Farnsworth BK-110, 111, 112. Since publication, the manufacturer has decided to furnish the avc voltage present and the fixed value of avc recommended during test.



**TABLE 1**

Antenna to r-f grid (600 kc) .....	6X
R-F grid to mixer grid (600 kc) .....	30X
Mixer grid (600 kc) to i-f grid (455 kc) .....	10X
First i-f to 2nd i-f grid (455 kc) .....	50X
Second i-f to diode plate (455 kc) ...	40X
First a-f grid to output tube grid .....	10X
Output tube grid to voice coil .....	-10X

facts because they could not interpret the full significance of such information.

But all of this is so much water over the dam. Not that every serviceman is fully cognizant of all facts relating to gain-per-stage information, but the receiver manufacturers now realize that the means of utilizing such gain data is available, that ample evidence exists of the benefits derived from the use of signal tracing and gain data in such work, and that educational efforts are being carried on. The net result is that the information which has heretofore been held in the archives of the engineer, will in the future produce beneficial results for the radio serviceman.

**VALUE OF COMPARISON**

Concerning the importance and advantages of gain-per-stage data, it would be foolish for us to say that without it, it is impossible for the radio servicing industry to exist. The fifteen years of radio service work which are in the past, is mute testimony that such is not the case. We appreciate that it is possible to get by without it, just as it is possible, as some servicemen say, to get by without certain kinds of test equipment, and they prove their point by pointing to the shingle over the door. But for every serviceman who can get by without modern test equipment, there are a hundred who find it tremendously advantageous.

And so it is with information. For every time that a serviced receiver is tested on the "air" in the shop and mentally judged to be in proper shape, there are ten, which are operative but do not perform as they should in the home of the customer. Proper application of gain information, makes the conditions in the service shop equal to those in the home of the set owner, no matter where he may live, and assures the serviceman that the receiver he is returning to the customer will perform as well as it did before the defect developed.

In entirely too many instances, receivers are judged to be satisfactory in the service shop and are entirely unsatisfactory in the home. The reason is simple—either the sensitivity of the serviced system is not what the serv-

iceman imagines it to be, based upon a performance comparison, or receiving conditions at the customer's home are not as favorable as in the service shop. And since the receiver is not as sensitive as it should be, or as sensitive as it was before the defect developed, it does not perform as well as it should or as is expected, in the home of the customer.

This latter is a very commonplace complaint. And it is to be expected. For seldom does a radio receiver pass through a service operation without alignment, and alignment manifests a very great effect upon overall sensitivity. Furthermore, there are ever so many defects, which do not indicate their presence when tests are made with very strong signals, such as are available from the average local broadcast station or with a signal source which may leak more signal than comes through the output cable.

**TRACING DEFECTS**

As important as gain or sensitivity data may be in determining the final performance of a radio receiver, it has its place in the location of defects when signal tracing. Again we are not presenting gain data as the only means of locating defects, for everybody knows that is not the case. But proper use of even approximate gain information, if not specific data, provides a much faster method of locating those irritating, mysterious defects than any other method known. In making this statement we are aware of every shortcut method used by servicemen, for it has been our business to be apprised of them. We appreciate and admit that checking gain during signal tracing, or even signal tracing, is not necessary in every case to locate a defect, for there are many defects which are obvious and others which can be localized by the usual "touching the grid," "grounding the grid," "grounding the plate" operations.

But all of these are at best approximations and of little, if any, value in a modern complex receiver wherein a number of systems are interlocked; or wherein the receiver is operative, but lacks sensitivity, or is afflicted with a trouble which does not make it completely "dead." In cases of this character, which may be the result of myriad defects, the most rapid form of localization is that test of amplification in the various portions of the system. Not necessarily a rigid and critical examination of the gain per stage, but rather an approximation of the available amplification, for that is sufficient to furnish general data of much value. It stands to reason, of course, that such operation calls for some knowledge of what amplification one may expect in different parts of

**TABLE 2**

Reference reading, 1.73 volts across speaker voice coil.

Antenna .....	1 microvolt .....	600 kc.
R-F grid .....	6 microvolts .....	600 kc
Mixer grid .....	180 microvolts .....	600 kc
First i-f grid .....	1800 microvolts .....	455 kc
Second i-f grid .....	90,000 microvolts .....	455 kc

different kinds of receivers—in r-f, mixer, i-f and a-f stages. It is here that gain-per-stage data presents itself as being of educational value as well as positive identification of operating conditions. Theory can teach us much about how amplification is obtained and what limits may be expected in different parts of a receiver, but having specific gain data on receivers which come into the shop and using this information, is the practical interpretation of the theory. We have evidence of what engineers are doing.

While different brands of receivers are the brain children of different engineers, a definite similarity still exists between designs—between the different parts of receivers and in the gain attained in different stages. This is to be expected, for the same basic principles are used in the designs, the same kinds of tubes are employed, the receivers are intended for similar application and are competitive in kind. Thus, when we see gain data and use it, minimum and maximum limits in the different stages of different kinds of receivers are soon remembered—at least sufficiently so that a stage which is bad, yet not dead, stands out among the rest like a tugboat among canoes. And if the stage is dead, then it's not a question of gain any more, for there is no gain at all.

We realize that among the many kinds of defects which may exist in a radio receiver there are many which do not entail amplification at all, in which case, either gain or sensitivity just does not enter into the picture. But that does not nullify the value of gain data. Then again, many applications of signal tracing, even in a dead receiver, consist of checking signal levels—not necessarily gain, but rather the presence of a signal and the fact that it is stronger as one advances along in the system, until that point is reached where there is no amplification, but rather a loss, if a signal at all. In other words, we recognize the number of places where specific gain data is not essential, yet we reiterate that publication and use of gain-per-stage information is very valuable. Its value lies in the fact that it provides rapid checking of complete stages and obviates the necessity for an in-

(Continued on page 16)

# Britain Calling ... —

THE program of National Defense has stimulated every form of industry into unprecedented activity. In the beginning this activity was felt only by the heavy industries, and the radio servicing field did not become the beneficiary of an increased income. Now that the heavy industries have become tooled up servicemen are beginning to feel the impetus of the defense effort. A still further increase in servicing activity may be expected when the curtailment of the manufacture of radio receivers, due to priorities, forces the public to have their old receivers repaired.

There are, however, other opportunities which are now open to capable servicemen. One of these, and one from which the serviceman can derive both immediate and future benefits, is enlistment in the Civilian Technical Corps.

The Civilian Technical Corps is comprised of skilled craftsmen who perform non-military duties in Great Britain. American technicians are being recruited to maintain and repair the special equipment needed for military purposes, for by placing Americans in civilian work, it becomes possible to release Englishmen for combat duty. In this civilian capacity American radio servicemen and engineers are needed to repair and operate communications equipment and the Radiolocator, one of Britain's secret weapons which is used to spot enemy airplanes with great accuracy.

## CTC AND THE DRAFT ... —

There are a number of men, who, although perfectly loyal American citizens and willing to die in the defense of their country, would prefer to retain their civilian status. Enlistment with the Civilian Technical Corps qualifies a man for deferment from the draft, and does so with the full consent and approval of President Roosevelt. All local draft boards have been authorized to put CTC volunteers in Class II-B, for it is felt that this civilian occupation is of considerable importance to our own National Defense. Enlistment in the CTC thus enables a man to satisfy his patriotic urge even though he is not serving in the armed forces.

It is becoming more and more apparent that the Radiolocator will soon prove of great importance in our own defense efforts. Trained men will be needed to teach others how to operate

and repair this device, and it is therefore quite likely that some of the CTC volunteers who have gained experience in the United Kingdom will be recalled to America to train other men in this work. It was possibly with this thought in mind that the British and United States Governments have come to an agreement having as its object the immediate release of any CTC member whose services are required by the United States Government. Since a man usually does not serve in the U. S. Army in a professional capacity as a private, any men so recalled would probably become officers.

## WAGES ... —

In the light of the extensive publicity given the coming boom in the radio servicing industry, it might, at first glance, appear that the wages given to members of the Civilian Technical Corps are not in accord with the income which a serviceman might make by remaining in the United States. An examination of the situation will rapidly dispel this erroneous impression. The average worker spends practically his entire income on food, clothing and shelter, very little of his income remaining for recreation and luxuries. When we consider that a member of the Civilian Technical Corps receives board and lodging, as well as most of his clothing free, we soon realize that almost his entire salary is his to spend as he will, and not subject to the financial drain imposed by the necessities of life under other circumstances. The salaries given members of the Civilian Technical Corps range from £6.0.0 (\$24.12) to £9:7:4 (\$38.65) a week and, since this is almost totally exempt from expenditures of the aforementioned necessities of life, corresponds to an actual salary which ranges from \$50 to \$75 a week. Even when the radio servicing boom is in full swing, it is unlikely that the real income of

the average serviceman will equal these figures.

There are also other financial advantages to enlistment in the Civilian Technical Corps. None of the income is liable to the British Income Tax. In addition, in case a volunteer becomes sick he receives free medical treatment and hospitalization facilities. Vacations with pay are from two to three weeks in extent. Upon completion of service with the Civilian Technical Corps, members receive a bonus of thirty days pay. Disability or death resulting from CTC service entitles the member or his dependent to a pension. The transportation to and from England is paid for by the British Government, which means that CTC members have the opportunity of traveling without expense to themselves.

## PEACETIME APPLICATIONS ... —

The increased safety which the peacetime application of the Radiolocator as an altimeter and a "night-eye" in all kinds of flying weather will be of such great importance that the creation of a new industry to manufacture, install, and service the equipment is inevitable. It would appear likely that the men who have become experienced in the theoretical and practical applications of this device while serving with the Civilian Technical Corps would become the key men in the new industry. Thus, membership in the CTC gives a man a preparatory training to become employed in a new and expanding form of endeavor, and from which, quite conceivably, he would derive a larger income than from servicing radio receivers.

## WHERE TO APPLY ... —

Application for membership in the CTC should be addressed to The Civilian Technical Corps, c/o British Consulate General, 25 Broadway, New York City.

## BOOK REVIEW

*PERPETUAL TROUBLE SHOOTER'S MANUAL, VOLUME XII, published by John F. Rider Publisher, Inc., 404 4th Ave., New York, N. Y. Stiff-cover mechanical binder, 9" x 11½"; page bulk, 4" thick. Including complete index for Volumes XI and XII. Price, \$10.*

This new volume in the Rider Manual series takes on special significance

in view of a definite curtailment in receiver production, placed as high as 70 percent in some quarters. Where ordinarily new receivers do not come up for servicing for a number of years—and sometimes never, because they are discarded for later models—it appears evident that service data on late models will be in demand within a short period.  
(Continued on page 19)

# TECHNICAL SERVICE PORTFOLIO

## SECTION XIII

# REPLACEMENT PARTS PROBLEMS

**G**OVERNMENT priorities for materials needed for national defense are apt to create shortages in many replacement parts required for radio servicing. Already the production of permanent-magnet speakers is being limited solely to the small models required for battery portables, so that replacement of the larger types will have to be made with electrodynamic models. Can-type electrolytics are fast becoming extinct, due to the shortage of aluminum, and in their stead those with cardboard or plastic containers are being supplied. For the same reason, variable condensers are now coming through with metals other than aluminum for the stator plates. Other components, such as coils, may be hard to obtain, not so much because the basic materials are scarce, but because the factories producing these components are so tied up with government orders that they may find it difficult to fill commercial requirements. All of which means that, if the service business is to keep going full blast, a good deal of ingenuity in improvising ways and means of getting sets to perk with substitute parts may be required of each and every one in the radio service business.

### COIL MATCHING

In this article we concern ourselves largely with problems arising from using coils which have to be modified to match those already in the receiver. And before we get too deeply into this, let us take this opportunity to point out that, wherever possible, exact replacements should always be used. This business of improvising takes time, and

should not be attempted unless no other way of fixing the set is available.

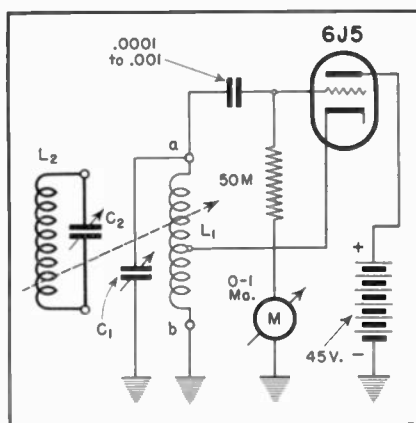
Accurate matching of coils is necessary in r-f and oscillator circuits; otherwise it is not possible to align the set so that proper tracking is obtained over the entire tuning range. In i-f circuits, some leeway is available, since the coils are adjusted to a single frequency. In audio circuits, the replacement coil problem is simply a matter of selecting transformers or chokes of approximately similar characteristics to those they replace. In power-supply circuits, where the speaker field so often forms a part of the filter, replacements must be so made that the voltages and hum filtration are not adversely affected.

For r-f, oscillator and i-f circuits, coil matching is usually accomplished by coupling the coil to be matched to an oscillating circuit. When this coil is

tuned to the same frequency as that to which the oscillator is tuned, its circuit absorbs energy from the oscillator circuit. If another coil is now substituted in the same circuit, and is so adjusted that it likewise absorbs energy from the oscillator at the same frequency when shunted by the same amount of tuning capacity, then the two coils are matched at this frequency. For r-f and oscillator coils, it is necessary to match the coils at more than one frequency, since in operation they are required to track over a wide tuning range.

### MATCHING CIRCUITS

The oscillator circuit used for such matching purposes may be of almost any type, provided that some means is incorporated to indicate the depth or strength of oscillation. A suitable circuit is shown in *Fig. 1*, which is a schematic of a typical grid-dip type of oscillator. In this circuit, the 0-1 ma meter in the grid circuit serves to indicate the depth of oscillation. In operation, when the tube is oscillating, the meter will read around 0.2 to 0.8 ma, depending upon the B-battery voltage, the amount of feedback in the circuit, and other factors. Whatever this reading is, when another coil is coupled to the circuit by placing it near the oscillator coil, a decrease in the meter reading will occur when the external coil is tuned to the same frequency as that of the oscillator coil—or, as it is usually done, when the oscillator is tuned to the same frequency as that of the external tuned circuit. It is, of course, possible to use a less sensitive meter, say 0-10 ma, and insert it in series with the plate circuit of the oscillator tube.



*Fig. 1. Set-up of typical oscillator circuit for the matching of coils.*

Then, when the external circuit coupled to the oscillator is of the same frequency as the oscillator, the meter reading will increase, instead of decreasing. But this arrangement is less sensitive.

The coil  $L_1$  in Fig. 1 is usually tapped for the cathode connection at about one-third the total number of turns above ground. This point will vary with the efficiency of the coil, the battery voltage and the amount of tuning capacity, but in any event is not particularly critical. It is good to have several coils so tapped and arranged to plug into the terminals  $a-b$  to cover any desired frequency range. Practically, it is not necessary to cover frequencies higher than a few megacycles, because short-wave coils are usually very simple in construction, employ heavy wire and usually don't require replacement.

The circuit of Fig. 2 is adaptable to a far wider range of application than that of Fig. 1. It employs a negative conductance type of oscillator circuit similar to that described in the March, 1941, issue of RADIO SERVICE-DEALER and is a favorite with us. The only coil required for oscillation is  $L_1$ , which, you will note, is not tapped. Further, any range from the lowest audio frequencies up to several megacycles may be obtained simply by changing  $L_1$ . The control-grid bias is variable, and the relative coil efficiency, or  $Q$ , can be obtained by noting the amount of grid bias which is required for oscillation. The higher the grid bias at which oscillation is obtained, the higher the coil  $Q$ . The meter  $M$  should be sensitive, preferably a 200-micro-ampere type, though a less sensitive meter (up to 1 ma) will serve the purpose. The blocking condenser  $C$  should be of the order of .001 mfd when using low audio frequencies; up to 2 mfd when using low audio frequencies.

This setup may be used in the same manner as that of Fig. 1, for r-f and i-f frequencies, coupling the coil to be checked (designated as  $L_2$  in the diagram) near the oscillator coil  $L_1$ , as

shown. For a-f ranges, an a-f amplifier and speaker may be coupled to the output terminals and chokes and audio transformer windings may be checked by feeding the resulting audio frequency into the grid circuit of the a-f amplifier and noting the audio response by ear.  $C_1$  may be adjusted until a recognizable audio tone is secured, and coils other than  $L_1$  may be substituted and the capacity required to produce a similar output frequency.

**CALIBRATION**

No matter which type of circuit is employed, the oscillator may be calibrated at r-f and i-f frequencies by picking up the radiated output signal with a calibrated radio receiver. The receiver should preferably be of the all-wave type, and should be fitted with a tuning eye to indicate the presence

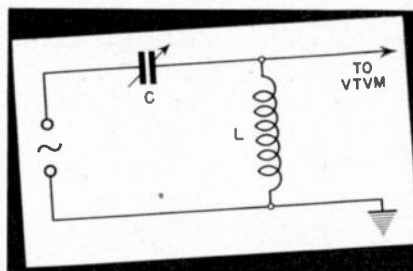


Fig. 3. Simple, calibrated circuit for use in determining coil inductance.

of the oscillator signal, which is unmodulated. While the oscillator signal may likewise be picked up with a receiver not so equipped, by noting the "thump" in the speaker when tuned to resonance with the oscillator signal, the tuning eye will be found much more accurate.

It is not necessary that the receiver have a long-wave band in order to cover frequencies below the broadcast band. Intermediate frequencies may be checked by noting the points at which harmonics are picked up on the broadcast band of the receiver. For instance,

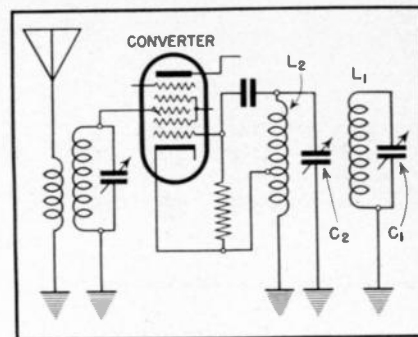


Fig. 4. Arrangement for checking and matching coils at high frequencies without using special oscillator.

for a frequency of 465 kc, the second harmonic will occur at 930 kc and the third at 1395 kc. It is necessary to determine two consecutive harmonics in order to be sure of the fundamental frequency, since it is apparent that the fourth harmonic of 232.5 kc will likewise be 930 kc and the sixth (but not the fifth) harmonic comes in at 1395 kc, just as does the third harmonic of 465 kc. In any case, the frequency difference between two consecutive harmonics is equal to the fundamental frequency.

For the lower frequencies, a suitable arrangement to determine coil inductance is to use a calibrated decade condenser box and a known test frequency in a circuit such as that shown in Fig. 3. The capacity and the coil form a series circuit which can be adjusted to resonance at the test frequency. If the test frequency and the capacity are known, the inductance may be determined by substitution in the formula

$$L = \frac{1,000,000}{(6.28f)^2 C}$$

where  $L$  is in henries,  $C$  is in microfarads and  $f$  is in cycles.

A very convenient simplified form of this equation, for use only when the test frequency is 60 cycles, is

$$L = \frac{7.1}{C}$$

in which  $L$  is in henries, and  $C$  is in microfarads.

Thus, in Fig. 3, if we connect a vacuum-tube voltmeter (or simply an a-f amplifier and output meter) across  $L$  and adjust  $C$  until maximum indication is obtained on the vacuum-tube voltmeter or the a-f output meter, when the test frequency is 60 cycles the inductance of  $L$  may be determined by simply dividing 7.1 by the capacity to which  $C$  has been adjusted for resonance. Thus, if  $C$  is 2 mfd,  $L$  is equal to 7.1 divided by 2, or 3.55 henries.

If the inductance is known, the ca-

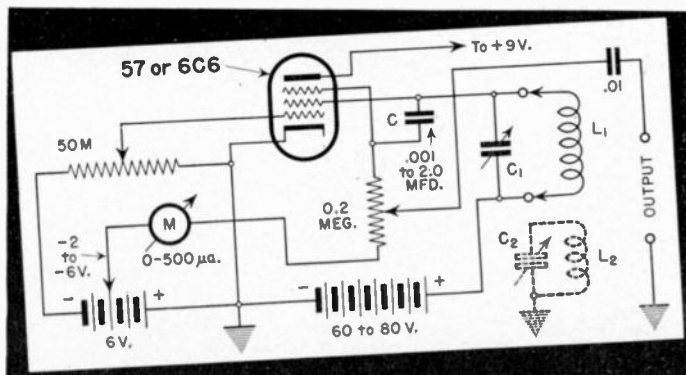


Fig. 2. Negative-conductance oscillator for coil matching. It has a wider range than the one shown in Fig. 1.

capacity may be determined by simply transposing the formula so that it reads

$$C = \frac{7.1}{L}$$

which again applies only when the test frequency is 60 cycles. Thus, if the inductance is known to be 3 henries, the capacity required to produce resonance at 60 cycles is equal to 7.1 divided by 3, or 2.37 mfd.

If LC charts are at hand—and such charts may be obtained from catalogs, handbooks and other sources—calculation may be avoided and the answer determined for any frequency by simply laying a straight edge along the chart. But, as is usually the case, we accumulate charts but never can lay our hands on them when we need them.

#### OTHER MEANS

Fig. 4 shows a convenient method of checking and matching coils at high frequencies without using a special oscillator. The coil *L1*, which is to be checked, is shunted by its tuning condenser *C1* and coupled close to the oscillator coil and tuning condenser *L2-C2* in a receiver. The receiver is tuned to a signal near the low-frequency end of its scale and *C1* is adjusted to resonate *L1* at the oscillator frequency of the receiver. This condition will be indicated by a decrease in the avc voltage of the receiver, which will cause the receiver tuning eye to open. The high-frequency end may be similarly checked

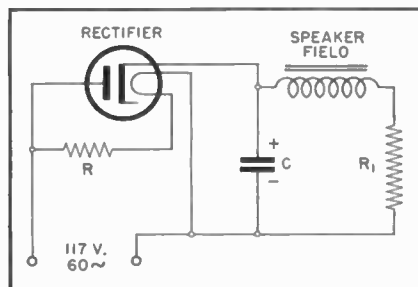


Fig. 5. Using separate rectifier, such as a 117Z6, or a 25Z5 with series resistor, for supplying field of replacement dynamic speaker.

by retuning the receiver to a signal near the high-frequency end of the scale and readjusting *C1* until resonance is again established. If the setting of the condenser dial which is required to produce resonance with *L1* at the high- and low-frequency tuning points is noted, then another coil may be substituted for *L1* and adjusted so that it likewise produces resonance at precisely the same tuning points. This is done by removing or adding turns (preferably the former). The coils are then matched.

The same procedure is employed when the circuits of Figs. 1 or 2 are used. Care should be taken, no matter which circuit is being used, that the coil to be checked is not coupled too closely to the oscillator circuit. Only sufficient coupling should be used as will provide an indication of resonance; otherwise the indication will be broad and inaccurate.

#### SELECTING COILS

In selecting coils for replacement purposes, try first to get one which matches in physical characteristics the one to be replaced. That is, it should have about the same diameter and length, the same type of winding and the same size of wire. For r-f and oscillator coils of present-day production, no difficulty should be had on this score. In any case, make sure that the tuning range is the same as that of the coil which is to be replaced. You will note that the tuning range is much greater when the coil is out of the set than when it is installed; this is due to the distributed capacity in the receiver circuit, which may be of the order of 20 to 35 mmfd in r-f circuits on the broadcast band.

Replacement antenna coils for midget ac-dc sets usually have a large primary, in order to produce maximum results with small indoor antennas; make certain that the replacement is similarly constructed. And, if only the primary is burned out, remember that it is possible to obtain primaries separately and these may be coupled to the secondary without further attention. The sole precaution is to make certain that the coupling is approximately the same as was present with the original primary, and that the same type of primary coil is employed.

#### SPEAKER REPLACEMENTS

As for the replacement of permanent-magnet dynamic speakers with those of the electrodynamic type, the simplest way out is to use a separate rectifier to handle the speaker field, as shown in Fig. 5. The rectifier may be of any type suitable for operation in ac-dc sets, such as the 25Z5, and the resistance *R* for the filament drop. Or, still simpler, the rectifier may be of the 117-volt type, in which case the filament is connected directly across the line. The hookup then will be just the same as that which would result in Fig. 5 if the resistor *R* were shorted out.

The resistor *R1* may be required for some of the smaller electrodynamic

speaker fields in order to limit the current to a safe value. Generally, speaker fields which are designed to be shunted directly across a 110-volt rectifier output have a field resistance of around 3000 ohms; those which are used as filter chokes in ac-dc sets have less resistance—about 450 ohms—in order to avoid excessive voltage drop. For the latter, the safe current rating may be obtained from the jobber or manufacturer and the resistor *R1* should be chosen to limit the current to this value. Actually, the value is not particularly

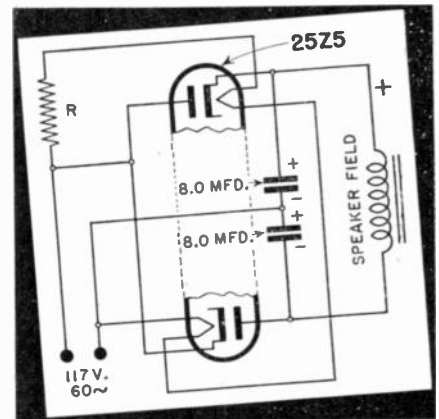


Fig. 6. A voltage-doubler circuit for supplying excitation for a dynamic speaker with high-resistance field coil.

critical; if the current through the field is 30% below maximum rated level, the performance is not appreciably affected. If *R1* is used, make certain that its wattage rating is sufficient; usually a wire-wound type will be required.

The condenser *C* will not be required as a rule; it serves to reduce the hum ripple and also to raise the voltage across the speaker field. For the smaller speakers, which give little response to hum frequencies when used with a small baffle, the easiest way to reduce the current through the speaker field is to eliminate this condenser. Then *R1* will ordinarily not be required. However, for larger speakers, such as are required for console sets or p-a work, it will be necessary to include *C* and perhaps to eliminate *R1*, in order to assure maximum excitation.

The voltage doubler type of rectifier also finds application as a relatively economical method of energizing the speaker field. A suitable circuit is shown in Fig. 6. This method will be required when the speaker being used has such a high resistance field that insufficient excitation is secured when the circuit of Fig. 5 is employed.

Of course, for any of these purposes a power transformer may be employed.

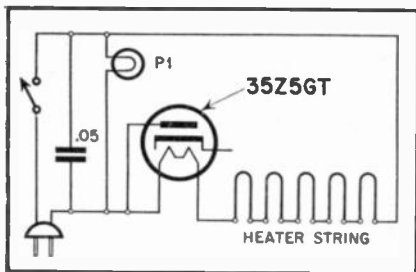
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# CIRCUIT COURT

## High-Voltage Pilot

DEPARTING FROM the usual practice of using a 6-to-8 volt pilot lamp connected across one-half of the rectifier heater in ac-dc sets, *General Electric* have turned to the use of a 110-125 volt lamp connected directly across the line, in their Model L-660. This lamp, *P1*, is shown in the circuit of *Fig. 1*.

Two advantages are gained from this arrangement—the lamp does not breathe or flicker when large signal inputs are impressed on the power tube; and there is far less chance of the heater of the rectifier tube burning out, which it is apt to do in the event of pilot-lamp failure in the usual circuit arrangement. The fact that the lamp



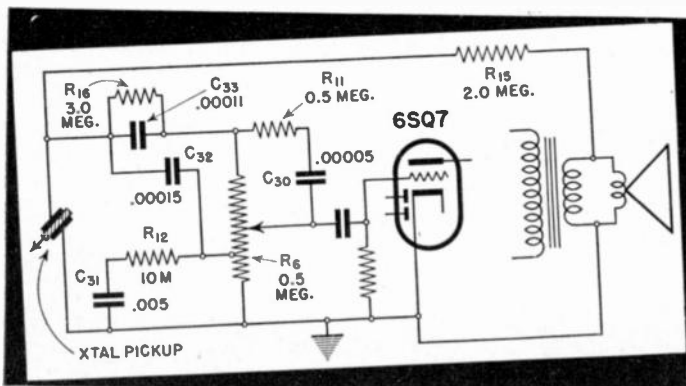
*Fig. 1.* Line-voltage pilot in G.E. set.

reaches full brilliance when the set is first turned on might be considered a third advantage.

## Frequency Correction

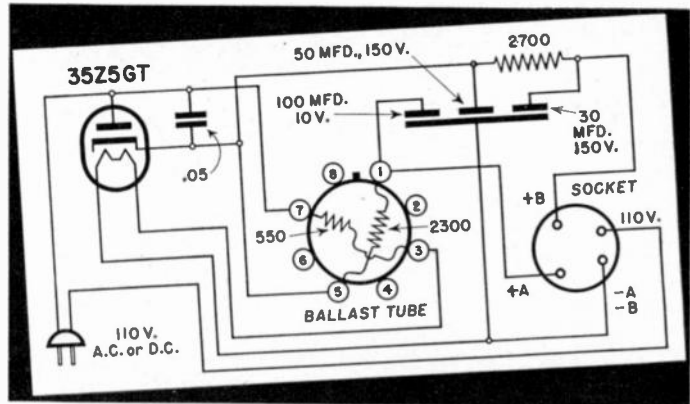
MORE THAN usual attention is paid to frequency compensation in the *Emerson* Model FE-409. The portion of the circuit involved is shown in *Fig. 2*.

The diagram, as drawn, is the circuit as it is for phonograph operation. It should be observed that, in this posi-



*Fig. 2.* Frequency-correction network in phono section of Emerson set.

*Fig. 3.* Schematic of RCA "Electrifier" for farm battery receivers or similar sets.



tion, a portion of the a-f voltage developed across the secondary of the output transformer is fed back to the hot side of the crystal pickup, by way of the 2-meg resistor *R15*. Aside from its value as a means of reducing distortion, this degenerative feedback loop attenuates frequencies in the vicinity of 60 cycles where turntable-motor rumble is most apparent.

Pickup response is flattened by means of the series equalizer made up of the 3-meg resistor *R16* and the .00011-mfd condenser *C33*.

The remainder of the compensation revolves around the tapped volume control *R6*. An apparent bass boost at low volume levels is gained by an attenuation of the higher frequencies by means of the filter *R12-C31* shunting the lower section of the control. At higher volume levels the treble is boosted by means of the filter *R11-C30*.

It is also interesting to observe that a secondary, capacitive, load is placed across the pickup, in the form of condenser *C32*, connected from the high side of the pickup to the tap on the volume control. Since the load is capacitive, it reduces the pickup output somewhat, but since it is in series with the

lower section of the volume-control resistance, it should be considered as a subsidiary equalizer which, without regard to the position of the volume-control arm, attenuates the higher frequencies and therefore provides artificial bass boost. However, the degree of bass boost is more apparent as the volume-control arm is moved closer to the tap, since the volume control in this circuit forms a part of an a-f voltage divider.

The selected values of capacity and resistance in the complete circuit are such that the level of response at the low, middle and treble frequencies is properly proportioned at all volume levels to meet corresponding aural deficiencies.

## "Electrifier"

FOR THE PURPOSE of "electrifying" their new 1942 "Security Model" battery receivers, *RCA Victor* has introduced the CV-42 Electrifier, a compact power-supply unit that will supplant the "A" and "B" batteries and conveniently fit into the cabinets of receiver Models 25BK, 25BT-2 and 25BT-3. Matters are so arranged that it is merely necessary to insert the receiver battery cable plug into a socket on the side of the Electrifier chassis, and setting a control knob on the receiver to a position marked "Electric." This latter operation places the tube filaments in series.

The circuit of the Electrifier is shown in *Fig. 3*. It consists of a 35Z5GT rectifier, a K-920117-1 ballast tube, a three-section electrolytic condenser and a 2700-ohm resistor which, together with the 50- and 30-mfd electrolytics, forms the resistance-capacity filter for the "B" supply. The 100-mfd electrolytic and the 2300-ohm resistor in the ballast tube filter the "A" supply.

# The RADIO FRONT

KARL A. KOPETZKY

## Washington Whoopla

THE blue-print stage of National Defense passed, we are rapidly approaching the manufacturing period. The transition has been somewhat gradual in spots, violent in others, with a resulting confusion that beggars description. While some industries have had the inside track with the *OPM*, the same cannot be said of radio. Although repeatedly rated fourth as a medium necessary for National Defense, radio has suffered from "too many cooks," too many "wise guys," too many self-assured manufacturers and dealers who believed that they could and would carry on with a "business-as-usual" attitude. Now, at long last, the shoe is beginning to pinch.

Rumors are rampant that the replacement parts business of radio is to be given a general priority rating. But in a list of civilian "necessities" published on July 11th, as "Civilian Allocation Program for . . . . . Maintenance and Repair Work for Durable Consumer's Goods," (and civilian radio is most certainly "durable goods"), one finds "Passenger automobiles, trucks and tractors, household refrigerators, stoves, water heaters, furnaces," etc., *but no radios!* The articles mentioned above are to be given priority over all other civilian competing demands.

Nor is that all. Some of the radio industry have gathered unto themselves substantial general priority ratings. For instance; radio transmitters and receivers being built for National Defense carry an A-1-c rating automatically; relays and solenoids one of A-10. What one sees, is a lot of talk that the replacement part of radio will be given a preference; but the burning question is *when and what*. Unless we are gravely mistaken, no blanket rating will be given replacement parts supply in radio until the *RMA's* or the parts manufacturer's bile overflows and they get mad enough to get one for themselves!

## What Happened to Plastics?

At the start of the National Defense Effort all one could hear was "That will be replaced with plastic!" However, what happened to cause the manufacturers to contract for more wooden cabinets than they had the year before; where is the plastic that was to be used inside and outside radio sets? Here is the story of a new industry that grew too fast, and has all but been gobbled up by the Government.

Six months ago the *OPM* advised the radio manufacturers to look to plastic as a suitable substitute. It took a while for that advice to sink in. When the radiomen finally went for the stuff they found "the cupboard bare."

The plastic industry had first been "raided" by the Air Corps which needed

the material for transparent "noses" on the Flying Fortresses, not to mention sliding hoods on fighters. Then the Navy went in and got it for the many, many uses on shipboard for which glass is dangerous. Came the Army to get some for its Signal Corps, for its Artillery, for its Tank Corps. There just wasn't any more left for the manufacturers.

Basically, most plastic is a by-product of formaldehyde, which comes from methanol, which in turn is manufactured by the same machinery which makes ammonia. This machinery has been making ammonia for gun-powder, and not methanol. Plastics require presses, and there is a shortage; also skilled die-makers, and the die-makers are engaged elsewhere on defense work. The dies must be made of nickel-steel, and there is little of that available for any civilian use!

Plastics are graded now as follows: *Grade A:* Army, Navy, Air Corps. *Grade B:* Heat, power, trucks, etc. *Grade C:* Radio. *Grade D:* Furniture. *Grade E:* Toys and decorations.

Suppliers haven't gotten beyond Grade A yet.

The plastic situation will be relieved when and if the ammonia shortage is corrected by having more plants engaged in its manufacture. Meanwhile, radio will have to struggle along with less of plastic and more of wood. But wood is not too hard to get right now.

## Technical Help Shift

Radio factories are booming, some with National Defense orders, and others with civilian work. The *OPM* is mighty interested in keeping *all* plants going. They have even coined a ribald, though truthful slogan, "*Don't let them catch us with our plants down!*" Meanwhile a shift from civilian to National Defense orders entails an increase of technical help of from 50% to 75%. To find these experts, every nook and corner is being scoured, and with good results. Most of the "raids" have been in the serviceman field, especially in the Middle West.

But the scramble for Defense work has also brought on another headache. It is the small manufacturer who has been unable to get either materials or National Defense orders. These small radio plants are closing down while their employees are hastily gobbled up by the large companies. That has not been easy on the working people who, in some cases, have had to move their whole families to new locations where the big plants are. The National Defense Effort though, has *not* been blitzed, and is going ahead faster now than ever. Even so, it is the opinion of the *OPM* that by the fall perhaps even 1/3 of all smaller radio plants will have been shut down—unless the *OPM* is successful in spreading a greater amount of sub-contracting out into the hands of the small fellow.

## Curtailment by Credit Methods

In spite of the failure during the period 1917-1919 to curtail buying by cutting down the time limit on installment purchases, the same thing is to be tried again. Particularly mentioned on the program are cars, refrigerators and radios. The Government is bringing pressure on the big merchandisers and national credit associations, who argue that installment buying gives employment to millions, and stabilizes our economy. In answer to that Uncle Sam says a slow-up is needed to: (a) prevent defense workers from going *buy-buy crazy*; and (b) to retard buying and stabilize markets.

First sign of which is winning: Big National Mail Order Houses have cut time purchases from 3 to 2 years. How does it affect jobber business? Well, it won't hurt radio sales nearly as much as it will refrigerators. Radios are usually sold on a one-year basis. But there is fear that if there is curtailment in one line, then radios may come to be sold on a 6-months basis, which would not be so good. There is nothing in the plan to prevent the small proprietor from selling on whatever time limit he desires, if he carries his own paper. Here the program may force the buyers away from the big chain houses into the stores of the small owners.

## Steel Condensers

Already the variable condenser men have solved the difficulties presented by the shortage of aluminum. Steel dipped to prevent rusting is their answer. Incidentally these condensers are far better than the aluminum ones, but weigh about 3 times as much even if they are considerably smaller. The sole drawback seems to be that they are somewhat unsuited for remote control because of their weight and the resulting abnormal power needed to overcome the thrust. But then, "padder" remotes can still be used to detour this contingency.

## More on Priorities and Ceilings

On August 1st, copper was placed on 100% priority. Zinc has already been so handled. Latest is cutting tools. *Reason:* Everything points to a long war; Hitler attacked Russia because he knew it, and Stimson, our Secretary of War and *OPMan* Knudsen are backing the St. Lawrence Seaway because they know it. In a long war eventually everything that has any bearing on National Defense will be under priority control. That about spells "the end" of the Business-as-usual School-of-thought.

Nor is that all. Some civilian businesses are being aided vitally by the government. Scientific apparatus and hearing devices were assured of supplies by being given priorities over other civilian re-

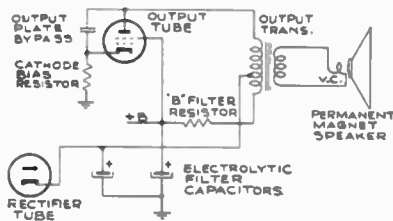
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# Shop Notes

## RCA AC-DC WITH P-M's Hum Reduction

In RCA ac-dc receivers using p-m speakers, effective hum bucking is obtained through the use of an output transformer with tapped primary. The tap is established at a point where the "ampere turns" of ripple in the direction of the output plate balances the "ampere turns" of ripple in the direction of the screen and other plate circuits.

High residual hum (at zero volume setting) may be due to incorrect balance, and can usually be remedied by one of the following steps:



Output tube with off-standard characteristics.

Filter capacitor too low in capacity, or too high in internal resistance.

"B" filter resistor not correct value. Measure resistance and change if necessary.

Cathode bias resistor of output tube not correct value.

If hum persists change the output-tube plate bypass to rectifier cathode instead of to output-tube cathode.

If none of preceding steps reduces the hum to a satisfactory level, replace the output transformer.

## MICROPHONICS IN PORTABLES Cushioned Sockets

According to *RCA Application Note No. 114*, which deals with the subject of microphonics, the vulnerable component is often a tube because the filaments of the dry-battery tubes are necessarily small, non-rigid, and therefore susceptible to vibration. Although the plate, screen, and grid electrodes can and do vibrate when a mechanical shock or a sustained vibromotive force is transmitted to the tube socket, the filament produces the most serious vibration. To complicate matters in small receivers, the close spacings of loudspeakers and vulnerable parts often result in highly efficient mechanical (and acoustical) transmission linkages.

In receivers not so equipped, microphonic troubles can be reduced, if not cured, by the installation of cushioned tube sockets and the use of flexible leads to the socket terminals.

The tube causing all or most of the trouble is likely to be the 1S5, as ordinarily used in the first a-f stage. However, when a strong carrier is applied to the receiver, either on or slightly off resonance, the 1R5 converter or the i-f tube may be found to require cushioning also.

## RCA 6SL7-GT TUBE

The 6SL7-GT is a twin-triode amplifier of the high- $\mu$  single-ended type with separate cathode terminals for each triode unit. For further details and socket connections, see data on 12SL7-GT, page 10, July RADIO SERVICE-DEALER.

## RCA 1631, 1632, 1633, 1634 TUBES

These are special-purpose tubes intended for applications where uniformity of characteristics are important.

The 1631 is similar to the 6L6, but has a 12-volt heater.

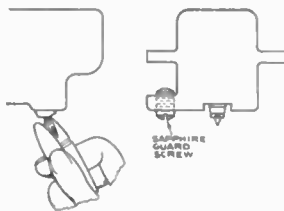
The 1632 is similar to the 25L6, but has a 12-volt heater.

The 1633 is similar to the 12SN7-GT, but has a 25-volt heater.

The 1634 is the same as the 12SC7.

## RCA RP-158 RECORD CHANGER Replacing Sapphire

As a precaution against rough handling, the top of the sapphire in the pickup is dipped in a rubber cement (such as Goodrich "Plasticon") before being inserted. To remove the sapphire, grasp it firmly with a pair of tweezers, give it a few turns to loosen the cement and then pull it out. Much easier handling of the sap-



phire will result if the tweezers are notched with a file, as shown. Naptha may be used as a thinner should difficulty with the rubber cement be experienced.

Before inserting the new sapphire it should be dipped in rubber cement previously thinned with naptha. After insertion clean the point with naptha if there is any doubt as to the presence of cement.

## RCA BATTERY SETS Low Output

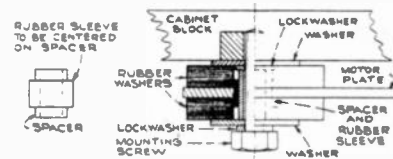
Low power output on battery models that use a 3Q5GT output tube may be caused by burnout of one-half of the double filament in this tube. Check for continuity between prongs 2 and 8 and between 8 and 7.

## RCA QB3 (RC-539) Capacitor Change

In second production of QB3, C15 is changed to 66 mmfd to improve tracking.

## RCA RP-153 (V-301, V-302) Motor Hum

Excessive hum may be caused by incorrect assembly of the rubber grommets on the two bolts that fasten the motor-mounting plate to the cabinet. The correct as-



RP-153 MOTOR MOUNTING ARRANGEMENT

sembly is shown in the accompanying sketch. The rubber sleeve must be centered on the metal spacer so that the motor plate can not come in metallic contact with the spacer.

## RCA STATION ALLOCATOR Changing Ranges

In locations where most of the popular "push-button" stations are in the upper half of the broadcast band, the push-button frequency ranges of the Station Allocator can be shifted upward by changing C3 and C4 from 1200 mmfd to 1000 mmfd. The frequency ranges are then as follows:

Buttons 1, 2	.....435 to 890 kc.
Buttons 3, 4, 5	.....640 to 1270 kc.
Buttons 6, 7, 8	.....890 to 1840 kc.

## Neon Modulator

To compensate for varying neon-lamp characteristics, R7 is changed from 1.5 to 2.2 megs, and C9 is changed from 1800 mmfd to 1200 mmfd.

## STEWART-WARNER 1941 SERIES Repairing On-Off Indicator

Models 12-4D1, 02-4C1, 02-5T1, 02-428, 205CA and 205CK utilize an on-off indicator located in the dial face. The indicator is operated mechanically by an arm attached to the volume-control shaft. Since this arrangement is of necessity a friction drive, isolated cases may be encountered where a small burr or rough surface will make the volume-control knob exceedingly hard to turn. This action is noted particularly when an attempt is made to turn the set off.

The remedy for the above condition is to first examine the arm and slider (arm attached to volume-control shaft and slider located under dial scale) to determine if these parts are smooth and free of burrs. Any burrs or roughness can be corrected by filing. Then place a small amount of grease or vaseline on the portions of both parts which make a sliding contact. This lubricant will make the parts operate much easier.



## SERVICE PORTFOLIO

(Continued from page 11)

But this is an unnecessary expense in most cases.

### FILTER CIRCUITS

When the speaker field is used in the power-supply circuit of the receiver itself, some modifications are usually required in order to maintain proper filtration and to keep the voltages down to normal. This is particularly true when the set in which the electrodynamic speaker is to be installed utilizes

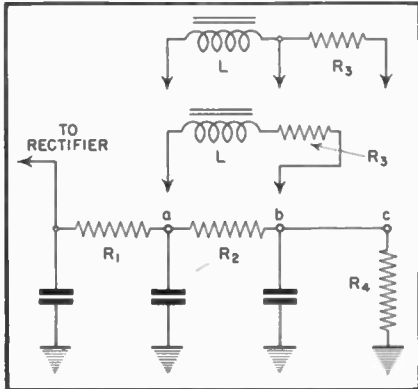


Fig. 7. Modified filter circuits with speaker field.

a resistance-capacity filter such as is shown in Fig. 7. Here a two-stage resistance-capacity filter is shown, in which the resistive elements are  $R_1$  and  $R_2$ . If we wish to install an electrodynamic speaker field in this circuit, the best plan for the type of field which is designed to be used as a series choke is to replace  $R_2$  with the speaker field as shown. If the resistance of  $R_2$  is greater than that of the speaker field  $L$ , then additional resistance,  $R_3$ , is inserted in series with  $L$  to bring up the total resistance of the combination of  $L$  and  $R_3$  to equal that of  $R_2$ . Then the output voltages of the power supply will remain unaffected.

For improved filtration, instead of inserting  $R_3$  in the filter section occupied by  $R_2$ , it may be placed in the external bleeder circuit, in series with  $R_4$ . In this way the efficiency of  $L$  as a choke is increased, yet the voltages are kept normal.

When the resistance of the speaker field is greater than  $R_2$ , it is desirable to shunt  $R_1$  with an additional resistance sufficient to make the total circuit resistance the same when  $L$  is substituted for  $R_2$ , as was the case when  $R_2$  was used alone. While shunting  $R_1$  reduces the filtering efficiency of the first section of the power-supply filter,

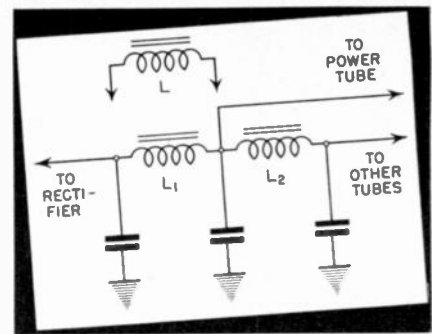


Fig. 8. Speaker field should occupy position of largest drain.

the improvement resulting from the use of the inductance  $L$  in place of  $R_2$  more than makes up for this loss.

Naturally, what has been said about using the speaker field to replace the resistance in a resistance-capacity filter applies likewise to the choke in a standard inductance-capacity filter circuit. However, if the high-current power tube drain is taken off the first section of the filter, as is usually the case, the speaker field should replace the first section choke  $L_1$  (see Fig. 8). Otherwise the current through the choke may be insufficient to supply proper excitation. This applies likewise to resistance-capacity filter circuits where the power

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tube current is drawn from the first filter section.

It is a good idea in any case to determine the current available for speaker field excitation. Then a speaker may be selected whose field current requirements correspond to the current available for excitation purposes. In those receivers where insufficient current is available for any readily obtainable speaker, it is advisable to employ a separate rectifier.

You will note that no mention has been made in this application of the type of speaker field which is designed to shunt the rectifier output. It is better not to use this type of speaker for this purpose, since the added drain on the rectifier, and especially on the power transformer, may be disastrous.

### PERFORMANCE RATINGS

(Continued from page 7)

dividual test of all components and voltages in a stage. If the gain is normal then the components and voltages are normal.

### INTERPRETATION

The interpretation of gain information has been the subject of innumerable discussions. We already have said

that it represented the performance of the radio system. Since there are performance factors which are not necessarily related to gain, it might be well to qualify the statement by saying that it represents the amount of amplification available in the system on a basis of stage-by-stage operation and also the overall sensitivity of a system with respect to a standard rated output. At the present time, both methods of presentation are used by receiver manufacturers. Such manufacturers as *RCA, Zenith, Farnsworth* and *G.E.* furnish data which states how much amplification is to be expected in the different stages at specified frequencies and between different points in that stage. *Motorola*, on the other hand, furnishes gain data in terms of signal levels required at different points in a system for a rated signal voltage across the voice coil.

Examples of both are given herewith. While these may look different, they are essentially the same, for both furnish like facts. For example, let's look at *Table 1*. It states that the gain in the antenna transformer at 600 kc is 6. In other words, if a signal of known intensity is fed into the primary of the antenna transformer, the signal voltage at the same frequency across the secondary winding, which may be connected to the control grid

of the first r-f tube or mixer tube—in this case to the r-f tube—will be 6 times as great as that applied across the primary. This gain is shown as 6X.

Now let's look at the same thing in *Table 2*. Here the story is told differently, for the manufacturer states the signal level required at the antenna and at the grid of the r-f tube for the same signal voltage across the voice coil. In other words, the voice coil voltage is the reference indication. At the antenna or the primary of the antenna transformer 1.0 microvolt at 600 kc is required to produce 1.73 volts a-f across the voice coil. At the grid of the r-f tube, 6 microvolts are required for the same signal voltage at the speaker voice coil. Since 6 microvolts are required at the grid of the r-f tube and only 1 microvolt at the antenna for the same signal voltage across the voice coil, the antenna transformer is amplifying the signal 6 times, for if the antenna transformer is not used, then 6 times as much signal voltage input is required at the mixer for the standard output.

### COMPUTATION

In *Table 1*, the gain of the antenna transformer is given. In *Table 2*, the

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gain of the antenna transformer must be computed by solving the ratio

$$\text{Gain} = \frac{\text{input voltage 2}}{\text{input voltage 1}}$$

which in this case is

$$\text{Gain} = \frac{6}{1} = 6X$$

In *Table 1*, the gain of the r-f stage, between the control grid of that stage and the control grid of the next tube, which is the mixer, is given as 30X. As you see, this includes the tube as well as the transformer primary and secondary, and the frequency is the same as that originally fed into the antenna; namely, 600 kilocycles. Recognition of what components comprise the stage, for which the gain or amplification is given is important, as will be discussed later.

In *Table 2*, this same gain data is given differently. Whereas the signal input required at the r-f tube control grid for a standard output voltage across the voice coil is 6 microvolts, the required signal input at the same frequency at the mixer control grid is 180 volts. Obviously, the r-f stage and its associated transformer which links the r-f tube to the mixer, supplies the difference in signal level between the r-f tube control grid and the mixer tube control grid. The ratio between the two required input voltages for the same standard output is the gain between the stages, viz;

$$\text{Gain} = \frac{180}{6} = 30X$$

In like manner, the amplification in the mixer tube or the conversion gain, inclusive of the 1st i-f transformer is established by both tables, except that in this case, the input signal to the mixer tube is at the radio frequency, whereas the frequency of the signal voltage at the 1st i-f tube control grid is at the intermediate frequency. The change in frequency takes place as a result of the operation of the mixer tube, into which is fed the r-f signal as well as the signal from the local heterodyning oscillator. In *Table 1* the conversion gain is given as 10X. In *Table 2*, this is given as 180 microvolts (600 kc) at the mixer control grid and 1800 microvolts (455 kc) required at the 1st i-f tube control grid. Solving the ratio

$$\text{Gain} = \frac{1800}{180} = 10X$$

#### GAIN BREAKDOWN

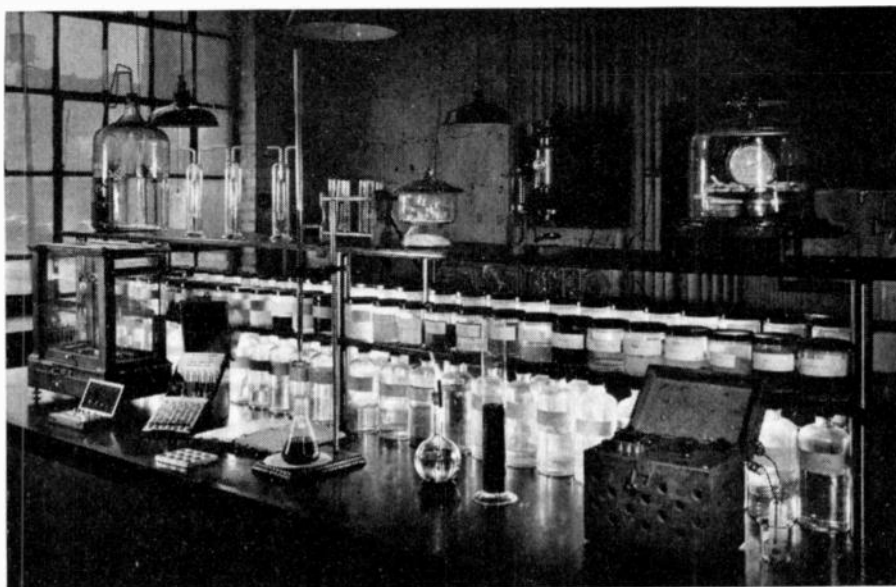
Now, before advancing any further, we feel that it might be well to men-

tion two significant facts pertaining to both methods of presenting such gain or sensitivity data. It is possible for *Table 1* to be made more elaborate by breakdown of the contribution to the gain by the tube and the associated transformer. Or such presentation of facts may be made right on the schematic wiring diagram. Thus, the antenna transformer would be identified as having a gain of 6X, but the overall r-f gain of 30 in the r-f tube and its associated transformer could be broken down as being 5 in the tube, between the control grid and the plate, and 6 in the transformer, between the

plate of the r-f tube and the control grid of the mixer tube.

On the other hand, such presentation cannot very well be made in the form of *Table 2*, because the signal cannot conveniently be fed into the various plate circuits; hence, individual tube and transformer breakdown is seldom given in such tabular form.

Another interesting detail is associated with mixer tube information. The example we gave stated the gain within this tube when it is used as a mixer or converter. In some cases, the operation of this tube as a straight-forward amplifier is given in the table

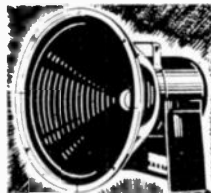


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and this differs from the operation of the tube as a mixer in two respects. First, the frequency of the signal fed into the tube control grid is the same as the intermediate frequency; second, the gain of the tube as an amplifier is usually less than that of the tube used as a mixer. The difference is about 10 percent.

The process of interpreting the remainder of the items given in both of these tables or shown on a schematic is like that already described, differing only in that when the demodulator tube is passed the signal is of audio character. As far as the points between when signals are checked or gain is established, they are like those which are used in r-f and i-f systems; that is, they embrace the vacuum tube

as well as the coupling device which links one tube to the next. Unfortunately we do not have the space here in which to discuss this operation fully for there is much more to be said about interpretation of gain information and what to expect under different conditions. But before we cease speaking about such tables, it is necessary to mention overall sensitivity.

#### OVERALL SENSITIVITY

By overall sensitivity is meant the sensitivity of the complete system from antenna to speaker, and when expressed in terms of gain, it is the ratio between the output voltage at the speaker and the input voltage at the antenna. Thus, if the reference voltage at the speaker voice coil is 1.73 volts and the rated input voltage at the antenna is 1.0 microvolt, the overall gain is

$$\frac{1,730,000}{1} = 1,730,000X$$

By itself such a rating of gain does not mean very much. It furnishes information, but it is not sufficiently definite, for it does not express the sensitivity unless both the input and output voltages are stated. Thus if 1.73 volts across the voice coil represents a certain amount of power, which is the reference setting, and this output is supposed to be obtained with an input of 1.0 microvolt, then the sensitivity is 1.0 microvolt. Without knowing either the output power or the input voltage, the mere statement of an overall gain of 1,730,000 times would mean very little. Why this is so will become evident soon.

In the case of those tables or charts which quote gain information, additional supplementary data also is given which provides the basis for computing overall sensitivity. Thus you can see that in the case of *Table 1*, gain is given directly, whereas in *Table 2* it must be computed. On the other hand, overall sensitivity must be computed in *Table 1*, whereas it is given directly in *Table 2*. For example, if presentation of gain data in tabular form shows an overall gain of 2,000,000 and the voltage across the voice coil for normal operation and correct sensitivity is 2 volts, then the input required is 1.0 microvolt and that is the sensitivity.

Now, in connection with all such gain and sensitivity measurements, proper interpretation depends upon recognition of certain contributing factors. Normally when we speak about amplification, it is supposed that as progress is made through a receiver, increased signal strength should be experienced between all

points. Such is not to be expected, for there are places in a radio receiver where there is no gain—in fact a loss is normal. This is more prominent in the gain tables than in those tables which quote signal levels for a standard output.

For example, while there is gain between the control grid of one tube and the control grid of the next tube with resistance-capacity coupling between the two, there is no gain between the plate of the first tube and the control grid of the second tube. In fact, there may even be a loss between these two points, depending entirely upon the de-

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sign of the system and the frequency of the signal. The same is true in the case of i-f systems, when working between the control grid of the last i-f tube and the diode plate; there is gain between these two points, yet there may be a two or three time loss, which is normal, between the last i-f tube plate and the succeeding diode tube plate. A similar condition exists in Class B amplifiers, in the driver stage. In the output stages of audio amplifiers, a major step-down takes place within the output transformer sometimes as high as 50 to 1 or 100 to 1. These points must be kept in mind.

(To be continued)

### BOOK REVIEW

(Continued from page 8)

riod, to meet the rise in servicing occasioned by increased receiver use and sheer necessity.

Further recommending Volume XII is the new Rider innovation—"Clarified Schematics"—a special section, printed on yellow paper, in which the intricate switching circuits of over 200 receiver schematics are broken down into multiple circuits which show at a glance which coils, condensers, resistors and switch contacts are used in the r-f, mixer and oscillator sections for each setting of the waveband switch. This method of circuit presentation saves time and prevents possible errors in determining circuit routes and the specific components in circuit for each waveband setting. In many original manufacturers' schematics, the switch connections are almost impossible to trace.

The entire Manual, like the ones previously issued, is well printed, has clear, readable schematics, and contains all necessary data for each receiver model.

Volume XII is definitely a "must" for the serviceman.

*ALIGNING PHILCO RECEIVERS, VOL. 2, by John F. Rider. Stiff cloth cover, 5 1/4" x 7 3/4", 192 pages. Published by John F. Rider Publisher, Inc., 404 4th Ave., New York, N. Y. Price \$1.60.*

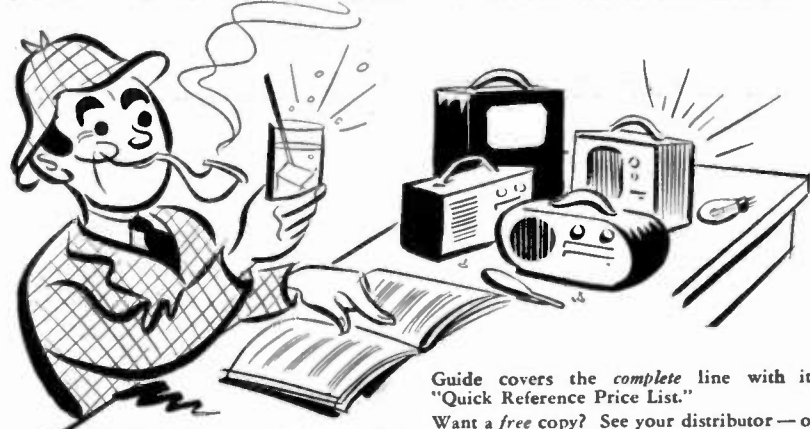
This volume picks up where Volume 1 left off, and covers the alignment data on Philco receivers from Model AR-1 to Model P-1841.

Those who have used the preceding book will recognize the tabular form of alignment instructions, the chassis layouts, and notes as following closely the other's style, which was so well received. The alignment instructions, for instance, read from left to right, in the order in which they are to be

carried out, giving first the signal generator connection, then the dummy antenna value, signal generator frequency, waveband switch setting, receiver dial setting, and trimmer number.

The back of the book carries chapters on the detailed instructions for adjusting the Philco Mystery-Control Frequency Amplifier and adjustment for the reception of stations, and an  
(Continued on page 22)

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"3. Making of no unreasonable promises.

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"5. Keeping of a comprehensive record of all work.

"6. Refraining from making derogatory comments or unjust criticism of the work of a competitor or a product of a manufacturer.

"7. Using replacement parts of equal or better quality than those used originally.

"8. Guaranteeing all work for a reasonable length of time.

"9. Handling of all complaints promptly and courteously.

"10. Refraining from making or participating in misleading advertisements.

"11. Maintenance of a respectable personal appearance.

"12. Conduct of business in a manner reflecting credit upon the entire radio service industry.

"13. Rendering of technical assistance to fellow members.

"14. Transaction of business with parties conducting their business in accordance with fair business practices.

"15. Refraining from actions or comments derogatory to the welfare of the Radio Servicemen of America, Inc., or any of its members or Chapters.

"BE IT FURTHER RESOLVED that a radio serviceman may be considered as qualified for membership in this organization when an investigation reveals that he conducts his business in a manner reflecting credit upon this Corporation and indicating that he maintains the necessary service equipment and has sufficient knowledge and experience to render efficient service."

Cut out the above and display it so your customers will know your business principles.

Since RSA members live up to this code of ethics and are subject to expulsion if they do not, the public has a protection in having an RSA member do his work that allows us to repeat with assurance: RSA members aren't gyps!

## Welcome LaPorte Chapter RSA

All RSA extends the heartiest welcome to the newest RSA Chapter, the LaPorte Radio Servicemen's Association of LaPorte, Indiana.

Ray B. Mould, 319 E. Maple St., LaPorte, is President of the new Chapter, and Stanley A. Kubit, 119 Laurel St., LaPorte, is Secretary-Treasurer. Eleven members form the nucleus of the new Chapter, an excellent job considering the size of the city of LaPorte.

RSA pledges its every cooperation to LaPorte Chapter. We are sure the association will be mutually pleasant and profitable.

• • • —



Calvin W Stapp, Danville, Ill., National Secretary to the Board of RSA

## RSA CHAPTER CHATTER

### Boston Chapter:

Although we have been "enjoying" very hot weather here, Boston RSA is carrying its usual schedule and finds that members turn out rather well. The present schedule provides a series of lectures on fundamentals of radio theory, with practical applications of the material to radio servicing. It is planned to continue this series from one branch of radio to another to present a well rounded coverage of the entire field. The speakers are selected from the membership, which promotes a very friendly atmosphere.

Boston RSA is increasing its membership in the suburbs, and interested radio servicemen can call the Secretary on the RSA phone, STadium 3060.

—Raymond C. Wyman, Chairman

• • • —

### Chicago Chapter:

Since the beginning of 1941, our Executive Board has devoted most of its time and efforts to finding ways and means of building up attendance at Chap-

ter meetings. In order to stimulate interest we arranged meetings at various radio manufacturers. The results: new members, better meeting attendance, and the name RSA further enhanced to the manufacturers.

For the summer months, we planned a series of "Jobber House Parties" so our members may get better acquainted with their parts distributors. The first one was held July 9th at the Radolek Company. Mr. Braun of Radolek told us about the parts situation under the present priority ratings.

The social highlight of July was our annual picnic on Sunday July 13th. Almost two hundred attended and enjoyed a swell time.

—Hellmuth Junkel, Publicity

• • • —

### Danville Chapter:

July 9th brought the annual election of officers to Danville Chapter. Elected were: President, F. S. "Mike" Mosier; Vice-President, Ben Williamson; Secretary, Eward Welch; Treasurer, Earl Drolinger; Membership, Harry Longer; Examiner, G. R. "Doc" McKinney; Advertising, Lyal Cummings; Program, Owen McArdle; and Editor the "Serviceman's Dirt", Cal Stapp.

The retiring officers entertained at an after dark picnic on July 23rd. The affair took place at Doc McKinney's "Ranch", and everything went fine until it started raining, and it really opened up and let us have it. Some of the fellows sought shelter under the beer truck and the rest drove to the RSA Hall to wind up the evening. The few that stayed under the beer truck really got soaked after the rain was all over!

The Sea Scout school conducted by Danville RSA has been dismissed for a summer vacation.

—From the "Serviceman's Dirt."

• • • —

### Detroit Chapter:

Business conditions have become so good for radio servicemen in this area that we cannot find enough men to turn out the work received, so we are considering writing our Congressmen to pass a bill for more than twenty-four hours a day, because with the oil shortage we may not be able to get enough midnight oil.

A swell turnout was given to a recent meeting with Sylvania speakers. Another very good meeting on Motorola was highly appreciated by the boys who work on radios in the "iron horses".

Art Cole took the fatal step July 5th and just returned to the test prods after a two week honeymoon. Congratulations Art and the Missus: May you never have any short circuits.

—Secretary, Detroit Chapter

• • • —

### Fremont Chapter:

We are on our summer schedule of one

meeting per month. We are making plans for our first big meeting of the fall with the RCA Dynamic Demonstrator as host.

—Robert M. Uhl, Secretary

**Interstate Chapter:**

Our Chapter of RSA got its start in Moline-Davenport-Rock Island in 1937. It grew rapidly and in the intervening years various activities were inaugurated.

We have enjoyed many good talks by engineers of large manufacturers. The members were instructed in FM and test equipment procedure by actual analysis. Midwest Timmermann, local distributor, allowed the Chapter the use of the RCA Dynamic Demonstrator in connection with the study of new test equipment.

We have a voucher system of Chapter bookkeeping which has worked to very good advantage. We would be glad to explain this system to interested Chapters.

We extend an invitation to other servicemen in this locality to join us. Meetings are held the second Tuesday of each month.

—Oscar W. Olson, Secretary

**Lehigh Valley Radio Service Association Chapter:**

The regular monthly meetings of the LVRSA are held in the Hotel Allen, Allentown, Pennsylvania, on the first Monday of each month—a closed meeting for members only, and an open meeting on the third Monday of each month.

The meeting of July 7th was called at 9:00 P. M. (President Hank Fillman late again!). The planned parts and equipment show for September was discussed. The forthcoming article in "Reader's Digest" was reported and communication with a member of their staff was established. A "Radio Quiz" of fifty questions, in which all present participated, found Rees as winner with Buss runner up. All agreed that this Quiz was not only interesting but educational. (If any Chapters are interested, would be glad to communicate with them and show the form used.)

The Third Annual Clambake will be held on August 18th at Feilbach's Grove, Bethlehem, from 6:00 to ??? (or until Carl can't stand up, and if you know Carl that's a long time!)

You might tell 'em all we're 100% RSA and right behind Captain Stover.

—Ray E. P. Abbott, Secretary

**Metropolitan New York Chapter:**

Our President, Charles Wardlow, returned from the Annual Convention in Chicago with the word "RSA is going places". Our fighting Commander-in-Chief pointed out many good things that are in store for the members of RSA in 1941. The Metropolitan Chapter is bending every effort to the successful achievement of the national objectives. President Wardlow said, "From now on, the course is clear: each Chapter, and more especially every and all members of the Chapter, must get behind the National Program and make it a success. RSA is going places".

Speaking at our meeting of July 14th, Clifford E. Denton, Chairman of the

**VICE-PRESIDENT'S LETTER**

Moline, Illinois,  
July 31, 1941

Members and Prospective Members of RSA:

To the old members of RSA I want to extend my sincere thanks for my election to the office of National Vice-President, and to assure you of my complete cooperation and support in the future progress of RSA.

To the prospective members I extend an invitation to become members of the one organization that is nationally recognized by all the radio industry as being representative of the radio serviceman in the field. Never has the opportunity been available before to join this organization at such a low price as one dollar. And your membership includes along with the national recognition as a competent serviceman and your RSA credentials, a subscription to an excellent monthly technical radio magazine. A bargain if there ever was one! No radio serviceman who has any thought for his own future or the future of the craft as a whole should turn down this chance of joining with us in safeguarding the future of the radio servicing business.

To both the present and prospective

members of RSA I want to say that today you hold the key position in the industry. Due to present conditions caused by the National Defense Program, manufacturers of radio receivers are being forced to curtail production of new sets. This is due in part to the scarcity of materials and to the fact that most of the radio receiver manufacturers are turning over part of their plants to the manufacture of defense equipment. The result of all this is the awakening of the radio set owners to the fact that they must have their old sets repaired or rechecked in order to be able to keep in touch with national news and happenings of the day. To you, Mr. Serviceman, comes a duty: the duty to see that these people are able to keep abreast of national affairs through good radio receivers. By so doing you are contributing to national unity and defense.

Again I extend an invitation to non-members to join with us now in building a greater RSA; and to the present members I say again, thanks for your loyalty and support in the past and may it continue in the future.

Respectfully yours,

RADIO SERVICEMEN OF AMERICA  
Edward H. Gordon (Signed)  
National Vice-President

Radio Education Commission of the Advisory Board on Radio Education, stressed the need for training and preparation. "For", he said, "there is a grave shortage of trained radio men and this shortage may become acute in the near future. Both civilian and military equipment must be built, tested, operated, and serviced. It is to the radio servicemen of today that the country looks for a nucleus for such defense efforts.

"While such training will result in a greatly increased number of trained radio men who after this emergency has passed will seek a livelihood in the radio field, there is every reason to believe that there will also be greatly increased opportunities for employment," said Mr. Denton. "The sensible radio man of today will brush up on his fundamentals and by preparing himself for the present emergency will be ready for the technological developments of the future."

—From the "RSA Bulletin,"  
Max Spitalny, Editor

**Radio Servicemen's Association of Pittsburgh Chapter:**

Ken Vaughan of Johnstown, the newly elected National President of RSA, visited our meeting of July 10th and told of the Chicago Board meeting and a few of the RSA plans for the future.

R. G. Devaney read a communication from Major Armstrong in regard to FM receivers. Pittsburgh RSA and W47P are planning to conduct an educational campaign in cooperation with WWSW in which FM will be explained to the public and they will be urged to buy FM from stores that are equipped to properly in-

stall and service them.

Our Annual Picnic and Field Day was held at Idlewild Park at Ligonier on July 27th. A very large turnout enjoyed the games and sports program, with fine prizes donated by the jobbers. Corn on the cob, coffee, and ice cream were served. It was one of our biggest affairs.

—Richard G. Devaney, Publicity

**Tri-County Chapter:**

At the regular meeting of our Chapter held in Johnstown, Pennsylvania, on July 22, installation of new officers was held. New officers are: Robert Pickerell, President; Sam Miros, Vice-President; Christ Ashcraft, Treasurer; and Blair Ressler, Secretary. Directors are James Gerber, John Krissinger, Steve Varnecky, and Stephen Nagy.

Plans were made to attend the picnic held by the Pittsburgh Chapter at Idlewild Park on July 27th. It was also decided that we would collect aluminum and save old radio tubes as our part in the National Defense Program.

—Blair Ressler, Secretary

**Oklahoma City Radio Service Association Chapter:**

It is our policy to meet the first and fourth Tuesday nights of each month, except during the summer months when one meeting a month is held.

Our Chapter is looking forward to having a large meeting in the near future at which we expect to have some one of our country's leading radio engineers as a speaker.

—R. B. Cherry, President

# Hi-Lo

VOLTAGE PRESSURE

## The New SHURE Lightweight Crystal Pickup



### Permanent Sapphire Point

**BOOST** replacement sales with this new, low cost, lightweight pickup. Only 1-ounce needle pressure with 1.4 volts output at 1000 cps (Audiotone record)—over twice the output of any other lightweight pickup. Makes possible easy replacement of conventional pickups—improves reproduction — practically eliminates record wear. Streamlined plastic arm in mahogany finish with offset head. Set screw permits changing permanent sapphire point needle without replacing entire cartridge. *Ask Your Jobber!*

Model 97AN. Complete with permanent sapphire point needle. **\$6.50**  
List Price

Model 97A. Same, less needle. **\$5.50**  
List Price

### New "Hi-Lo" Crystal Pickup Cartridges



Will directly replace other flat type cartridges in pickups with pressure of 1-ounce or more and give improved performance.

Model 42A. Without needle. **\$4.00**  
List Price

Licensed under Brush Patents



Shure Patents Pending

**SHURE BROTHERS**  
225 W. Huron St., Chicago, Ill.

Please send free Bulletin 212D.

Name .....

Address .....

City ..... State .....  
RSD-Aug. '41

(Continued from page 19)

Appendix covering alignment tool reaction, alignment of i-f transformers, receiver dials, wave traps, r-f circuits, magnetic tuning, adjustment of 10-kc filters, etc.

This book is highly recommended, as the data is so presented that the receivers covered can be aligned with the least amount of waste motion.

*THE BUSINESS HELPER*, by Leslie C. Rucker. Stiff cloth cover, 5" x 7½", 128 pages. Published by Leslie C. Rucker, Publisher, Washington, D. C. Price, \$2.00.

Written, as it is, by a prominent radio parts jobber, this handbook for the small businessman will be of special interest to radio jobbers, dealers and servicemen.

The author has done a remarkably good job of keeping down to earth in his writing, and presenting the highlights of his own long experience as a small businessman in a manner easily followed. Moreover, the theoretical is conspicuous by its absence—every bit of the material is based on practical applications which any man can advantageously put to his own use.

There are chapters on storekeeping, locations, customers, buying and selling, estimating, overhead expenses, credit and its use, banking, and so on—22 chapters in all.

Mr. Rucker's chapter on overhead expenses is of particular interest at this time, as it offers suggestions on cutting expenses to meet income—a point we may all have to consider in the light of National Defense.

Just the book for the man who wants to solidify his position and take out insurance on the future. We are pleased to recommend it.

### THE RADIOFRONT

(Continued from page 13)

quirements. And in order to spread out radio business (among others) so that the "season" will be wiped out, Clifton E. Mack of the *Treasury Dept.* announced that a study of markets is being made to determine if purchases could be made "out of season" to be of mutual advantage to the Government and the manufacturer.

Price ceilings are occupying the men under the Capitol dome these days. Leon Henderson has been testifying that he has been fixing price ceilings, albeit without Congressional authority. He says that he will continue to do so until stopped either by the President or Congress. Specifically he is asking for and getting price ceilings on refrigerators and radios, although this latter item has not yet been officially announced.

## Here's the DEATH-BLOW to FEEDBACK



### New TURNER CARDIOID

Compare its performance  
with MIKES costing  
Twice as Much!

When the going is tough, and acoustic conditions practically impossible . . . set up a Turner Cardioid! It's the answer to the sound man's problems! Two element generator provides true cardioid characteristics. Gives you the best features of both the velocity and the dynamic. Extremely sensitive to sounds originating in front of the mike; low sensitivity in rear. And look at the prices!

101A Standard, List . . . \$55  
101B De Luxe, with 3-way switch, List . . . \$65  
101C Broadcast, with range extended to 10,000 cycles, List . . . \$70

Write for Free Catalog

### FREE

16 page manual for Radio Service Engineers.

Offers a wealth of technical information and complete details on

Turner Push-Pull Vibrators

Write for Your Free Copy Today!

### THE TURNER COMPANY

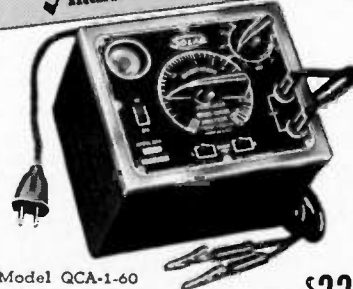
919 17th St., N.E., Cedar Rapids, Iowa

## SOLAR CONDENSER

# Quick-check Analyzer

MODEL **QCA**

- ✓ Measures Capacity
  - ✓ Indicates Leakage
  - ✓ Shows Insulation Resistance
  - ✓ Indicates Power Factor
  - ✓ Affords Dynamic Checking for
- OPENS . . . SHORTS  
INTERMITTENTS**
- ✓ Acts as Continuity Meter
  - ✓ Indicates R. F. Impedance



Model QCA-1-60

Complete Analyzer, ready to operate . . . ONLY \$22.90

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



# BUT WHAT OF Tomorrow?

"All-out" production to meet today's pyramiding orders does not mean that Triplett has lost sight of the broader requirements of tomorrow. Instead, research and engineering programs actually have been "stepped-up" to assure constant improvements in products and processes; in addition to needed developments in new fields.

Today's demands are important, but the needs of tomorrow cannot be slighted—and are anticipated in never flagging engineering and research developments. You have assurance that in the months and years to come, new Triplett products will serve in expanded fields, where they will merit values and savings for every dollar spent in their purchase.

**THE TRIPLETT ELECTRICAL INSTRUMENT CO.**  
Bluffton, Ohio




## BRACH Antennae

Automobile  
Home — All types  
F-M Systems  
Television  
Police • Marine  
Multiple Systems  
Complete Kits  
Accessories

Made by World's Oldest and Largest  
Manufacturers of Radio Aerial Systems

**L. S. BRACH MFG. CORP.**  
55 DICKERSON STREET  
NEWARK, N. J.



### Odds 'n' Ends

Catch that FCC General Information Release dated July 14, 1941 for a good joke at the expense of the FCC. But you must know your English . . . —

That article in *Reader's Digest* (August 1941) anent radio servicemen won't help the honest ones a bit . . . —

In spite of reports to the contrary, discs are still being made at the rate of 1 in 3 with aluminum backing; and 6 out of 27 use paper. Glass, hailed at the last radio show, is still in the great minority . . . —

The hams lost the 80 meter band to the Army for the duration . . . —

They also lost their distinction between A, B and C licenses. All licensed hams can operate in any band phone or cw, as the case may be. And are the Class A men sore . . . —

The FCC has let up slightly on the b.c. chains. Fear of unconstitutionality of their edict as regards previous contracts made by the broadcasters with clients is said to be the reason . . . —

There are no priorities in the matter of service. But Uncle Sam will crack down if a manufacturer will not service an instrument . . . —

OPMan Stettinius has "frozen" certain tools for a specified period to expedite defense . . . —

Ceiling prices have been fixed on brass scrap. But some dealers have already found a loop hole. If they haven't, a recent broadcast told them exactly where to look for it . . . —

Servicemen will *not* have to improvise replacement parts. OPMan Knudsen promises that there will be replacement parts to fix the usual 10 million radios every year, war or no war. But it will take time . . . —

Refrigerator output was to be cut 50% if Leon Henderson had his way . . . —

A new static-less rubber for truck and auto tires has been developed. It's the answer to high-speed mobile reception, eliminating the tire "roar" entirely from the receiver . . . —

Selling as a business is on the decline. Lessons of 1917-1918 are being rapidly forgotten. It's the buyer who is doing all the work . . . —

Coming Soon: National Defense Production Chief. Mentioned as a possibility is W. Willkie. But insiders say no-go . . . —

In spite of National Defense, the Draft, the Priorities, jobbers report a 10% better business than for the same period last year . . . —

Could it be that the OPACS is giving the Replacement Parts Manufacturers the run-around? . . . —

It's still a matter of the three M's—Men, Materials and Money . . . —

Vertrod—The Vertrod Mfg. Co., New York City, announces the appointment of the following representatives:

John O. Olsen, 1456 Waterbury Road, Lakewood, Cleveland, Ohio, for the states of Kentucky, West Virginia, and Ohio.

J. Earl Smith, P. O. Box 1805, Dallas, Texas, for the states of Texas, Oklahoma, Arkansas, and Louisiana.

Harry A. Lasure, 2216 11th St., Los Angeles, Calif., for the states of Arizona and California.



**SUNCO**  
*Sell* CARILLONS  
MUSICAL TOWERS

THE PROFIT ON SALES IS BULKY

Our steady advertising in leading church publications, and our direct mail, bring us live inquiries for Chime Carillons, High Power Automatic Reproducers, and Musical Tower Recordings. These we pass on to the rated sound men affiliated with us, to turn into profits for themselves. These profits are substantial for Carillons, Musical Towers and Belfry Chimes run into money.

If you are interested and preferably rated in *Quin & Bradstreet*, write us at once. We will send literature and confidential information definitely interesting.

### A New Big Field for You

Carillons are bought by individuals and organizations who are sincere in their desire for service and community welfare. They are generous. Into this market the Sunco representative comes with equipment that can be, and is, guaranteed to equal in power and beauty of performance, anything of similar nature, costing ten times its price.

We also produce special recordings of sacred and semi-sacred music of high quality, and have a large repertoire available. This gives our representatives an exclusive advantage, for recordings of this quality and variety are unobtainable anywhere. Write for prospectus and list of recordings today.

**SUNDT ENGINEERING COMPANY**  
4789 N. Ravenswood Ave. Chicago, Ill.

## PUBLIC ADDRESS HEADQUARTERS



**RADOLEK De Luxe Public Address Systems** offer the most for your money in Styling—Hi-Fidelity Performance—Reserve Power—fast, convenient, easy installation. Offered in 15, 30, 50 and 100 watt sizes—for permanent, portable or mobile use. They feature from 2 to 6 input channels, built-in input and mixing controls, AVC, and the newly developed "feedback" tone control circuit. Wide choice of microphones and speakers. Mail coupon for complete information.

### RADOLEK'S NEW 1941 RADIO PROFIT GUIDE

**FREE!** Indispensable to every serviceman, dealer and sound engineer. Send for big FREE Radolek Profit Guide now!

**SEND TODAY!** PASTE ON A PENNY POST CARD

RADOLEK CO., Dept. SD-37  
601 W. Randolph St., Chicago, Ill.

Please send information on Radolek Public Address equipment—also the Big Radio Profit Guide.

Name .....

Address .....

DEALER  SERVICEMAN  ENGINEER

## NEW LITERATURE

**IRC Control Manual**—The new IRC Volume Control Replacement Manual lists  $\frac{1}{2}$  more models, contains 136 pages in  $8\frac{1}{2} \times 11$ " size. All needed data from manufacturers' original part numbers to Rider's Manual reference, price, resis-



stance value, switch data, etc., is provided. Trade and brand names are listed alphabetically. Auto radios are listed by make of car. Chassis and model numbers are cross-indexed. Control and resistor catalog, charts and formulas included. Copies available from IRC jobbers or direct from International Resistance Co., 401 N. Broad St., Philadelphia, Pa.

**Sound Catalogs**—"Simplified Sound Systems," a two-section catalog, the first directed to the entertainment field, the second to the soundman. Each includes the new lines of Airline Amplifiers and associated sound equipment. Also records, record players, recorders, etc.

A copy of either edition is available by writing to Montgomery Ward & Co., 618 W. Chicago Ave., Chicago, Ill.

## APPOINTMENTS

**Turner**—The Turner Company, Cedar Rapids, has appointed *Irvin I. Aaron & Associates*, 4028 N. 16th St., Milwaukee, Wis., as their representatives in Minnesota, Wisconsin, and parts of N. Dakota and Illinois.

*H. Geo. Sheffer*, 2360 E. Moreland, Phoenix, Ariz., will represent Turner in Arizona, New Mexico, and El Paso, Texas.

## NATIONAL DEFENSE FRONT

**Plant Addition**—The Ohmite Manufacturing Co., Chicago, has recently completed an addition to the factory on West Flournoy St. The enlarged plant, extending the frontage to several hundred feet, doubles the production space and greatly expands the company's facilities to take care of the increased requirements for Ohmite products in industry and National Defense.

**CTC Volunteer**—*Miss Kay Mamola*, a tester with Emerson Radio & Phonograph Corp., New York, was the first of the fair sex to apply for service in the British Civilian Technical Corps.

Years of experience in testing Emerson sets, at which she is an expert will stand Miss Mamola in good stead in the event she is accepted and goes abroad.

When interviewed, she expressed great eagerness to contribute her bit towards the Allied cause and stated she was anxious to sail at the earliest possible moment.

**Priorities Committee**—The Sales Managers Club, Western Group, has appointed a Priorities Committee to make an effort on behalf of the manufacturers of radio parts to secure a better rating for (a) the parts industry in general, (b) parts to be used to maintain existing receivers, and (c) parts which find their way, either directly or indirectly, into defense supplies. Eventually it will be necessary for everyone in the industry to keep accurate records relating to the sale of their merchandise.

In order to facilitate its work the Sales Managers Club urges all purchasers of radio parts and accessories to adopt the following procedure:

1. Find out from your customer what use will be made of the merchandise;
2. If it is sold to a government agency or is destined to find its way into Defense Supplies then get:
  - (a) the contract number, or
  - (b) a preference rating, or
  - (c) if there is no number or rating, then get the customers' affidavit that the merchandise is being used for Defense Supplies;
3. When you place an order with a manufacturer for component parts to replace merchandise sold 'off-your-shelves' or being used by you in the completion of a defense contract, be sure to attach to the order, the contract number, the preference rating or the customers' affidavits."

This may enable parts manufacturers to keep you stocked with new merchandise. This practice should permit manufacturers to get larger quantities of scarce materials to fabricate parts which will replace those you are selling and will sell.

This is *your* fight and *you* must carry your part of the load.

# For Less Than 2c a Week . . .

## RSA Members Receive:

1. Membership certificate and RSA decal—they will give you prestige and help you maintain proper price schedules.
2. Membership card to identify you as a serviceman to be trusted.
3. Monthly technical and news magazine—full of help in your work.
4. "Plugs" on many radio stations, through the courtesy of NAB, advising listeners to have their servicing done by RSA members.
5. Access to RSA Technical Helps Bureau.
6. Representation in the councils of the radio industry.
7. Chapter activities—technical, business, social—from which you may benefit greatly, if you are in a Chapter area, by becoming a Chapter member, Chapter dues being extra, of course.

Get all these Benefits—Join the RSA.

**RADIO SERVICEMEN OF AMERICA, Inc.**

"Reliable Service Assured"

Donald H. Stover — Executive Secretary

Nat'l. Headquarters: 1216 W. American St., Freeport, Ill.



RSA is the only national radio servicemen's organization having the sponsorship of the Radio Manufacturers Association, the National Association of Broadcasters, the Sales Managers Clubs, and the Radio Trade Papers. Anyone of high ethics, legitimately engaged in the radio servicing profession, whether he owns his own business or not, is eligible for membership in the National Association of RSA. Immediate and courteous consideration is given every applicant . . . so hurry . . . apply today!

CLIP and MAIL COUPON TODAY

RADIO SERVICEMEN OF AMERICA, INC.  
1216 W. American St., Freeport, Illinois.

I enclose \$1.00 for one year's national dues and apply for membership in RSA.

Name .....

Address .....

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

Radio S.D.—August 1941



Centralab controls are always in step with progress in civilian or defensive use. In peaceful pursuits or in punishing, gruelling manoeuvres Centralab controls continue to perform smoothly and efficiently. And when you are called . . . remember that Centralab controls are the ideal replacements on every job.

**CENTRALAB: Division of Globe-Union Inc., Milwaukee, Wis.**

# Centralab RADIOHMS

## A—STANDARD

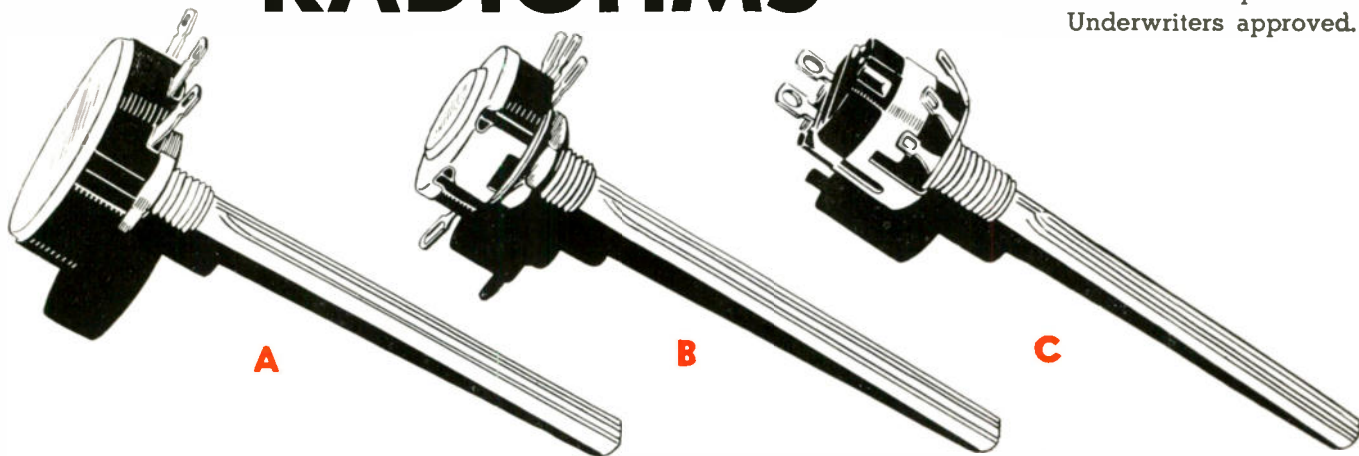
Long famous for the reliability of Centralab's non-rubbing contact and long wall type resistor. Available plain, or with one, two, or three taps, and with SPST, DPST, or SPDT Underwriters Approved Switches.

## B—MIDGET

Small in size, but large control efficiency. Available single, dual, or triple, plain, or tapped, with SPST, SPDT, DPST.

## C—ELF

Small . . . but it too, features the long, straight, resistor strip, with SPST Switch . . . with, or without dummy lug. Switch rated . . . 2 Amps. 125 V. Underwriters approved.



Great Name...

Great Line...

Great Market

—AND

# GREAT SELLING-HELPS, TOO!

## with RADIOLA "Preferred Type" Radios

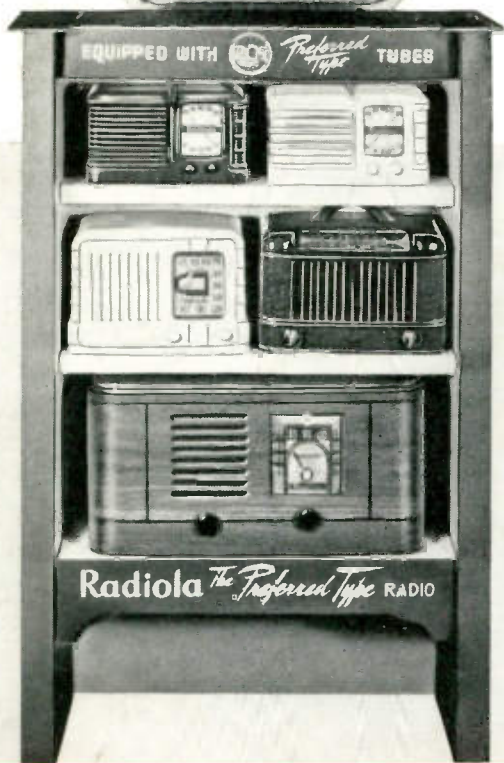


When you're selling RADIOLA, you've got *support*—and how! For you're selling a grand old *name*—a name almost as old as broadcasting itself. You're selling a great new *line*—with "Preferred Type" features all the way from antenna to speaker. You've got a real wide-open *market*... for RADIOLA models are the only sets designed and built exclusively for *servicemen* to sell!

And to top it off, your distributor is ready to supply you with the most powerful array

of *sales-helps* that you've ever seen! Merchandisers and Electric Signs. Banners and Displays. Mailing Pieces. Handbills, Streamers, Folders and Booklets!

They're *tested* sales-helps—tested and proved for profits. Hundreds of servicemen and service dealers have boosted their bank-accounts with just this material; complete list is in your RADIOLA catalog. Check the items you can use. Put them to work. They'll pay *big* dividends for a long, long time.



**EYE-CATCHING** is the word for this new Radiola Merchandiser! It features Jinx Falkenburg, the "Radiola Girl"—America's most popular model and star of the new Columbia Pictures' feature, "Two Latins From Manhattan." Jinx, in person, enjoyed meeting many Radiola Distributors at the recent RCA Tube and Equipment Convention in Chicago.



**COUNTER AND WINDOW DISPLAY**—Stops either store-traffic or street-traffic with equal effectiveness! Illuminated, with arresting third-dimension effect from offset background.



**BRILLIANT ELECTRIC SIGN**—Green translucent ends, with four-color panel illuminated, to get the *right* kind of attention!



**DIRECT MAIL CAMPAIGN** on 8 cards. Inexpensive to use, but *tested* for sure-fire results! Has proved its business-bringing ability again and again.



**RED SILK BANNER**, four colors, with attractive fringe and tassels. Stands out anywhere—and adds a lot to your store's appearance.



**RADIOLA PRESENTATION BOOK**—All the great Radiola sales-features are fully described; the cabinets beautifully reproduced!



**SERVICEMAN'S CARRYING CASE**—Holds a Radiola Model for demonstration, when serviceman goes on job. Sturdy and handsome.

# Radiola Preferred Type Radios

Made by RCA Manufacturing Co., Inc., Camden, N. J., U. S. A.  
A Service of the Radio Corporation of America  
In Canada, RCA Victor Company, Ltd., Montreal