RADIO'S *Complete* MAGAZINE

RADIO & TELEVISION

RADIO BEGINNER Department

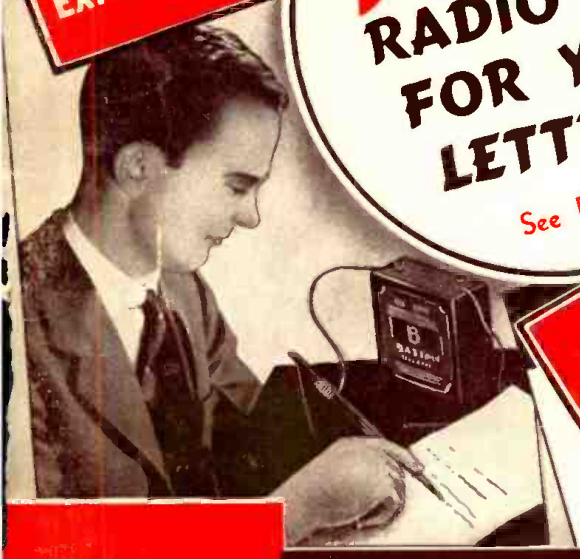
AMATEUR RADIO Department

RADIO CONSTRUCTION Department

TELEVISION NEWS Department

RADIO KINKS Department

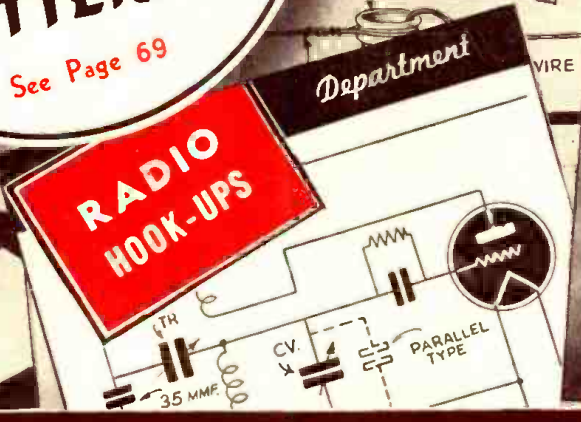
ELECTRICAL EXPERIMENTS



FREE!
RADIO SETS FOR YOUR LETTERS !
See Page 69

MARCH OF RADIO Department

RADIO HOOK-UPS Department

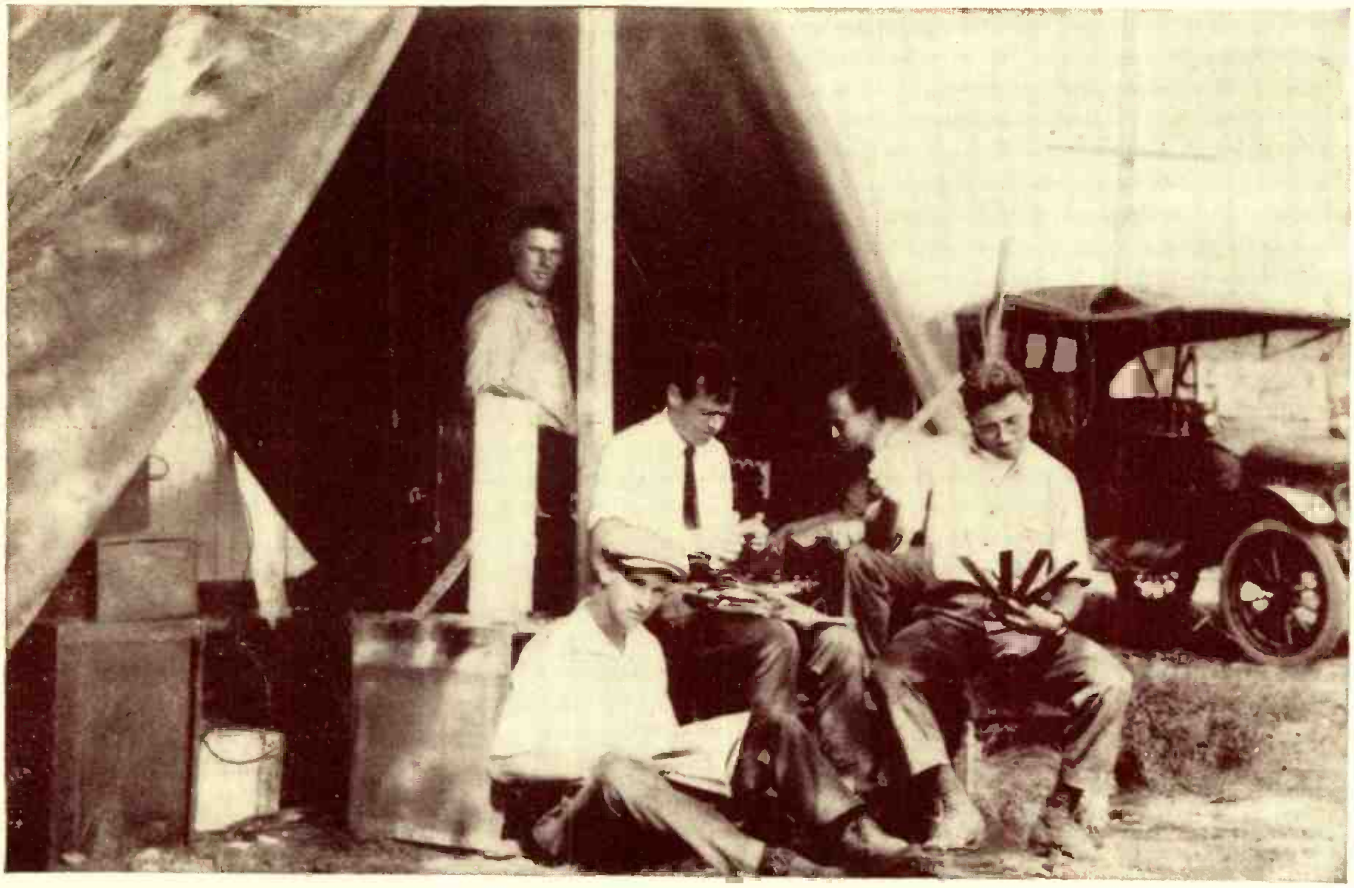


25¢
CANADA 30¢

HUGO GERNSBACK
EDITOR

AMATEUR & EXPERIMENTAL RADIO JUNE

CONSTRUCTIVE RADIO ARTICLES 1941



It all started in a tent...

AGAINST the horizon of "the spires of Princeton," the world's largest radio research laboratories are to be built by the Radio Corporation of America at Princeton, New Jersey.

The new RCA Laboratories, to be completed before the year-end, are planned to promote the growth of radio as an art and industry, and to meet the expanding demands of national defense. Several hundred research experts and engineers will coordinate their efforts to create new products and services, and improve existing ones, in all fields of radio and electronics.

The march of progress which has led to Princeton started back in 1919 when the first RCA laboratory was located in a tent, later to be augmented by a shack 15 feet square at Riverhead, L. I. From that humble beginning, with public service as the watchword, RCA has pioneered in radio manufacturing, international communications, marine radio, broadcasting, sound reproduction and television. Through continuous research it has discovered keys that have unlocked new doors of radio science, and has extended the usefulness of radio into many realms of public service.

Now, RCA research experts on a united front at Princeton are to take another historic step to enhance America's preeminence in radio, and to increase the services of radio to the Government, to the people of the United States and to industry.

RCA LABORATORIES

A SERVICE OF RADIO CORPORATION OF AMERICA
Radio City, New York

RCA Manufacturing Co., Inc. • Radiomarine Corporation of America
RCA Laboratories • National Broadcasting Company, Inc.
R.C.A. Communications, Inc. • RCA Institutes, Inc.

Be a RADIO Technician

J. E. SMITH, President, National Radio Institute
Established 25 years
He has directed the training of more men for the Radio Industry than anyone else.

Many make $30 $40 $50 a week

I Train *Beginners* at Home for Good Spare Time and Full Time Radio Jobs

Radio is a young, growing field with a future. It offers many good pay spare time and full time job opportunities. And you don't have to give up your present job, go away from home, or spend a lot of money to become a Radio Technician. I train you at home nights in your spare time.

Set Servicing pays many Radio Technicians $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 extra a week in spare time.

Broadcasting Stations employ operators, installation, maintenance men and Radio Technicians in other capacities and pay well.

Loudspeaker System building, installing, servicing and operating is another growing field for well trained Radio Technicians.

Jobs Like These Go to Men Who Know Radio

Radio broadcasting stations employ Radio Technicians as operators, maintenance men and pay well for trained men. Radio manufacturers employ testers, inspectors, servicemen in good pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio, loudspeaker systems, electronic devices, are newer fields offering good opportunities to qualified men. And my Course includes Television, which promises to open many good jobs soon.

Why Many Radio Technicians Make $30, $40, $50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios go out of date and are replaced. Millions more need new tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch Radio is offering more opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred $30, $40, $50 a week jobs of 20 years ago have grown to thousands.

Many Make $5 to $10 a Week Extra in Spare Time While Learning

The day you enroll, in addition to my regular Course, I start sending you Extra Money Job Sheets—start showing you how to do actual Radio repair jobs. Throughout your Course I send plans and directions which have helped many make $5 to $10 a week in spare time while learning. I send special Radio equipment; show you how to conduct experiments, build circuits. My Course includes Television, too.

You Get This Professional Servicing Instrument

This instrument makes practically any test you will be called upon to make in Radio service work on both spare time and full time jobs. It can be used on the test bench, or carried along when out on calls. It measures A.C. and D.C. voltages and currents; tests resistances; has a multi-band oscillator for aligning any set, old or new. You get this instrument to keep as part of your N. R. I. Course.

Draft Registrants Attention!

Hundreds of men who know Radio when they enter military service are going to win specialist ratings in the Army, Navy and Marine Corps. These ratings pay up to 6 times a private's or seaman's base pay, in addition to carrying extra rank and prestige! If you ARE NOT called, you are getting into Radio when the Government is pouring millions into the Radio industry to buy Defense equipment, on top of boom civilian Radio business. Whether you enlist or wait for conscription—IT'S SMART TO LEARN RADIO—NOW!

Find Out How N. R. I. Teaches You Radio and Television— Mail Coupon

Act today. Mail coupon now for Sample Lesson and 64-page Book. They're FREE. They point out Radio's spare time and full time opportunities and those coming in Television; tell about my Course in Radio and Television; show more than 100 letters from men I trained, telling what they are doing and earning. Read my money back agreement. Find out what Radio offers you. Mail coupon in envelope or paste on penny postcard—**NOW.**

J. E. SMITH, President,
Dept. 1FB3, National Radio Institute
Washington, D. C.

I Trained These Men

$10 to $20 a Week in Spare Time

"I repaired some Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half, and I have made an average of $10 to $20 a week—just spare time."
JOHN JERRY, 1529 Arapahoe St., Denver, Colo.

Makes $50 to $60 a Week

"I am making between $50 and $60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." H. W. SPANGLER, 126½ S. Gay St., Knoxville, Tenn.

Operates Public Address System

"I have a position with the Los Angeles Civil Service, operating the Public Address System in the City Hall Council. My salary is $170 a month." R. H. ROOD, R. 136, City Hall, Los Angeles, Calif.

Sample Lesson Free

I want to prove our Course gives practical, money-making information; that it is easy to understand—what you need to master Radio. My sample lesson text, "Radio Receiver Troubles—Their Cause and Remedy," covers a long list of Radio receiver troubles in A.C., D.C., battery, universal, auto, T.R.F., superheterodyne, all-wave, and other types of sets. And a cross reference system gives you the probable cause and a quick way to locate and remedy these set troubles. A special section is devoted to receiver check-up, alignment, balancing, neutralizing, testing. Get this lesson Free by mailing the coupon.

Good for Both 64 PAGE BOOK SAMPLE LESSON Free

J. E. SMITH, President, Dept. 1FB3
National Radio Institute, Washington, D. C.

Without obligating me, mail your Sample Lesson and 64-page Book FREE.
I am particularly interested in the branch of Radio checked below. (No salesman will call. Write plainly.)

- ☐ Radio Service Business of My Own
- ☐ Service Technician for Retail Stores
- ☐ Spare Time Radio Repair Work
- ☐ Broadcasting Station Operator
- ☐ Loudspeaker Systems, Installations and Service
- ☐ Auto Radio Installations and Service
- ☐ Television
- ☐ All-around Servicing Technician

(If you have not decided which branch you prefer—mail coupon now, for information to help you decide.)

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RADIO & TELEVISION

The Popular Radio Magazine

June — 1941
Vol. XII No. 2

HUGO GERNSBACK, Editor
H. WINFIELD SECOR, Manag. Editor
ROBERT EICHBERG, Television and Digest Editor

In July Issue

The T.R.F.-7 Receiver—Stanley Weber

600 Watt Transmitter—Larry LeKashman, W2IOP

12-Watt Amateur Phone and CW Transmitter

How to Make Good "Home" Recordings—With Amplifier Notes—Herman Yellin, W2AJL

The Super T.R.F.-3 Receiver—Ralph W. Martin

An Improved Audio Amplifier of High Quality—Andrew Tait

In This Issue

GENERAL FEATURES

RADIO CONSTRUCTION

AMATEUR RADIO

NEW FEATURES

TELEVISION NEWS

MISCELLANEOUS

Cover Composition by Hugo Gernsback and Thomas D. Pentz

Certified Circuits

When you see this seal on a set it is a guarantee that it has been tested and certified in our laboratories, as well as privately in different parts of the country. Only constructional—experimental sets are certified.

You need not hesitate to spend money on parts because the set and circuit are bona fide.

This is the only magazine that renders such a service.

RADIO & TELEVISION—Published monthly on the tenth of the month. Entered as second-class matter Feb. 15, 1938, at the post office at Springfield, Mass., under the act of March 3, 1879. Trademarks and copyrights by permission of H. Gernsback. Text and illustrations are copyright and may not be reproduced without permission. Subscription price $2.50 a year in the United States (in foreign countries, 75c additional per year to cover postage; Canada 50c additional). Make all subscription checks payable to Popular Book Corporation.

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What Do YOU Think?

FACSIMILE TO LEAD, HE SAYS

Editor,

Now and then someone pipes up with a seemingly far-fetched notion that some old "standby" is on its way out, or it would soon be replaced with a new-fangled idea.

Well, here's one of them, and though it's probably been talked over many times before this, I think it is a subject worthy of deep consideration. Nevertheless, it is my firm conviction that *facsimile* transmission is going to give CW or code transmission a "slap in the face"! Whereas code is confined to "dits" and "dahs" and cryptograms —actual documents, maps, photographs and written messages can be transmitted via wire or radio, and reproduced in correct duplicate at the receiver. Telegraph forms, typewritten sheets, letters (both personal and business), actual signatures and a host of other possibilities that could be sent in exact duplicate of the original, would completely revolutionize the communications industry.

Important items that would not be entrusted to the (relatively) slow-moving mails (and time is valuable in some cases), would benefit immensely by this new type of transmission.

What a boon to war-time communications! Intercepted messages would most likely have to be sound-recorded by the interceptor, and decoding would start from there. Again the time element in a crisis or zero hour. Anyway, I think that some day in the near future we'll hear an awful lot about this new type of communication. Don't you?

PVT. MELVIN TANIS,
311 Signal Co. (Aviation),
March Field, Calif.

(What do you think, readers?—Editor.)

WHAT HE LIKES

Editor,

I have been reading your FB magazine ever since it was called *Short Wave Craft.* The departments that interest me most are: What Do You Think, Radio Construction, Amateur Radio and "CQ." My receiver is a 6-tube Hallicrafter S19R, using two antennas—a 40-ft. doublet NW-SE, and a 60-ft. inverted L. I am a 100% QSLer and would like you SWL's to send me your cards.

WALTER MISCHOWSKI, JR.,
Member S.W.L.R.,
785 Broadway,
Buffalo, New York.

OUR SETS WORK!

Editor,

I like all the departments of your magazine. I have built four receivers you have described and they worked so well that I sold three of them. The people I sold them to told me they worked wonders, *even better than their own sets.* The set I kept brought in over 230 different stations. Later on I intend to go in business for myself. I have learned very much from your fine magazine. I am an SWL and am having 200 SWL cards printed. I would like to hear from other readers of "R. & T." I will answer all mail. Best of luck to RADIO & TELEVISION magazine.

BUD PARKER,
4424 Loclede Ave.,
St. Louis, Mo.

"F-M" ARTICLES APPRECIATED

Editor,

I've been a silent reader of your "FB" magazine for a year and a half, and must say that it's really great. I'm always looking for the next one to come, so that it, too, can be read from cover to cover.

I like all the articles published, especially the articles on *Frequency Modulation*—please give us more. The articles on Ultra-High frequency receivers and transmitters are also greedily consumed.

Here's hoping that RADIO & TELEVISION keeps on rolling off the press for a long time to come!

REINO O. MARTIN,
Biscotasing, Ont.,
Canada.

LIKES OUR CONSTRUCTION DATA

Editor,

I have read your magazine for seven months and I think it's the best radio magazine ever. I built many receivers and some transmitters from it. I've constructed the high-fidelity phono amplifier in April's issue of this year. It works like a charm with very good tone and volume. More power to your article on *Frequency Modulation* and 73 to you.

RUSSELL BARTELS,
3925 E. Martin Ave.,
Cudahy, Wis.

HOW SWL'S CAN AID DEFENSE

Editor,

I've been a reader of RADIO & TELEVISION for years and find it a swell magazine.

The way things are today and with the rapid expansion of our national defenses, I think it is a fine thing for the good old U.S.A. Our Hams are certainly doing their part in defense work.

I should think that the SWL's (Short Wave Listeners) would like to have a part in this defense work, too. The only thing that we listeners could do is to have the F.C.C. let the SWL's have 1¼ meter band, but not to give this band to us alone, but to amateurs as well, and have us take an examination just for operating on 1¼ meters.

This will not mean that SWL can go on any other band, but that because his license is for 1¼ meters he will not be permitted to go on any other band. The SWL must pass the standard amateur examination for other amateur bands.

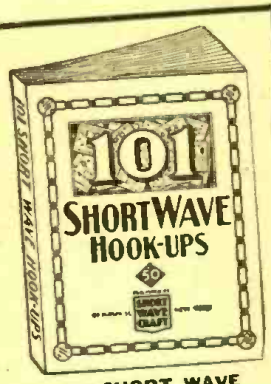
I think this will help in our defense work, because there are SWL's in about every small town in the country. What do you think of this plan to help our defense program?

ALBERT BRAMAN,
Central St.,
South Acton, Mass.

(Let's have your opinions, readers.—Ed.)

These Are the 6 Best Selling Short Wave Books . . . SEE THEM AT YOUR DEALER!

YOU buy parts, tubes, kits, accessories from your local radio dealer—that's what countless thousands of short-wave fans do. Through a nation-wide distribution service our numerous books are available at your favorite radio dealer—right where you buy other radio equipment. It's more convenient, saves time and you can inspect the books before you buy. Ask your dealer to show you all the books advertised on this page—they're always in stock.



101 SHORT WAVE HOOK-UPS

Compiled by the Editors of RADIO & TELEVISION

Here is a worthwhile book that every short wave listener, every short wave fan, and every short wave amateur has wanted for a long time. It gives you the 101 best short wave hook-ups which have appeared heretofore.

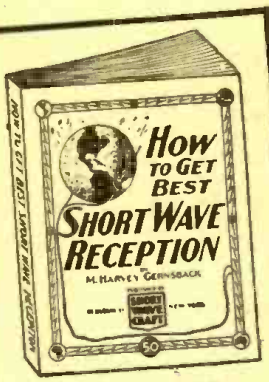
100 Illustrations
72 Pages
50c

HOW TO BUILD AND OPERATE SHORT WAVE RECEIVERS

Including
Receivers for the Beginners
Short Wave Converters
S-W Superheterodynes
Super-Regenerators
Television Receivers

This is the best and most up-to-date book on the subject. It is edited and prepared by the editors of RADIO & TELEVISION and contains a wealth of material on the building and operation, not only of typical short wave receivers, but short wave converters as well.

150 Illustrations
72 Pages
50c



HOW TO GET BEST SHORT WAVE RECEPTION

M. HARVEY GERNSBACK tells you everything you have ever wanted to know about short wave reception. The author, a professional radio listener and radio fan for many years, gives you his long experience in radio reception and all that goes with it.

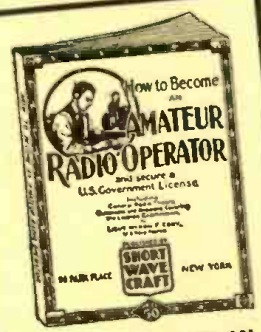
40 Illustrations
72 Pages
50c

TEN MOST POPULAR SHORT WAVE RECEIVERS

HOW TO MAKE AND WORK THEM

The editors of RADIO & TELEVISION have selected ten outstanding short wave receivers and these are described in the new volume. Each receiver is fully illustrated with a complete layout, pictorial representation, photographs of the set complete, hook-up and all worthwhile specifications.

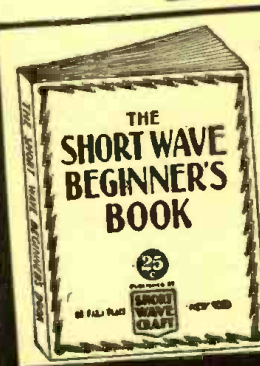
75 Illustrations
40 Pages
25c



HOW TO BECOME AN AMATEUR RADIO OPERATOR

By Lieut. Myron F. Eddy, whose experience in the amateur field has made him pre-eminent in this line. If you intend to become a licensed code operator, if you wish to take up phone work eventually —this is the book you must set.

150 Illustrations
72 Pages
50c



THE SHORT WAVE BEGINNER'S BOOK

Including
Complete Instruction in Short Waves for Beginners. Details for Making S-W Aerials, etc.

Here is a book that solves your short wave problems leading you in easy stages from the simplest fundamentals to the present stage of the art as it is known today. It is the only low-priced reference book on short waves for the beginner.

75 Illustrations
40 Pages
25c

LOOK FOR YOUR NEAREST DEALER

For convenience the publishers list below dealers in all parts of the world where our books are available. On your next shopping trip be certain to examine these volumes. You're sure to want them for your technical library.

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Radio Labs., Kansas City
Walter Ashe Radio Co., St. Louis
Van Sickle Radio Co., St. Louis
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Radio Accessories Company, Omaha
NEW JERSEY
Radio Apparatus Co., Newark
United Radio Co., Newark
Radio Wire Television, Inc., Newark
NEW YORK
Fort Orange Radio Dist. Co., Albany
Radio Wire Television, Inc., Bronx
Radio Wire Television, Inc., Jamaica, L. I.
Harrison Radio Co., New York City
American News Co., New York City
Baker & Taylor Co., New York City
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Adson Radio, New York City
Eagle Radio Co., New York City
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Radio Circular Co., New York City
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Thor Radio Corp., New York City
Try-Mo Radio Co., New York City
Van Riemsdyck Book Stores, New York City
Radio Wire Television, Inc., New York City
H. W. Wilson Co., New York City
Radio Parts & Equipment Co., Rochester
M. Schwartz & Son, Schenectady
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News Exchange, Akron
United Radio, Inc., Cincinnati
College Book Exchange, Toledo
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RADIO & TELEVISION

Readers' Editorials

More Radio in Spanish

● *"RADIO is everything" is said to have been the definition given by Marconi to an inquisitive and sagacious newspaper man. No doubt that definition is being confirmed by radio's everyday progress. Its message now reaches all corners of the earth, in all languages. What has been done, not only to convey entertainment but to carry knowledge of the most precious kind of radio itself with all its wonderful possibilities?*

Referring specifically to my own country, Mexico, where of course the national language is Spanish, we ask this question emphatically, because it is of the utmost importance. More so to those whose business is radio, because from the Rio Grande down to Cape Horn—excepting Brazil—Spanish is spoken.

There are treasures of radio knowledge that thousands of Spanish-speaking people are missing today due to the fact that books, magazines, etc., are published solely in the English language and only a small percentage of Uncle Sam's southern neighbors can understand them. In Mexico we have a few radio books of which translation into Spanish has been done apparently for commercial purposes only, which is not enough, of course.

We are now living moments in a world of political uncertainty and the United States, Mexico and many other countries are preparing to defend themselves. If we know that radio, besides its entertainment possibilities in times of peace, has no less importance in times of war, why not see that more men get the necessary knowledge through duly authorized and carefully supervised editions of books and magazines, so that they can widen their field of activities?

HECTOR M. IRIGOYEN,
Calle 62 No. 562,
Mérida, Yucatan, Mexico.

This Month's Prize Winner

Prize Award

RADIOLA MODEL 515

Value $24.95

Awarded to Hector M. Irigoyen for his Guest Editorial
All others receive a year's subscription.

NATIONAL DEFENSE

● I'VE been reading a lot in R. & T. about the Amateur's points of view on the National Defense and how the Radio Amateurs may help. Well, I'm going to step out of the radio field for a minute and step into the military ranks. Of course the amateurs have the right idea, but there's an exception and that is—can they do it? Why not prove it, instead of making a lot of statements? Why not organize a *secret service* organization among themselves to combat sabotage and subversive activities, by combing the air with their equipment. The F. B. I. in Washington isn't there for love. They need all the cooperation that they can get, especially from radio amateurs. Why not "cover the air" 24 hours a day? Have a man in each amateur station and a certain time devoted to his detecting work. How about you experimenters in the television field? The Air Corps could use some television ideas for its airplanes. Let me give you an example. An airplane equipped with a television transmitter and receiver and a special equipment on the ground, set up to transmit the enemy approaches, can be transmitted to the airplane and relayed from the plane to the G.H.Q., where such maneuvers can be studied. This is 1941 not 1914, so wake up, men, and help fight this monstrosity to regain peace in the world! Every American radio man, whether he be an *amateur* or just plain *experimenter,* can do his bit to defend and protect the Constitution of the U. S. A. Radio is the most powerful weapon in defense!

STANLEY DOWGIALA,
21 2nd Street,
Jersey City, N. J.

THE RADIO EXPERIMENTER

● TODAY radio has definitely earned its place in the sun. It has made the world smaller. It has linked far-flung countries. It has brought to all, in the comfort of our homes, the leaders in sports, politics, science, drama, movies, etc. It has made London, Paris, Rome, Australia, etc., as close to us as the switch on our short wave set. Radio has proved itself as the greatest force in the twentieth century for bringing knowledge, pleasure, and joy to all mankind.

No matter how far radio progresses, there will always be a place for the *Experimenter-Builder.* Generally, the experimenter-builder is a radio "fan," and he is in radio because he likes it and cares to build his own sets, experiment with circuit layouts, and try to improve the results he gets.

The average radio listener, if he stops to think about it at all, regards radio as a deep and dark mystery. He is content merely to twirl a dial or push a button and sit back and be entertained.

If something goes wrong with the works, as he calls it, he has to call in an expert to repair it. But since radio is becoming so popular, every man in the future should understand some of the theory behind radio or learn something about repairing radio receivers.

JOSEPH LA MONDA,
75 Engert Ave.,
Brooklyn, N. Y.

THE CALL!

● WE speak of the potentialities, the possible value and capabilities, of amateur radio operators and radio experimenters in times of national contingencies and emergencies. We speak about it; we do nothing to make our idle chatter into constructive, forceful reality.

In troubled and perilous times, such as we are now facing, our government—as it never did before—needs the entire and undivided assistance of all its citizens and compatriots. Paying taxes and serving as a conscript in the Army does not mean that you have fulfilled your obligations to the government. Your association with the art or science of radio places a further obligation upon you. How many of you can actually say that you can assist the government by taking a position as a civilian radio operator, instructor of code and principles of radio, or as a repairman if the government needs you?

I fear that only a few—a minority—can say *yes* to the above question! The number of radio instructors is exceedingly small.

Now is the time to prepare. Make yourself a potential and practical source of aid, not hindrance, to your government by

(Continued on page 128)

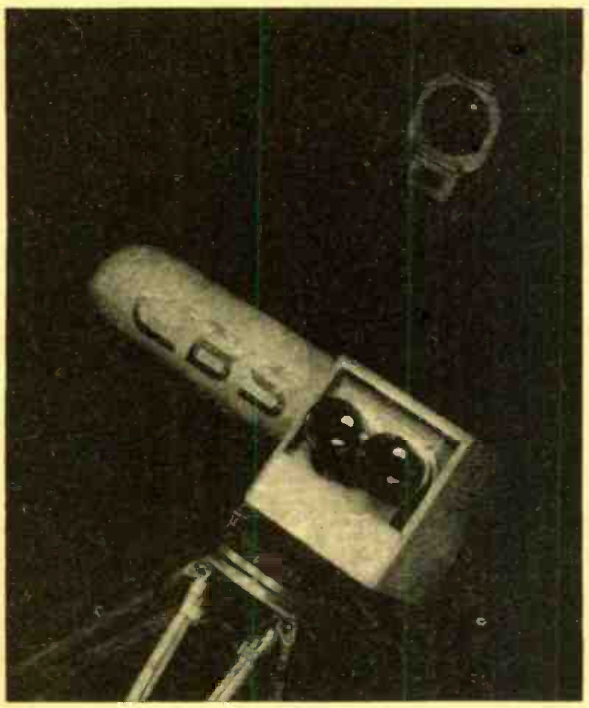
3-COLOR TELEVISION "OLD HAT" TO BRITAIN BUT CBS HAS REPLY

The three-color revolving disc for color television recently demonstrated as a new development by Dr. Peter S. Goldmark, CBS engineer, apparently is an old story to British radio men. In a recent issue of *Wireless World*, a British publication, a contributor and the editor have a discussion of the Baird color system which now uses a two-color disc. The correspondent points out that a far truer color rendering is obtained with a three-color disc. We now quote the editor of *Wireless World*, speaking of the newer 2-color system:

"The net result is of such a standard that deficiencies in color rendering are overlooked.

"Mr. Baird, in his earlier work, used three filters, but latterly employed the two-filter process, the use of which enabled greater detail to be transmitted within the available waveband, any inferiority in color rendering being more than compensated for by the increased definition. The aim was to get the best final result within the waveband available.

"While dealing with the subject of the Baird Color System, I should like to point out that the system of scanning employed was demonstrated by Mr. Baird eighteen months ago *(Wireless World*, August 17th, 1939), the receiver employing a cathode-ray tube in conjunction with a revolving color disc. A year later a similar scanning system, using a CR tube and color disc receiver, was shown in the U.S.A. and greeted as a new discovery."



At left is a picture of the new CBS color television camera. The 3-color drum is housed within the apparatus. It is the latest model yet produced by Dr. Goldmark.

The article at the left, in the interests of fairness, was referred to Mr. Wil Marcus, Director of Television Publicity for the Columbia Broadcasting System. Mr. Marcus' reply follows:

I read the advance copy of *Three Color Television "Old Hat" to Britain*, and took particular note of the statement that the CBS color television system developed by Dr. Peter C. Goldmark is an old story to British radio men. This strikes me as just another case (and we have seen many) of belittling an accomplishment of others, and detracting at least indirectly from its importance.

In saying this, we ourselves do not wish to belittle the work of Mr. Baird, whose many contributions to the television art are well known. However, with respect to color television, the fact remains that although many experimenters in many countries for many years have been trying to lift the curtain of color-blindness from television, Dr. Goldmark was the first to do it in an effective and practical manner. Before CBS announced its color last August, color television was dormant in this and other countries.

It is pertinent to note that the National Television System Committee, comprised of the outstanding brains in the American television field, reviewed all known color television systems (including Mr. Baird's) and agreed that the three-color system proposed by Dr. Goldmark is the preferable one for the frequency band width now in use.

Moreover, Dr. W. R. G. Baker, Chairman of the NTSC, recently testified before the Federal Communications Commission that a three-color process such as that of the Columbia Broadcasting System is the most desirable. Dr. Baker went so far as to say that a two-color system *"would hardly be expected to be as good"* as a three-color system.

The foregoing, I think, adequately covers the matter. However, for your possible interest I am adding a few of the more detailed technical considerations which account for the clear superiority of a *three-color* system over one with only *two colors*.

Intrinsically, a two-color system, even at its best, cannot do much more than give the picture an effect of "tinting" instead of natural color, and even then most of the tints bear a noticeable degree of resemblance to either one or the other of the two basic colors. The reason is that when all visible colors are plotted as an area, the only colors that can be produced by a combination of two colors must lie on a line connecting the points representing these two colors. This rules out whole families of colors including all colors of appreciable saturation.

In addition, the amount of information that a person gets from a television picture does not increase in proportion to the increase in the definition of the picture, regardless of whether such increase in definition is accomplished by greater horizontal or vertical definition, or both. As a matter of fact, I believe the article you sent me is in error in confusing the meaning of "detail." I think it meant "definition," and definition is meaningless unless the eye can distinguish between the elements in the picture. Color increases this distinguishability, or in other words, color adds to the "detail" which the eye can see.

I hope you will understand that the critical nature of this comment springs from a desire to put the matter in its true light.

This concludes Mr. Marcus' comment.

Checking on the early Baird three-color television experiments brings to light a fact that apparently is not known to CBS—or even to the editor of *Wireless World*—the Baird 3-color, it is said, lacked detail not because three colors were used, but because the system employed less than 200 scanning lines. The CBS system, using three colors, would afford approximately 4 to 8 times the detail secured by the British pioneer. Therefore, Dr. Goldmark's system should provide better detail than Baird's two-color and of course far more faithful color rendition.

A photograph of the newly designed CBS color television camera is reproduced herewith. It incorporates a special view finder and contains both the pickup tube and color drum. Company claims are that it is exceedingly compact and easy to handle.

POWERLESS FREQUENCY METER USES SPECIAL FIXED XTAL RECTIFIER

A frequency meter, which is extremely sensitive, affords great precision of measurement, is easily portable and uses no batteries or tubes, has been designed by E. L. Hall of the radio section of the National Bureau of Standards.

The meter consists of a variable condenser, sturdily constructed coils and a resonance indicator. A condenser and indicating system are mounted in a metal box which provides shielding. The resonance indicator consists of a 20 micro-ampere D.C. meter, a special fixed crystal rectifier and a coupling conductor connected in series.

The sensitivity of the instrument is such that very loose coupling to an oscillator must be employed. For example a large deflection is obtained several feet from a 65 mc. oscillator using an acorn tube and an input .25 watt. With suitable generators, harmonics — including the eighth — have been indicated.

This might well be a boon to Hams.

RADIO MAGS REFLECT WAR TREND

Radio publications from Britain, France, Germany, Denmark and Italy were the major ones reaching this office prior to the outbreak of war. Soon after the British clamped on their blockade, all publications save those from Great Britain failed to reach the desk of R. & T. but as the German counter-blockade was incurred, the picture changed slightly. The publication now receives German and Scandinavian papers, as well as those from Britain. Those from France and Italy, however, are still rather sparse.

U.H.F. FOR THE AIR FORCE

Commenting upon President Roosevelt's recent request to Congress for an appropriation of $2,477,000 for the installation of ultra high frequency radio ranges and radio landing systems throughout the country, Colonel Donald H. Connolly, Administrator of Civil Aeronautics, said that the ultra high frequency range was the result of development during the past four years by the Radio Technical Committee for Aeronautics made up of reports of the Army, Navy, Coast Guard, F.C.C., Bureau of Standards, radio manufacturers, scientific institutions, CAA and air carriers.

POOR INJUN TO GET HEAP BIG BROADCAST, UGH!

The magic of the pale-faces is conquering distance in northern Arizona, where the Navajos on the reservation are installing a *short-wave* network for intercommunication. E. R. Fryer, superintendent of Indian affairs in that locality, says that 27 stationary home receivers and one portable unit are being used to direct educational programs to the Indians. As the tract on which they live has an area of 25,000 acres, this is the only way in which the noble red men could be put in touch with modern science. But won't they be happier without it?

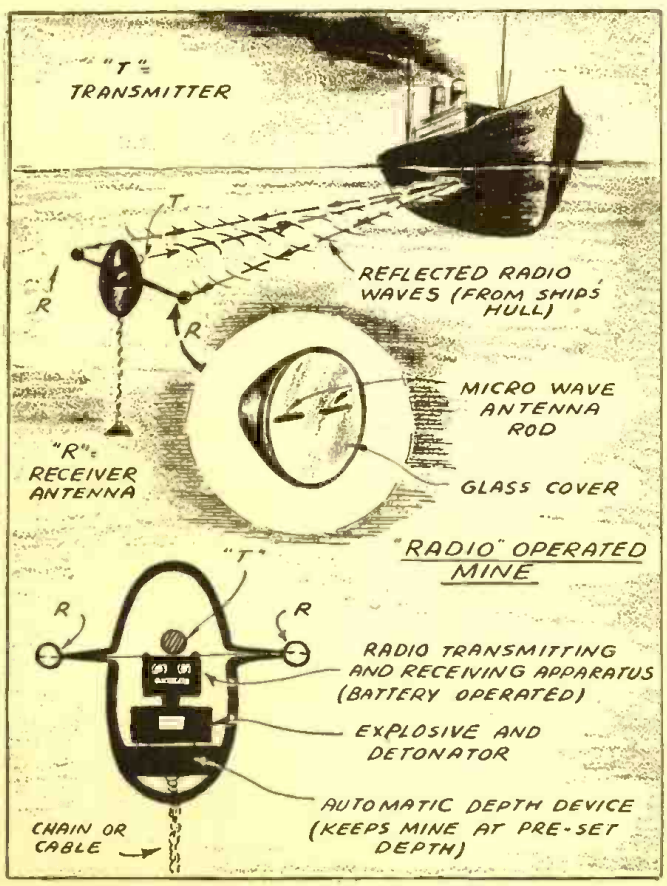
Radio Operated Mine Called Latest Nazi Sea Weapon

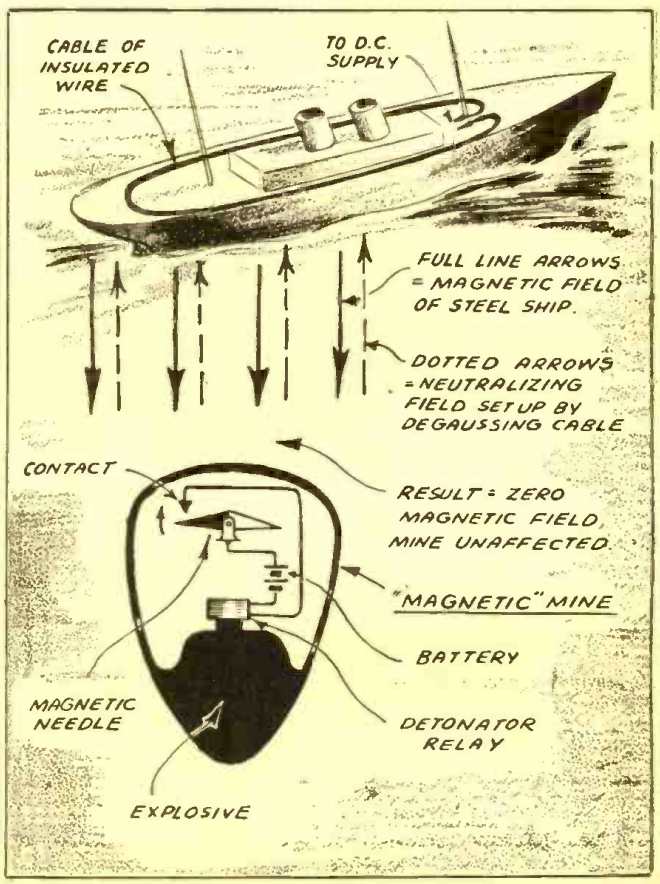
● RECENT reports from Europe state that a new type of mine is being sowed by the Nazis in the waters surrounding Great Britain and in important English shipping lanes. This new mine has been analyzed theoretically by some of the British military experts and one theory is that it may operate by *radio waves*.

One of the accompanying pictures shows how a short-wave oscillator may be arranged in a mine, the waves being radiated from one or more directive antennas. These antennas might be arranged in reflectors (in the picture only one transmitting antenna and two receiving antennas are shown but more, of course, could be arranged on each mine, so as to cover a greater area). If such a radiated wave is reflected by striking against the submerged hull of a passing ship, the reflected wave will be picked up by the receiving antennas, arranged also in reflectors to intensify the energy picked up. The range of ultra short or micro-waves through salt water would probably be rather short, but only a short range of action would be required of such a radio-operated mine in any case, for the very good reason that it would be useless to explode the mine when the ship was too far from it. To be effective the ship would have to be within about 100 ft. to 150 ft. of the mine in order to exert any appreciable effect on the hull.

These mines could be dropped from airplanes or dumped overboard from fast motor-boats, possibly at night. The mine would have an automatic depth-gauge on it, which would cause the anchor cable to stop unwinding when the mine proper had reached a certain pre-determined distance below the surface.

The second picture shows the action of the so-called *magnetic mine*, which received a great deal of publicity some time ago. When a steel ship passes over one of these magnetic mines, the delicately pivoted magnetic needle is caused to move, due to the magnetic field surrounding every steel vessel, and an electric circuit is then closed through a relay to explode the charge of powder or TNT in the mine. In the drawing the full line arrows show the magnetic field due to the ship's steel hull, which ordinarily would serve to attract the magnetic needle at the top of the mine. The dotted arrows show the neutralized magnetic field set up by the "degaussing" cable now carried by British ships. A strong electric current is passed through this cable and a counter magnetic field is set up, whenever the ship is passing through mine-infested waters. The resultant magnetic field in such a case (with the "degaussing" cable in action) is zero, and the magnetic mines are left unexploded by the passage of the ship.

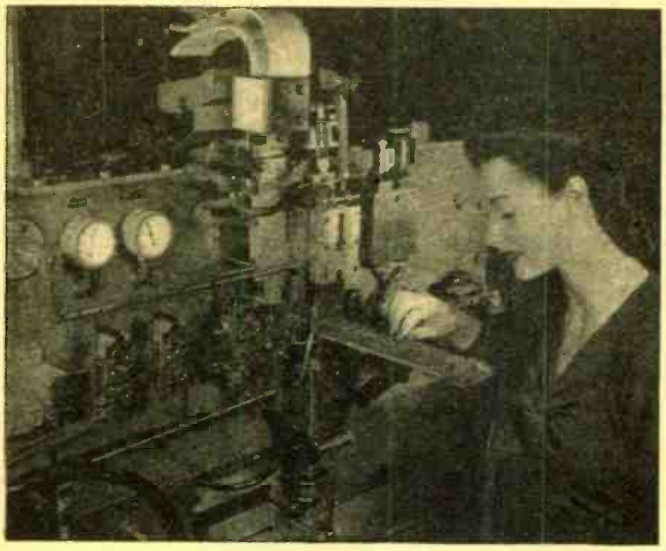




NEW MACHINE MAKES TUBE GRIDS MORE EFFICIENTLY, SPEEDS PRODUCTION

Improved efficiency in manufacturing grids used in radio tubes, has been achieved by the new *automatic grid machine* perfected by RCA at its radio tube plant at Harrison, N. J. It produces grids ready for use, except for cleaning.

The new machine, which has been under development for a number of years, was made possible economically by the success of the RCA "Preferred Type" tube standardization program. By concentrating much of its receiving tube business in 31 types of tubes, the company has been able to manufacture tubes of a given type in immensely increased quantities.



The decorative damsel at the left is inspecting a row of grids as they are rapped out by the new machine which speeds up vacuum tube production.

The new grid machine is a fully automatic device as compared with the lathes used for winding grids under the older method. Full-turn grid spirals are made by welding half-section spirals to side rods to form a single grid unit. Grids are vital tube electrodes. The number of turns and the pitch of their windings must satisfy rigid geometrical requirements. These characteristics vary with individual tube types. Once adjusted for a particular grid construction, this machine turns out highly accurate grid coils.

The lathes formerly used fabricated the grids continuously in short strips. It was necessary to heat and stretch the side rods, cut the strips apart, and remove the excess turns of wire between each grid. The new machine simplifies these operations and, in addition, avoids waste of the wire.

The new machine makes grids by welding formed wires to the side rods at a single operation. The welding operation is controlled by radio tube circuits to assure the exact amount of electric current for the exact time required to make perfect welds of all the grid wires to the side rods. Water-cooled electrodes perform the welding operation. A variable-speed motor is used to drive the machine so that it may be adjusted to the most efficient production speed for each grid type.

FREQUENCY SHIFT IMPROVES RECEPTION

We all reset our push buttons or learned new points on the dial on the 29th of March, when the majority of United States radio stations had their wave lengths changed. Reports coming into Washington indicate that through the excellent cooperation of both the press and the radio, set-owners had sufficient advance information to enable them to make the shift without difficulty.

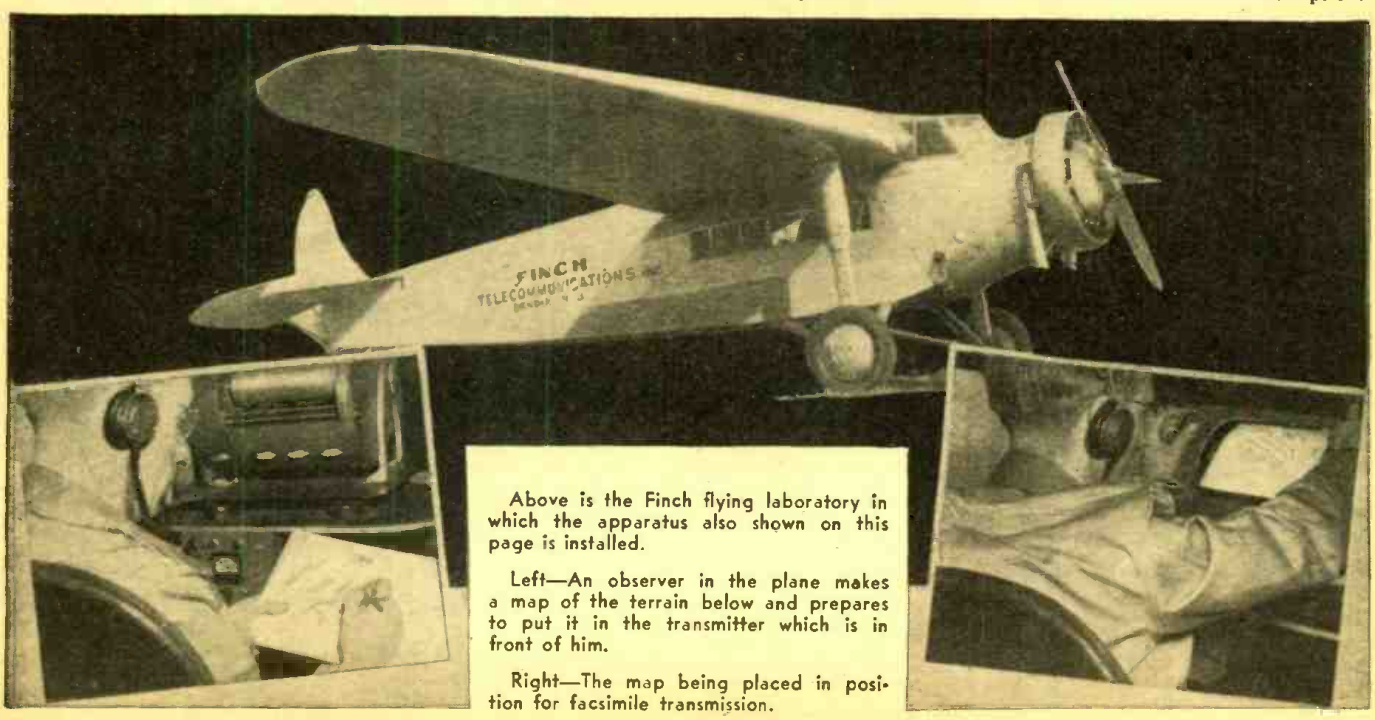
Early reports indicated that not only is there less interference but that station quality, and in some cases signal strength, is considerably improved. There were a few reports of interference but those which have reached the F.C.C.'s attention have been traced to specific cases in which final adjustments had not yet been made.

» » » Picture - Story Tells How Maps Are

The pictures on this page and continuing on the next show how facsimile may be used to relay maps and information from airplanes to portable field stations or to central headquarters. In the large photo you will see a plane as it prepares to leave its base, carrying aboard it complete equipment for transmitting and receiving facsimile images, using the Finch system.

The observer now sketches the terrain which appears beneath him.

Next we see the radio man placing a sketch which has just been drawn on the drum of the transmitter. The plane continues to fly and its ignition in no way interferes with the transmission of this visual image. Written reports, sketches, maps, etc., may be transmitted with equal facility and the latter are particularly important as they can convey data on enemy movements and locations better than a verbal description.



Above is the Finch flying laboratory in which the apparatus also shown on this page is installed.

Left—An observer in the plane makes a map of the terrain below and prepares to put it in the transmitter which is in front of him.

Right—The map being placed in position for facsimile transmission.

NEW ORDER FOR AMATEURS! ATTENTION!

The attention of amateurs is called to Federal Communications Commission order No. 73D the text of which follows:

IT APPEARING, That the annual Field Day tests of the American Radio Relay League will be held beginning at 4:00 p.m. E.S.T., June 7, 1941, and ending at 6:00 p.m. E.S.T., June 8, 1941; and

IT APPEARING, That the annual interest would be served by permitting portable and portable mobile operation during this period by amateur stations participating in such tests.

IT IS ORDERED, That during the period of the American Radio Relay League Field Day test from 4:00 p.m. E.S.T., June 7, 1941, to 6:00 p.m. E.S.T., June 8, 1941, the prohibitions contained in Commission Order No. 73 shall not apply to communications transmitted by licensed portable and portable mobile amateur stations participating in such tests.

This Order shall become effective immediately.

The Commission is also considering another order prohibiting portable and portable-mobile radio station operation by licensed radio amateurs.

NEW DEVELOPMENTS IN FM

In order to stimulate development in frequency modulation broadcasting, the F.C.C. has relaxed requirements with respect to the area to be served. This action was taken upon suggestion of the industry and is of temporary nature. In such cities as Washington, Houston, St. Louis, and Kansas City, and others beyond large basic trading areas, the new rules permit the stations to be authorized on a temporary basis to serve less than the basic trade area but at least the metropolitan district. The Commission may in the future require that these stations serve the entire basic trade area.

In view of the increasing number of applications by newspapers which wish to operate FM stations, the F.C.C. has ordered public hearings and investigations to determine what policy should be adopted in connection with ownership of high frequency broadcasting stations by the press. Commission records indicate that approximately one-fourth of all commercial FM applications are filed by newspaper interests. Of 94 received up to the time of this report, 27 were from concerns in newspaper business. In standard broadcasting more than a 1/3 of the existing stations are more or less identified with newspapers. At least 100 standard broadcast stations are owned by publishers with more than one newspaper or more than one radio station connection; and in more than 90 localities, the only radio outlet is in the hands of the only local newspaper. In undertaking public hearings however, the Commission does not imply that it is opposed to newspaper ownership of radio stations. It is just a fact-finding hearing.

F.C.C. MAIL BAG CONTAINS SOME STRANGE REQUESTS

More and odder are the requests which pile up daily in the F.C.C.'s ever-growing mail. The latest is a letter from a certain organization complaining of "dissemination by publications and broadcasters of alleged false and misleading information designed to eliminate the use of horses and mules." As false advertising claims were alleged in the complaint, the Commissioners turned the letter over to the Federal Trade Commission.

Here are some more: The basketball team of a particular university wants to converse over an amateur station in connection with a scheduled trip to Hawaii. The Commission said that as long as they obeyed all the rules concerning amateur operation, they could go to it—but nix on any direct or indirect *commercialization.*

The Black-and-Blue Network, the Pussy Cat Network, and the Garbage Network, all active in Eastern amateur circles, have their counterpart in California, for a man there asked what special frequencies were assigned to the Golden Gate area amateurs for network use. The reply is that as long as the amateurs stick in the amateur bands and obey the terms of their licenses and the F.C.C. rules, they can use any frequency they want.

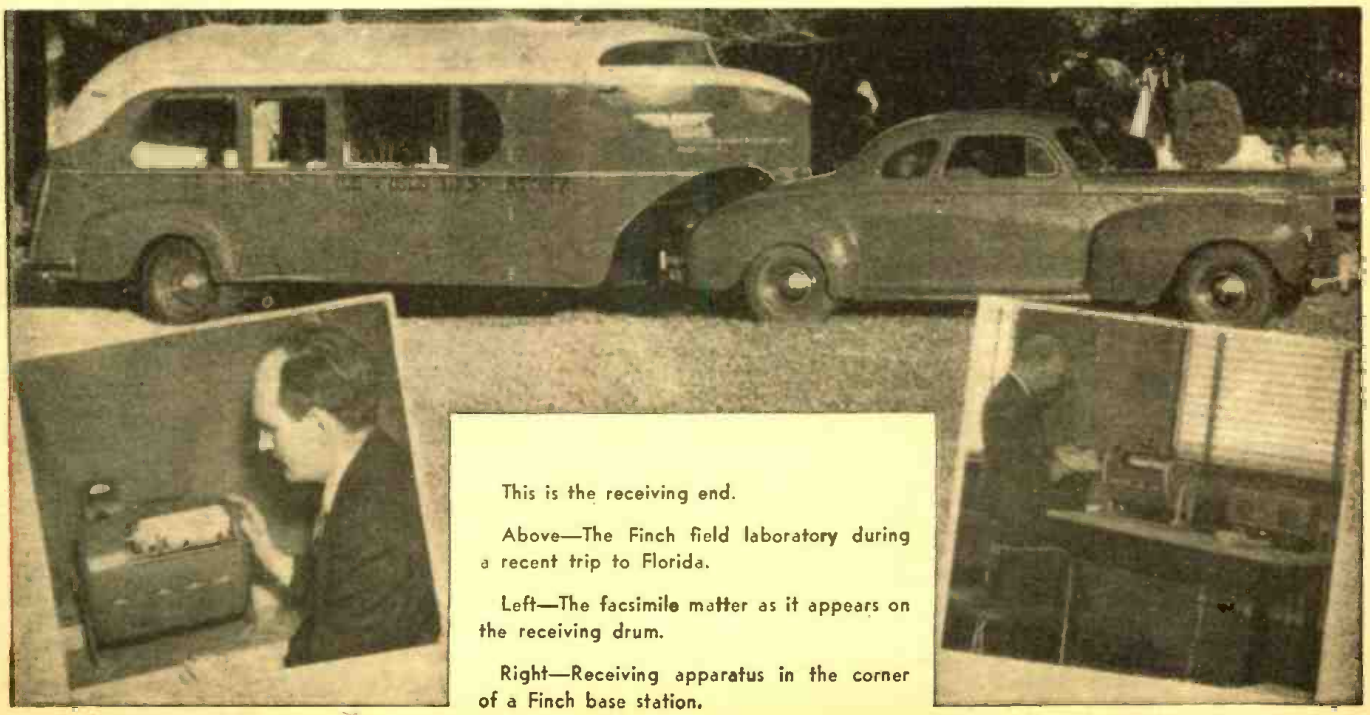
And oh, so many people want to know what is the best radio school to go to, what are the chances of getting work in radio, or even ask for aid in writing radio scripts. This is, of course, outside the Commission's field.

Sent from Planes to Stations on Ground « « «

On this page receiving is shown, the first picture illustrating the self-synchronizing receiver, which automatically starts recording when the first impulse is received from the plane. In less than five minutes the complete message, *including a drawing or photograph,* is received in the finished facsimile form. A new development permits "scrambling" so that only receivers specifically set to do so can receive the message or picture; other receivers are unable to pick up and assemble the elements which go to make the complete image. Thus complete *secrecy* is assured.

The truck which recently made a test in Florida is shown in the top picture.

The final illustration presents the interior of the base station, where a technician is found receiving a Finch facsimile image on his receiver. The apparatus, as can be seen, is simple and compact.



This is the receiving end.

Above—The Finch field laboratory during a recent trip to Florida.

Left—The facsimile matter as it appears on the receiving drum.

Right—Receiving apparatus in the corner of a Finch base station.

BRITISH EXPERT GIVES DATA ON ADAPTING METER TO WIDE USE

● SIMPLE methods of adapting ordinary meters to a wide variety of uses are described by W. A. Flint in *Electronics and Television & Short-Wave World*. While there is nothing particularly new in this idea, the author has stressed simplicity to such a degree that his article is of unusual interest. For example, using a 1 ma. D.C. milliammeter he first shows its adaptation for use as a D.C. voltmeter. This is done by merely connecting suitable resistances in series. He says:

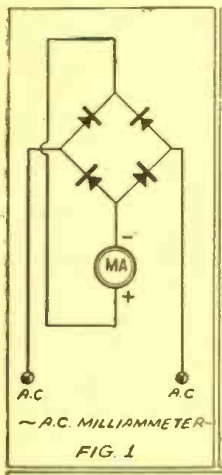


FIG. 1

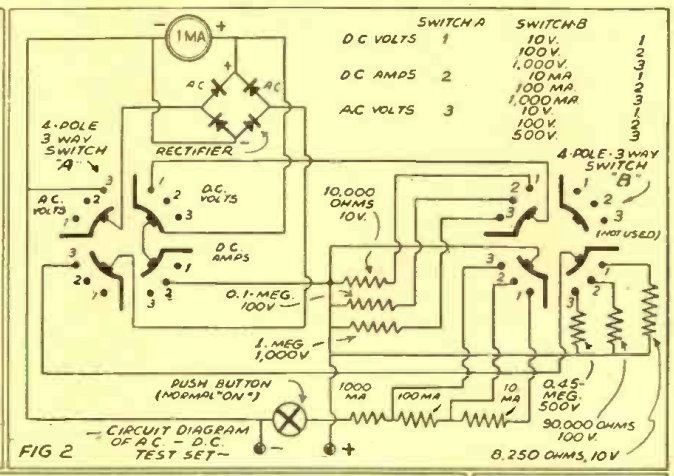


FIG 2

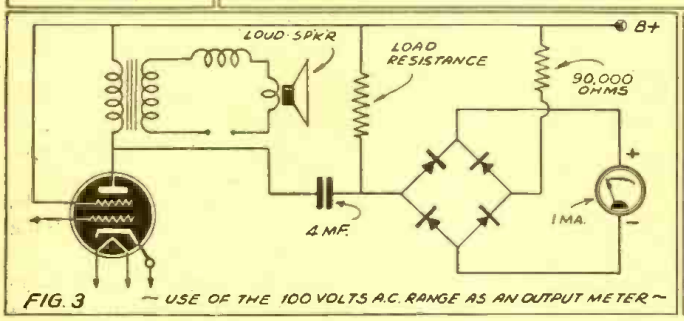
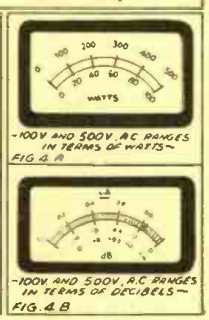


FIG. 3



Most 1 ma. milliammeters have scales calibrated into 50 divisions and by the suitable choice of full scale voltage ranges, most of the readings can be made direct. For example, on a 10-volt range, a reading of 0.2 ma. would indicate 2 volts; on a 100-volt range 20 volts; etc.

Three voltage ranges should be sufficient; they may conveniently be 0-10 volts, 0-100 volts and 0-1,000 volts. The first range would be suitable for measuring cathode voltages generally, the second screen voltages, and the third for general high voltage measurements.

Values of the resistances may be easily calculated from Ohm's law. Since the current flow is always 1 ma., the value of the resistance for a certain full scale range becomes 1,000 times the full scale voltage required. Thus for a 10 volts range, a resistance of 10,000 ohms is required.

As the accuracy of the finished instrument depends on the accuracy of the resistances and shunts, it is advisable to have these specially tested for accuracy.

Extending Scale

When the meter movement is shunted by a resistance, and current flows through the circuit it has two paths open to it, i.e., one through the meter movement and the other through the shunt resistance. If, therefore, the value of the shunt is arranged so that no matter what the total current through the circuit, only 1 ma. will flow through the meter movement, it will be possible to measure higher ranges of current. In other words, to measure a full scale current of 10 ma., a shunt resistance that will pass 9 ma. must be used. For 100 ma. the shunt must pass 99 ma., and so on.

If the meter resistance is 100 ohms, the value of the shunt to convert it to a 10 ma. meter will be 100/9 or 11.1 ohms, for 100 ma., 1.01 ohms, and so forth.

Suitable shunts and specially selected resistances are available or the shunts may be wound from resistance wire. For the higher ranges of current, care must be taken to select a wire of sufficient carrying capacity and it is usually preferable to use a single shunt and tap off for the various ranges. If it is desired to have ranges of 10, 100 and 1,000 ma., the approximate length of the wire required for the 10 ma. shunt (11.1 ohms) is calculated and the shunt adjusted against a meter of known accuracy as follows:— Exactly 1 ma. is passed through the meter with no shunt connected. The 10 ma. shunt is then switched in (it is advisable to keep any switch in circuit when adjusting shunts in order to allow for the resistance of the switch contacts) and then the shunt is adjusted so that exactly 0.1 ma. flows through the meter, indicating that 0.9 ma. is flowing through the shunt, so that when reading 10 ma., 1 ma. would flow through the meter and 9 ma. through the shunt.

When the 10 ma. shunt is correct, the circuit is arranged so that exactly 10 ma. flows and then the shunt is tapped off (again keeping any switching in circuit) until the meter again reads 0.1 ma. indicating that the 10 ma. shunt is multiplied by 10 and that the full scale range is now 100 ma. The same procedure may be adopted for further ranges.

The writer next discusses the conversion of the same milliammeter for use as an A.C. milliammeter. This is illustrated in Fig. 1.

A.C. Milliammeter

The addition of a metal rectifier to the milliammeter is shown in Fig. 1. This adapts the instrument to act as an A.C. milliammeter with *11 per cent higher* full scale deflection due to the fact that the instrument movement is still giving a deflection proportional to the mean value of the current passing through it, whereas, in the case of an A.C. sinusoidal quantity, the measurement required is the R.M.S. value which is greater than the mean value and bears a constant ratio to it of 1.11. The 1 ma. D.C. instrument now reads 1.11 ma. R.M.S. A.C. full scale. The scale shape of the D.C. instrument will not be distorted and the frequency error of the rectifier itself can be ignored up to 100,000 cps, so that such a rectifier-type instrument is suited to AF measurements.

For the measurement of higher ranges of alternating current, it will be necessary to use a current transformer, but the design of this is outside the scope of this article.

A.C. Voltmeter

The unit is easily adapted from an A.C. milliammeter to an A.C. voltmeter by adding resistances in series with one of the leads to the rectifier in the same way that the D.C. milliammeter was made into a D.C. voltmeter. Noninductive resistances should be used.

In order to calculate the values of the series resistances to be employed for reading A.C. voltages, it is necessary to know first the voltage drop which occurs across the A.C. terminals of the rectifier, and the current consumption of the *complete instrument movement and rectifier* at full-scale deflection. The leakage current of the rectifier itself is negligible so the current to be passed through the resistance at full scale deflection is 1.11 times the full scale meter current when the waveform is assumed sinusoidal.

The total voltage to be measured at full scale is the sum of the A.C. voltage across the rectifier A.C. terminals and the voltage to be dropped by the series resistance. The value of this resistance is easily calculated by subtracting the rectifier voltage drop from the full scale voltage to be measured, and dividing the remainder by 1.11 times the meter full scale current expressed in amperes. The voltage drop across the rectifier does not change linearly with current, so that if it is an appreciable fraction of the total voltage, it must necessarily distort the scale shape. Hence a voltage transformer becomes necessary to step up the very low voltages to be measured. For general radio testing, however, a full scale voltage range of less than 10 volts is not likely to be necessary and it is sufficiently accurate to calculate the resistance required for the correct full scale deflection by assuming that the voltage drop across the rectifier and the meter movement at full scale current is 0.9 volt, and across the meter movement 0.1 volt (assuming the use of a 1 ma. D.C. instrument).

For a 10-volt range, therefore, the required resistance will be

$$(10-0.8\times1000)/1.11=\text{ohms}$$

or about 8,250 ohms.

For 100 volts full scale, the value of the series resistance is 90,000 ohms and for 500 volts 450,000 ohms.

Very great care must be taken to ensure that the meter movement is connected to the rectifier *before any A.C. is applied to the rectifier.* Otherwise the rectifier will almost certainly be destroyed.

Test Set Design

A suitable design for an A.C./D.C. test set designed on the lines outlined above is illustrated in Fig. 3. The D.C. shunts connected to the negative terminals should have a switch or a push-button control inserted in series where the lead is broken. If a push button is used, it should be arranged to disconnect the shunts when in the "push" position. The push button affords a measure of protection as, no matter what the positions of switches "A" and "B," there will always be some resistance in circuit should either of these switches not be set correctly. Such a meter will be suitable for measuring alternating voltages in A.C. or A.C./D.C. receivers as well as audio voltages in amplifiers and at the output stage of an amplifier. The meter will have an accuracy of the order of 2 per cent. and be easily read.

The 10-volt range A.C. will be suitable for checking heater circuits, the 100-volt range the heater circuits of universal receivers, and for checking line and rectifier input voltages, the range of 500 volts is satisfactory.

Output Meters

The frequency error of a rectifier type instrument can be ignored over the whole of the audio-frequency band, and such an instrument can be used for trimming or for measuring the frequency characteristics of a receiver and amplifier.

The most usual requirement is for trimming or ganging with the loudspeaker disconnected and when this is done, it is necessary that the instrument should have incorporated in it a dummy load of suitable impedance to act as a substitute for the loudspeaker. It is also necessary that the instrument shall be choke-capacity or else transformer coupled so as to avoid any plate current causing a reading.

The 100-volt A.C. range should be used connected through a large capacity paper condenser in parallel with the speaker, If the speaker itself is to be disconnected for purposes of quietness, a load of the same impedance must be connected across the voltmeter.

The necessary circuit arrangements are shown in Fig. 3.

With a load resistance of 10,000 ohms (a common value for a pentode output valve) the full scale deflection of 100 volts will correspond to an A.F. output of 1 watt. Using the 500-volt range, the corresponding full scale reading is 25 watts.

For tubes with a matching impedance other than 10,000 ohms, the load resistance may readily be changed to suit, the value used being obtained from the tube maker's data sheets. The watts output may be calculated from the formula V^2/R where V is the voltmeter reading and R the value of the load resistance in ohms. With a load resistance of 5,000 ohms, for example, a reading of 50 volts corresponds to ½-watt. Such an output meter may be made up with a series of resistances to suit the tubes most commonly in use and the scale calibrated to read direct in watts. The scale is of square shape and a typical scale for 100-volt and 500-volt ranges with 10,000 ohms load resistance is shown in Fig. 4A, while the following table gives the calibration of the cardinal points of the scale for a range of load resistances when using the meter for 100 volts full scale deflection.

The 4-mfd. series condenser should be increased inversely in proportion as the load resistance is decreased.

Decibels

Sometimes the scale is calibrated in db. A typical scale shape is shown in Fig. 4B and can be calculated from $20 \log_{10} (V_1/V_2)$ where V_1 is the power output being measured (in volts) and V_2 the standard output in volts.

The 1-watt and 25-watt scales are obtained by using the 100-volt and 500-volt ranges of the instrument with a load resistance of 10,000 ohms. If the same marking is employed for other values of load resistance, the direct gain or loss in db. will still be correct, but the zero level instead of being 1-watt will become the full scale value given by the bottom figure of the appropriate column of the table below.

Meter reading	*Load resistance values*						
	10,000	7,500	6,000	5,000	4,000	3,000	2,000
ma.	*Watts output*						
0.2	0.04	0.053	0.07	0.08	0.1	0.14	0.2
0.4	0.16	0.213	0.27	0.32	0.4	0.54	0.8
0.6	0.36	0.48	0.6	0.72	0.9	1.2	1.8
0.8	0.64	0.85	1.07	1.28	1.6	2.14	3.2
1.0	1.0	1.33	1.7	2.0	2.5	3.4	5.0

Ohmmeter

By connecting an external battery in series with one of the D.C. milliampere ranges, the meter can be employed as an ohmmeter. A scale can easily be calculated for this purpose using Ohm's law, when the battery is of known voltage and the current is indicated on the meter. The resistance is calculated from the formula R=E/I; or if the resistor is known, I=E/R.

AUSSIE PLANT PUTS 130 SPEAKERS IN

● ACCORDING to *Australasian Radio World*, one of the largest industrial plants in Australia has been equipped with loudspeakers. Although the sound system was installed essentially for paging, the management permits electrical gramophone records and radio programs to be broadcast at certain times of the day.

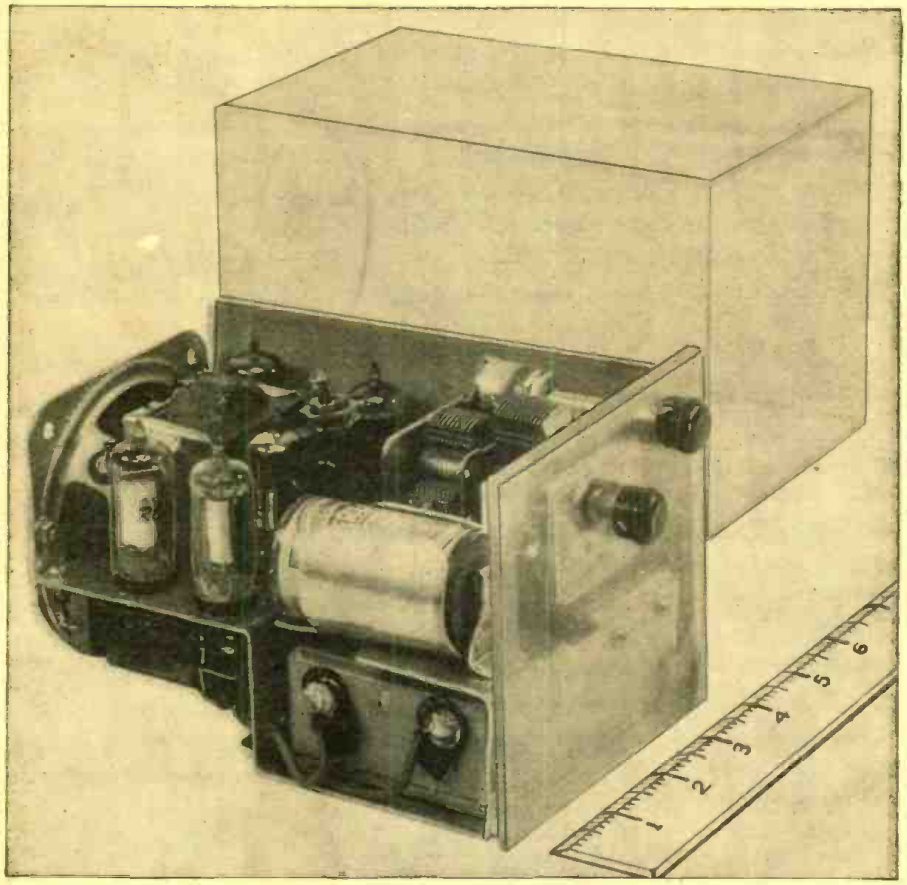
This plant employs 130 of the latest type permanent magnet loud-speakers, and the same speaker is used in all sections of the works, adjustment of power level being made by transformer ratio.

The speakers are mounted upon large baffle boards at strategic points throughout the plant and wired to the telephonist's switchboard, where they join the power amplifier which develops an undistorted output of 1200 watts.

Two channels are used, and there are two other relay units. Several miles of wire were used to connect up the speakers, each one being given a different voice and music power, correlated with the noise and area of the particular section.

Can YOU Answer These Radio Questions?

1. **How can short waves explode a mine submerged under water, when a ship approaches it?** *(See page 71)*
2. **What is the advantage of using two tubes in parallel in the "output" stage of a miniature receiver?** *(See page 76)*
3. **How can the selectivity of a midget receiver be improved by the addition of a simple inexpensive device?** *(See page 85)*
4. **What is the purpose of "response expansion" in an audio frequency amplifier?** *(See page 86)*
5. **What is the advantage of a T.R.F. circuit over a superhet, with regard to high-fidelity reception?** *(See page 90)*
6. **What is the principal use of a "bass suppressor" in an amateur transmitter?** *(See page 92)*
7. **What is an "electronic relay," and what is it used for?** *(See page 95)*
8. **What is the advantage of a center-fed Zepp aerial for receiving, as compared to an ordinary antenna?** *(See page 98)*
9. **What is a "capacity type" burglar alarm, and how does it work?** *(See page 105)*
10. **What is the advantage of a fixed frequency booster in television reception?** *(See page 106)*
11. **How can the frequency of a miniature transmitter be changed, without the use of a tuned circuit?** *(See page 108)*
12. **What is the purpose of a Stroboscope, and how is it used?** *(See page 112)*
13. **What is *Teledeltos* paper, and what is it used for?** *(See page 116)*
14. **How many people do experts estimate will be served by the forty-odd F-M stations?** *(See page 121)*



About the size of a Kodak, the "Miniport" is a remarkable little broadcast receiver and brings in the stations on a loudspeaker! The cabinet was made of transparent plastic, but if desired, a small wooden or other cabinet, covered with leather or velvet, may be made for it.

This is the first article explaining how to build a miniature portable set of the "personal" type now so popular. It weighs but 3¾ lbs. and utilizes five of the new low-drain battery tubes. It provides loudspeaker reception of all the major broadcast stations in a given locality; two tubes in parallel provide exceptional power in the output stage.

R. & T. Miniport—A 5-Tube Battery Portable You Can Build

Ricardo Muniz, E. E.*
and
S. Morton Decker**

● DESCRIBED herewith is a real miniature receiver for the *home constructor* and the *amateur*. The authors show you how to put a really good 5 tube superheterodyne complete with batteries, speaker and antenna in a box with inside dimensions 3¾ by 4 by 6 inches. The set has one tube more than commercial jobs at present available and is therefore louder. It is smaller than any commercial job the authors have examined. It can be built in the *home workshop* with very ordinary tools, and will play right away if the wiring diagram and parts placement are adhered to rigidly.

Circuit—The superheterodyne circuit was chosen because of its well known superior sensitivity. The tube line up is as follows: 1R5 Pentagrid Converter; 1T4 Intermediate Frequency Amplifier; 1S5 Detector, A.V.C., 1st A.F.; two 1S4's in parallel output Audio Power Stage. The set it will be noted uses two dual purpose tubes so as to cut down size. The 1R5 acts as oscillator and first detector in the superheterodyne: a dual function. The 1S5 acts as 2nd Detector with Automatic Volume Control and also as the first stage of audio frequency amplification, another tube with dual function. The tubes selected are all of the new R.C.A. "glass button" base type. These are very small in size and have a low filament drain. The 1R5, 1T4 and 1S5 each draw .05 amp.; the 1S4's draw 0.1 amp. each.

One of the failings of the commercial "mini" sets has been the low audio power output. The result has been low volume operation. By using two 1S4's in parallel the power output has been practically doubled. The proper output transformer has been specified in the parts list to "match" the output impedance of these two 1S4's.

In order to obviate danger of "blowing" the filaments if B+ is inadvertently shorted to filament an 800 ohm resistor has been connected in series with the B supply to limit possible current flow to a value too low to blow out filaments.

It will be noted that the loop antenna acts as both signal pick up and as the antenna coil. It is tuned by the first condenser in the two-gang variable tuning condenser. The trimmer on this condenser is adjusted for maximum volume of reception.

The B supply is one of the new Eveready Minimax 67.5 volt batteries which weighs just about one pound. The choice of this powerful miniature battery is an important contributing factor to the small size and loud volume of the receiver.

Choice of Parts—One of the major problems which confronted the authors in designing this receiver was the unavailability on the open market of miniature component parts. This obstacle was finally overcome by using Emerson "replacement" parts which can be readily purchased by the constructor. Thus Emerson: Oscillator Coil, 1st and 2nd I.F. transformer, and two-gang cut-plate oscillator tuning condenser were used.

A two inch and a three inch Oxford-Tartak speaker were tried out by the authors. It was decided to use the three-inch speaker because the tone quality was found to be much better. The output transformer was of the same make. An effort was made to obtain a smaller output transformer with the proper impedances but it was found that none was available. It was decided that making one up was not worth the effort in saving of space and weight.

A very small volume control was found in the Centralab "sub-midget" potentiometer. This control however does not come with a switch and a separate switch is used to turn on the filaments.

Half-watt IRC resistors were used throughout because of their small size and "insulated" feature which made the danger

*Engineer WNYE, Radio Instructor Brooklyn Technical High School, Supervisor Radio Defense Classes at B.T.H.S.
**Senior Student at B.T.H.S., President Tech Television Club.

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The Sky Traveler (Model S-29) A universal receiver, you can take it with you anywhere. Operates on 110 volt AC-DC or from self-contained batteries. 9 tubes. Covers from 542 kc. to 30.5 mc. (553 to 9.85 meters) on 4 bands. Self-contained extension type antenna. Wt. including batteries 18 lbs. **$59.50**

Model SX-25 Incorporates every worthwhile advancement that has been made in the communications field. 12 tubes, covers from 540 kc. to 42 mc. in 4 bands. Separate calibrated bandspread dial for the 10/20/40/80 meter amateur bands. 10" heavy duty PM dynamic speaker in matching metal cabinet. Complete with speaker, crystal and tubes **$99.50**

The Sky Buddy (Model S-19R) designed to produce superior performance at a moderate price. 6 tubes; 4 bands; continuous coverage 44 mc. to 545 kc.; Electrical bandspread; built-in line filter **$29.50**

Model SX-24. A great communications receiver value. 9 tubes; 4 bands; frequency range of from 540 kc. to 43.5 mc.; one stage of preselection; Single-signal crystal filter standard equipment; DC operation socket-battery or vibrapack **$69.50**

The 1941 Sky Champion (Model S-20R) Represents the best value in the communications field. 9 tubes; 4 bands; covers 545 kc. to 44 mc.; separate electrical bandspread; Inertia bandspread tuning; battery-vibrapack DC operation socket **$49.50**

New 1941 Super Skyrider Model SX-28. Sets a new high in quality performance. 15 tubes; Two stages preselection; 80/40/20/10 meter amateur bands calibrated; 6 step wide range variable selectivity; Calibrated bandspread inertia controlled; Frequency coverage 550 kc. to 42 mc. With Crystal and Tubes **$159.50**

HENRY RADIO SHOP
BUTLER, MISSOURI

of short-circuits very small.

It was decided to make the *loop antenna* to fit the size box to be used as it is difficult to purchase one of suitable dimensions. 40 turns of No. 20 cotton and enamel insulated wire was found suitable. The winding dimensions are given in the drawings.

The size of the Eveready Minimax "B" battery is only 1 and 5/16 by 2 and 11/16 by 3 and 5/8, making this battery eminently suitable for the "mini" type set, as the battery is necessarily the largest single component. The set was actually designed around the "B" battery and the loudspeaker, which are the two largest components. An Eveready No. 950 flashlight cell was used as an "A" battery; it is 1 and 5/16 diameter and 2 and 3/8 long. The "B" battery provides about 40 hours of operation; the A battery about 4 hours. Batteries of the dry cell type always last longer on "intermittent" service for short, widely-spaced periods than in "continuous" service over long shortly-spaced periods, so no DEFINITE figures can be quoted.

The rest of the parts are more or less standard; these are specified in the *parts list*. It is suggested that the selected components be adhered to, however, as high quality is very essential for trouble free service. Since a *mini* set is necessarily built in "layers," servicing is difficult.

Construction Hints: The chassis is made of 1/16 inch aluminum and is bent in such form as to "clamp" the "B" battery in place. The "A" battery is held by a clip of the same material which is mounted on the main chassis. The speaker and chassis form a complete unit which will "stand up" by itself. Refer to drawings for details and dimensions. The chassis has a "cut-out" which accommodates the speaker. The tube sockets are mounted around this cut-out as close together as their mounting rings permit. The I.F. transformers are also mounted around the cut-out.

The volume control is mounted on the baffle plate at the middle of the condenser; this economizes space. The tuning condenser itself is mounted on the part of the chassis which is acting as a B battery "clip." The speaker and controls are mounted on opposite ends of the chassis, which permits it to be easily slipped into the cabinet, the *control end* of which is removable. This also makes possible much more compact construction with the parts available. The output transformer is soldered directly onto one of the mounting flanges provided on the speaker. The mounting flanges of the transformer and one of the mounting flanges of the speaker having been previously clipped off. Thus one side of the transformer case is soldered to the remaining speaker transformer-mounting flange.

Right-angle wiring was adhered to throughout, with all parts at right-angles under the chassis to give neat appearance. This is especially important since a transparent Polystyrene cabinet is used. You will be repaid a thousand times over if you stick to this feature—it will be good looking AND you won't have to pull the chassis out of its box many times a day to show well-meaning "friends," who marvel at your powerful "mini-radio" and want to see its "innards." (The authors were DRIVEN to a transparent cabinet in desperation, because everyone wanted to see "the works.") The parts layout permits short leads to be used, in spite of the right-angling of components on the under part of the chassis.

Aligning the Receiver: After all the parts have been assembled and all the wiring completed, it is well to check it very carefully yourself before applying power. This may save you a set of batteries.

The set will probably "play" right away when it is turned on and tuned. (Remember that the inside of a steel building is pretty well shielded and a very poor place to test a loop-operated receiver, "mini" or not.) Reception will usually be improved by aligning the set. While a signal generator is preferable it may be aligned "on the air." Tune in the *weakest* station you can pick up; adjust the antenna condenser trimmer for maximum volume, with the volume control all the way up. If you are not concerned about the station positions on the dial (and you can after all calibrate your own dial) you can proceed to adjust the I.F. trimmers. Use a *weak* station and have the volume turned up all the way.

If you want good calibration on the tuning dial you had best use a signal generator and peak your I.F.'s at 456 kc. with the sig. gen. connected from prong 6 of the 1R5 (control grid) and chassis. Ground prong 4 temporarily (oscillator grid). Next

Diagram of connections for the "Miniport" miniature receiver—it weighs less than many similar commercial sets.

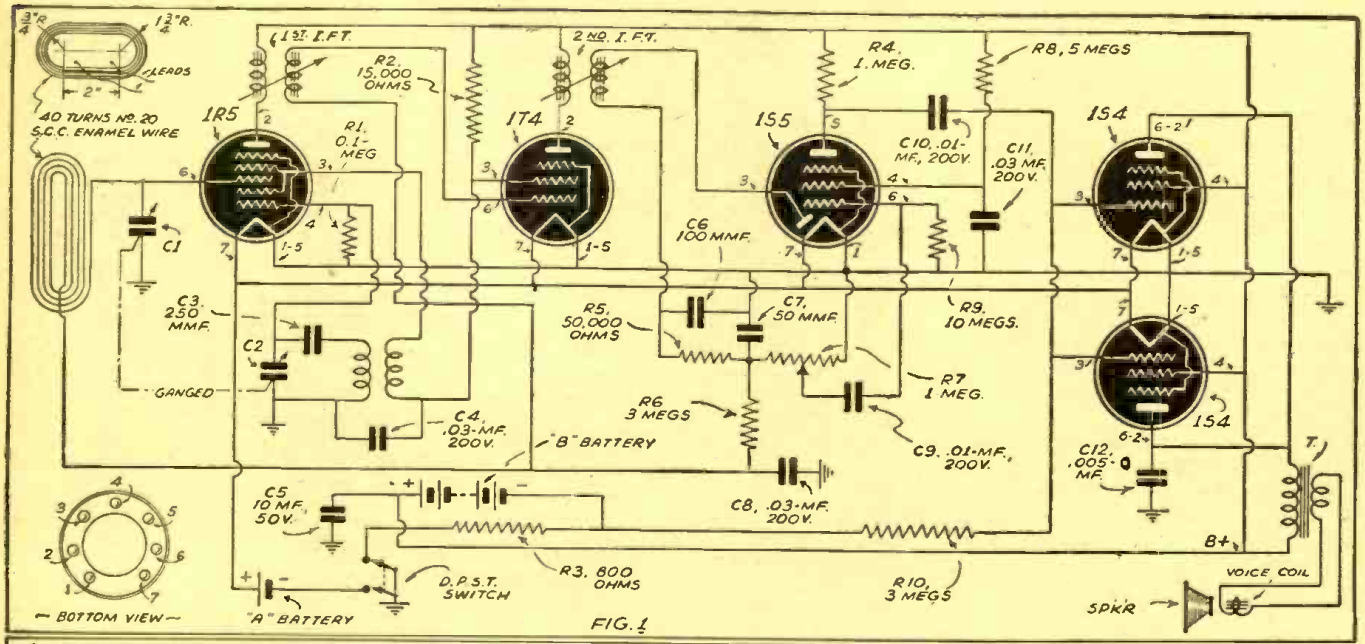


FIG. 1

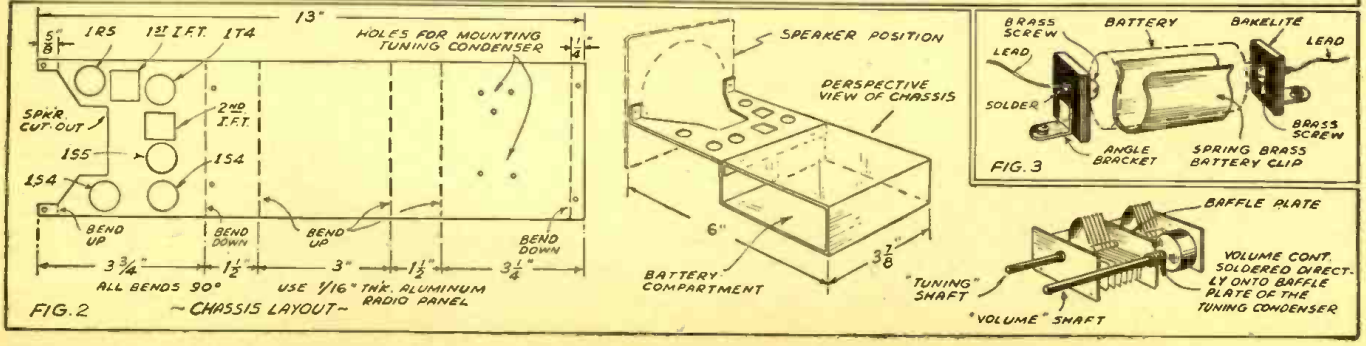


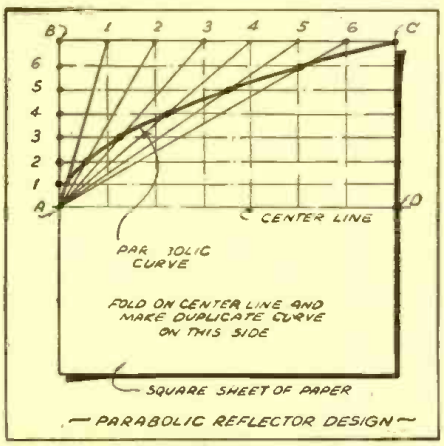
FIG. 2 —CHASSIS LAYOUT—

FIG. 3

adjust the oscillator trimmer to maximum response with circuit restored to normal and tuning condenser set at 1500 kc. and feeding 1500 kc. in from the sig. gen. (by coupling it to the loop by means of a loop of wire connected to the terminals of the sig. gen. and brought near). Adjust the osc. trimmer. Also adjust the ant. trimmer. Since a fixed padding condenser is used, no adjustment is needed at the *low frequency end* of the dial. When adjusted in this manner (which is only a very brief description of standard superheterodyne alignment procedure) the various stations will always come out at the same place on the dial, even if at a later time you find it desirable to realign. It will therefore be a convenience in that you need make a calibrated dial only once. If the constructor is not familiar with alignment procedure, he is referred to any of the amateur radio handbooks for detailed information.

Since you are going to make a hand-calibrated dial anyway—aligning on a station is really good enough.

Now that the summer is here—you will find this receiver a great source of pleasure: especially one you built yourself which will be a great source of pride besides. We wish you lots of happiness with your "R and T" "Miniport." It weighs 3¾ pounds, compared to 4½ pounds weight for the smallest commercial portables.



The drawing above shows one of the simplest methods of laying out a parabolic curve. Radio experimenters at one time or another will find this method very useful. Once the half curve shown is plotted and drawn, the other half can be made by simply reversing the templet.

PARABOLIC REFLECTOR DESIGN FOR U.H.F. WORK

● WAY down in the ultra-ultra high frequency spectrum, in the centimeter section, the parabolic reflector antenna system predominates. But many are puzzled as to how a parabola should be drawn. The following method of scaling of a parabola will be found simple and effective.

Lay a square sheet of paper, as large along the sides as the reflector is to be, on the floor and scribe a center line as shown. Then lay off six equi-distant points along the left upper edge and the top edge. Mark the corners A-B-C and D. Rule off parallel lines between A and B and number each point from one to six on each marked edge.

Then draw lines from A to B1, A to B2 etc., along to B6. Where these lines intersect A 1-2-3-4-5 and 6, make dots. Then spring a thin batten along these dots and draw a soft pencil along the batten. The curve formed is parabolic. By folding the paper along the center line this curve can be traced onto the lower section and you will have your full parabolic curve.—*L. B. Robbins.*

Parts List

I.R.C.—(Resistors)

1—Type BT-½ 10 megohm resistor, R9
1—Type BT-½ 5 megohm resistor, R8
2—Type BT-½ 3 megohm resistors, R6, R10
1—Type BT-½ 1 megohm resistor, R4
1—Type BT-½ 100,000 ohm resistor, R1
1—Type BT-½ 50,000 ohm resistor, R5
1—Type BT-½ 15,000 ohm resistor, R2
1—Type BT-½ 800 ohm resistor, R3
1—Type D13-137 1 megohm pot. may be used in place of Centralab submidget control, R7

R.C.A. RADIOTRON—(Tubes)

1—Type 1R5 glass button tube
1—Type 1T4 glass button tube
1—Type 1S5 glass button tube
2—Type 1S4 glass button tube

CENTRAL RADIO LABORATORIES

1—1 megohm potentiometer, R7

CROWE

2—No. 5128 red knobs

AMERICAN PHENOLIC CORPORATION

5—No. 78-7P miniature tube sockets
1—Sheet No. 65-125 plastic (for cabinet)
1—Bottle No. 53-901-4 cement (for cabinet)
1—Bottle No. 53-901-2T thinner (for cabinet)

GUTHMAN

The following parts may be substituted for the smaller ones listed above.
1—Type 4515 I.F. transformer
1—Type 4516 I.F. transformer
1—Type 4531 oscillator coil

EMERSON—(Obtain as Replacement Parts)

1—No. 7UC 469 tuning condenser
1—No. 7UT 539A oscillator coil
1—No. 7UT 540 first I.F. transformer
1—No. 7UT 541 second I.F. transformer
(Tun. cond. cap. about .00032 mf. Osc. cond. cap. about .00027 mf.

AEROVOX CORPORATION—(Condensers)

1—Type 1489 .00005 mf., C7
1—Type 1469 .00025 mf., C3
1—Type 1469 .0001 mf., C6
1—Type 1464 .005 mf., CT2
3—Type 284 .03 mf., C4, C8, C11
2—Type 284 .01 mf., C9, C10
1—Type PRS 50 mf., C5
Circuit legend (repeated above)
C1—Variable condenser
C2—Variable condenser
C3—.00025 mf. mica
C4—.03 mf. tubular (200 V.)
C5—10 mf. (50 V.)
C6—.0001 mf. mica
C7—.00005 mf. mica
C8—.03 mf. (200 V.)
C9—.01 mf. (200 V.)
C10—.01 mf. (200 V.)
C11—.03 mf. (200 V.)
C12—.005 mf. mica

OXFORD-TARTAK

1—Type 32MP 3" loudspeaker
1—Type U21 output transformer

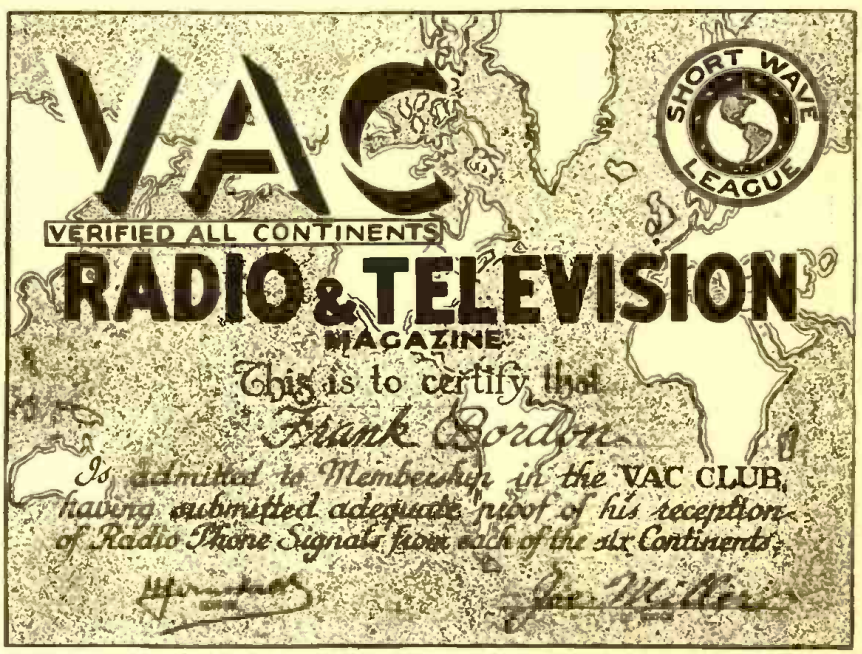
NATIONAL CARBON COMPANY (Batteries)

1—Eveready No. 950 cell
1—Eveready No. 467 battery

(The editors will be very glad to hear from those who may build the Miniport receiver, especially if any improvements are made which enhance the efficiency of the set. If you make a good looking job of it, we shall be pleased to publish pictures of the set, if it's particularly neat. Let's hear from you fellows!!—Editor)

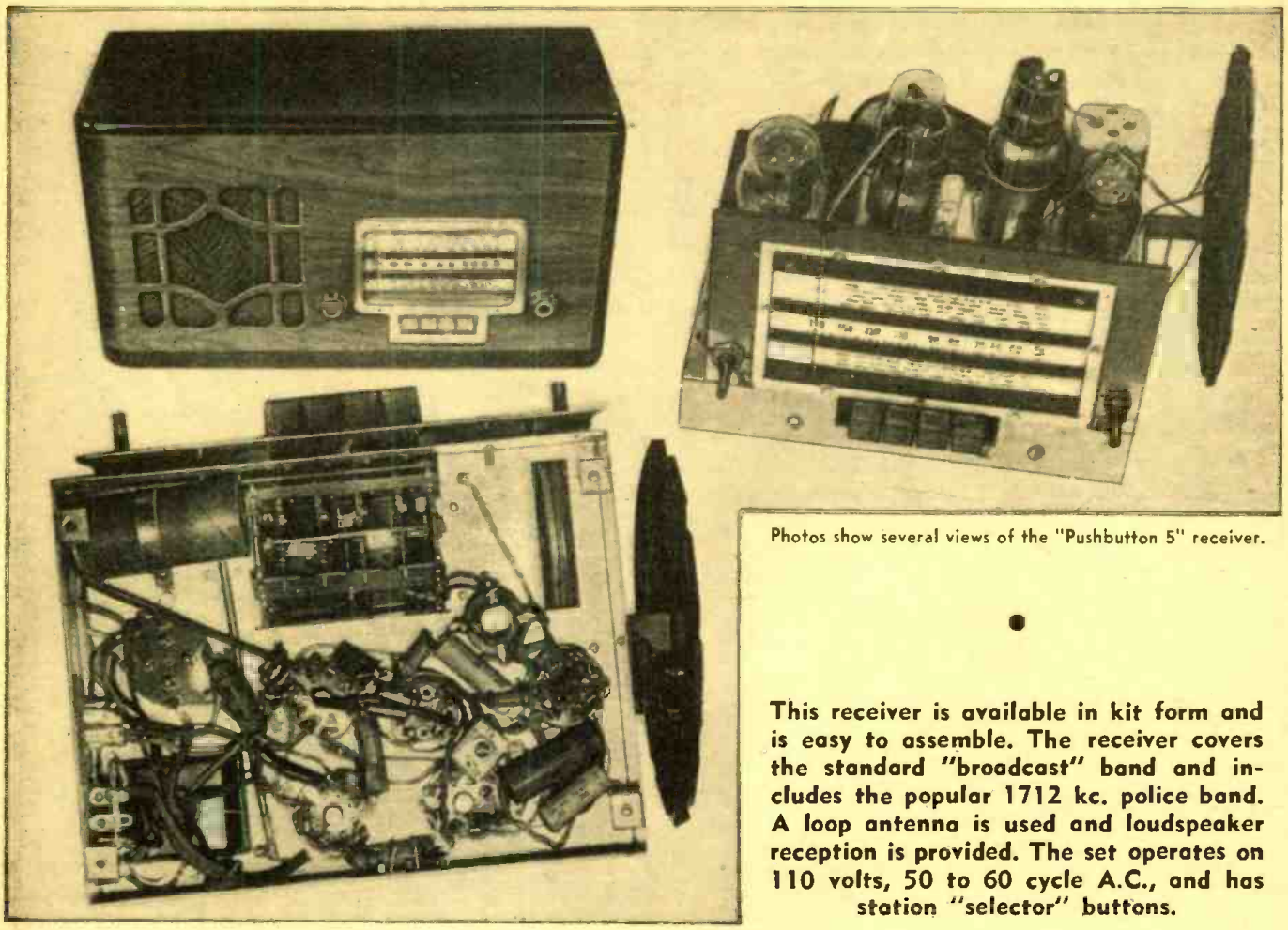
Have You VAC?

● THE handsome 9" x 12" VAC Certificates are still available and will grace any DXer's wall. To be eligible for this DX honor, a phone QSL is needed from each of the 6 continents, Asia, Africa, Europe, Australia, North America and South America (Java and Philippines count as Asia). Send in these six QSL's with 25c for handling and costs; after checking, the QSL's will be returned with certificate. Address *VAC Editor,* RADIO & TELEVISION, *20 Vesey St., New York, N. Y.*



THE EDITORS WANT

good constructional articles (with clear photos and diagrams), Radio Receivers and other sets, especially "FM" Tuners and Adapters. We also are anxious to see constructional articles on Short Wave Receivers; also general articles on Antennas, etc.



Photos show several views of the "Pushbutton 5" receiver.

This receiver is available in kit form and is easy to assemble. The receiver covers the standard "broadcast" band and includes the popular 1712 kc. police band. A loop antenna is used and loudspeaker reception is provided. The set operates on 110 volts, 50 to 60 cycle A.C., and has station "selector" buttons.

Build-Your-Own

L. M. Dezettel, W9SFW*

"Pushbutton 5" Receiver

● HOW often we have *day-dreamed* on the construction of a receiver for the home that would really have the appearance and performance of a commercial receiver. The receiver described here is simple and straightforward in design and all parts are available as a kit or individually.

This receiver is designed to operate over the standard *broadcast* band and includes the popular 1712 kc. police band. The frequency range is from 535 kc. to 1720 kc. (174 to 560 meters.)

This "Pushbutton 5" super operates from 110-125 volts, 50-60 cycles, A.C. A "Magna Beam" (loop) antenna is used for signal pickup of local broadcast stations. An extra *pick-up winding* on the loop permits the use of an *outdoor* aerial and *ground* for receiving stations several hundred miles away. Four plastic pushbuttons provide automatic tuning of four of your favorite stations. The pearloid dial is marked off in tenths of a kilocycle.

The circuit uses standard tube types which are available anywhere. Adequate tube shielding is provided to prevent feedback. Automatic volume control voltage is developed in the 6Q7G second detector and fed back to both the 6A8G converter and 6K7G I.F. tubes. AVC reduces fading on DX signals and keeps the volume of all local stations nearly constant, thus preventing "blasting" by the more powerful stations as you tune across the dial.

The triode portion of the 6Q7G is used as the 1st audio stage. This stage and the 6K6G power stage has semi-fixed bias on the grids which helps improve the quality of reproduction. A slight amount of degeneration in the 6K6G power stage is used to improve quality further. Nearly 3 watts of audio power is produced in this stage.

Terminals for Phono, Television or F.M.

A terminal strip on the back of the chassis provides for connection to a record player, or television or frequency modulation tuner when desired.

Front panel controls are volume, manual tuning and the four automatic pushbuttons. You may make your own cabinet or purchase one like the one shown in the picture.

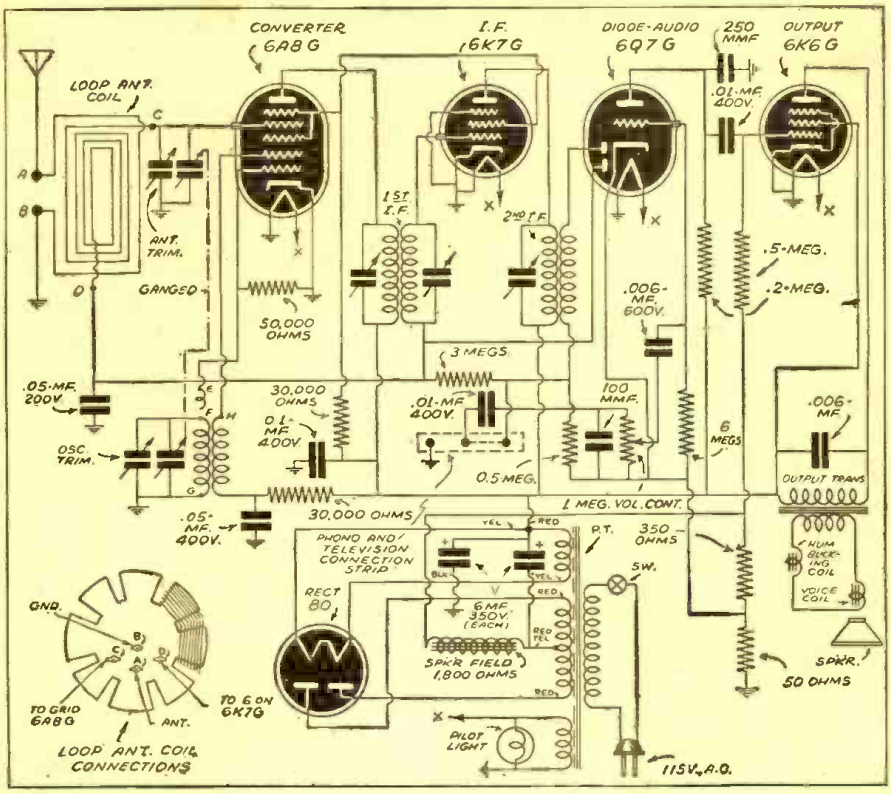
The chassis is available already punched with the necessary holes. The only tools required are a long-nosed side-cutting plier, a screwdriver and a soldering iron.

Building the Set: The first thing to do is assemble the parts to the chassis. The pictorial diagram and the top view on the schematic diagram clearly show the location of the various parts.

Sockets are mounted from beneath the chassis. Be sure the tube guide slot faces in the direction indicated in the diagram. The panel is mounted away from the front apron of the chassis by means of two ⅜" spacers. Shield clips for the 6K7G and 6Q7G tubes are fastened above the chassis at the same time as the sockets are mounted. The large drum is fastened to the condenser shaft by means of the set-screws on the hub. The entire assembly is then mounted over the chassis cutout from above. The tuning knob rotates the drum by clutch action. The dial pointer string is first inserted through the hole in the drum. A light spiral spring is fastened to the string and slipped over a cut-a-way on the inside of the drum. This spring serves to keep the string taut after it is threaded over the pulley.

The oscillator coil is mounted by means of two tabs which slip under the cut-a-way on the chassis. These tabs are then soldered

*Engineer, Allied Radio Corp.



Wiring diagram for the "Pushbutton 5" receiver.

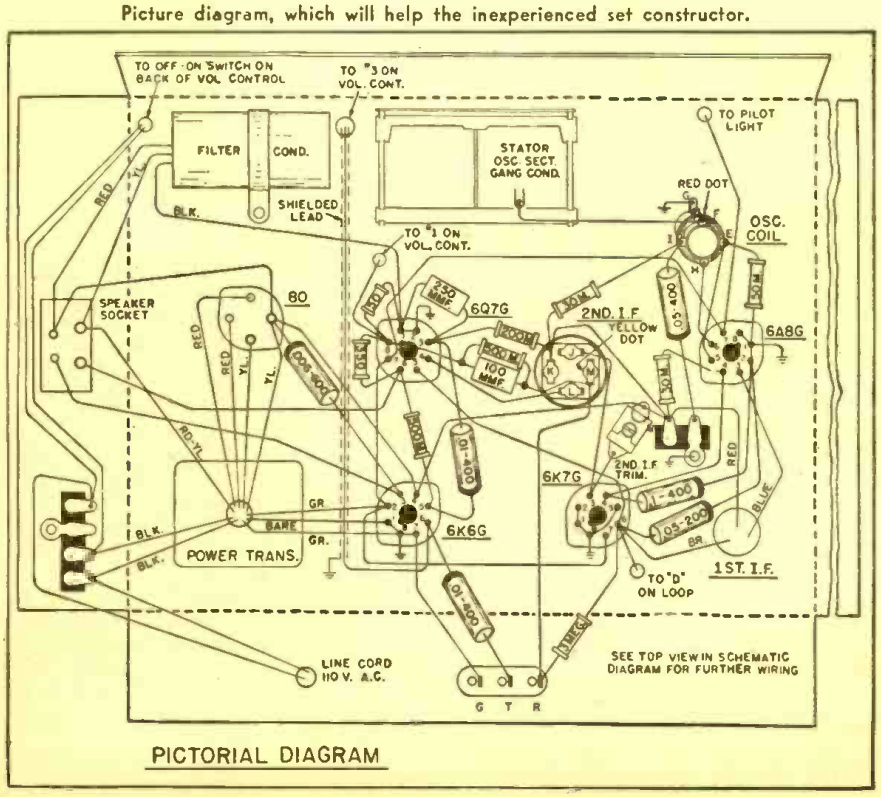
to insure solid mounting. The second I.F. transformer mounts under the chassis in a cup. If all parts are mounted neatly and fastened securely, wiring will be much easier.

Wiring

Wiring should be done slowly and neatly. A hot, well tinned soldering iron will help make cleaner joints. Soldering is done by touching the iron to the connection and holding it there a few seconds until the *connection* is hot enough to flow the solder.

It is best to start with the loop antenna and work from stage to stage, in order, up to the speaker socket. Make all connections as short and direct as possible. Fixed condensers and resistors are supported by their own leads. If the leads are longer than they need to be, clip them off as you wire. The second I.F. trimmer condenser is soldered directly to the wiring tie-point and to the number 3 terminal of the 6K7G

Picture diagram, which will help the inexperienced set constructor.



PICTORIAL DIAGRAM

socket. A connection is made from the F terminal on the oscillator coil to the stator of the oscillator section on the gang condenser. The terminal on the stator is located on a brown bakelite strip between the push-button mechanism and the condenser opening on the chassis. Care must be used in reaching the connection with the soldering iron. The shielded lead under the chassis consists of a piece of wire threaded through a long metal spiral tube. The shield is soldered to the chassis at two or three points. The spiral tube located above the chassis is soldered at its lower end to the grounded terminal of the wiring tie-point.

It is a good idea to check off each lead on the diagram as you wire the receiver. A carefully wired job will result in immediate reception of broadcast programs and will save many hours of rechecking.

Adjustment

With the tubes in their correct sockets and speaker plugged in, turn on the set. Stations should be heard immediately, but a little alignment may be necessary for peak performance. Tune the receiver to a station at the low frequency end of the band, and securely fasten the pointer to the dial string at the correct frequency. Now, tune the set to a station at the high frequency end of the band. With the condenser set to read the frequency on the dial that coincides with the frequency of the station, adjust first the oscillator trimmer condenser for loudest response. Then adjust the antenna trimmer condenser similarly. Turn the volume control down to prevent overloading and adjust each I.F. trimmer condenser for loudest signal. Two of them are reached through the holes on top of the first I.F. transformer shield, and the third is the small condenser soldered to the number 3 contact of the 6K7G socket. Your set should now be operating perfectly. Any tendency it may have to squeal or distort music will be due to wiring leads that are too long, or to the fact that leads connecting to grid and plate terminals on the sockets are too close to each other.

Setting "Selector" Buttons

The automatic pushbuttons are adjusted from the front and with the pushbutton knobs off. Loosen each of the screws located under the knobs. Tune in a station with the manual tuning knob and depress one of the levers with a screw-driver. While holding the tuning knob to prevent the condenser from turning and with lever depressed, tighten the screw. Repeat this operation for each of the levers. Insert the proper station call in each of the buttons and replace them on the levers by pushing them on firmly.

The connection strip marked "R," "T," and "G" on the diagram permits use of the audio amplifier portion of the receiver. To use this attachment with a phonograph, remove the connecting link between "R" and "T." Connect the two terminals from the phonograph pick-up to terminals "G" and "T." If your pick-up has a shielded lead, the shield connects to "G" and the inner conductor to "T." If your pickup has two unshielded leads, the black one goes to "G" and the other one to "T."

Parts List

1—Formed and punched chassis, Knight SN2044
1—5" P.M. dynamic speaker
1—Output transformer to match 6K6 tube to speaker
1—2-gang variable condenser with push-button mechanism, 365 mmf. R.F. section and cut oscillator section, Knight SN2000
1—Loop antenna, Knight SN2222
1—Oscillator coil to match cut section oscillator gang on tuning condenser, Knight SN1452
1—Input I.F. transformer, standard 456 kc.
1—Output I.F. transformer, sub-chassis type, Knight SN1596
1—1 Megohm volume control with switch
1—6-10 mf., 350 volt electrolytic condenser
1—Power transformer, 650 V. A.C. at 45 MA., 5 V. at 2A., 6.3 V. at 1.8A, Knight SN2226
1—50,000 ohm, ½ watt resistor
2—30,000 ohm, ½ watt resistor
2—500,000 ohm, ½ watt resistor
1—50,000 ohm ½ watt resistor
1—350,000 ohm ½ watt resistor
1—200,000 ohm ½ watt resistor
1—3-megohm ½ watt resistor
1—6-megohm ½ watt resistor
1—3-30 mmf., I.F. trimmer condenser
2—.006 mf., 600 volt tubular condenser
2—.01 mf., 400 volt tubular condenser
1—250 mmf., mica condenser
1—100 mmf., mica condenser
1—.05 mf., 400 volt tubular condenser
1—.1 mf., 400 volt tubular condenser
1—.05 mf., 200 volt tubular condenser
2—Tube shields, goat
1—3-terminal phono connection strip
1—4-prong speaker socket
4—Octal tube sockets
1—4-prong tube socket
1—2-lug wiring tie point
1—4-lug wiring tie point
1—Punched front panel, Knight SN-1966
1—Pearloid dial scale, Knight SN-1993
1—Dial string pulley and shaft, Knight SN-1987
1—Dial pointer, Knight SN-2198
1—Dial lamp socket and bracket
1—Line cord and plug
1—Dial escutcheon for cabinet, Knight SN-1925
2—Wood knobs
4—Plastic pushbuttons, Knight SN-1972
1—Set of call letter tabs, Knight SN-2191
3—Grid clips

Knight is Allied Radio Corp. trade name.

Tubes

1—6A8G tube
1—6K7G tube
1—6Q7G tube
1—6K6G tube
1—80 tube
1—No. 47 pilot bulb

ARTICLES ON FREQUENCY MODULATION

In past Issues of this Magazine

A Frequency Modulation "Converter"—R. Muniz, E.E., and J. Haddad—June 1940

Frequency Modulation—R. Muniz, E.E., and J. Haddad—July 1940.

Hints on Operating the "F.M." Receiver—R. Muniz, E.E., W. Oestreicher—Aug. 1940.

Principles of Frequency Modulation—R. Muniz, E.E.,—Aug. 1940.

Principles of Frequency Modulation — R. Muniz, E.E., Part 2—Sept. 1940.

Building the Browning "Frequency Modulation"—G. H. Browning—Oct. 1940.

Frequency Modulation "Tuner"—to Suit Your Pocketbook—Larry LeKashman and Anton Schmidt—Oct. 1940.

A Frequency Modulation Tuner—Herman Yellin—Dec. 1940.

A "Pull-Swing" Frequency Modulation System for the Amateur—R. Muniz, E.E., Donald & Warren Oestreicher—Feb. 1941. (Also March, April and May 1941.)

Principles of Frequency Modulation—F. L. Sprayberry—Feb. 1941.

An U.H.F. Receiver for FM and AM—S. Gordon Taylor—Feb. 1941.

F-M Receiver for the Home—L. M. Dezettel—March 1941.

Principles of Frequency Modulation—Part 2—F. L. Sprayberry—March 1941.

Principles of Frequency Modulation—Part 3—F. L. Sprayberry—April 1941.

"How to Build a Useful Phono-Oscillator"

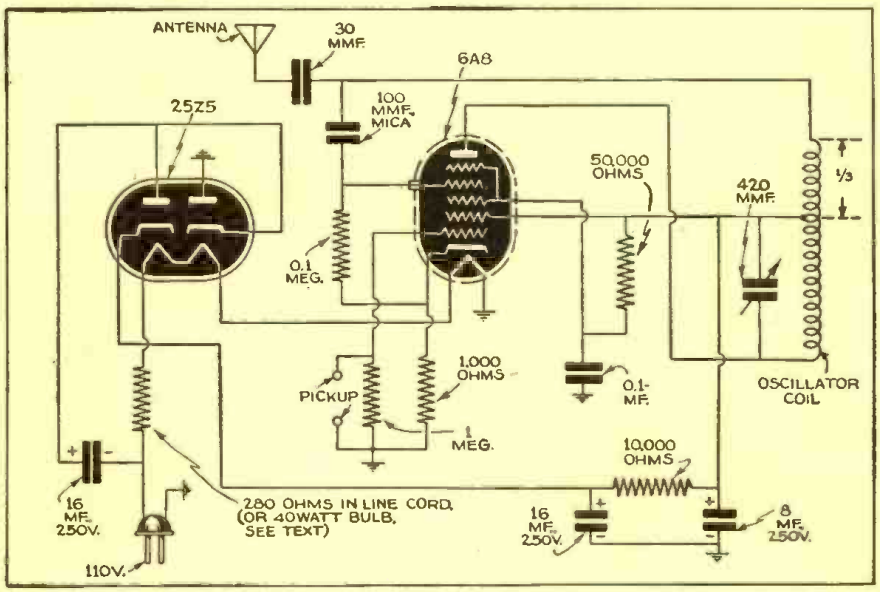
CARL J. BERRY and WILLIAM HOUNSELL

● THE original of this circuit was a diagram for a standard Philco "wireless" oscillator. However, due to slack finances and a collection of parts on hand, we made several drastic changes from the original. At the time of building, we were unable to obtain a standard oscillator coil and after several experiments constructed a coil from an old broadcast band antenna coil. This coil is made by stripping the original coil of all windings, except that which resonates with the tuning condenser. Then, one third of the way down from the top, one turn is cut. The wire is peeled back one half of a turn from the cut ends so that they meet on the other side of the coil and may be twisted together. This forms the tap shown in the diagram. Other than this, the circuit is as shown. The power-supply is a voltage-doubler taken from an article by Steve Kusen (*Radio-Craft*, Jan. 1940).

A variation from the use of the standard line cord resistor is the use of a 40-watt bulb to obtain filament voltage. In sections where the line voltage is fairly constant at 110 volts, the bulb can be used in series with the 25Z5 filament alone, for use as a field supply for a small speaker or other low-watt loads. This facilitates the installation of a dynamic speaker at any point where line voltage is available.

Regardless of the design shown, the oscillator will operate with a half-wave rectifier very satisfactorily. This reduces the required working voltage on the filter condensers. Also, it makes it possible to wreck an old A.C.-D.C. set (which can be picked up for practically nothing) and build the entire apparatus from the salvaged parts.

What! Another phono-oscillator? Yep, and according to the authors of the present article, it's a good one. All of the parts employed are standard ones and the phono pick-up is connected to the terminals indicated on the grid resistor.



SHORT-WAVE STATION HONORED

The only short-wave station to be honored in the first annual awards by the University of Georgia in the George Foster Peabody awards for meritorious public service is Station WGEO operated by General Electric in Schenectady. This station was cited for its service to the U. S. Antarctic Service expedition, which consisted of a radio program every other Friday night, sponsored by some prominent newspaper, followed by the reading of 150 to 200 letters from relatives and friends back home, known as the "Byrd mail bag." Occasionally some relative came to Schenectady to have a personal two-way chat over WGEO with her husband or son at the South Pole. The Little America service was inaugurated in December, 1939, and continued until May 1, when the men of the expedition were back within "calling distance" of the United States.

The importance of radio and the WGEO mail bag program to the snow-bound explorers in Little America is graphically described by Rear Admiral Richard E. Byrd, who said: "In Antarctica, during the long night there are few diversions except those you make yourselves. Your homesickness becomes a nostalgia. Actually to hear the voice of your friend, your brother or sister or father or wife brings sunshine to the long, dark night."

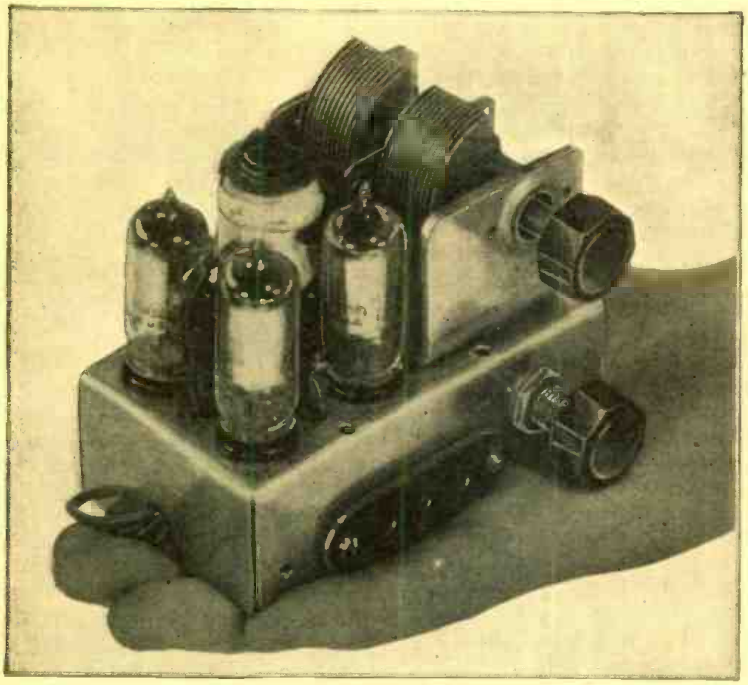
The "Byrd mail bag" was inaugurated during the first Antarctic expedition from 1928 to 1930. General Electric's short-wave station was then known as W2XAF; and it was at that time that Dr. E. F. W. Alexanderson designed the short-wave directional antenna, which had the effect of increasing the signal strength of the station in the direction of the South Pole about 10 times. It became known as the Byrd antenna and is very much the same type as used by the company in short-wave programs to Europe and South America.

• When the second Byrd expedition left for the Antarctic in 1933, the mail bag program was resumed. It proved the one short-wave station heard consistently down at Little America. The third expedition has enjoyed the benefits of an increase in the station's power from 40 to 100 kilowatts.

4-Tube Ultra Midget Receiver

Wm. J. Nelson

This is one of the smallest 4-tube battery receivers we have seen—it is of the Tuned-Radio-Frequency type. It uses two 1T4 and two 1S4 type tubes; the author states that it has given very unusual results, bringing in even distant broadcast stations on loudspeaker.



Left — the 4-tube ultra midget receiver — note the comparison in size to the hand.

●

Mr. Nelson's hookup for the 4-tube ultra midget receiver is reproduced below.

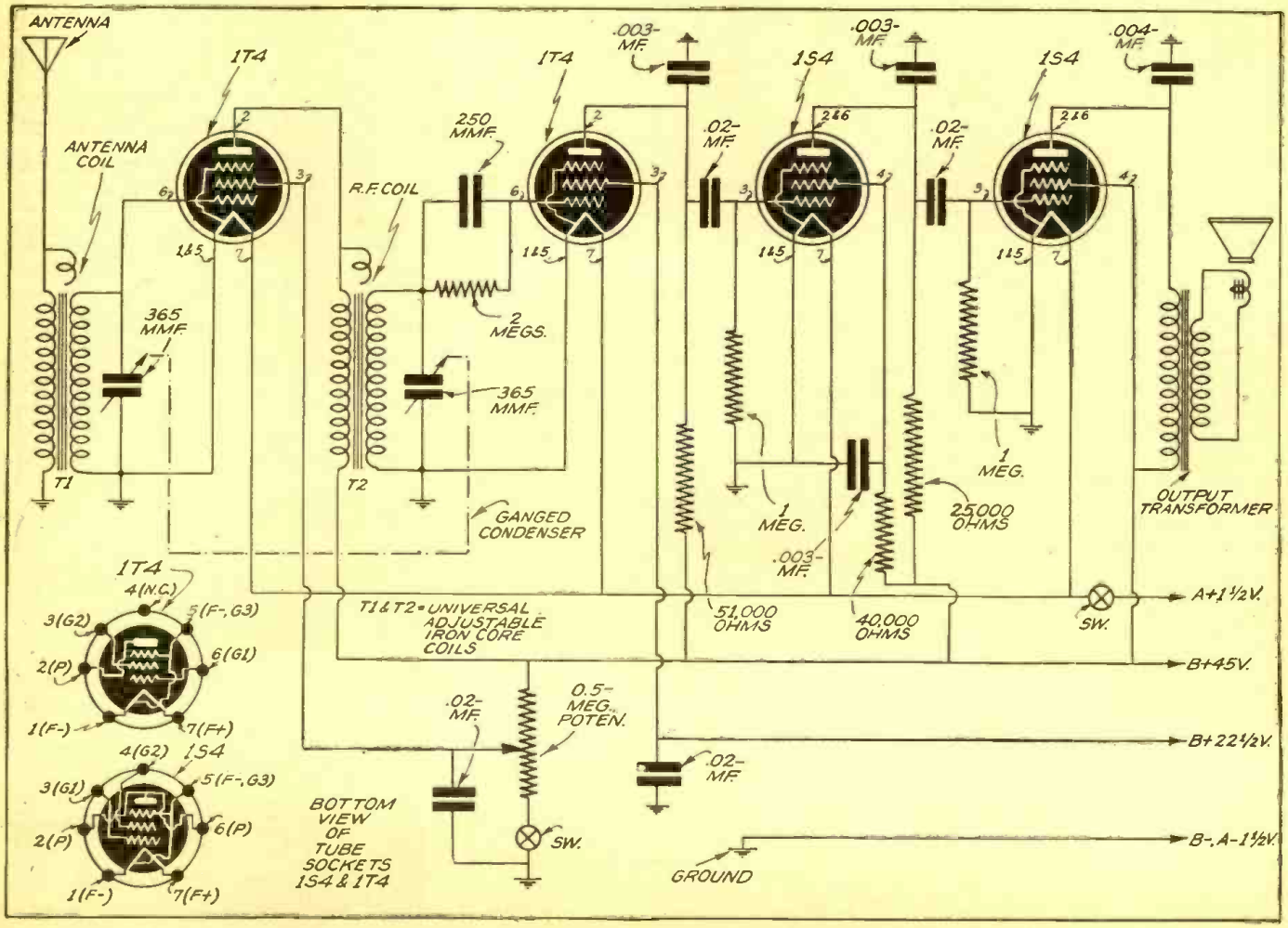
●

● THE accompanying pictures and diagram show how I built an ultra midget four-tube receiver which has been giving excellent results for many months. The circuit used is a tuned radio frequency type, employing adjustable iron core transformers, tuned by a ganged 365 mmf. condenser.

The tubes used are of the new button bottom type midgets, two of the 1T4 and two of the 1S4 type.

As the photos show, the set is really an ultra midget even though it operates a loudspeaker. The overall dimensions are four inches long by 2¼ inches wide by 3½ inches high. The set weighs less than 1 lb. In the town where I am located (Orr, Minn.), there is no local broadcasting station nearby, but this tiny receiver brings in the broadcast stations from all over the country, with plenty of loudspeaker volume. Only 45 volts of B battery is used and the 1½ volts of battery for the A current. This dandy little receiver is about the smallest I have seen, and the list of the necessary parts is appended herewith.

As there are no oscillator or I.F. circuits



to adjust, the average radio experimenter will find this set particularly welcome. All of the parts are standard and can be procured in any local radio store, or from one of the mail order radio supply houses. The tube lineup comprises an R.F. stage using a 1T4, a detector stage using a 1T4, and 2 audio amplifier stages using 1S4 tubes. The loudspeaker is one of the permanent magnet type, and where desired a pair of phones may be substituted for the speaker. Where the set is to be used with a fairly long aerial and the tuning should become too broad, the selectivity may be sharpened by inserting a small trimmer condenser in series with the antenna, one having a capacity of 30 to 50 mmf. maximum.

The output of the detector stage is introduced to the grid of the first audio tube by a resistance-capacity coupling network; likewise the output of the first A.F. stage feeds into the grid of the second A.F. stage, through a resistance-capacity network. The output of the last stage is fed into the primary winding of a suitable output transformer, to match the loudspeaker used.

The two T.R.F. tuning condensers of 365 mmf. capacity each are ganged, so as to be tuned by one dial.

Parts List

LAFAYETTE
1—365 mmf. ganged condenser

I.R.C.
2—1 meg. resistors, ½ watt
1—2 meg. resistors, ¼ watt
1—51,000 ohms, ½ watt
1—40,000 ohms, ½ watt
1—25,000 ohms, ½ watt

AEROVOX
1—.00025 mf. midget mica; 2—.003 mf. mica; 1—.004 mf. mica
4—.02 mf. tubular; 1—.003 mf. tubular

FERROCART
1—Ant. adjustable iron core coil
1—R.F. adjustable iron core coil

CENTRALAB
1—500,000 ohms pot.—D.P.S.T. switch

AMPHENOL
4—Tube sockets

MISCELLANEOUS
2—1T4 button bottom tubes
2—1S4 button bottom tubes
1—Aluminum panel 6 x 4½ inches
1—Twin jack
2—Knobs
1—Mini-Max B battery, 45 volts
2—Flashlight A batteries, 1½ volts
Hook-up wire

TELEVISION ARTICLES IN PAST ISSUES OF RADIO & TELEVISION

New Portable Television Pickup — Sept. 1940.

10 by 8 Inch Television Images—Television Club, Brooklyn Tech. High School—Oct. 1940.

Amateur Television Made Practical by New Image Pickup Tube—Aug. 1940.

A Semi-Portable Television Receiver—R. H. Horn—Jan. 1941.

Television Travels 190 Miles Over Wires—Mar. 1941.

Interference Phenomena in Television Reception—Thornton Chew—April 1941.

The JUNE Issue of Radio-Craft

Features the Following Articles

Selling Radio Service—or Answers to Customers' Questions

Radio Service Data Sheets: Montgomery Ward Airline Model 04BR-1105A

Oriental Slant on Radio

Sound Engineering

Latest Acoustic Speaker Housings

Buying Test Equipment

How to Build a Simple Miniature Portable Transmitter

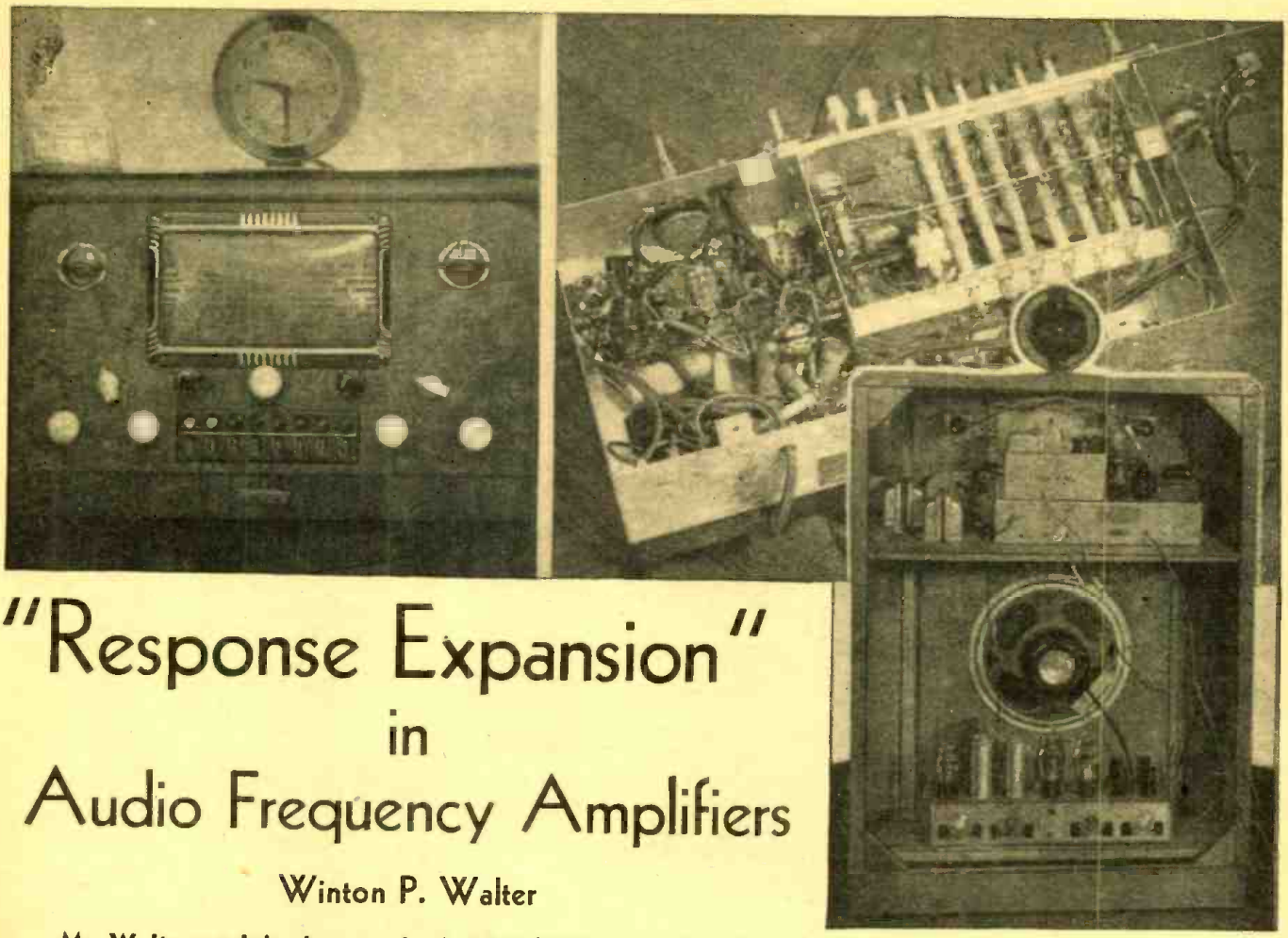
How to Build and Use a "Leak" Detector

Theory and Design of R.F. and I.F. Coils in F.M. Receivers (Including List of Articles in Past Issues of *Radio-Craft* on Frequency Modulation)

Shop Notes—Kinks—Circuits

New Circuits in Modern Radio Receivers

Classified Radio Directory — Section III (Revised)



"Response Expansion" in Audio Frequency Amplifiers

Winton P. Walter

Mr. Walter explains how to obtain high fidelity reproduction from an audio amplifier by making certain inexpensive changes. In other words he tells you how to obtain "response expansion" with a minimum of expense and maximum satisfaction. Everyone interested in better quality speech and music should read this article.

Front view at left shows position of the "sound" controls; three on the left are for bass, medium and high notes, respectively. Right-hand control is a 2-way switch to cut in or out the "response expansion" circuit. The rear view shows power amplifier in lower part of cabinet. Top—right: view of chassis.

● HIGH fidelity is a beautiful thing to hear in sound reproduction. Very few people have ever heard truly *high fidelity*, and the careless phrasing of radio and amplifier manufacturers has done much to cheapen the title. Thanks to the development of sound engineering, *high fidelity* is becoming more and more a requirement of modern sound equipment.

Many sound technicians owning amplifiers and associate equipment of good quality realize the significance of *high fidelity*, for although perhaps not attained from their equipment, such an approach is made as to express its beauty. This article is written especially for such men so that they may improve the quality of reproduction of their present owned good equipment.

How can we attain this much sought feature of high fidelity from moderately priced equipment? First, let us point out that there are good amplifiers on the market having a remarkable frequency response. If one of these amplifiers is used with the best of associate equipment, a good approach to perfection can be attained. Very few sound technicians or radio Servicemen can afford such equipment, and even so, they would be glad to obtain equipment of *high fidelity* characteristics so that it could be sold at a reasonable sum with profit.

Most of the modern amplifiers on the market today have a so-called "substantial" response of from 50 to 10,000 cycles per second. This word "substantial" generally means that there will be less than three decibels difference in the response level over the above cited range of frequencies.

Truly speaking, if sound equipment is capable of reproducing with a response within three db. from 50 to 10,000 cps., the quality will be better than many people realize can be attained. However, this condition is seldom realized, mainly because the associate equipment (as could be expected) is not perfect. Now since perfect, or nearly perfect, associate equipment (or amplifiers) cannot be had, due to limits in expense, the next best thing that can be done is to change the response of the amplifier or network circuits so that the overall response will approach or attain high fidelity.

Response Expander

There are a number of ways of achieving this desired result. Special *equalizers*, such as are used in the more expensive networks of broadcast stations, may be inserted into the circuits. *Reverse feedback* flattens the response curve as well as reduces distortion. However, the simplest, as well as the most economical means to attain such an end, is by means of a simple *response expander* circuit as will be described.

Response expansion means bringing up the volume level of the high and low notes or other definite frequencies in an amplifier, at a point on the response curve where the amplifier and associate equipment are not so efficient. See Fig. 1.

This must be done is such a way that the middle register of the response is not altered. Now to do this would mean that the final resultant curve would be absolutely flat, with equal gain in the system at all frequencies. Such perfection is not expected by the author, even if all the following information is utilized. However, a closer approximation to a flat response, than originally, can be obtained by making use of a very simple circuit, to be described, in your *high gain* amplifier.

Let us consider a way to get the highest fidelity possible with our present owned equipment, from ordinary phonograph records. Phonograph records as produced today are not conducive to perfect reproduction, but the results obtainable from them

can be a pleasant surprise and good enough to win the approval of most music enthusiasts.

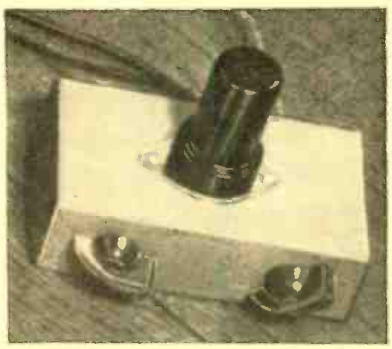
Most amplifiers, and we'll assume yours, have necessary gain and provisions for use of a low-level microphone such as crystal, sound cell or ribbon type. Provisions are also generally made for use of higher level devices such as phonograph pick-ups of crystal and magnetic types. The inputs of the amplifiers are most often of high impedance—on the order of 1/10 to ½ megohm.

The circuits of most amplifiers contain a *mixing circuit* so that the mike or high gain output can be mixed in with the phonograph output, as shown in Fig. 2. Now if such is the case in your amplifier, almost perfect set-up is had for *response expansion* with very little change in the amplifier.

Suppose we design *filters* in such a way that we can feed the high frequency component of the music—say above 2,000 cps. (cycles per second) into the low gain input of the amplifier from our pick-up as shown in the lower portion of Fig. 3. The response will increase with frequency. In this circuit is shown a crystal pick-up which may be used more advantageously. The condenser C1, of the size shown, will offer very high reactance to frequencies below 2,000 cycles, and comparatively low reactance to higher frequencies, so that only frequencies above 2,000 cycles produce any great voltage drop or signal across the input impedance of the amplifier. For instance: The .0003 mf. condenser offers a reactance of about 18,000,000 ohms to frequencies of 30 cycles and about 5,300 ohms to currents of a frequency of 10,000 cps. Thus the condenser, being in series with the comparatively low resistance of the amplifier input resistance, will cause a larger per cent of the voltage drop to be across the condenser for low frequencies, and the larger percentage of the voltage drop will be across the input resistance or impedance for higher frequencies. This will result of course in giving a signal to the grid which will be greater at the higher tones.

If such a set-up is used as has thus far been described, the tone of the output will sound very "tinny" or high-pitched, which is not desirable in itself. However, frequencies up to 9 or 10 thousand cps. should come through the amplifier with volume at least equalling that of frequencies of about 3,000 cps.

Now if we connect a high resistance of 5 megohms to the output of the pick-up



Above—model of a device which can be used whenever it is desired to incorporate "response expansion" in a set (or audio amplifier) without making expensive changes in the equipment.

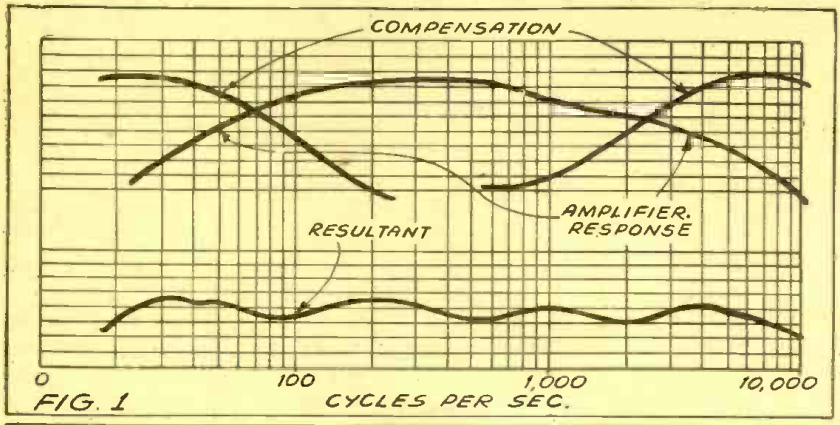


FIG. 1

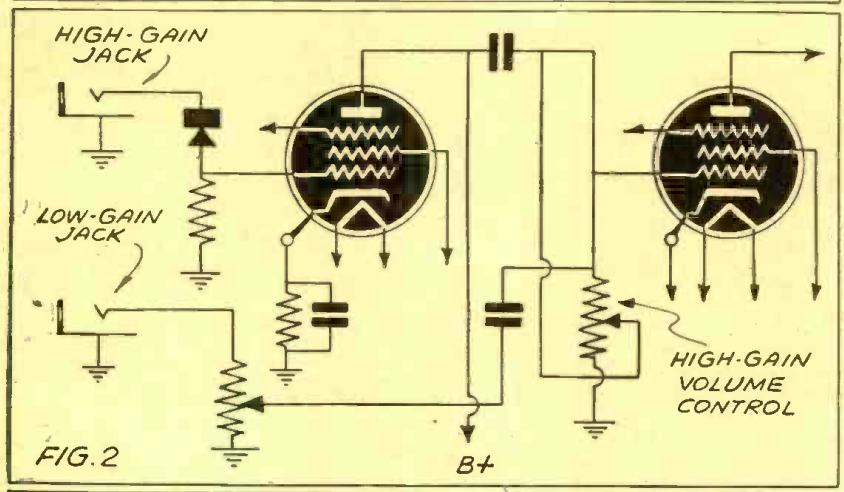


FIG. 2

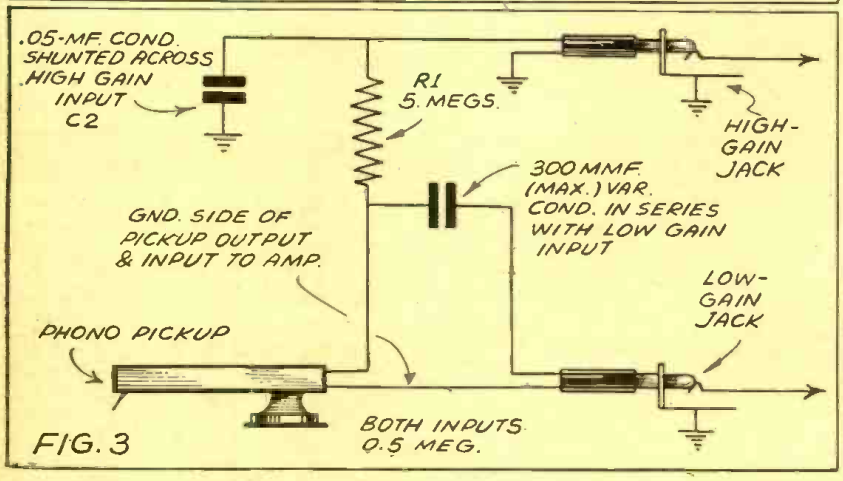


FIG. 3

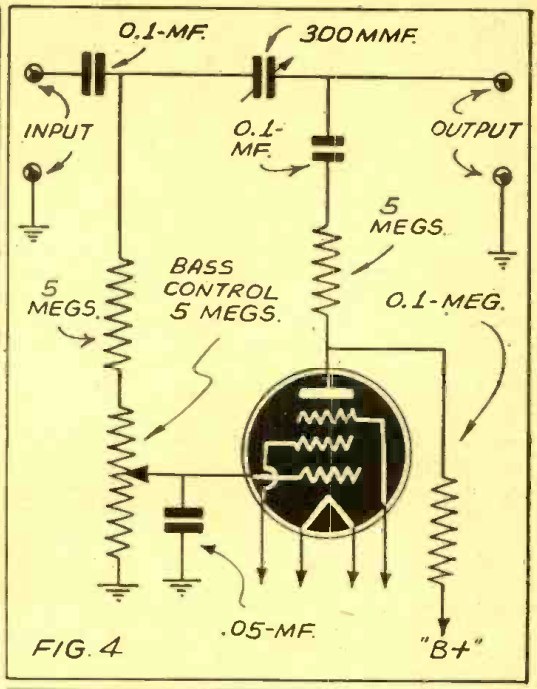


FIG. 4

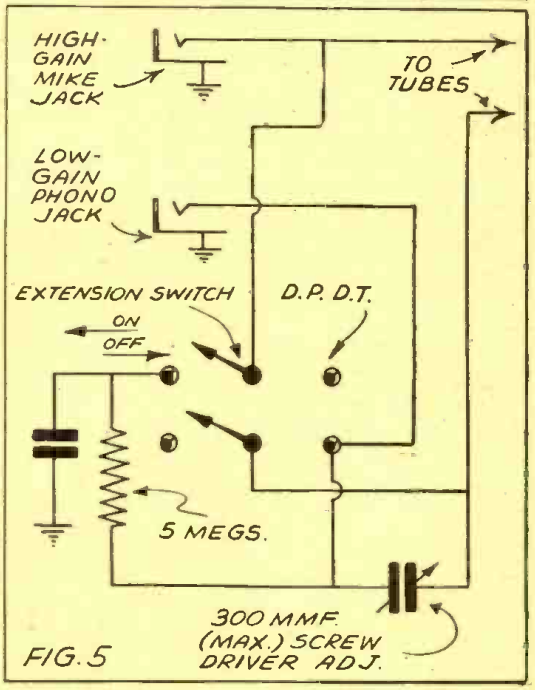


FIG. 5

Diagrams showing the action of the "bass booster" and other functions of Response Expansion as here described by the author. Other illustrations show how response expansion can be adapted to an average audio amplifier.

and feed off a signal through it to a condenser of .05 mf. value, which is connected across the high gain input of the amplifier (upper portion, Fig. 3) we may obtain at considerable loss, a musical component containing and composed of almost entirely low frequencies. (Response *decreasing* with frequency.)

This component will be developed across the high gain input, due to the fact that the condenser C2 offers low reactance to current of high frequency, and high reactance to current of low frequency (in figures, 107,200 ohms to 30 cps., and approximately 310 ohms to current of 10,000 cps.). Since the resistor, R1, and the input resistance of the amplifier offer the same impedance to all frequencies, there will be developed across the high gain input, *higher voltage at lower frequencies.*

The resistor, R1, serves several functions, among them—acting as a segregator or divider, so that the condenser C2, will not greatly affect the operation of the high frequency filter circuit described previously, and shown in the lower portion of Fig. 3. If a crystal pickup is used, the resistor provides a high resistance input to the system.

Now if the system is operated using only the bass booster circuit as just described, the reproduction will sound exceptionally low-pitched and "bassy." A good system operated thus will reproduce so much bass power that even the walls and windows of a room can be made to rattle and resound, when the control of the high gain input is turned up.

To mix the two inputs together to cause equal response at all frequencies, simply turn up both volume controls (*high* and *low* gain circuits) until the response is most pleasing. This setting will vary with different recordings, however.

Variation of the above circuits may be had to advantage if the condenser C1 is of the variable type, such as trimmer condensers for R.F. circuits. With such an arrangement, adjustments may be made as required. A switch can make the circuit effective or not as shown in Fig. 5. With the switch in the "off" position, the microphone circuit is conventional and the mike may be used as normally.

If the above described circuit is incorporated into a good amplifier with good associate equipment and adjusted properly,

there is no assurance that you cannot attain a nearly flat response from 25 to 10,000 cps. from the output of your speakers. At least, there is little doubt that your present system can be vastly improved.

In the event that your amplifier does *not* have a high gain mike stage, a special response "booster" may be built into a small cabinet, and connected as shown, or may be built into the amplifier.

If special accentuation is desired on any band of frequencies, e.g., bass emphasis, which is loved by many, it may be necessary to disconnect the reverse feed-back circuit in the amplifier. The reason for this is that reverse feed-back tends to equalize the gain at all frequencies, giving a flat curve.

To obtain adequate *bass* response it is necessary, or at least highly desirable, to employ speakers with large cones and voice coils. However, one must not sacrifice high note response to attain bass. It may be necessary to employ a large "woofer" speaker and a "tweeter" for very best results, but with the variation possible with this *response expander circuit*, it is likely that you will be pleased with the results of an ordinary good large dynamic speaker. An infinite baffle or some other specially designed baffle will no doubt improve the fidelity of tone, but very good results can be had with an ordinary console cabinet or if beauty is of little importance, a 5 ft. square celotex board.

A good pick-up is important and although the circuit will be effective with all high impedance types, better results are likely to be obtained from a *crystal pick-up* because of the flexibility of response due to the fact that a crystal is literally a *capacity*, and its response is largely determined by the impedance it is fed into. This circuit was especially designed for a crystal pick-up and if other types are used, they should be of as high impedance as possible.

If such a *response expander* circuit is desired for microphone, radio, or any other form of sound input, the circuit shown in Fig. 4 may be built into the circuit following the pre-amplifier stage of any amplifier, or may be built into a radio.

The author has been highly successful in redesigning a good radio set so as to incorporate the principles herein described. In this radio, there is now an individual volume control for bass, medium and treble notes. Of course an over-all volume control is essential.

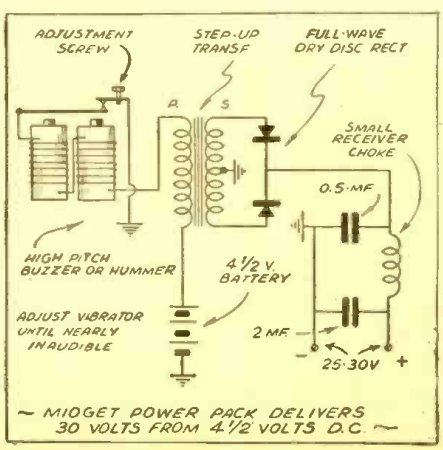
While the circuit described is exceedingly simple and economical, description cannot convince the reader of its qualities. Build it; listen to the results! You'll be pleasantly surprised!

MIDGET POWER PACK DELIVERS 30 VOLTS FROM 4½ VOLTS D.C.

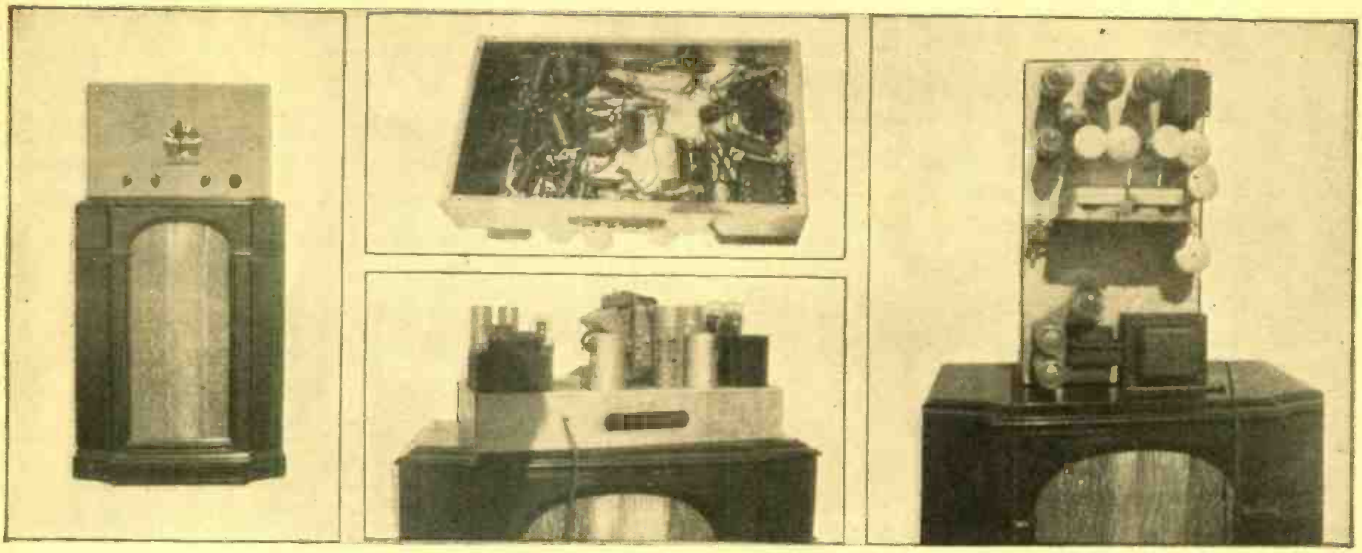
● THE accompanying hook-up is based upon one used by a British experimenter in operating a portable receiver. By its means he lighted the filaments of the set and delivered about 30 volts to the tube plates; all from one 4½ volts flashlight cell battery.

Three methods of supplying pulsating D.C. to the rectifier can be employed. One, used by the originator, used a microphone button attached to the moving arm of an old speaker unit. This, while excellent, utilized too much space. A telephone hummer proved nearly as good but I personally, used a midget high frequency buzzer adjusted for an almost inaudible note. This gave a 500 cycle frequency and was easily rectified and filtered by the components shown. The secondary of a step-up midget vibrator transformer carried the resulting high voltage to a full wave copper-oxide rectifier and from there to a small receiver choke, with the condenser capacities as shown.

The battery drain is small with the buzzer carefully adjusted and the delivered voltage is that necessary to operate the plate of any such tube as a 230, 199, 19 and the like. It is well worth experimenting with.—*L. B. Robbins.*



~ MIDGET POWER PACK DELIVERS 30 VOLTS FROM 4½ VOLTS D.C. ~



Several views of the high fidelity T.R.F. broadcast receiver are here illustrated.

High Fidelity Receiver with "Ear Appeal"

Ralph Heikila, W9MNF

This high fidelity audio receiver will be of interest to every real radio enthusiast who is looking for better tone quality. The signals are amplified in a broad tuning two-stage T.R.F. circuit, and are then amplified in a substantial A.F. section.

● PRESENT-DAY transmitters in the standard broadcast band transmit much higher fidelity than is reproduced in the moderately priced receiver. To reproduce sound with the same fidelity as that produced at the standard broadcast transmitter requires a very costly receiver. However the cost of the receiver can be cut considerably by building it for local reception alone, because a set which is both sensitive and will at the same time pass a wide frequency band (in order to obtain high fidelity reception) is not only expensive, but practically impossible. We must sacrifice one in order to obtain the other.

True, many receivers which have appeared lately are high fidelity, and have backed up their statement by producing a frequency response curve flat from 30 to 10,000 cycles, but let's take a look at this response curve from the viewpoint of the human ear, which after all is the final judge as to the quality reproduced.

A *high-fidelity* receiver in order to reproduce a flat response curve, as far as the ear is concerned, must be operated at a volume level extremely louder than any of us would care to operate it in our living room, and as the volume is decreased, so also are the high and low frequencies—as detected by the ear, and the less volume the less sensitive the ear will become to these frequencies, until a point is reached where they are almost inaudible. This point is at a volume level where most receivers are operated in the average size room. So the frequency response curve begins to look like one taken from a single button carbon mike, unless these frequencies are compensated for.

Most receivers today have a tone control, in order to bring up the bass which is lost to the ear at low volume; but in order for them to accomplish this at low cost, they merely reduce the high frequencies, thus making the bass more pronounced. Here, once again, the receiver is destroying the high fidelity of sound that is produced at the broadcast station.

An ideal receiver would be one which would vary the high and low frequency response of the receiver at different volume levels automatically. This would not be practical due to the wide discrepancy of the ear in different individuals. The best way to compensate for this is to have a receiver on which the bass and treble response can be varied to suit the individual listener, and the receiver at the same time designed to receive these wide bands of frequencies. It can be seen that some type of bass and treble control must be used, that will not sacrifice one, in order to obtain the other, but still secure the correct tonal balance.

For a radio set to receive a wide band of frequencies and reproduce them faithfully is another problem again. The amplifier must have an output of at least 10 watts. For a set operating at normal volume in an average size room, the high notes will require an output of approximately .025 watt, while the low bass notes will demand the full 10 watts. The low notes are apt to be badly distorted if the output of the receiver is less than 10 watts.

Triode Tubes Used

The audio amplifier in this receiver makes use of triode type tubes throughout; it is possible to obtain more output from pentode type tubes, but the distortion is much higher. Hence the output tubes in this set make use of two type 2A3 in push-pull class A; however 6A3 tubes may be substituted, provided the transformer has a 6 volt winding separate from that which supplies the filament voltage to the rest of the receiver.

2-Stage T.R.F. Circuit

The *tuner* unit consists of a two-stage *radio-frequency amplifier*, followed by a diode detector and one stage of audio amplification. Just enough A.V.C. is used to prevent blasting when tuned between stations. The tuned R.F. circuit was chosen not only for its simplicity and cost, but more important, for its wide band acceptance.

The output from the tuner is fed to separate amplifier elements through separate filter networks for the control of the bass, middle tones and treble. Two potentiometers are used in this network P_1-P_2 for the control of bass and treble. The output from the 75 tube is fed through potentiometer P_1 through a non-resonant high pass filter, to one of the control grids of the dual triodes tube 6N7, to control the treble response.

The middle frequencies are fed through a low-loss resistance network R_5-R_6 to the grid of the other triode unit of the 6N7, and this resistance network must be so adjusted that the volume will be the same at the plate of the 6N7 as at the plate of 75, or less.

The grid from the triode unit of the other 6N7 is connected to the output of the 75 through a non-resonant low-pass filter network through potentiometers P_2 and is used to control the bass, while the grid of the other triode unit is used for phonograph input from a crystal pickup. The plates of the two 6N7's are connected together, which in turn is coupled to the grids of the *phase-inverter* through coupling condenser C_6.

In building the receiver care should be taken to see that all leads from R.F. transformers are as short as possible, or unstable operation will result; also all leads from the potentiometers to their respective grids must be well shielded to prevent hum pickup.

The author's receiver was built on a metal chassis 12 x 14 x 3 inches, with the variable condenser mounted in the center, and the R.F. coils and tubes placed as close to it as possible and well shielded.

The speaker used should be of the 15 watt, 12 inch, high-fidelity type, enclosed in a cabinet 30 x 23 x 12 inches in size, with the receiver placed on top.

When the receiver is operating at normal volume, both bass and treble controls are set at maximum position; the more volume the less bass, and treble boost is needed to obtain the correct tonal balance, until at full volume both controls are set at minimum position. On the other hand for those who like an over-abundance of bass, they can vary the bass and treble booster to obtain it, and still not sacrifice the high notes.

Parts List

C25—4 mf., 400 volt
C1, C2, C3—.1 mf., tubular
C4—.25 mf., tubular
C5, C6—.1 mf., tubular
C7—.00025 mf., mica
C8—.05 mf., tubular
C9—.00025 mf., mica
C10, C11—.1 mf., tubular
C12—.8 mf., tubular, 50 volt
C13, C14, C21—.1 mf., tubular
C15, C16, C17, C18—8 mf., 475 volt
C19—8 mf., 50 volt
C20—.0001 mf., mica

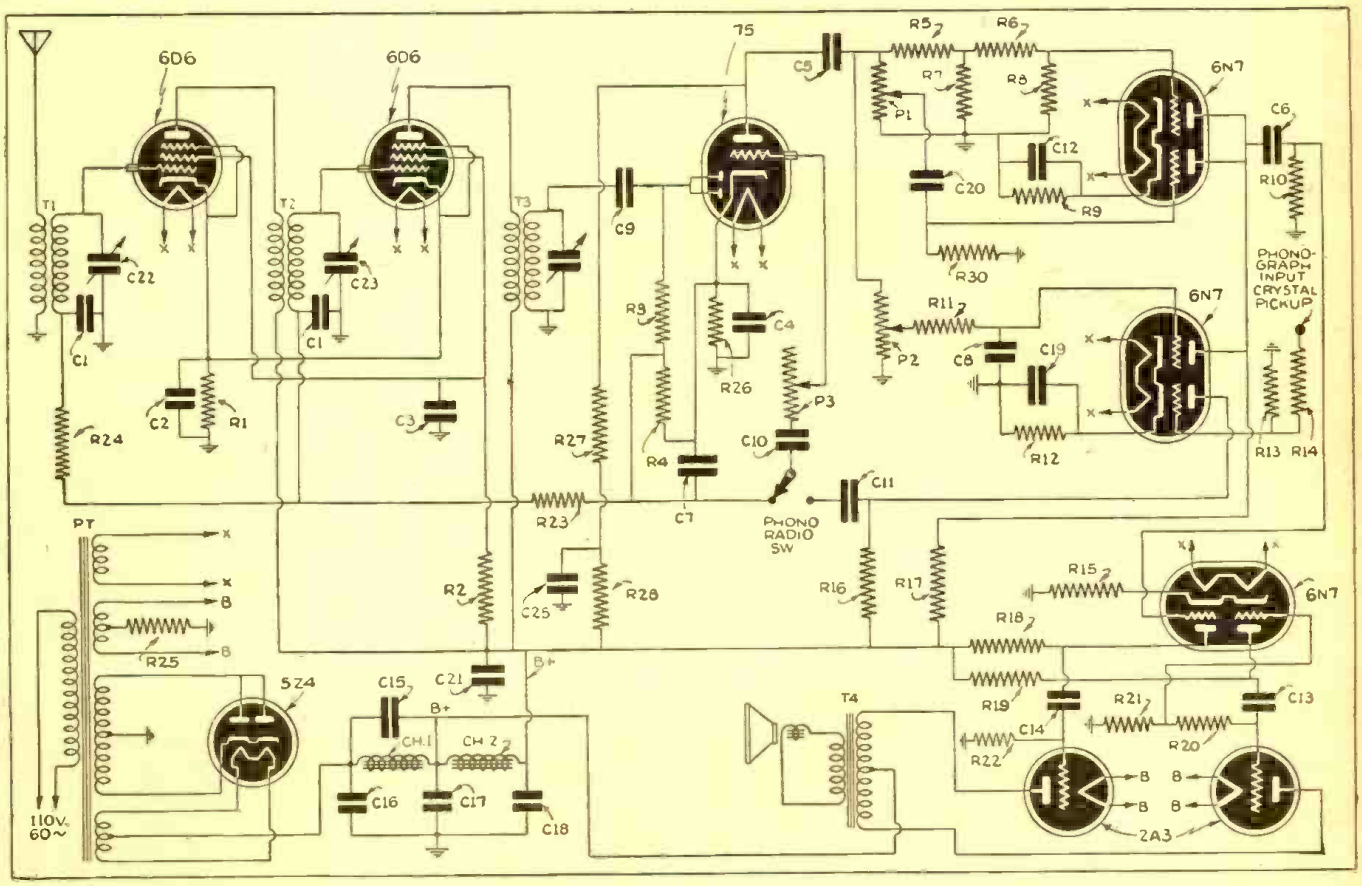
MEISSNER
C22, C23, C24—3 gang, 365 mf., #21-5222
T1—Ant. coil, shielded, #14-1004
T2, T3—R.F. coil, shielded, #14-1005

THORDARSON
T4—Power transformer, T-13R09
CH1—Filter choke, 20 h., 200 mills (ma.)
CH2—Filter choke, 20 h., 80 mills
T5—Output transformer, Hi-Fi, T-90s08

BUD
S.W.—S.P.D.T. switch, SW. #1118
R1—200 ohm, 1 watt
R2—50,000 ohm, 1 watt
R4—250,000 ohm, 1 watt
R3, R28—50,000 ohm, 1 watt
R5—1 meg., 1 watt
R6—500,000 ohm, 1 watt
R7, R30—125,000 ohm, 1 watt
R8, R10—250,000 ohm, 1 watt
R9, R12—2,500 ohm, 1 watt
R11—500,000 ohm, 1 watt
R13, R27—250,000 ohm, 1 watt
R14—2 meg., 1 watt
R15—5,000 ohm, 1 watt
R16, R17, R18, R19—250,000 ohm, 1 watt
R20—475,000 ohm, 1 watt
R21—23,000 ohm, 1 watt
R22—500,000 ohm, 1 watt
R23—1 meg., 1 watt
R24—500,000 ohm, 1 watt
R25—750 ohm, 10 watt
R26—3,500 ohm, 1 watt
P1, P2, P3—500,000 ohm

(Resistors—I.R.C.)

Complete wiring diagram of the Hi-Fi receiver, with its two stages of T.R.F.



What the F.C.C. Can't Do!

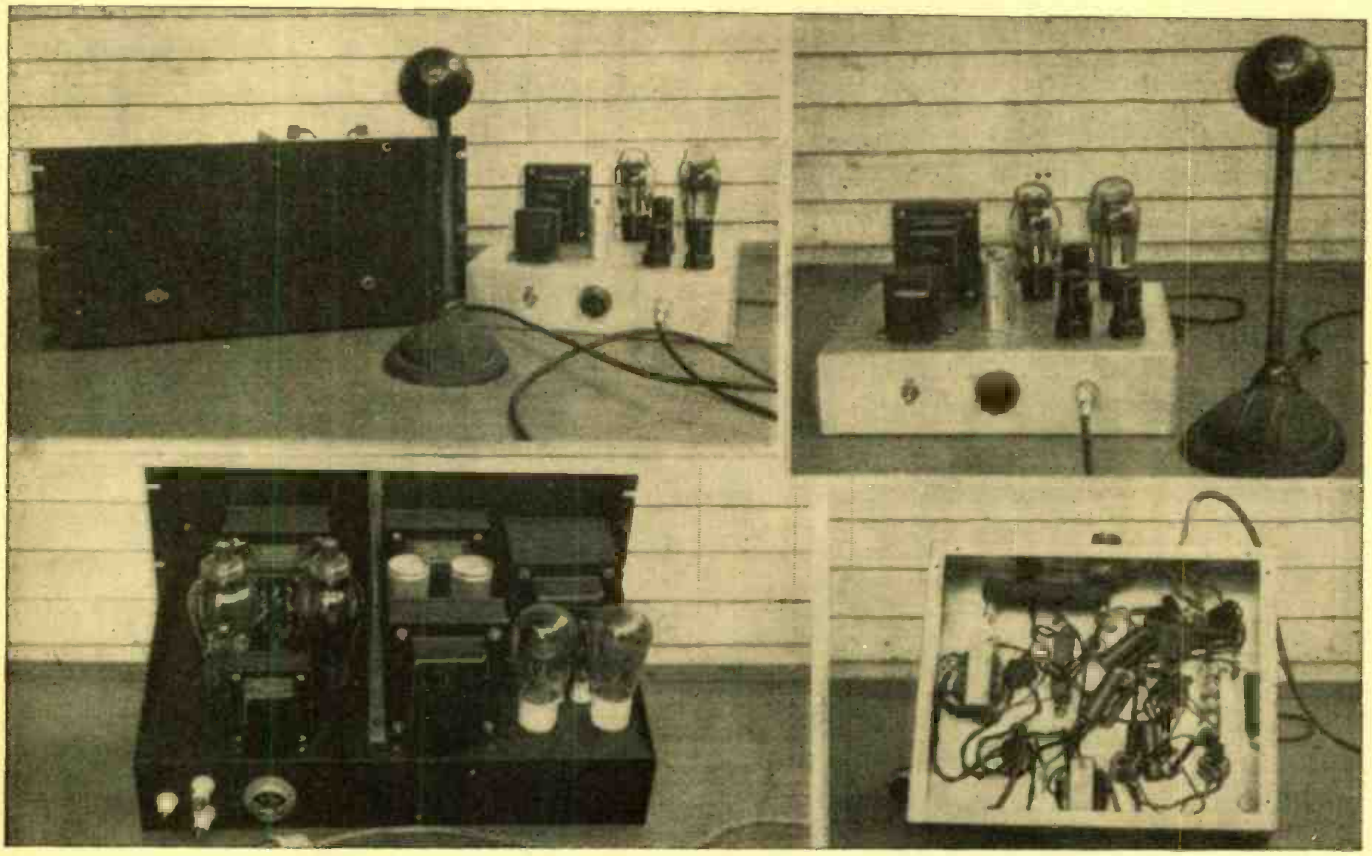
An announcer at a radio station writes to the F.C.C. saying that his hours are long and his wages low. His letter was sent to the Wage and Hour Division of the Department of Labor.

A newly fledged radio operator, if ops are fledged, wants to know whether to sign the program log with his name in full as it appears on his license, or with his favorite shorter version. He was probably relieved when he was informed that no prescribed form other than "the person having actual knowledge of the facts required shall sign the log when starting duty and again when going off duty."

Persons who write in for frequency radio spectrum charts are told that none are available for distribution. A frequency allocation table is contained in "General Rules Governing Standard Broadcast Stations" (Part 2 of the Commission's Rules and Regulations), available from the government printing office in Washington at 10c a copy. Incidentally, a new printed general information pamphlet "Radio, a Public Primer" is available on request from the same address.

W8KPX Modulator for a 400 Watt Transmitter

Harry D. Hooton, W8KPX



Photos above illustrate the construction of the modulator described by Mr. Hooton. It has given very excellent results in actual transmission tests made by the author.

● HIGH-LEVEL Class B plate modulation is generally considered the simplest and most satisfactory method of plate modulating all types of Class C radio frequency amplifiers, running from 50 to 1,000 watts input. Since the majority of amateur transmitters fall within this range, we shall discuss the problems involved in Class B modulator design, and present a practical inexpensive unit suitable for use with any R.F. final amplifier running up to 400 watts input.

Most text-books and manufacturer's data sheets list the average modulator power as one-half the Class C input for 100% modulation. This is correct only if the wave form of the modulating power is a true sine wave. In the amateur transmitter, where the modulator wave form is *speech* only, the average modulator power for 100% modulation is very much less and, in fact, the difference between speech and the pure sine wave is so great that a 100-watt Class B modulator using inexpensive tubes, such as the 809, will, if properly designed for speech, fully modulate an input of from 300 to 400 watts to the Class C radio frequency amplifier! "Speech modulation" can only be applied to Class B audio stages. The reasons are readily apparent when one recalls that Class A modulators run hottest when resting and that plate dissipation is a limiting factor for both peak and average power output.

Engineers have determined by experiment that the ratio of peak to average power in a speech wave form is approximately four to one in contrast to a ratio of two to one in a pure sine wave. The reason is because of the high harmonic content of the speech wave, and also to the fact that this high harmonic content manifests itself by making the wave unsymmetrical, causing sharp peaks of high energy content to appear. In view of this fact it then appears that, for a speech wave form, the average modulator plate current, plate dissipation and power output are approximately one-half the sine wave values as given on the data sheets. Or, in other words, if we use a 200 watt Class B modulator to 100% modulate a Class C radio frequency amplifier running 400 watts input *and use a speech wave form,* our modulator will deliver an average power of only about 100 watts and the average plate current and plate dissipation will be only about *fifty per cent* of the permissible values. It seems logical then to design the modulator for the amateur phone transmitter for voice wave operation in order to take full advantage of the tube ratings. The plate-to-plate load should be altered so that the peak power output is increased until the plate dissipation becomes the limiting factor.

The Class B modulator described is used in the author's amateur transmitter, which uses a pair of TW-75's in the final amplifier, operating at 400 watts input. The construction of the modulator is simple and straightforward. The adjustment of the voice-wave modulator is discussed in detail. The use of a bass suppressor and the surprising results obtained with it are described by the author.

TW-75's in Final Amplifier

The Class B modulator to be described in this article is used in the author's transmitter which uses a pair of Taylor TW-75's in the final amplifier running at 400 watts input. A pair of 809's with 1,000 volts on the plates and 13 volts of negative bias on the grids are the tubes used. In this arrangement the plate-to-plate load is 7,200 ohms and the average plate current is about 150 milliamperes. A separate *speech*

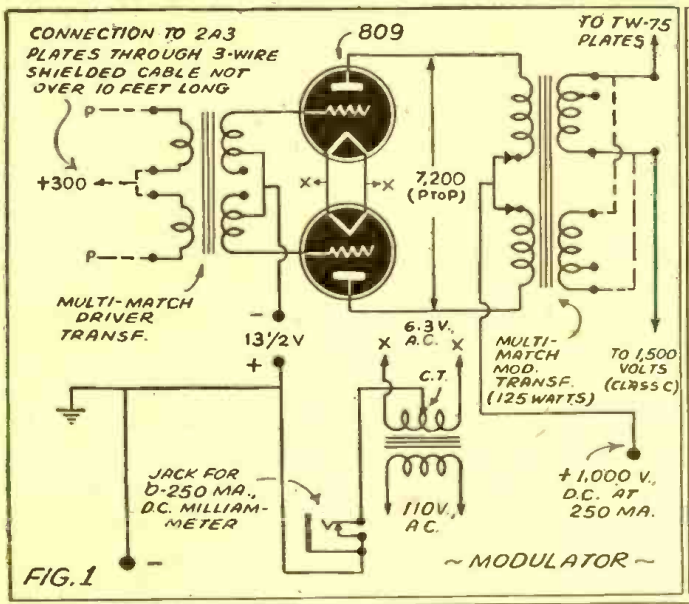


FIG. 1

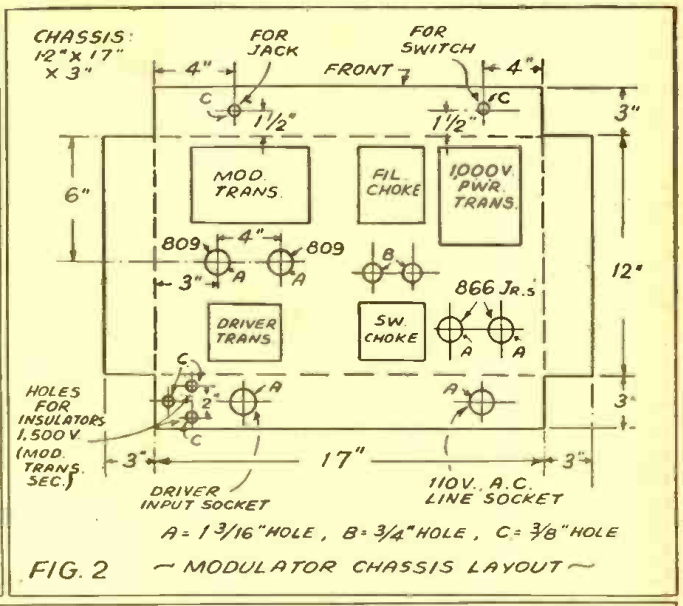


FIG. 2 ~ MODULATOR CHASSIS LAYOUT ~

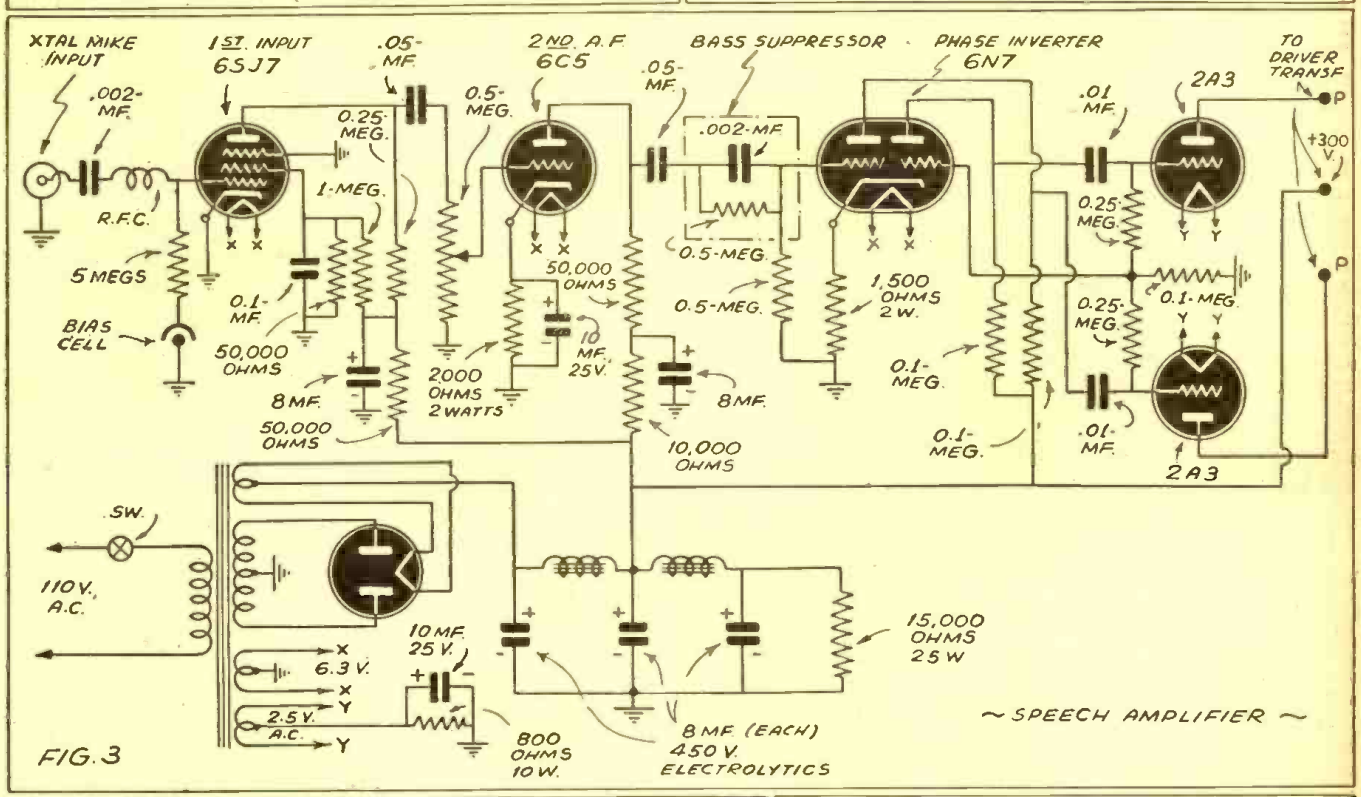


FIG. 3

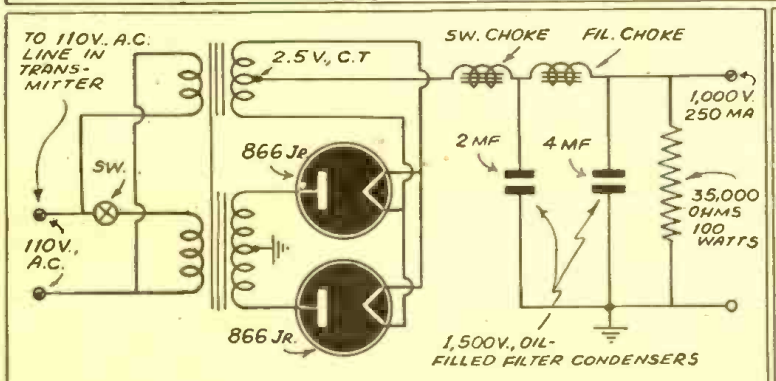


FIG. 4 ~1,000 V. POWER SUPPLY FOR 809 MODULATORS~

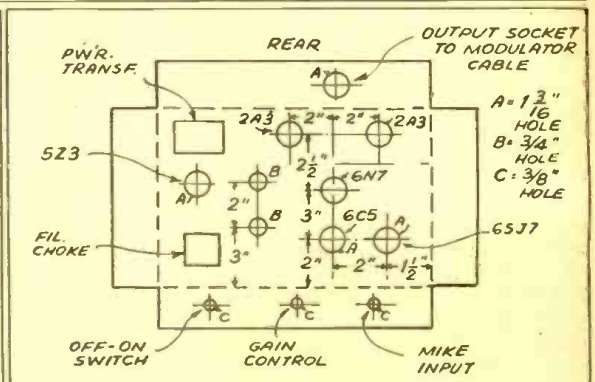


FIG. 5 ~ SPEECH AMPLIFIER CHASSIS LAYOUT ~

Wiring diagram for the W8KPX modulator is reproduced above, including hookup of the Power-Supply. The method of switching in or out of circuit the "bass suppressor" is also indicated. Other constructional details are included, such as dimensions of the chassis and panel. A 1,000 volt power-supply is used; the various transformers and chokes should be placed in the positions indicated with their core laminations in the directions shown by the arrows, in order to avoid A.C. hum caused by inductive pick-up.

amplifier using a pair of 2A3s as drivers is used to excite the 809s.

The construction of the modulator is extremely simple and straightforward. The 1,000 volt power supply is built up on one-half of the 12 x 17-inch chassis, the various transformers, chokes and the 866 Jr. rectifiers being placed as shown in Fig. 2. The other half of the chassis holds the driver transformer, the 809 tubes and the modulation transformer. The various transformers and chokes should be placed in the positions shown with their core laminations in the directions indicated by the arrows; otherwise, A.C. hum may be induced in the driver transformer which, while not extremely serious, may cause some hum on the carrier. It is not necessary to use a 500 ohm line transformer at either the output of the 2A3s or the input to the 809s, provided the distance between the two units is not more than ten or fifteen feet. The author uses an ordinary three-wire shielded cable approximately ten feet in length, feeding the plates of the 2A3s directly into the driver transformer. The proper driver transformer ratio primary to one-half the secondary is 5.0:1.

Adjustment of Voice-Wave Modulator

The adjustment of the voice-wave modulator is not different from that of any other Class B audio amplifier. The proper adjustment of the taps on the modulation transformer for both the plate-to-plate load of the 809s and the Class C secondary load is absolutely essential for good voice quality as well as maximum transfer of modulator power. With this particular type of transformer, it is first necessary to determine the approximate Class C load resistance presented to the modulation transformer by dividing the D.C. plate-to-filament voltage by the plate current of the stage. For example, a pair of TW-75s operating at 1,500 volts and 230 milliamperes present a load impedance of about 6,592 ohms (1,500 volts divided by 0.23 ampere) which gives an input of about 345 watts. The 809 plate-to-plate impedance, in this case, is 7,200 ohms and in order to properly match this value to the Class C load impedance, an actual stepdown ratio in the modulation transformer will be required. It is not necessary to actually determine the ratio of the transformer; all manufacturers of universal or multi-match modulation transformers supply data sheets giving instructions for obtaining almost any desired value of load impedances. *Make sure that you use a connection that will carry the Class C amplifier plate current through the modulation transformer secondary windings.* If a series connection is used, and excessive Class C plate current is drawn through the transformer, the windings may burn out or the transformer core may become saturated or the insulation between the windings may break down. The 125 watt modulation transformer specified will be plenty large enough to handle the audio power developed, provided the proper load conditions are used.

Speech Amplifier

The *speech amplifier* used to raise the audio to the proper level for excitation of the 809 Class B modulators, consists of a 6SJ7 input from the crystal microphone to a 6C5 second audio frequency amplifier, to a 6N7 phase inverter, which is resistance-coupled to a pair of 2A3s in push-pull Class A arrangement. The 2A3s supply ample driving power to the 809s but the frequency response, believe it or not, is entirely too wide for voice. So we deliberately introduce the bass suppressor, shown in Fig. 3, which sharply cuts off the frequencies below 400 cycles. Most amateurs who have never used a circuit of this type will shudder at any suggestion of limiting the frequency response of the speech amplifier; however, if you will listen to some one's *voice* through the amplifier with the suppressor in the circuit, and again with it switched out, you will agree that the voice is much "cleaner" and more readily understandable. Furthermore, this device causes overmodulation to take place first at *voice frequencies* if the gain is turned up until this occurs. This means that one can work the modulator-speech amplifier with the gain control up for 100% modulation at voice frequencies, without the danger of overmodulation occurring at the lower frequencies. The author has tried the modulator on the 20 meter phone band especially where the QRM is nearly always excessive, with and without the bass suppressor. In each and every case the distant operator reported that he could read us better and that the voice was sharper *with the suppressor switched into the circuit.*

The construction of the speech amplifier is not difficult but care must be used to shield all grid and plate leads against any possibility of hum pickup. The radio frequency choke shown in Fig. 3 should not be omitted, especially if the transmitter is being operated on the 20 or 10 meter bands; otherwise, it may be difficult to open up the gain to any appreciable amount because of R.F. feedback into the audio stages. All of the ground circuits may be brought to a central point on the chassis, which will eliminate any possibility of the high gain circuits amplifying small A.C. circulating currents on the chassis.

Parts List

STANDARD TRANSFORMER CORPORATION —(Transformers & Chokes)

BUD RADIO, INC.

1—12 x 17 x 3 inch black crackle finish chassis
1—8¾ x 19 steel panel
2—Chassis mounting brackets, 11 inch size
1—Interstage shield
1—Heavy-duty toggle switch, 1,200 watt size
1—12 x 10 x 3 inch chassis (for speech amplifier)

I.R.C.—(Resistors)

1—Fixed resistor, metallized type, 5 megohms, ¼ watt
3—Fixed resistors, metallized type, 50,000 ohms, 1 watt
3—Fixed resistors, metallized type, 250,000 ohms, 1 watt
2—Fixed resistors, metallized type, 500,000 ohms, 1 watt
3—Fixed resistors, metallized type, 100,000 ohms, 1 watt
1—Fixed resistor, metallized type, 1 meg., 1 watt
1—Fixed resistor, metallized type, 10,000 ohms, 1 watt
1—Fixed resistor, metallized type, 1,500 ohms, 2 watts
1—Fixed resistor, metallized type, 2,000 ohms, 1 watt
1—Fixed resistor, wire-wound type, 15,000 ohms, 25 watts
1—Fixed resistor, wire-wound type, 800 ohms, 10 watts
1—Fixed resistor, wire-wound type, 35,000 ohms, 100 watts
1—Volume control, carbon element type, 500,000 ohms

RCA—(Tubes)

1—6SJ7 metal tube
1—6C5 metal tube
1—6N7 metal tube
2—2A3 glass tubes
2—809 glass tubes

AMPHENOL—(Sockets & Connectors)

4—Steatite sockets, 4-prong chassis mounting type
3—Bakelite sockets, 4-prong chassis mounting type
3—Bakelite sockets, 8-prong chassis mounting type
1—Connector for microphone cable, circuit-closing type
2—Power cable connectors, female, 4-prong sockets
2—Power cable connectors, male, chassis-mounting, 4-prong plugs
1—10 ft. length two-wire co-axial cable (2A3 plates to driver transformer)

CORNELL-DUBILIER—(Condensers)

1—Oil-filled transmitting condenser, 2 mf., 1500 volts, round can-mounting type
1—Oil-filled transmitting condenser, 4 mf., 1500 volts, round can-mounting type
1—Paper tubular condenser, 0.1 mf., 600 volts
2—Paper tubular condensers, 0.05 mf., 600 volts
2—Paper tubular condensers, 0.01 mf., 600 volts
2—Mica fixed condensers, .002 mf., 600 volts
2—Electrolytic condensers, 10 mf., 25 volts
2—Electrolytic condensers, 8 mf., 450 volts, midget tubular type
3—Electrolytic condensers, 8 mf., 450 volts, can-mounting type

Modulator Stage

1—Plate transformer, 1,000 and 750 volts D.C. after filter at 250 milliamperes. Type P-4030
1—Swinging choke, 8-30 henries at 250 ma. Type C-1402
1—Smoothing choke, 15 henries at 250 ma. Type C-1412
1—Filament transformer, 2.5 volts at 10 amp. Type P-3025

Speech Amplifier

1—Plate and filament transformer 700 v. c.t. at 110 ma., 6.3 v. at 4.5 amp. and 5 v. at 3 amp. Type P-4080
2—Filter chokes, 30 henries at 110 ma. Type C-1001
1—Polypedance driver transformer, universal, 15 watt size. Type A-4762
1—Polypedance modulation transformer, 125 watt size. Type A-3894

TAYLOR TUBES, INC—(Tubes)

2—Type 866 Jr. mercury vapor rectifier tubes

EGBERT VON LEPEL

EGBERT VON LEPEL, well known to students of radio, passed away at the age of 60 on April 7 in New York City. In recent years Mr. Von Lepel has been interested in the manufacture of short wave diathermy apparatus. He was always very original in his radio and electrical inventions and, unlike the usual SW diathermy machines, his did not use vacuum tubes but a quenched gap instead. Mr. Von Lepel was president of the Lepel High Frequency Laboratories, Inc., of New York City.

Students of radio history will remember Von Lepel as one of the shining lights among the German radio geniuses back in the days of quenched spark gaps and arcs. He will be remembered as the inventor of the quenched arc, which employed a piece of paper between two electrodes spaced a slight distance apart. A pin-hole was made in the piece of paper and when the current was applied to the arc electrodes (accurately machined), a spark jumped through the hole in the paper and the paper slowly burned away toward the circular edges, where it was clamped between the electrodes. Directly, the oxygen in the air trapped between the electrodes was consumed and a quenched arc resulted. The high frequency quenched spark gap was due to the early radio investigations of Von Lepel, and without a doubt he was one of the greatest radio geniuses ever turned out by the German schools. Strange as it might seem, after a whole generation, there are ships today sailing the high seas carrying quenched gap transmitters, the idea for which was first born in the mind of Egbert von Lepel.

How to Build a Useful Electronic Relay

Theodore Smith

Assistant to Chief Engineer, Tech. Div., NYA Radio Workshop, New York

● AT the NYA Radio Workshop's amateur station the problem of monitoring the transmitter and permitting a number of people to listen in arose. A fundamental circuit consisting of 6C5 signal amplifier, a 76 relay control and a 76 as rectifier was constructed of spare parts to test the design.

With the addition of a simple single-tone oscillator to supply the signal, the unit was connected with the relay contacts to replace the key in the transmitter. After connecting a pair of headphones across the audio oscillator, the key was closed and the tone adjusted to pleasing pitch. The relay control was then adjusted to maximum sensitivity and the transmitter power turned on. When the key was depressed, the relay contacts closed the transmitter oscillator circuit operating the transmitter in the same manner as the regular telegraph key. A speaker was connected across the output of the audio oscillator permitting the operator to *monitor* his sending.

The circuit worked well from the start and with a few improvements to provide smoother operation, the electronic relay was rebuilt into a permanent unit. In building the outfit shown, a 9½" x 5" x 3" chassis was used. All parts were mounted below the chassis with the exception of tubes and relay. The chassis provides ample room for mounting all components, and wiring should not be difficult as parts used are standard and placement is not critical.

To start the construction, the chassis is laid out with tubes to the rear, with mounting holes for sockets marked and center-punched. The relay position is also marked and punched as shown and the potentiometer and A.C. switch are located on the front face of the chassis. The input and output terminals are mounted on the rear.

To put the unit in operation, the power is turned on and the potentiometer is adjusted until the relay just closes. The control is then backed off slightly until the relay opens, which means the relay is correctly adjusted. Any alternating voltage source can be used as the control signal, for the operation of this electronic relay.

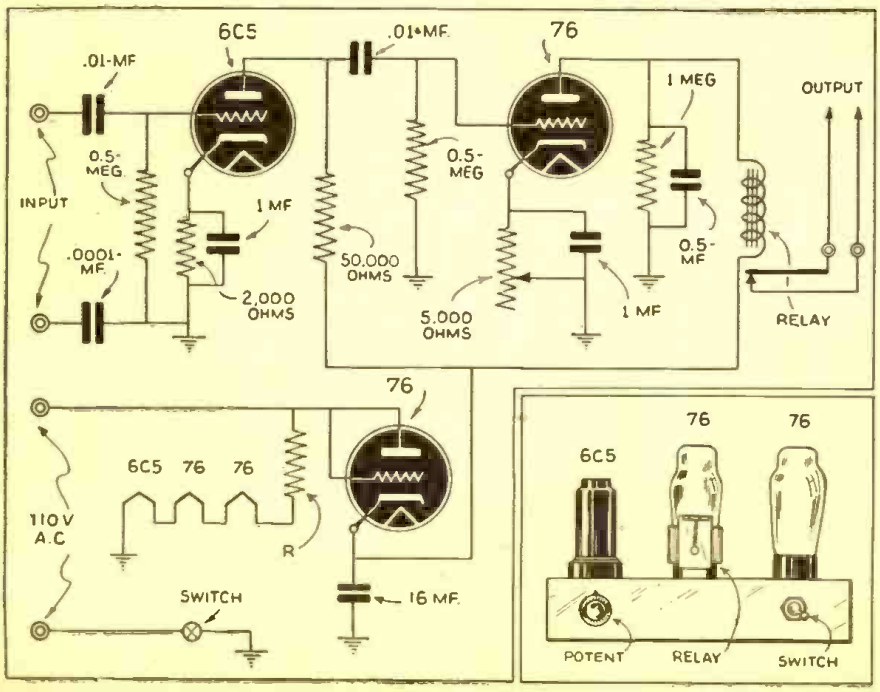
This unit is very versatile and can be applied to many things. It has been used at the Workshop to key a transmitter, to control a tape cutter, making possible the cutting of tapes from signals picked up on a receiver. It has also been used as a relay for a photo-electric cell experiment, and a remote control circuit. The constructor will, no doubt, find many more uses for this instrument.

Parts List

2—.01 mf. condensers (400 v.)
1—.0001 mf. condenser (400 v.)
2—1 mf. condensers (400 v.)
1—.5 mf. condenser (400 v.)
1—16 mf. electrolytic condenser (200 v.)
2—.5 meg. 1 watt resistors
1—1 meg. 1 watt resistor
1—2000 ohm 1 watt resistor
1—50,000 ohm 1 watt resistor
1—5,000 ohm potentiometer
1—Single-pole switch
1—Line cord for 3 6.3 volt tubes
1—S.P.D.T.—2500 ohm plate circuit relay

R.C.A.
1—6C5 tube
2—76 tubes
1—9½" x 5" x 3" chassis

Circuit of the electronic relay here described is shown below, as well as a sketch of the assembled relay and amplifier set-up.



F-M 59 Mc. Amplifier

Part 5—of "Pull-Swing" F-M System for Amateurs,

Ricardo Muniz* Donald Oestreicher** Warren Oestreicher***

● IN Article IV we discussed the basis of design of a reliable and efficient *high frequency* amplifier. In this article we will discuss its construction, operation and test.

The photographs show the layout of the chassis, top and bottom, also the panel quite well, and since the individual builder may vary his choice of parts widely, we decided not to give more exact layout plans.

The first step in construction is to wind the coils. With the exception of the final tank they are all wound with #14 enameled wire and mounted on a strip of Amphenol 912B, 2½" x ⅜" x ⅛". They are fastened to this strip by means of 6/32 screws and nuts; under the head of the screw is placed a good-sized soldering lug. This lug must not touch the mounting strip! (Amphenol 912B melts at soldering temperature, or at least the finish will be marred.) Three coils of this type are needed besides the final tank.

*Radio Instructor, Brooklyn Tech. H. S., Eng. WYNE.
**Student, Electrical Eng., Brooklyn Polytech., W2LOE.
***Student, Electrical Eng., Cooper Union, Night.

Details are given in the accompanying article for constructing an efficient high frequency amplifier, including the coil data. Instructions are also given for aligning and tuning the amplifier.

COIL SPECIFICATIONS

Coil Application	*Turns*	*Dia.*	*Length*	*Inductance*
L1—6L6G grid	6	¾"	¼"	.5 mh
L2—6L6G plate	8	⅝"	1"	1.0 mh
L3—829 grid	8	⅝"	1"	1.0 mh
L4—829 plate	8	1¼"	3"	1.0 mh

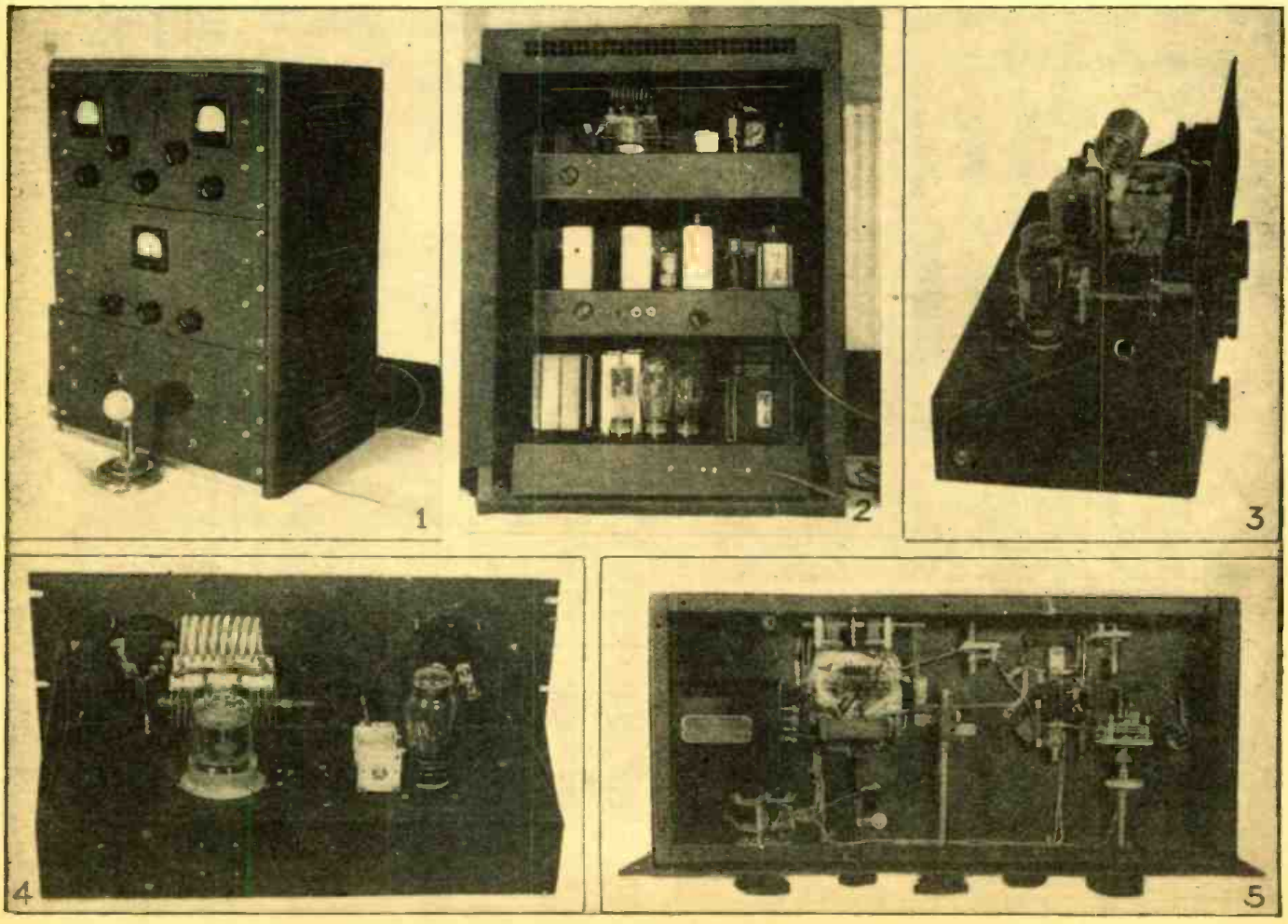
(Copper tubing 3/16" dia.)

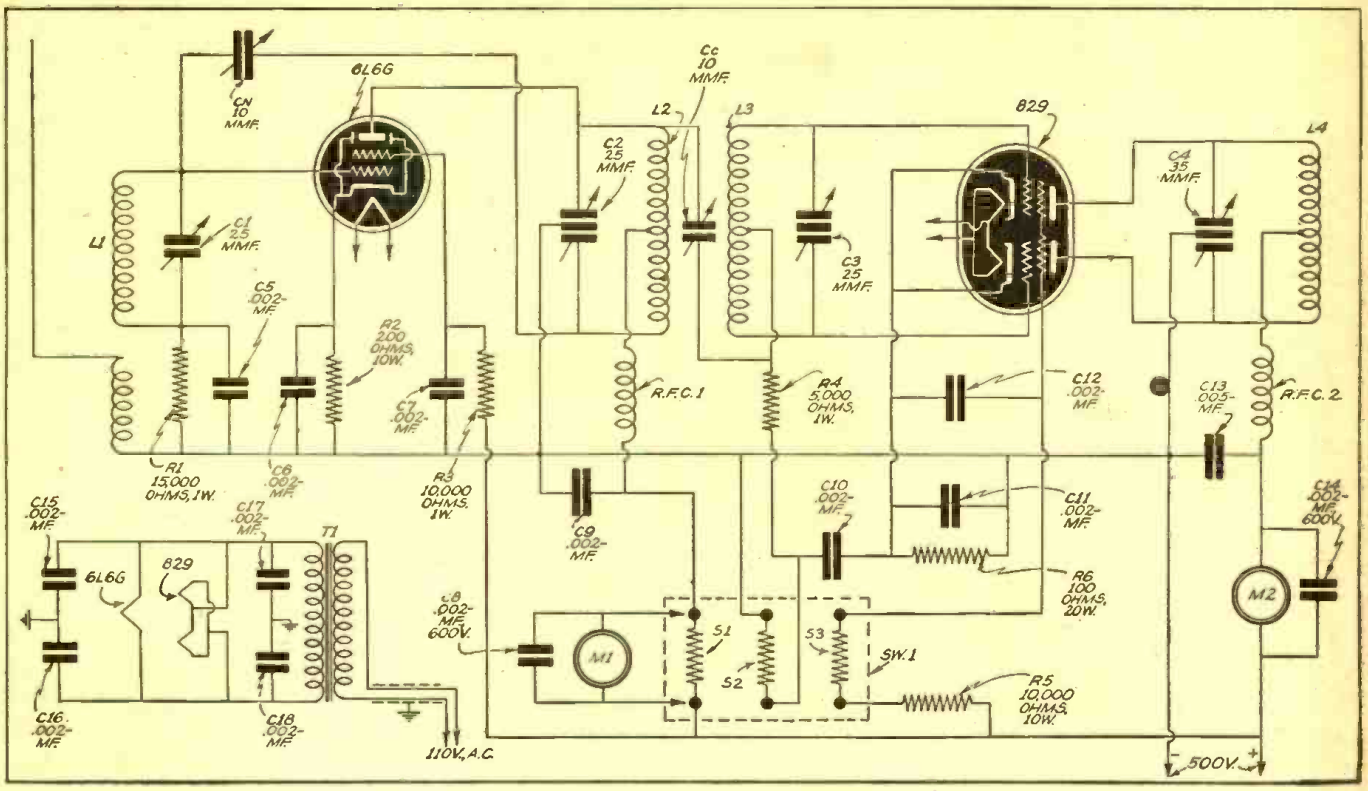
L1 may be wound on an Amphenol miniature form. It has a one-turn link of #16 tinned wire coupled to it ¼" from the *cold* end. This form may then be mounted directly to the chassis, as is shown in the photograph of the bottom. L2 and L3 should be identical and so should their tuning condenser, since these two circuits comprise a band-pass filter and it is desirable to have the same Q in each component. L4 should be designed to mount as directly as possible on the stator terminals of the final tank condenser.

R.F. chokes—We found it necessary to use two R.F. chokes in spite of our caution against them. After thorough investigation and test we found the Bud ultra high frequency R.F. choke to be entirely satisfactory. You may notice, however, that in accordance with our design notes in Article IV, all chokes are at low R.F. potential, a condition which is true at the center-top of a balanced tank circuit. The chokes, however, must be mounted at least two diameters away from surrounding apparatus, especially the chassis, *or their inductance will fall off sharply.*

By-pass condensers—In the photographs are shown the close grouping of parts, especially bypass condensers about their respective circuits. Most condensers are .002 mf. silver mica types, and, we believe, none of the "pigtails" on these condensers is more than a half-inch long in our wiring job. Notice, too, that *all bypass is returned to the cathode. This is very important!* The plate lead bypass condenser for the 829 is

Several views of the high frequency amplifier here described are shown below.





The diagram of connections for the high frequency amplifier is given above.

.005 mf. 2500 volt test rating. This unit is supplied with small ceramic mounting feet and it would be wise to order a few extra of these as they are invaluable for mounting parts. The meters are bypassed by .005 mf. condensers. Cornell-Dubilier has a condenser with a mounting specially designed for the standard meter terminals.

Meters—The 0-100 ma. meter (shown at the left in the panel photographs) has the shunt removed. Equivalent shunts are wired across the switch (Mallory "Hamswitch"), and the meter is switched to each of them in turn.

All voltages, including 110 A.C. for the filament transformer, are entered through a six-conductor receptacle. The *driver signal* is brought in through a length of flexible Amphenol coaxial line and appropriate chassis connectors.

Details—The grid coil of the 829 straddles the tube socket. Its tuning condenser is mounted on the back wall of the chassis and driven through a home-made right-angle drive. A piece of commercial flexible shafting may be used also.

In order to do a neat wiring job cut the wire in eighteen inch lengths. Use one set of colors for the wires to the B plus side of the meter switch, and another set for the apparatus side. Solder all wires to the switch first, then group the B plus wires into a cable and lead them to the plug receptacle, picking up the 110 V.A.C., lead (in shielded wire) on the way. The apparatus wires may then be grouped and run across the chassis, appropriate leads being taken off at intervals. Dress the wiring into a neat position and, with waxed string, carefully tie the wires into a compact cable. This will give a professional appearing and sturdy wiring job. (The above discussion does *not* apply to R.F. wiring.)

Do *not* trust the chassis for grounds! There are two *ground points* on this unit, one for the 6L6G and one for the 829. Connect all rotors of the variable condensers to these points with heavy braid and then *connect the grounds together!*

The 829 requires only one-tenth of a watt driving power for full output. It may, therefore, be possible to use the 6L6G as an oscillator with a twenty meter crystal, and obtain enough fourth harmonic output to drive the final in the five meter band. (For this service the 10 mmf. coupling condenser should be increased to 50 mmf.)

Neutralization of the 6L6G and adjustment of the coupling are made by means of a screw-driver through the back wall of the chassis, since they are permanent adjustments. It is not necessary to neutralize the 829 since the grid and plate circuits are shielded by the excellent design of the tube, and the circuit components are on opposite sides of the chassis.

When this amplifier is to be used with the "R. & T." frequency modulator, the alignment and tuning is as follows:

With driver voltage into the 6L6G, but no plate voltage, it may be neutralized in the conventional manner. Plate voltage is then applied through a 5000 ohm ten-watt resistor and the plate circuit is tuned to resonance. The meter is switched to the 829 grid and the grid condenser tuned for maximum meter reading with no plate voltage. Three hundred volts is then applied to the plate, the meter is switched to the 829 screen grid and the plate circuit is tuned. On no account should the screen current exceed manufacturer's ratings! This fact will be assured if the amplifier is kept loaded during this adjustment. It's as simple as that! No fuss or bother with tapping coils or changing bypass values, etc. And it's all due to careful design and conservative high-quality parts.

In a future article an *antenna coupling* arrangement will be described, together with some "field tests" of this unit. (Any conventional coupling arrangement may be used for A.M. work.)

Parts List

I.R.C. (Resistors)
1—R1, 15,000 ohms, 1 watt
1—R2, 200 ohms, 10 watts
1—R3, 10,000 ohms, 1 watt
1—R4, 5,000 ohms, 1 watt
1—R5, 10,000 ohms, 10 watts
1—R6, 100 ohms, 20 watts

JAMES MILLEN MFG. CO.
1—C4, 35 mmf. per section var. cond., 11035

KENYON TRANSFORMER COMPANY, INC.
1—T1, 6.3 v., 7 amp., ct. fil. trans., T-378

RCA RADIOTRON
1—829 dual-beam power pentode
1—Tube socket for 829

BUD RADIO, INC.
2—RFC1 and RFC2, Ultra-high frequency choke, CH-925

PAR-METAL PRODUCTS CORP.
1—19" steel rack panel, 8¾", 3604
1—Cabinet, 28" x 21" x 13½", DL-2613
1—8" x 17" x 3" chassis, 15281
1—Mounting bracket for 8" base, SB-78

TRIPLETT ELECT. INST. CO.
1—M1, 0-100 ma., model 327, TRJJW
1—M2, 0-500 ma., model 327, TROOB

ALLEN D. CARDWELL
1—C1, 25 mmf. var. trim-air, ZR-25-AS
2—Cn, Cc, 10 mmf. var. trim-air, ZR-10-AS
2—C2, C3, Dual, 25 mmf. var. trim-air, ER-125-ADD

CORNELL-DUBILIER
C5, C6, C7, C9, C12, C11, C18, C15, C16, C17—.002 mf. silver mica bypass cond., IR-SD2
C14, C8—.002 mf. 600 v. D.C. mica cond., 12020 4E (with meter brackets)
C13—.005 mf., 1,200 vt. test, 9M-22050

NATIONAL UNION RADIO CORP.
1—6L6G

P. R. MALLORY AND CO.
1—Ham-switch for metering, 151-L

AMERICAN PHENOLIC CORP. (Amphenol)
1—Octal steatite socket, SS8
1—Sheet 912B, 12" x 4" x ⅛", 65-125
1—Plug, 6-prong, PM6
1—Coaxial cable chassis connector, 93-C

INSULINE CORP. OF AMERICA
5—Type "A" Dial, 1168
2—Brass extension rod, 6", R117

Center-Fed ZEPP for Receiving

Rod Newkirk, W9BRD

● MOST short wave listeners are already aware of the great improvement in reception which can be given by a resonant antenna over a non-resonant piece of wire or a non-resonant doublet. Tuning the antenna to exact resonance at the frequency of the received station not only results in signal strength increase but increases the ratio of signal to noise picked up. The latter is most important nowadays with the modern high-gain receiver. This is a description of two Zepp antennas which will give coverage of the four best shortwave broadcast bands and the two best amateur bands for radiophone DX reception, namely, the 49, 31, 25 and 19 meter broadcast bands; the 20 and 10 meter amateur radiophone bands.

Not many listeners are acquainted with the Zeppelin type of antenna as they are not widely used for receiving. The reason for this is probably that to the average listener they seem somewhat complicated in construction and adjustment. Also that their advantage over wires of random lengths is not realized.

Advantages of Zepp Antenna

Two important operating advantages which the Zepp has over the doublet are, first, that the Zepp antenna is effective over a much wider range of frequencies because of its tuned transmission which compensates for discrepancy in the length of the flat-top when the Zepp is used somewhat off the frequency for which it is cut. In other words, with a Zepp and a doublet cut for the same frequency, the Zepp will have the greatest effectiveness over a wider range of frequencies on either side of the one for which it is cut. The efficiency of the doublet decreases quite rapidly the farther it is used off its resonant frequency.

The second advantage lies in the fact that a Zepp can be used just as well at a frequency twice that for which it is cut. This means that a zepp-fed antenna a half wave long for 49 meters can be used just as effectively for reception of 25 meter stations. (The two bands are not in exact harmonic relation but since the center-fed Zepp is not too critical in this respect both bands can be covered efficiently.)

These two advantages alone are worth the small bother encountered in constructing the zepp feeders.

The theoretical operation of the zepp can be found in any antenna handbook and need not be gone into here. When properly operating as a *receiving* antenna, it is an ideal noisy-location "skywire" since the pickup by the feedline from the flat-top to the receiver is very small. The flat-top, up in the clear, does the work of picking up the signal while the feeders carry the energy down to the receiver, strictly minding their business while they do so.

Feeder

For a center-fed Zepp, the feeders consist of two wires, which can be of the same size and material as the flat-top, which are connected to each half of the flat-top (Fig. 1). The length of the flat-top (A plus A) is equal to a half wave at the fundamental frequency for which the antenna is to be used, 49 meters in our case. These two feeder wires are separated from three to six inches by 'feeder-spreaders' attached at intervals along the line (Fig. 4). This feedline leads to the antenna tuning and coupling unit at the receiver.

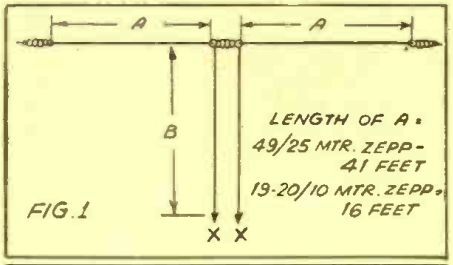


FIG. 1

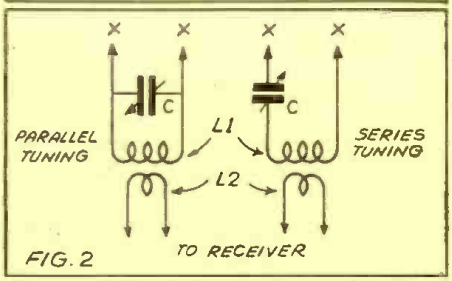


FIG. 2

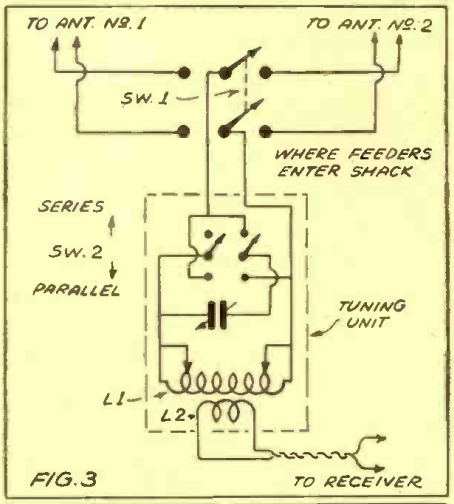


FIG. 3

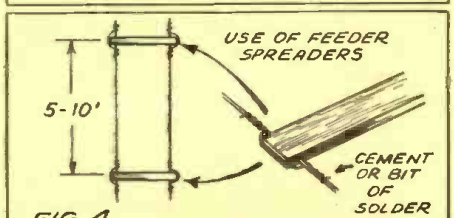


FIG. 4

49/25 M. ZEPP.				19-20/10 M. ZEPP.			
49 MTRS.		25 MTRS.		19-20 MTRS.		10 MTRS.	
FEEDER LENGTH (B FIG. 1)	METHOD TO TUNE (FIG. 2)	B'	SER. OR PAR.	B'	SER. OR PAR.	B'	SER. OR PAR.
41 FT.	PAR.	41 FT.	PAR.	16 FT.	PAR.	16 FT.	PAR.
82 "	SER.	82 "	"	32 "	SER.	32 "	"
123 "	PAR.	123 "	"	48 "	PAR.	48 "	"
164 "	SER.	164 "	"	64 "	SER.	64 "	"
				80 "	PAR.	80 "	"
				96 "	SER.	96 "	"

FEEDLINE LENGTHS AND HOW TO TUNE
FIG. 5

Short wave reception can be intensified to a great extent by use of the center-fed Zepp antenna, used as here shown.

While insulated wire is not necessary for the feeders, care must be taken to see that no metallic objects are encountered by it which would hinder its operation. It is also important to keep the length of each feeder wire the same as that of the other, and thus they should be kept symmetrical.

Feeder spreaders can either be bought from radio supply houses or home-made by boiling four-inch wood strips in paraffin (for weather-proofing). Where the feedline is not exposed to much wind a spreader every ten feet will suffice; otherwise, one every five or six feet may be necessary.

The length of the feedline is not limited but the length, in multiples of half and quarter waves, will determine the method of tuning in the tuning unit at the receiver (series or parallel, Fig. 2). The table for the two Zepp antennas we are dealing with as regards the method of tuning for different feeder lengths is given. One of the lengths specified should be chosen, since random-length feeders may result in difficulty in getting the Zepp to perform properly. These specified lengths are not too critical, however, and a deviation of a few feet either way, shorter or longer, should not affect performance noticeably.

One Zepp antenna 82 feet long, fed in the center, is used for the 49 and 25 meter bands. Another is for use on the 19 meter band as well as the 10 and 20 meter amateur bands. This latter antenna can also be used for the 31 meter band although some experimentation may be necessary to find the correct method of tuning for the length of feeders used. Another Zepp is not recommended for the 31 meter band because the average location prohibits the erection of more than two antennas if all antennas are to give maximum performance. No difficulty should be encountered in getting the 19-20/10 meter Zepp to perform on 31 meters if a 32 foot length of feedline is used with parallel tuning. If another feeder length is used, experimentation may be necessary.

This antenna combination to cover the best bands for short-wave radiophone reception will be most effective if care is taken in placing the flat-tops at sharp angles with each other and at different heights so that as little inter-action as possible will occur to interfere with performance. Feedlines should be separated by several feet as they come down to the shack although they must necessarily be close together upon entering.

The Tuning Unit

The tuning and coupling unit consists of nothing more than an inexpensive 200 or 250 mmf. variable condenser and a coil of the appropriate number of turns of wire.

The size and type of wire in the coil is not important. For parallel tuning the number of turns for 49 meters is approximately 25, for 31 meters and 25 meters about 15, for 19 and 20 meters about 10 or 12 and for 10 meters about 5 or 6. For series tuning about half of the turns specified for parallel need be used for each band. Diameter may be 1½ to 2 inches with slight spacing in between turns.

Plug-in coils wound for each band may

be used although it may be handier to wind a 25 turn coil on a large size Bud coil form, mount either vertically or horizontally and then short out the number of turns not desired by use of alligator clips. This calls for uninsulated wire or wire with a section of each turn scraped clean for good contact with the clips. The use of this method will eliminate the need for several coils and will also facilitate any coil experimentation desired.

The unit is coupled to the receiver by a link, L2. This consists of merely a few turns of insulated wire wrapped around L1, just described, and the link connects to the doublet input antenna terminals on the receiver. If there is only one antenna terminal on the set, one wire from the link goes to this terminal and the other to the chassis (ground terminal).

Figure 3 shows the tuning unit and two double-pole double-throw switches, one for selecting the desired antenna and the other in the tuning unit to switch for either series or parallel tuning.

Adjustment

Let us take for example the 49 meter Zepp in tuning up on the 49 meter band. With three turns of link, L2, wrapped around the center of L1 and the condenser C at a random setting, tune the receiver to a signal in the 49 meter band. Now rotate the condenser to a point where the signal is strongest. This is the point where the Zepp is resonant. The increase of signal strength should be very pronounced.

If there is no difference in the strength of the signal as the condenser is rotated, short out a turn on each end of L1 with the clips and try again. This should not be necessary, however. If more than a half dozen or so turns have been shorted out and still the signal does not vary when the condenser is rotated, check connections and make sure that the correct method of tuning is being used. There should be no trouble experienced in this procedure, if the feeder lengths specified are used and the corresponding method of tuning, series or parallel, is used.

When the point is reached during the rotation of the condenser where there is a sharp increase in signal strength, the Zepp is functioning properly. This point of resonance should not be too broad; that is, it should not cover more than a few degrees of rotation of C if the full signal-to-noise ratio given by the antenna is to be received. If the resonance point is quite broad, remove a turn from the link around L1. This should make the resonance point sharper without dropping the strength of the signal. This aids in reducing noise pickup.

Two or three turns of L2 are usually sufficient although in some cases, especially on the higher frequencies, even one turn of link may be enough. Rarely more than four turns need be used. If you find you must use more than four turns for L2, something is not working properly in the system. Miscalculation of feeder length may cause this and can be checked by adding or subtracting a few feet of each feeder.

You may find that operation on different bands calls for different sizes of link around L1. If this is the case then plug-in coils with a link wound for each band may be necessary. However, there are numerous ways of varying the coupling between the link and L1, such as shorting a turn or two out of the link when necessary or moving it with respect to L1.

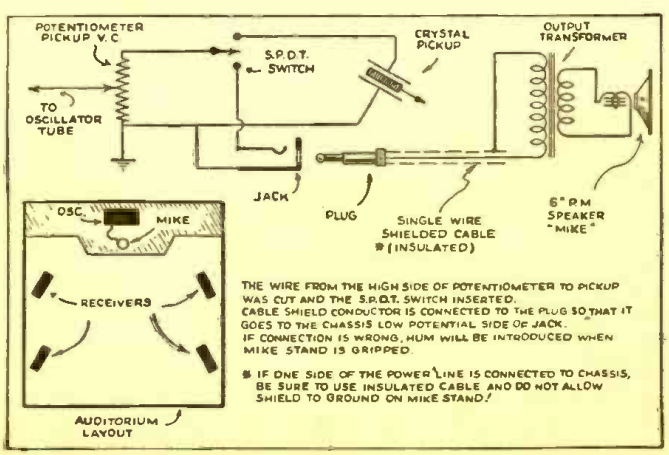
Use of this combination of antennas for shortwave radiophone reception should give you a noticeable improvement over any random-length single wire or doublet you have been using. You will also notice discrimination against images on the higher frequencies which is important in modern low-priced superheterodynes without preselection.

AUXILIARY P.A. SYSTEM

● THIS is a description of a simple auxiliary P.A. system that should prove very economical and easily set up for club groups, etc. I have a wireless record player in a portable case, to which I added a microphone jack and an S.P.P.T. switch to change from *pickup* to *mike*, with a separate switch to shut off phono turntable motor when using the mike. I have used it quite a lot at parties with excellent results. I also used it in a small auditorium in conjunction with four small radio receivers of the A.C.-D.C. type (all different makes) which members of the club loaned for the occasion. There is no objection from the radio owners as there are no wire connections to the receivers, except to plug them into the ordinary outlets. In this instance vacuum cleaner receptacles around the auditorium served with no need for extension power cords. The placement of the receivers were such that they gave complete coverage of the audience.

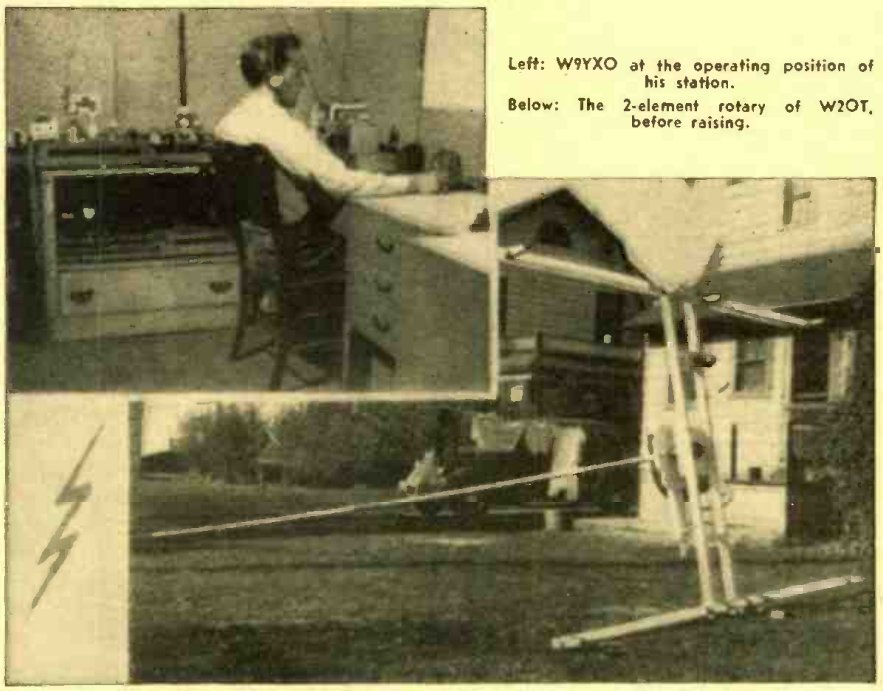
A 5" permanent magnet speaker suspended in a ring type desk stand was used as the microphone, with its output transformer connected by the jack and plug arrangement directly into the pickup input, as shown in the diagram. It gave remarkably good volume and response, with no apparent distortion, with the speaker's or singer's lips about 4 to 6 inches from the mike.

Practically any phono oscillator unit can be used, and some of them are already equipped with a mike jack; or any simple home-made oscillator can be adapted in the same way. The diagram consists of only the additions I have made, as there have been a number of oscillator circuits published and these are easily obtainable.



"CQ"

Larry LeKashman, W2IOP



Left: W9YXO at the operating position of his station.

Below: The 2-element rotary of W2OT, before raising.

● TROUBLE continues to spread throughout the world, and among amateur radio, where international friendships are commonplace, the first sad reverberations are being felt. Issue after issue of *QST, The T & R Bulletin, Radio*—all the amateur publications, carry a sad and growing list of "silent keys." Good amateurs and good citizens, not until the cauldron of death has stopped brewing will we fully realize and appreciate the heroic part they have played to serve their country. We, too, should like to pay, in our own futile manner, our final respects to the forever silent signals of the following amateurs who have died in the service of their government.

Telegraphist J. Hamilton	G5JH
Flight-Lt. G. Zech	GM8TT
Telegraphist K. Abbott	G3JY
Lt. W. G. P. Brigstocke	G5ZQ
A.C.1 R. W. Hunter	G3FL
A.C.1 J. Buchan	G4QA
Flight-Lt. E. J. Allway	G5AU
Wireless Officer J. Vyse	G4IR
L.A. C. D. Briggs	G6BI
Sub-Lt. L. E. H. Scholenfield	G5SO
Wireless Officer H. S. Simmons	G5SI

How good it would be to be QRM'd by these boys agajn.

From Cuba comes word of the death of another famous ham, Frank Jones, CO6OM, who died after a brief illness. Well known on 20 meter phone, CO6OM will be grieved throughout the world, but particularly in the States where he had a host of personal friends.

Also from war-torn Europe we learn that G6SN and G5LG have been captured and are prisoners of war. The Radio Society of Great Britain is carrying on with G6LL, G6NF, G6GR, G6OT, G5CD, G2NH, G6LJ, G2CD, G2WS, G2YD, and G6WN serving as executive council. While not attempting to turn "CQ" into a strictly "overseas" column the following list will no doubt prove of extreme interest to all amateurs in this country. It is a partial list of amateurs now serving with the British in England. By no means complete, it will serve as a basis for future listings of a similar nature.

GM3WO; G3TG; G8QR; G3JF; ZB1X; GM3BA; G5UH; W9SAL; G5VU; G8TM; G8TC; G8VS; VS1AL; G2WR; G2GB; G2WR; G3UF; G4HK; GM8FR; G8SB; EI8N; VE-4QW; 5MH; 3AGB; 2DD; 3AFF; 3CO; 3HZ; 3BC; 3APY; 2EE; 3AWC; 4YG; 4LC; 3AZZ; 2GR; 4MV; 4JV; 3AQZ; 4NG; 4AHH; 4AFE; 4AET; 3AKH; 1CK; 4MO; 2DQ; 4AHM; 3BAI; 3RI; 4QA; 3PX; 4AKH; 3FO; 5VE; 1KQ; 4ARR; 3DJ; 9CD; 3ARF; 4IM; 4ARX; 1EY; 3AYR; 3IC; 4AOH; 4ANN; 4OE; 3ADP; 2FE; 3AYY; 1IC; 3AKA; 2MN; 3ADK; 2LT; 3ABN; 2PR; 3AJH; 3AIJ; 20A; 2IQ; 4AFY; 3PE; 4AFK; 4APU; 4CJ; 4AAE; 2FI; 5PT; 4VC; 4AJZ; 4APQ; 5AFZ; 4WQ; 4ADP; 1EX; 3YC; 2OI; 4BJ; ZL1AE; 1AJ; 1GP; 1IU; 1IY; 1JZ; 1NZ; 2IO; 2QG; 2SV; 2TL; 2UG and 3DU.

Before returning to news of the U.S.A., it is with profound regret we must add to "Silent Keys" the famous call of G2GM who was killed in an air raid in London; G3LI, who gave his life at Dunkirk; and the well-known 40 meter ham G5BW who died after a long illness at his home in Eastbourne.

* * *

Lots of reports have been coming through of German amateur activity. The usual procedure is for the D to call a W and give a report during the call, finally signing at the very end, and often omitting

the prefix "D." Several W's have been picked up actually in QSO with foreign stations, a situation which is intolerable at the present time. Every ham is cautioned against the so-called "one-way" type transmission, since this is just as much a violation of the law as actually working foreigners. Chief offenders have been well-known phone DX men who couldn't bear giving up Central and South American friendships. While it is easy to understand their feelings, their unprovoked action might easily jeopardize *all* amateur radio.

Another thing the boys and girls are getting notes from Grand Island for is failing to sign call letters *often enough*. Round-table addicts and long-winded rag-chewers better watch their step! W9BRD's letter got caught in between columns; as a result some of Rod's stuff is dated. But most of it is worth passing right along.

Several dozen fellows worked K4DTH on 160 meter CW during the WAS party. Cuba can still be worked if you're lucky enough to hook one of the few NY4's still on the air. DX men can take up knitting or join Herb "W9" Becker and work Mid-west isolationists. If you need a Hawaiian this list may help you out a bit: K6QMC—7250; K6TMM—7280; K6TDZ—7050; K6THG—7240; K6SXX—7070; K6TCF—7080; K6QUJ—7200; K6RQO—7060; K6RGZ—7180; K6RBR—7180; K6SZP—7160; K6SHB—7170; K6SSB—7190, and KB6GJX (Guam)—7160. Don't overlook KD4HHS on 20 meters.

* * *

The American Red Cross-ARRL test was run on April 4th and results will be anxiously awaited by amateur and military authorities. According to recent figures of the League, nearly 5000 hams have qualified for their code proficiency certificates. Over 90% received the certificate for 20 words or faster, which meets the usual requirements of military communication services. This outstanding performance is certainly an electrifying answer to any critics of the ARRL or amateur radio as a doubtful instrument of national defense.

W9VES was knocking them off in the Illinois section contest and then his 80 meter Zepp blew down. 9KIO's parallel T20 rig is beginning to go to town on 7MC. 9KFY dabbles on the UHF with FM and occasionally pounds brass on 40. 9MCM is heading for his 40 meter WAS and is plugging AARS 160 phone net. 9PIU is new on 40 and is knocking 'em off. 9ZTN tore down and is rebuilding. 9MUX mowed 'em down in the 160 WAS party. 9QLA has several hundred watts on 20 and 40. 9KZN took down his pipe antenna and is now using a Hertz. W5EGA skeds KD4HHS. W2KZN is trying to sell out, but no takers so far. W9GGG pushes traffic with the FTS net. 9AI is holding his own on 20 phone with low power—the call must awe the boys or something.

* * *

W9EYH got back on the air with the same old whopping signal and got de-rusted in the FTS party. Wally hopes to put up an 80 meter half wave before the next ORS party comes around. W9HMO bought a

bug from 9BRD and had to practically rebuild the thing—which is to be expected. Irv, W9HMO, continues to absorb a terrific checker beating from his pal W9FWR on 7200. W9ELC put up a centerfed zepp for 80 meters and reports FB results as compared to his old impedance-matched wire. W9VDY pushes oodles of traffic up in Wausau between chess games with 9BRD. W9TKX/9 in Winona, Minn., chimes in with the boys on 7 mc. with a tape fist; Bob will argue for hours on the subject of keys and keying. 9ABD joined the Chess Wireless Association on 40; Minneapolis certainly puts out a flock of chess artists. W9NCS is gunning for three band WAS, despite hard work at school. Watch out for him in the next ORS party.

* * *

A few notes on eights. W8ULO gave his 812's a rest in favor of his 6L6 xtal and can't wait until he gets his new hand-picked QTH. 8SCW is getting back into harness with FTS traffic and is really working his ECO. 8UKB opped his brother's station, 8VCN, during the 160 meter WAS party; Bill also put his 400 watts on 7 mc. for the FTS Anniversary party. W8BCV enjoys an occasional ragchew on 40 in the afternoon. 8UFH in Detroit contemplates starting an afternoon traffic net on 40 in conjunction with the FTS. 8UZJ likes 40 meter chess playing. 8SBP joined FTS. W8USK has a 616G on 40 and puts out a fb signal right through Pittsburgh's private Heaviside layer. W8TTD is gunning for QRP WAS on 80 meters from Export, Pa. 8ROX gave 160 a whirl during the WAS party and also plugged away in FTS affair. 8JHN schedules' buddy 8NOE/4 in Fort Benning; NOE really gives that electronic bug "the works" on 7 mc. 8SBU's DX on 160 CW from Hilton, N. Y., represents nice U.S. coverage.

* * *

Some sixes: 6PFL slaps a traffic signal with a rhombic on 14 mc.; Stan complains about the decline of DX after he began to really get out. 6DUC breaks the monotony of working YL's with a schedule with K6QUJ. DUC is getting a *screen test* soon and is to appear as a serious competitor for the title of American Matinee idol. 6ROZ handles loads of traffic with 3GKO and K6's on 7240 kc. 6TFF gives the boys Nevada on 7235 kc. 6QD can be mournfully heard on the low end of forty working his favorite W9's; judging from his signal, he still keeps the light companies out there in the black. (Block that metaphor.) FLASH: 6DUC is reported to be on 14 mc. phone now. His hearing 5DEW one day was probably responsible for this. Usually reliable high official circles and sources voice the opinion that he will still keep his bug handy as YL's are still plenty thick on 40 and 80 CW.

Fives: 51GO holds her own as the snappiest YL op in W5 by shoving traffic on 80; Thelma has ECO now and is able to avoid 6DUC more consistently. 5EGA shoves traffic on 80 between 14 mc. ragchews and passing out cards for KD4GYM. Hal is the 20 meter branch member of the Chess Wireless boys. 5GZU is pretty QRL right now and has put himself on the semi-inactive list. 5FCM at Fort Sill has plenty of ops these days. Another crack YL op, 5IKC, holds out on 7225 kc., in YLRL and FTS nets. 5KC rolled up a score in the 160 meter WAS party. Besides 5KC, 5INL, and 5IKP, were busy giving the boys Louisiana in the party. 5GWT represented Arkansas in the same affair. 5HPV is smack on the borderline between Arizona and New Mexico and claims the distinction of being the "Farthest West W5." 5JFW cured his harmonic trouble and operates on 7 mc. with a clear conscience now. 5JMI is new to 40 and is trying to up his CW speed. 5IGW is a ringer for 3.5 mc. WAS hunters—100% QSL from Mississippi.

* * *

Fours: 4GRD rattles the bug on 7230 kc. and gets out swell after QRO'ing. DX man, 4BPD, boomed through during the 160 meter party and along with 4AFQ gave everybody SC. 4FIJ, another DX and contest hound, also hit 160 for the weekend after a possible WAS. 4EPE is plugging with FTS. 4HER represented NC during the 160 meter party. 4DWB is plugging away at school.

Ones: 1AW is putting in a more consistent signal on 7280 into the Midwest, now that night skip is shortening a bit on 40; best bet for good code practice is still their rig on 80, however, since QSB is less. 1AW also is good on 160 when QRN is sufficiently low. 1KXU keeps busy with traffic on 40. 1KKS put his heap on 160 for the Party. 1KYT represented Maine during the same affair. 1MGC is Bridgeport's ardent FTS member. 1LAE is good for R.I. during the afternoons on 40, 7210 kc. 1AJ gets on occasionally with his rockcrusher on 40. YL 1FRO occasionally enhances 7 mc. traffic ranges. Members of the HQ gang on during the 160 meter Party: 1SZ, 1DF, and 1TS. TS was really hustling and no doubt will have one of the top totals. 1CJK works out well on 160 CW. 1KIO's QRG is close to 9KIO and both are in FTS.

* * *

Some twos: 2LZR is back on the air with a swell signal and is gunning for traffic BPL on 40 and 80. Doc Braendle, 2NDQ, is knocking the lads for a loop on 7 mc. 2MXK, and 2LSD have been helping to fill up 2BGR's log with some 7 mc. brass pounding. 2LXI took a swig of 160 during the contest. 2MCB has a couple of TW75's on 14 mc. 2ANM and 2ANW are on the same frequency on 40 and confuse the boys no end. 2AOA has a good 20 meter sock with his 50 watter in Hicksville. 2HZY roams 3.5 mc. with 90 watts and a tape fist. 2LPJ of the FTS moves plenty of traffic. 2MXQ has a TZ40 and a doublet on 40.

Three dope: 3IJN has 140 watts on 7 mc. to an 814. 3IKP has a swell wallop for 75 watts on 20 CW. 3DGM and 3BES got into each other's way on 160 CW in the recent scramble. 3GEW sports 50 watts on 20 CW. 3DK packs plenty of sock on 14 mc. CW as does DX-man 3AG. 3IXJ has a 6L6G-T20-T40 rig near 7225 kc. 3EML varies traffic work with a little ragchewing on 40. 3BZX takes a slug at 40 meter traffic. 3IEM holds down Baltimore for FTS. 3IWM passed out Va. contacts on 160 CW.

Sevens: 7AHX is on 7150 with 430 watts. 7AWD/7 has an 802 ECO-6L6G rig with 30 watts on 20 CW. 7IKQ puts 100 watts on 7225. Sevens are awful rare on 160 during most activities and were not much more active during the WAS Party.

"Honor" Plaque Awarded

To H. O. Pattison, Jr., W2MYH

For Best HAM Station Photo

● THE accompanying picture shows the magnificent Ham shack operated by H. O. Pattison, Jr., W2MYH, at 81 Hillcrest Ave., Summit, N. J. The photo was furnished through the courtesy of the Terminal Radio Corp., in New York City, who supplied the equipment shown. The receiver used at this station is a Hammarlund Super-Pro. The broadcast tuner is a Miller Hi-Fi tuner. The transmitter was built by "Pat" himself. It consists of a Meissner ECO unit working into an RCA 812, into push-pull RCA 810's, modulated by a pair of RCA 810's in class B. The transmitter operates on 10 and 160 meter phone, and also 20 and 40 meter cw. Antenna is 3 element "Mims" beam on 10 meters. Recorder built by "Pat," utilizing Presto overhead feed mechanism and cutter. Brush PL-50 playback arm is used.

●

Here is the new "Award of Honor" Plaque which measures 5" x 7" in size. It is handsomely executed in colors on metal, and is framed, ready to hang on the wall. The name of the winner will be suitably inscribed.

●

Note These Important Rules

Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name of receiver.

State briefly the number of continents worked, the total number of stations logged or contacted, and other features of general interest. Mention the type of aerial system and what type of break-in relay system, if any.

Important — Enclose a good photograph of yourself, if your likeness does not appear in the picture!

You do not have to be a reader of RADIO & TELEVISION in order to enter the contest.

Address all photos and station descriptions to Editor, Ham Station Photo Contest, c/o RADIO & TELEVISION, 20 Vesey Street, New York, N. Y.

Portable Radio-Phono Oscillator

Lee Garrison

● IN RADIO AND TELEVISION, and its companion magazine, *Radio-Craft*, I have several times noticed phono oscillators described that were said to be *portable*. There was just one thing about them I did not care for, they all depended on the 110 volt power lines for operation.

I know that out in the country, away from the power lines, the farmers also have radios. Those radios depend on *battery* power.

If a farmer wishes to play the records through his radio, he has to get a service man to cut in a jack for him to plug in the phono pickup. That works all right, but when he wants to play the radio, he has to remove the phono pickup.

We have tried that stunt but the folks did not seem to like the tone of the music. When we use a phono oscillator, the music seems so much better.

When you use the entire set to reproduce the music, needle scratch is practically absent.

Until the advent of the 1D8GT tube, a "compact" oscillator was out.

This oscillator measures only 4½ inches by 5¾ inches by 3½ inches. The batteries are contained in the cabinet, and it is *independent* of the power lines.

In selecting the circuit to be used, I chose the one used in the Meissner phono oscillator. The 6F7 and the 1D8GT are practically alike in internal construction. Using the same circuit, except for minor changes, the results are the same. The changes include different power supplies, home-wound oscillator coil, volume control to control the modulation percentage, and a different way to couple the output of the oscillator to the radio.

The pentode section of the 1D8GT was not biased, as it was not found necessary to do so. The resistance used keeps the plate voltage and current down to a safe level, as measured at the plate terminal.

The cabinet was made from a couple of cigar boxes. The wood, being so thin that screws could not be used, I settled on two straps obtained from the ten-cent store to hold the front panel in.

When the front panel is removed the oscillator and the batteries come out; this makes changing of batteries easy.

Airplane type luggage linen covering would make a very attractive covering for the cabinet, and it would also harmonize with most of the portable radios.

The size "D" flashlight cell should give about five hours of service before it needs replacing. The "B" battery should give more than four hundred hours of service. If the oscillator is not to be portable, a larger size "A" supply can be used, notably, a No. 6 dry cell, which will give about two hundred hours of service before replacement is needed.

You will see that I have specified five coil forms in the parts list. This is necessary, as they are sold in kits of five only. Also that I said the coil dope was not needed, unless the oscillator was to be used where it would collect moisture. To be safe, I would recommend that the "dope" be purchased and used. One never knows where he will take a portable outfit like this, and it does not take much moisture to cause trouble. I know from experience with an *undoped* loop antenna for a portable radio. When the loop got damp (and you couldn't feel the dampness, either), I couldn't even raise a station twenty-five miles away!

I have used this oscillator for about a month, and it has always given excellent performance. I loaned it out to some of the farmers just to see if it was good.

When they returned it they said that the tone was good and that the music sounded just like that received from the broadcast stations.

Primarily, this oscillator was built to see if the rural dweller couldn't be given the same chance at good music that their city cousins have.

Parts List

I.R.C.
2—100,000 ohm, ½ watt resistors
1—250,000 ohm, ½ watt resistor

NEW ENGLAND RADIO-CRAFTERS
5—Radio-Crafter "C" coil forms (five, as no less than that are sold)
1—Bottle Polystyrene No. PDQ coil dope, to dope coil (not really needed unless oscillator is to be used where it will collect moisture)

BUD RADIO CORPORATION
1—Midget jack and plug

CENTRALAB
1—100,000 ohm volume control with A.C. switch

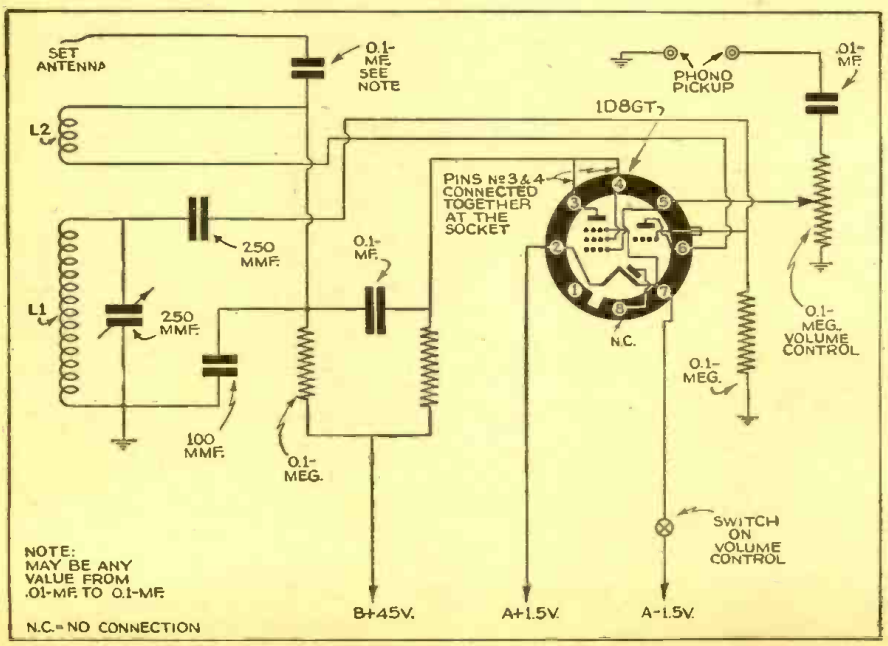
AEROVOX
3—.01 mf. 200 volt paper condensers
1—.00025 mf. mica, midget condenser
1—.0001 mf. mica, midget condenser

MEISSNER
1—.00025 mf. variable padding condenser

NATIONAL CARBON CO. (Batteries)
1—#482 Minimax 45 V. "B" with plug
1—Size "D" flashlight cell, or 1 #6 dry cell

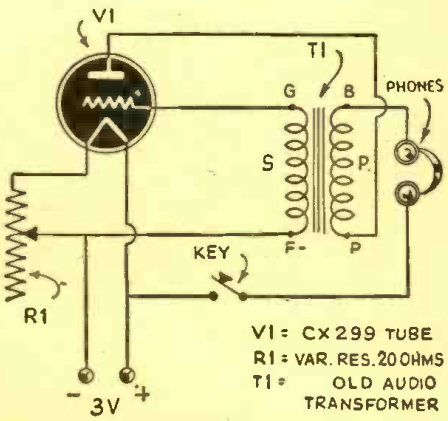
MISCELLANEOUS
L is wound with #32 enamel wire, 170 turns. Winding space one and one half inches. The tickler is wound over the bottom end of the coil. A strip of paper wound on the bottom end of the tuning coil first and tickler wound on that. Otherwise there is not enough room on the coil form for it. Tickler winding is 40 turns of #32 enamel.

Hook-up of the 1D8GT tube in the simple circuit used by Mr. Garrison in his "phono oscillator."



SIMPLE CODE OSCILLATOR

Here is the simplest code oscillator I have come across. A couple of flashlight cells at a dime apiece furnish the current and the tube may be one suited to operation on three volts, such as a CX299. A low value variable resistor (about 20 ohms) is connected in series with the filament; an audio transformer of about 3 to 1 ratio will serve to couple the grid and plate circuits. The tone of the signal can be varied by adjusting R1.—*Herbert Kynor.*

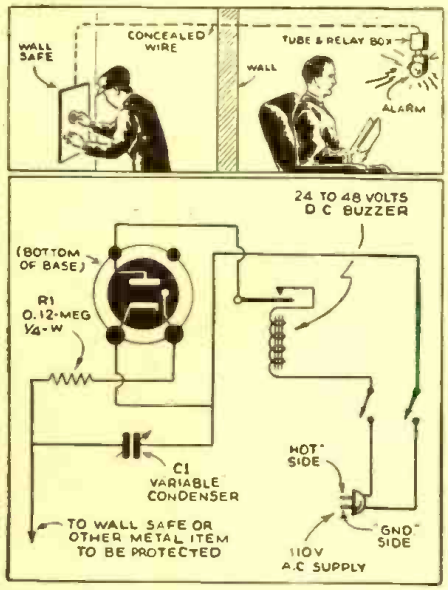


A simple code oscillator, constructed at slight cost, from parts indicated in diagram.

Capacity-Type Burglar Alarm

● WHEN a low-cost burglar alarm is desired, the experimenter would do well to consider the advantages offered by the use of a cold-cathode type rectifier tube such as the Western Electric Company's 333A or 333C tubes. When used as a burglar alarm to protect a wall safe, the entrance to a room, etc., the circuit indicated provides a very sensitive and reliable alarm, not dependent upon the making of an electrical contact. When the safe or other device protected is touched, or even approached closely, the device operates. Any attempt to cut the wire leading to the safe also will set off the alarm.

The 333A tube is connected as indicated in the diagram. The yellow tube wire is



Wiring diagram for the capacity-type burglar alarm.

connected, through a switch if desired, to the grounded side of the 115 volt A.C. supply. The black tube wire is connected, as indicated, through a buzzer or bell normally rated at from 24 to 48 volts D.C., to the ungrounded or "hot" side of the 115 volt A.C. supply. The red tube wire goes to the safe or other metal object which is to be protected. A variable condenser (about 300 mmf.) is connected between the red and yellow tube leads.

The action of the burglar alarm is based on the fact that when the tube is connected as indicated, the tube will not break down and conduct between the yellow and black leads, until the capacity between the red and yellow leads exceeds a certain value. Then the tube breaks down and conducts.

The variable condenser indicated should be adjusted by increasing from zero capacity, until the tube breaks down and the buzzer sounds. Then it should be backed off until the buzzer stops. The alarm is now set. Any person touching the red lead or the metal article to which it is connected increases the capacity from the red wire to ground, and thus to the yellow tube lead, which is connected through the lighting system to ground. The longer the lead going to the safe, the more capacity to ground it will have, and thus the less compensating capacity will be needed in the variable condenser. It is possible, by careful adjustment of the capacity, to set the alarm so that direct contact with the protected surface is not necessary—just passing in the vicinity will set it off.

One precaution should be observed. Do not try to protect an item located outdoors, such as outdoor screens, etc., because atmospheric changes such as rain, fog and mist will change the characteristics of the circuit enough to set off the alarm.

A D.C. relay, rating about the same as for the buzzer, may be used in the circuit in place of the buzzer, utilizing the off-normal contacts to actuate some other signal. However, since the tube acts as a half-wave rectifier only, the relay should be shunted by about 4 mf. condenser to prevent relay chatter. In this case, if the alarm is set near the critical break-down capacity, once the alarm is set off, it will maintain operation even after the contact with the protected article has been removed. This is not the case when the buzzer is used, since the make and break contacts will cause the tube to relax when contact with the protected article is removed.—*Wm. D. Montgomery*, W8PNQ.

LISTENING POSTS FOR DEFENSE

A *24-hour watch* for subversive and other pertinent radio propaganda from abroad is being set up to record, translate, transcribe and analyze foreign *short-wave* broadcasts. These national defense listening posts are being established by the F.C.C. in cooperation with the Defense Communications Board and will be strategically located throughout the United States and its possessions.

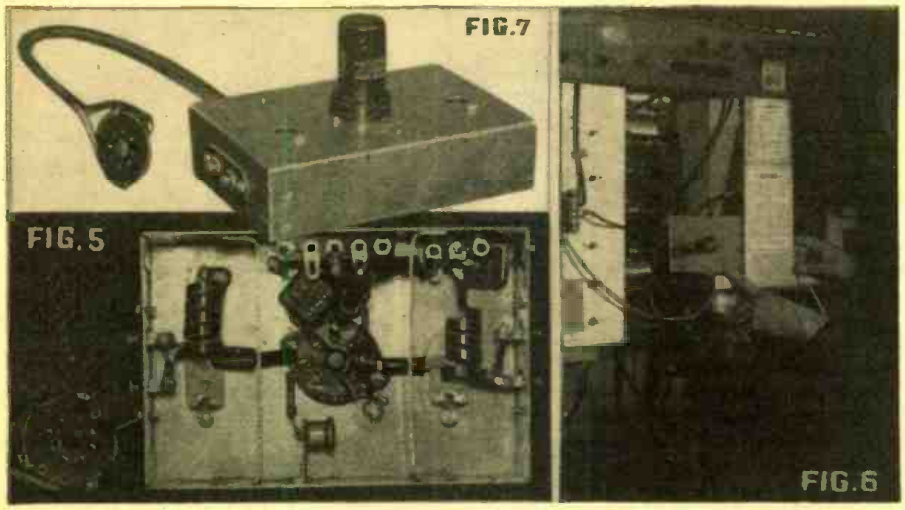
A picked force of 350 technicians, translators, clerks, propaganda analysts and other experts will work in eight-hour shifts to keep abreast of all overseas emissions, which may involve propaganda intended for persons in this country or neighboring countries. Such continuous listening is necessitated by the difference in time and propagation characteristics of international broadcasts. The listeners and analysts will pay particular attention to voice broadcasts, including newscasts, speeches, announcements and playlets, as well as some musical programs.

After being recorded in the field, all this material will be coordinated and studied at Washington. The extent of the work involved is indicated by the fact that it requires an average of seven hours of translation and transcription to process one hour of recorded material. It will be necessary to record and analyze matter of which 75 per cent will be in languages other than English.

This necessary step to deal with vital national defense problems developed by radio is taken on recommendation of the Defense Communications Board, as approved by the President and the Bureau of the Budget.

A Fixed-Frequency Booster for Television

Thornton Chew, Television Engineer



Appearance of the fixed-frequency R.F. booster amplifier for television signals.

This fixed-frequency booster R.F. amplifier may be used for ultra short-wave reception in general; the particular application described is for boosting weak television signals. This booster does not involve any extra tuning controls; it is a small unit and may be concealed within any television receiver cabinet.

● FREQUENTLY, where signal field-strength is inadequate, an R.F. "Booster" amplifier is the most happy solution of a difficult problem. It may be the difference between satisfied customer and no sale when the television or frequency modulation receiver is to be located on the fringe of the transmitter's service area.

Useful amplification at the superheterodyne intermediate frequency is limited to the point at which thermal agitation and shot noise in the first detector begins to show as a "snow" or *grainy* quality in the picture. See Figure 1. Most well known commercial television receivers are designed to work very close to this limit. Further amplification, therefore, must of necessity be undertaken at the carrier frequency.

If only one television band is to be covered, an R.F. *fixed-frequency* booster amplifier is to be recommended, since it involves no added tuning control, may be entirely concealed within the cabinet, and the receiver chassis need not be removed from the cabinet while it is being installed. The unit is small and seldom presents an installation problem.

Occasionally an unsatisfactory over-all frequency response may be improved by an added R.F. amplifier stage tuned to fill in the low points of the response curve as shown in figure 2. Thus in several instances a weak sound signal has been raised to match an otherwise satisfactory picture signal.

The frequency response of the single stage booster described here is good over a bandwidth of 2.5 megacycles. It has a stage gain of slightly over 4. This gain may be increased by operating the 6AC7/1852 suppressor grid about 50 volts above the screen-grid voltage, but the tube life will be shortened and instability may result.

The response curve can be broadened considerably by shunting the grid and plate inductances with 1,000 ohm loading resistors; the stage gain will then drop to about 2. Figure 3 shows the frequency response curves with and without loading resistors. The extent of this loading may be varied to balance gain requirements against bandwidth.

The plate and filament power is supplied by the receiver through a wafer type adapter which will work with any of the 6F6, 6V6, 6L6, 6Y6, etc., types of audio power output tubes having a screen voltage not exceeding the 300 volt plate maximum of the 6AC7/1852 tube used in the booster.

Since both input and output impedances are low, connection between booster and receiver may be by means of low impedance twisted pair transmission line or coaxial cable, and the input impedance will also match the commonly used commercial twisted pair lead-ins. If stage gain is high it may be necessary to shield the connecting line to prevent excessive feed-back and resultant oscillation.

Feed-back should be minimized to obvi-

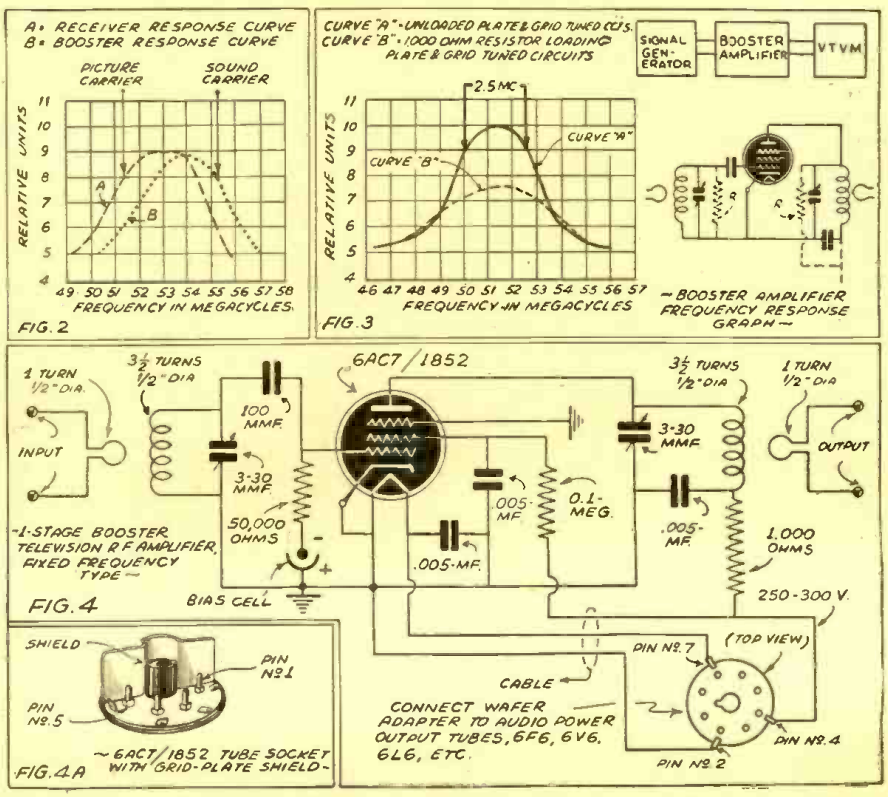


Diagram of the booster amplifier and how it works.

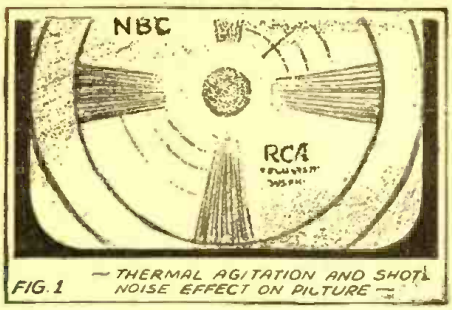


FIG. 1 — THERMAL AGITATION AND SHOT NOISE EFFECT ON PICTURE —

"Snow Effect" due to thermal agitation and shot noise.

ate the sharpening of the response curve caused by regeneration. In the design of this booster amplifier, a number of steps have been taken to reduce feed-back. The input and output inductances are separated by two copper shield plates—copper being most effective as a shield at these high frequencies.

A small shield placed between the grid and plate socket prong connections and curved to fit snugly around the tube aligning plug, is soldered directly to the cathode and shell socket connections as shown in figure 4A. This serves to further reduce grid-plate capacitance, a prolific source of feed-back.

The hot filament wire and the screen-grid are bypassed by mica condensers grounded to a point near the low R.F. potential end of the grid inductance. The plate circuit includes a resistance-capacity decoupling filter. Input and output connectors are at opposite ends of the chassis.

These precautions may seem extreme but they will be found well worth while.

The picture, figure 5, shows the coils made of ⅛ inch wide copper ribbon but No. 12 or 14 wire may be used without materially affecting the frequency range. The coils are 3½ turns spaced 1 wire thickness, ½ inch diameter. The input primary and output secondary coils are 1 turn, ½ inch diameter.

These coils shunt-tuned by 3-30 mmf. trimmer condensers will tune over a band from about 50 to 60 megacycles. If it is desired to tune bands on either side of this, a turn may be added or subtracted at a rate of about 1 turn for each 5 megacycles change in range.

Grounding the adjustment screw side of the trimmer condenser will eliminate body capacity effects while tuning the amplifier; the insulative qualities of many "anti-body-capacity" screw drivers are not adequate and false adjustments may result.

Grid bias is supplied by one Mallory bias cell. If it should be desired to substitute the 6AB7/1853 type tube for the 6AC7/-1852 type, use two bias cells in series.

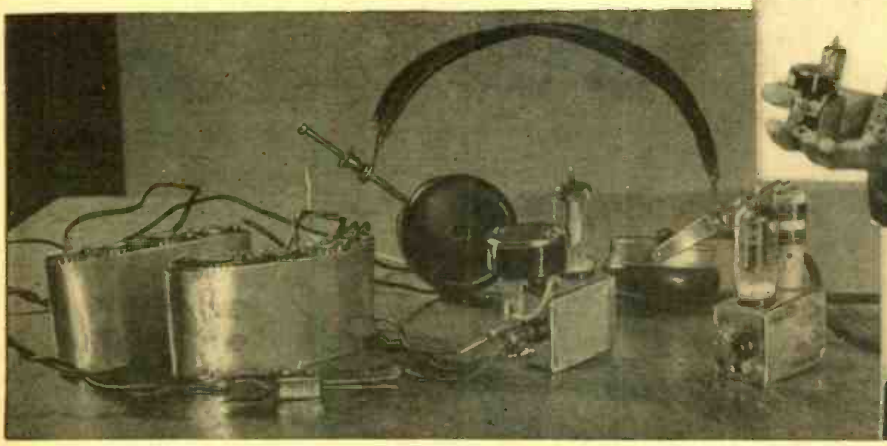
The screen-grid series resistor may be varied to limit plate current to the rated 10 ma. value; resistance values between 100,000 and 125,000 ohms will be proper. With the 6AB7/1853 this resistance should be between 60,000 and 75,000 ohms.

The chassis is cadmium plated sheet iron, dimensions 6x4x1½ inches. For this application, the laminated bakelite wafer socket is entirely satisfactory notwithstanding the high frequencies involved.

A typical installation in one of the popular models of commercial television receivers is shown in figure 6.

This article describes a miniature radio transmitter and receiver, the transmitter having a very short range. It will appeal as a novelty to Hams and radio experimenters in general, and may also find application for certain purposes. The transmitter is designed for code operation with a key. The apparatus is battery-operated.

Photos herewith show tiny radio transmitter and receiver, the crystal-controlled transmitter operating on 160 meters.



Xmitter-Receiver in Palm of Hand

Robert Joseph Stahl*

● HERE is an original design of a radio transmitter and receiver so small that both units will fit comfortably into the palm of the hand. Using current from dry cells producing a pressure of 21 volts from 16 vest pocket flashlight cells (two of which furnish current for the filament of the tubes), the transmitter and receiver become extremely economical to operate. An outstanding feature is the use of a crystal-controlled oscillator in the transmitter which causes the transmitter to maintain a constant frequency.

We will describe first the construction of the receiver. The specifications which follow are for receiver to operate on 160 meters; but coil data for other wavelengths are contained in the table. The chassis for the receiver was cut from a sheet of tin, soldered together at the edges to form a small box-like unit opened at the bottom. However, the corners of this box were soldered only after the unit was completely wired to facilitate handling of the parts. In the top of this box is mounted a socket to receive one of the new type 1S4 miniature tubes. The front panel contains two insulated pin jacks into which the leads from the battery are plugged; here also is a connection to the chassis for the negative lead of the "B" battery. To the top is soldered a small coil made by winding 110 turns of No. 32 enamel wire on a form ⅜ inch in diameter and 1⅝ inches long. This is the "secondary." This circuit has no real primary. Around this secondary wrap four layers of ordinary writing paper loosely enough so that it will slide. On top of this wind 20 turns of No. 32 enamel wire which serves as the tickler.

For operation of the receiver on other bands, this coil and the capacity of the condenser would have to be changed in accordance with the table given here.

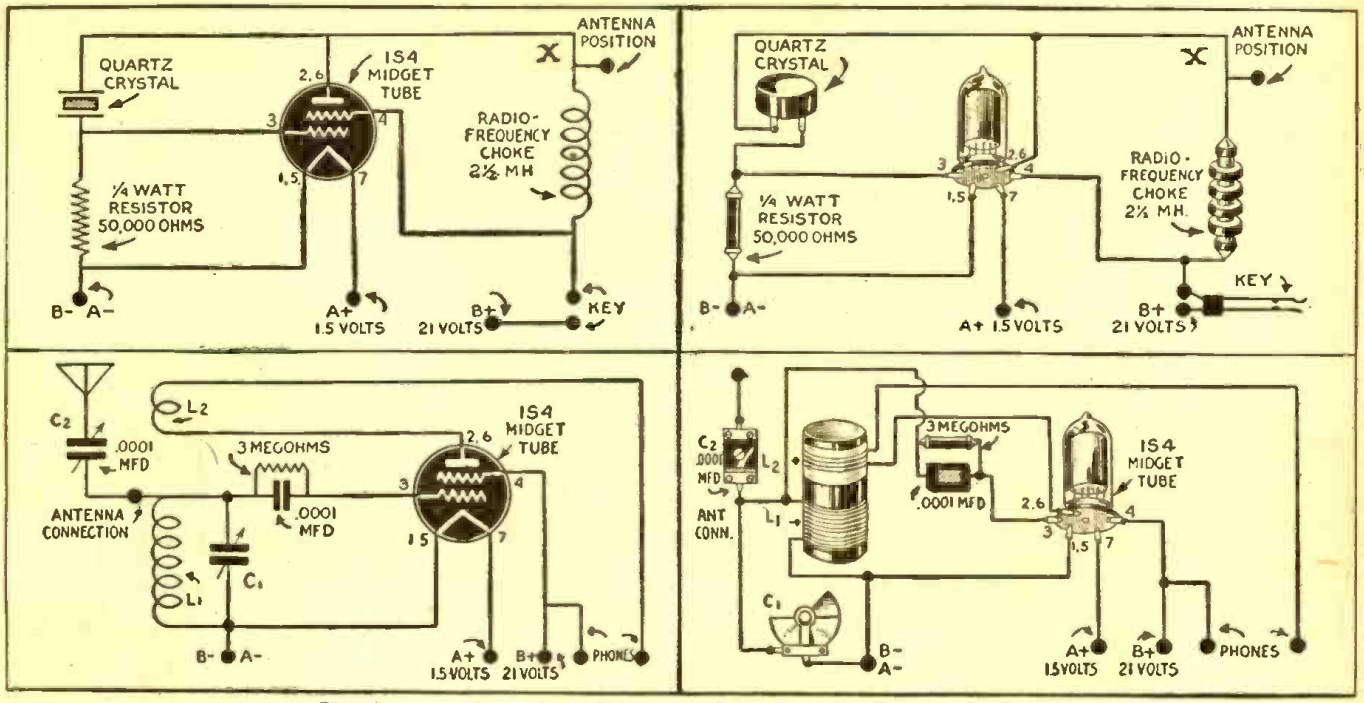
The fixed mica condensers as well as the resistors are of the midget variety. The variable condenser used in the tuning circuit is a compression type trimming condenser (frequently used for adjusting values of variable condensers in ordinary receiving sets so that the gang condenser will tune accurately). The maximum capacity for 160 meter operation is 225 micro-microfarads.

There is only one point which might give the novice a little difficulty and that is making the connections to the vacuum tube properly. This is made easy by referring to the diagram. If you will pick up the tube socket and look at it from the bottom you will find that while there is room for eight prongs only seven appear. Counting from the missing prong in a clockwise direction you can place the numbers from one to seven upon the prongs which are visible. Then make the connections as illustrated in the diagram to the respectively numbered prongs. It should be remembered that this socket should be purchased with the 1S4 tube. It is a special socket made to fit this series of tubes.

What has been said about the receiver also holds with the transmitter in so far as the tube and socket are concerned. The transmitter of this set is unique in that it has no tuned circuits. It uses a quartz crystal ground to the desired frequency. (The frequency of the transmitter can be altered by merely changing the crystal.)

The oscillator circuit is of the Pierce type which explains the lack of a tuned circuit. The radio frequency choke is available in any radio parts store. It is not advisable to attempt to wind this as the unit itself is not expensive. At the point marked "X" in the diagram of the transmitter circuit, an antenna may be connected preferably through a small mica condenser of .0001 M.F. capacity. The purpose of this would be to prevent overloading the oscillator. The antenna should be 30 feet long, if possible; longer if better results can be ob-

*1940 Marconi Memorial Scholarship Winner.



Top diagrams—Transmitter diagrams. Bottom diagrams—Receiver hookups.

tained. This can be determined by test.

The battery cases are made from thin pieces of tin soldered as shown in the photograph and made to hold eight pen flashlight cells each. Any other standard cells can, of course, be substituted, such as dry cells, flashlight cells, or suitable block "B" batteries. These cells are connected in series in one case and in the other case six are connected in series and two are connected in parallel. Naturally, the bottom of these metal battery cases must be well insulated to prevent shorting the cells and the same holds true of all connections in the transmitter and receiver. The crystal oscillator, for example, must be well insulated from the case. The battery cases are connected together by a flexible cord. If both transmitter and receiver are to be used simultaneously or in conjunction with each other, two sets of batteries should be employed, one for each.

Great care must be preserved to see to it that no connections accidentally touch the ground or touch each other. The construction should typify any similar high frequency wiring practice.

A standard telegraph key can be used in the transmitter or the very simple "pocket style" key made from ordinary discarded jack switch may be employed. This is shown in the photograph. However, with such a key no speed can be attained in transmitting and therefore the regulation keys are recommended.

In the operation of the receiver, the tickler coil must be so positioned with relation to the secondary winding that you will hear a hissing sound when the tickler is adjusted properly. A movement to one side of this will stop. (This position is outward from the chassis.) Moving the tickler toward the chassis will cause the circuit to oscillate but moving the coil too far toward the chassis will lower the sensitivity. If the circuit does not oscillate properly try reversing the connections to the tickler. To tune the circuit the small midget condenser is rotated by an insulated screwdriver. (If the builder desires he can fit a small knob to his condenser.) The receiver should have an antenna, the same as the transmitter.

There is nothing intricate in getting the transmitter to work if the circuit is connected as illustrated in the diagrams and a good crystal is used. The power input to the transmitter is .06 watts and the plate current is between 2 and 3 milliamperes when operating correctly, hence it is necessary that the individual using the transmitter be a licensed operator. It is illegal to operate the transmitter without a license.

With a good pair of phones signals from stations 1,000 miles from the receiver will be heard at a good volume. By moving the tickler out from the chassis you will hear a whistle. Then by moving the tickler out from the chassis just the barest fraction of an inch this whistle will cease and you will hear radio telephonic communications when the set is tuned.—Courtesy *Science Service*, American Institute of the City of New York.

Coil Data

L_1 indicates the secondary winding; L_2 the tickler and C_1 the maximum capacity of the condenser. All coils are close wound on form specified in text.

For 160 Meters

L_1—110 turns No. 32 enamel
L_2—20 turns No. 32 enamel
C_1—225 Max. MMFD. trimmer

For 80 Meters

L_1—60 turns No. 30 enamel
L_2—14 turns No. 32 enamel
C_1—150 Max. MMFD.

For 40 Meters

L_1—35 turns No. 28 enamel
L_2—9 turns No. 32 enamel
C_1—100 Max. MMFD.

BOOK REVIEW

CALLING C-Q, by Clinton B. DeSoto. Cloth covers, 292 pages, size 5½ x 7¾ inches. Published by Doubleday, Doran & Co., N. Y.

Everyone interested in the dramatic story of amateur radio men's exploits, will find this book "must" reading. Mr. DeSoto describes the human side of amateur radio—heroic tales of midnight watches by radio amateurs, who have helped to alleviate human sufferings in floods and storms. Such long distance amateur contacts as those made with Commander Byrd in the Antarctic and others are interestingly told. The valuable work performed by Hams in the interest of science are given a place in the book, and a great deal of valuable research in short-wave transmission has been carried on by the Ham fraternity, although little known to the general public.

RADIO LABORATORY JOB SHEET MANUAL, by Sol D. Prensky. Flexible cloth covers, 78 pages, illustrated, size 8¼ x 11¼ inches. Published by Radiolab Publishing Co., Brooklyn, N. Y.

The real student of radio will like this book, as a series of experiments are given, these being divided into groups such as—voltage control, electro-magnets, voltage by induction, telephone and carbon microphone, simple tests for radio parts, how the vacuum tube works, etc. The author is an instructor in radio in Jefferson High School, Brooklyn, N. Y., and is also the author of "Learn by Experimenting Course." Clear diagrams are later given, showing how to hook up the meters to the various radio apparatus, so that the person reading the book can easily set up the apparatus in order to carry out certain tests, just the same as he would were a personal teacher present.

VACUUM TUBE VOLTMETERS, by John F. Rider. Stiff cloth covers, 180 pages, illustrated, size 5¾ x 8¼ inches. Published by John F. Rider Publisher, Inc., New York, N. Y.

The opening chapters of this valuable treatise deal with the fundamentals of vacuum tube voltmeters, with simple diagrams illustrating just how they work; including the diode vacuum tube voltmeter, the triode vacuum tube voltmeter, etc. Later chapters take up the slide-back vacuum tube voltmeter; the rectifier-amplifier; tuned vacuum tube voltmeters; A-F and logarithmic voltmeters; E, I and R measurements, etc. Final chapters cover design and construction, as well as the calibration and testing, of vacuum tube voltmeters—with a very valuable chapter on the application of V-T voltmeters, including signal-tracing, measuring transformer turns-ratio, low frequency impedance measurements, measuring inductance, capacitance and resistance, etc.

SIMPLIFIED RADIO SERVICING BY COMPARISON METHOD, by M. N. Beitman. Stiff paper covers, 108 pages, illustrated, size 8⅜ x 11 inches. Published by Supreme Publications, Chicago, Ill.

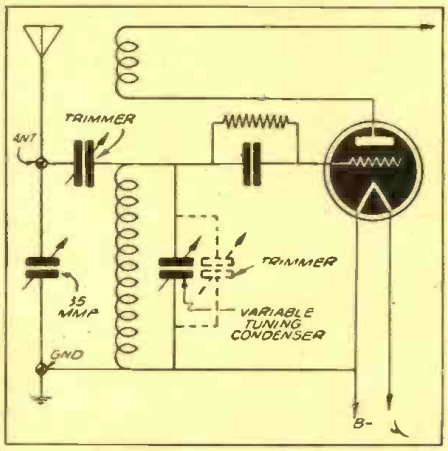
This book will appeal especially to students and beginners in the servicing field, and may well prove its value to many Old-timers. It gives, in crystallized form, simple methods of quickly locating faults in receivers. A tube data chart is included, and the symbols used in diagrams are shown and explained in the opening chapters. Later, the reader learns about small receivers and trouble-shooting on them. Large diagrams, printed in white line on blue backgrounds, together with simplified instructions, explain how to locate trouble on various types of sets, including automobile sets and the alignment of I.F. stages.

Diagrams of Interest

This is a new department. If you have a new Hook-Up, send it along; a pencil diagram will do. Be sure to include a brief description.

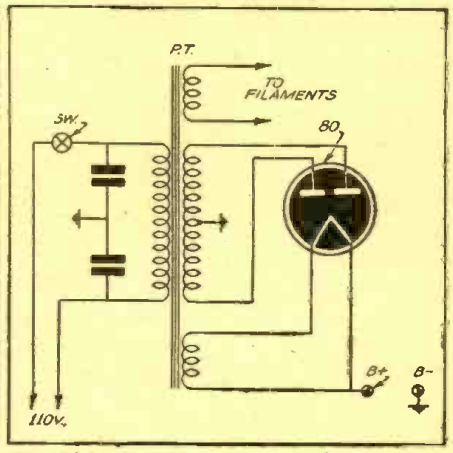
All diagrams and descriptions accepted and published will be awarded a year's subscription. Diagrams may be for receivers, adapters, amplifiers, etc. Send them to Hook-Up Editor, RADIO & TELEVISION, 20 Vesey Street, New York City.

"BAND-SPREAD" HOOK-UP



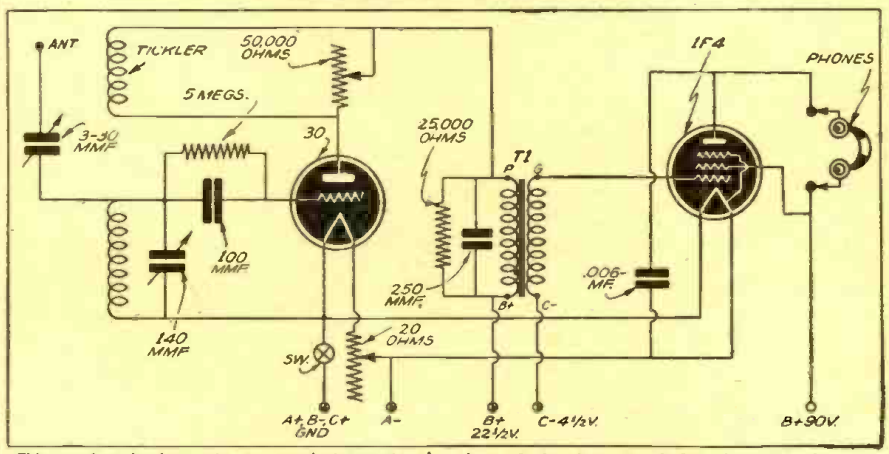
(Front Cover) This band-spread hook-up for short-wave reception has proved practical, says D. W. Dierauer, Rt. 2, Box 95, Alma, Wis. A 35 mmf. variable condenser is connected from Ant. to Gnd. as shown, in preference to the usual band-spread connection (dotted lines.)

CONVERTING SETS



H. Malvin, Box 43, Cumberland, Ohio, suggests this power-supply circuit, when converting 6 and 32 volt sets for 110 volts A.C. An 80 rectifier is substituted for the vibrator. Instead of the old power transformer, one of 6.3 volt type is used. Use filter choke already in set.

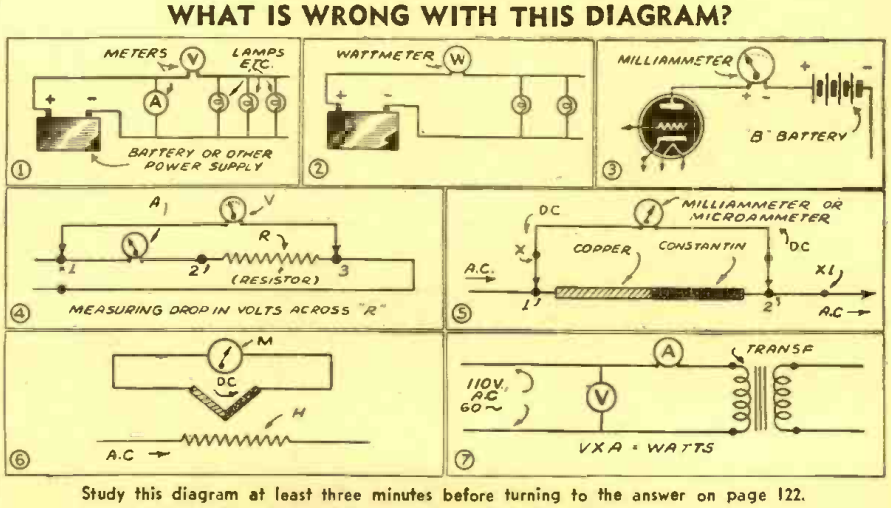
2-TUBE RECEIVER HOOK-UP



This receiver hook-up gives a good strong signal on a 10 ft. antenna. To obtain good results use good quality parts. Use an audio transformer of the ratio listed. Parts list: Condensers—C1, 3-30 mf.; C2, .00014 mf.; C3, .0001 mf.; C4, .00025 mf.; C5, .006 mf; Resistors—R1, 5 megohms; R2, 50,000 ohms R3, 20 ohms; R4, 25,000 ohms; Transformers—T1, No. T-13A34 3-1 ratio Thordarson A.F. transformer.

Allen J. Schwartz,
268 Clinton Ave.,
Albany, N. Y.

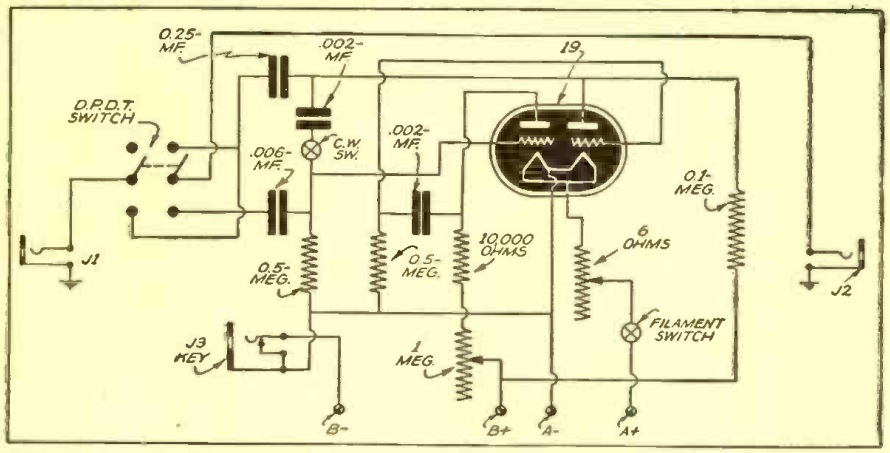
WHAT IS WRONG WITH THIS DIAGRAM?



Study this diagram at least three minutes before turning to the answer on page 122.

to the Radio Experimenter

AN "ALL-AROUND" 1-TUBE A.F. AMPLIFIER



● This *one-tube circuit* can be used for many purposes. Fundamentally it is a *resistance-coupled amplifier* with a double-pole, double-throw switch used to alternate two speakers (or headsets) between the input and output, so as to make a "talk-back" system.

By connecting the output section to the input, with a resistor and condenser, oscillations are set up, the frequency of which can be controlled to some extent with the potentiometer in the plate lead of the input section. The closed-circuit jack in the B-lead to ground permits the insertion of a key for code practice.

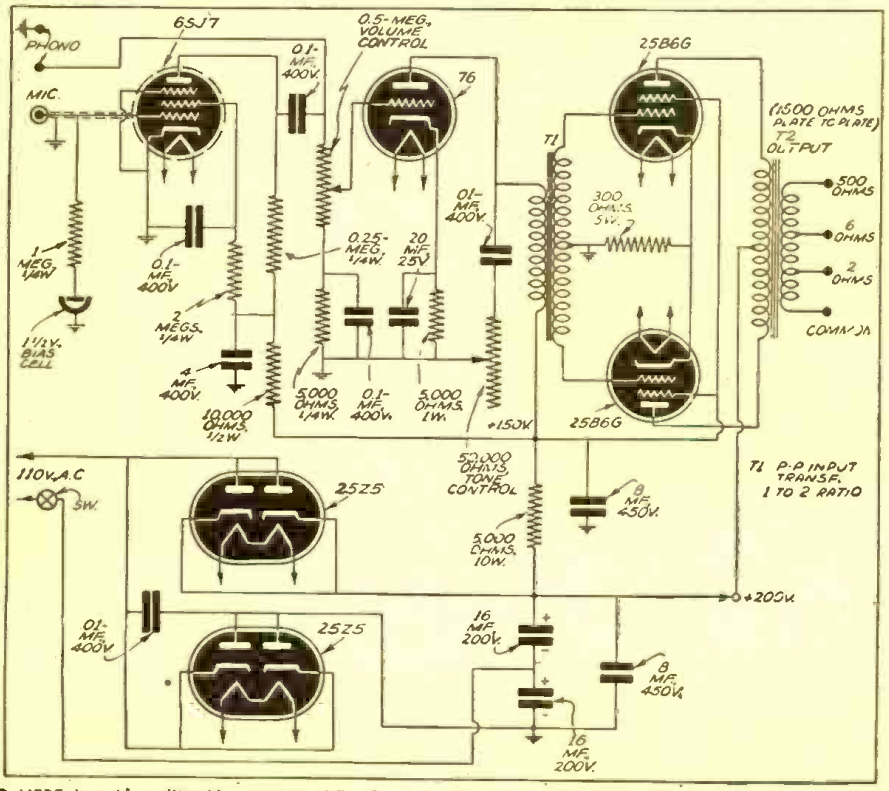
Although a 2-volt type '19 tube was used, practically any dual element tube may be used.

This unit will not give hi-fidelity reproduction as an amplifier for musical purposes, with the circuit constants indicated, but does give good *voice* reproduction. Employed as the audio stage of a simple S.W. receiver, it will provide enough power to operate a small magnetic speaker on most stations, with ninety volts on a '19 type tube.

An improvement as an amplifier would be a 0.5 megohm volume control used in place of the fixed grid resistor of the output section.

E. D. Butt,
R. D. No. 1,
Gnadenhutten, Ohio.

A FOOL-PROOF LOW-COST HI OUTPUT AMPLIFIER



● HERE is a hi-quality, hi-output amplifier for use on A.C. current only, giving as much as 22 watts peak output.

The tubes used are 2—25Z5's, 1—76, 1—6SJ7 and 2—25B6G's for pentode output.

The 25Z5 rectifiers are used in a voltage-doubling circuit and deliver under full load of amplifier (which is about 145 ma.) approx. 200 volts of hum-free D.C. The author has built and used this amplifier and has had very good results with it. The entire unit is constructed on a metal chassis 12 x 7 x 3 inches. The gain is more than ample, using any crystal or dynamic microphone, having an output of around 54-db. Provisions are also made for phono pickup. Features are low cost, fool-proof, hi-fidelity, hi-output, utilizing pentode output operation, compactness and light weight. The volume control has a resistor in series with it; a fixed condenser, tapped and connected to ground, permit bass booster control. A switch may be connected in conjunction with it, to shunt it out if not needed. Output is for voice coil or line. We use the amplifier in public address with 3—8-inch PM speakers, crystal mike and crystal pickup. Input is for hi impedance. Shielding the input from the input connector to grid of the 6SJ7. The output impedance is 1500 ohms plate-to-plate, although one with 2000 ohms will work. Be sure to connect the 2-16 mf. voltage-doubling condensers as shown.

Ed. Keers, 7850 Constance Ave., Chicago, Ill.

Edited by Herman Yellin, W2AJL

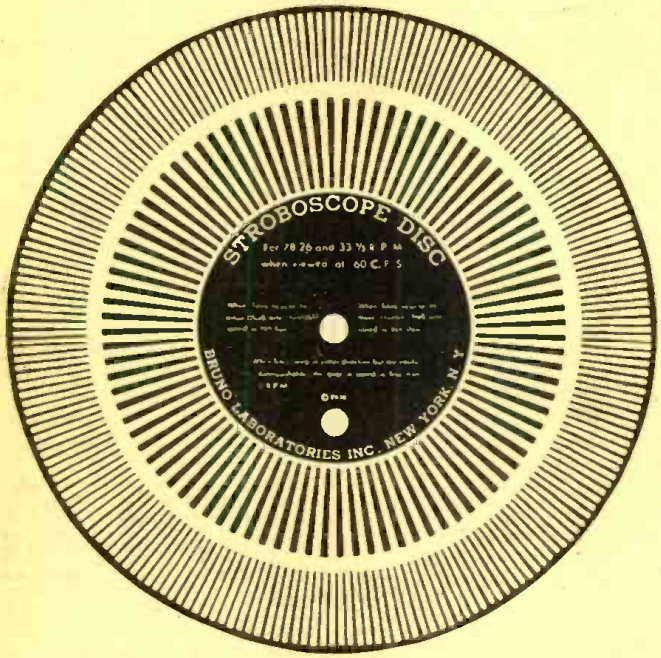
Stroboscope

What is a stroboscope?—J. Schneider, Detroit, Mich.

A. Stroboscope discs are used to check the speed of phonograph motors. These small discs of cardboard are imprinted with a number of radial lines, the number of which is definitely related to the frequency of the flashing light used to illuminate the disc, which is rotated by the phonograph motor. The frequency of the flashing light and the speed of the phonograph motor determine the lines in the disc and when the disc is turning at its rated speed and illuminated at the proper flashing frequency, the lines will appear to remain *stationary*.

This is so because the light flashes on only when the lines are in the one position and when the light is off, the lines move up to the position occupied by the preceding lines of the disc. For checking ordinary phonograph motors, the ordinary 60 cycle house supply can be used and although an ordinary filament bulb can be used, a neon bulb of one or two watts will produce much sharper lines.

We are printing a stroboscope for use with 60 cycles A.C. for phono speeds of 33 1/3 r.p.m. and 78 r.p.m.



This stroboscope disc may be redrawn larger size. It will be found very useful in checking phonograph speeds as it will indicate when the turn-table is revolving at 33-1/3 r.p.m. or 78 r.p.m. (No. 1252)

Line Filter

I am greatly troubled with power line interference on the short waves. Can you furnish me with information on a line filter for use with my superhet.?—N. Rose, Stamford, Conn.

A. A pair of 0.1 mf. condensers, one connected from each side of the 110 volt line to ground at the receiver is frequently of some help. Sometimes a pair of R.F. chokes placed in series with the line and bypassed on each side with 0.1 mf. condensers is also of some assistance. The best method of all, however, is to eliminate the noise at its source, that is, use such filters as the above mentioned, directly at the noise producing electrical instrument.

Battery Set Question

I plan on constructing the 3-tube battery set described on page 564 of the January issue, but I am somewhat puzzled by the type of tube sockets to use.—W. Poole, Aurora, Ill.

A. All three tubes use 8-prong octal sockets. However, the tubes do not make use of all the prongs, so some of the socket contacts will remain unused. The numbers shown around the tubes on the diagram refer to the terminal number of the socket. Most octal sockets are numbered from one to eight on the underside of the socket.

Adding Audio Stage to "Duette"

Can you show me how to add a stage of audio to the "Duette" battery-operated receiver described in the March issue?—G. Spaiel, Lehew, W. Va.

A. A diagram showing the method of adding a tube of audio amplification is shown here. The tube used is the 3Q5GT. Note that the double filament is connected in parallel, similarly to the 3A8GT, for operation on 1½ volts. The coils used can be any two winding plug-in coils, complete data on which was published in the March issue.

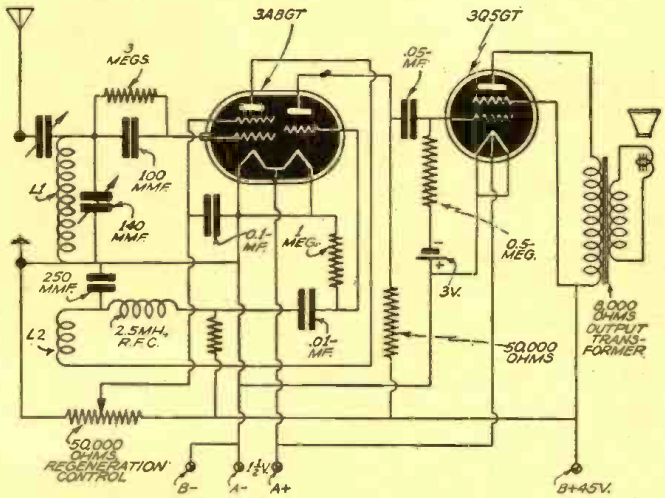


Diagram above shows one method of adding a stage of audio amplification to a small battery-operated receiver of the Duette type, described in the March issue. (No. 1253)

Hi-Fi Amplifier

I am building the high fidelity F-M amplifier described in the January issue for use with a T.R.F. tuner. What changes should be made in the input circuit, since I notice there are two poles coming from the volume control.—N. Kraft, N. Y. C.

A. The amplifier was provided with two inputs so that two tuners could be used with the single amplifier. For use with only one tuner, merely eliminate the two 0.1 megohm input resistors and connect the tuner output in series with a .1 mf. condenser to the top of the volume control. Substitution of a 1000 ohm field for the second choke will result in some drop in voltage, but this can be tolerated.

Interference

I have an eight-tube all-wave radio set which persists in bringing-in code signals between JGEI (9690 kc.) and VLQ5 (9680 kc.). Is there any way of eliminating this signal?—A. Abernathy, Daytona Beach, Fla.

A. There is no way to eliminate a station on its properly assigned frequency, other than tuning it out. Use of extra trap circuits will result in the non-reception of any other stations on that frequency.

Cathode Resistor

Can you advise me as to the value of the cathode resistance in the push-pull 2A5 amplifier shown on page 498 of the December issue?—E. Williams, S. Weymouth, Mass.

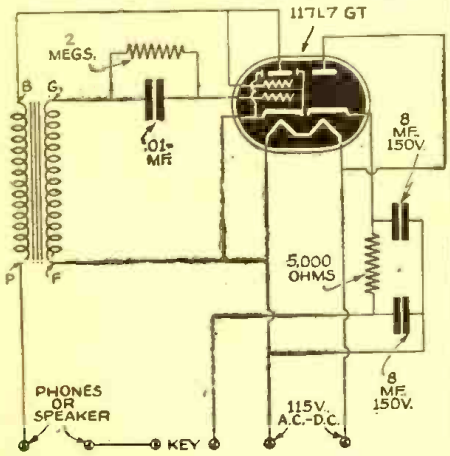
A. The cathode resistor should be 320 ohms and capable of dissipating 5 watts.

Queries to be answered by mail (not on this page) should be accompanied by fee of 25c (stamps, coin or money order). Where schematic diagram is necessary, our fee is 50c up to 5 tubes; for 5 to 8 tubes fee is 75c; over 8 tubes, fee is $1.00. *No picture diagrams can be supplied.*

Code Practice Oscillator

Could you print a diagram of a code practice oscillator, suitable for operating from the electric light line?—A. Schmidt, Albany, N. Y.

A. The 117L7GT tube is well adapted to your purpose since it contains a rectifier section as well as a pentode section. The filament is rated at 117 volts and no line cord resistor will be necessary. If at first the oscillator refuses to "perk," merely reverse the connections to either the primary or secondary windings.



Simple code practice oscillator. (No. 1254)

Untuned 10-Meter R.F. Stage

Please print a diagram of a highly efficient, untuned R.F. amplifier for ten meters. I wish to use an untuned amplifier in order to eliminate the necessity for changing coils.—E. W. Keller, Williamsport, Pa.

A. Untuned R.F. amplifiers, especially at the higher frequencies, are highly inefficient and therefore are not recommended, since the only benefit derived from it would be to isolate the antenna from the receiver and make the receiver's first stage tuning independent of the antenna. Untuned R.F. stages can also be used with regenerative and super-regenerative receivers to prevent any radiation from the detector. They are not worth the trouble of installing in a superhet receiver.

Converting Set for Short Wave

I have a small T.R.F. commercial "broadcast" band receiver and would like to change it to short-wave operation.—B. Gayso, E. Port Chester, Conn.

A. A comparatively simple method would be to remove the R.F. coils and substitute 4 or 5 prong sockets in their stead. In this way, the original coils can be plugged into the set later on. Sets of coils can be made up to cover various sections of the short-wave spectrum. If broadcast operation is no longer desired, it might be advisable to replace the original tuning condensers with smaller units; about 140 mmf. units will give good station spread, when used with a vernier dial.

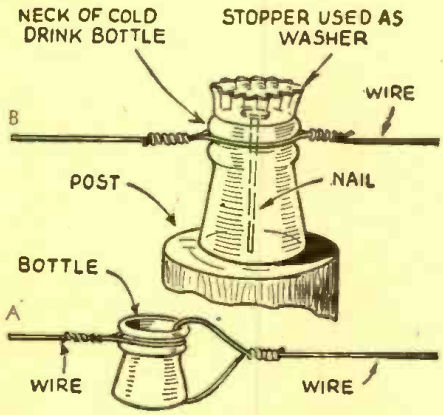
In winding the coils, care should be taken to make all the coils for a particular frequency range as much alike as possible, in order to minimize any "tracking" difficulties.

The Cover Kink

First Prize Winner

HOME-MADE INSULATOR

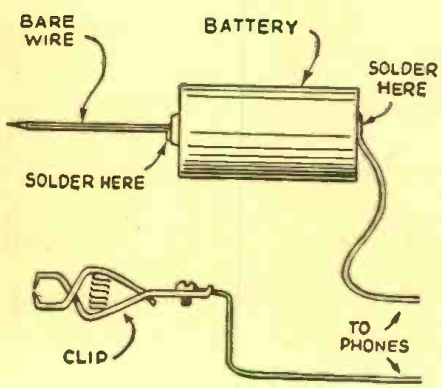
Here is an insulator which is especially suited for the radio experimenter who has an empty pocketbook. It is made from an empty screw-top bottle which has been cut or broken the desired length. When used to insulate a wire from a post, a cold drink bottle cap must be used with the nail as a washer. In Fig. A one wire goes through the center and the other goes in the threaded groove. In Fig. B it is attached as shown. The method shown in Fig. A can be used to insulate two wires from each other, guy wires, antennas and corner posts. Method B is used to insulate a wire from a post.—*Gene Clardy.*



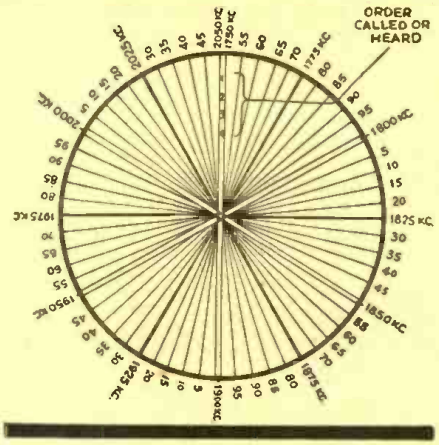
TEST DEVICE

With this device I found a broken connection in the voice coil of our radio set. The bare wire is about four inches long and is soldered to the positive tap of the battery. One lead of the earphones is connected to the negative post of the battery. On the other lead to the earphones a clip is connected. When an object is under test, connect the clip to one terminal of the object under test and touch the bare wire, which is soldered to the battery, to the other terminal. If a click is heard in the earphones, the circuit is good. If no click is heard the circuit is open and should be repaired.

Many things, such as transformers, coils, chokes, speaker field and voice coils, etc., can be tested with this tester.—*Logan B. Lawson.*



STATION LOCATOR



Many times when a CQ is called and an answer is listened for—more than one amateur will come back to the operator who called the CQ. Here is the kink I use so I will know where to look for the boys that do come back. As I hear the station, I place a pin in the chart at the approximate frequency. Many times 3 or 4 come back. When I can't hear any more, I use the chart for reference. In that way I know just where to look for the fellows. Then I pass the information down the line, so that everyone will know where to look for them. Many other uses can be found for this chart. Although the 160 meter band is shown, the same idea applies for any frequency.—*W2MPT.*

TEST PRODS

The accompanying diagrams show very serviceable test prods made out of mechanical pencils whose mechanism has become inoperative (diagram A); or mechanical pencils of the variety in which the mechanism is still operative (diagram B). Diagram A shows the two-section type pencil converted by inserting a darning needle (soldered in place within mechanism) in the end. In the top end a hole is drilled just large enough to accommodate a phone tip jack—this being screwed in, as it makes its own threads in the composition material. A flexible wire extends from the phone tip to the mechanism. To effect this, first remove the mechanism by pulling it out, solder the wire to it, then replace. Now thread wire through the barrel, solder to phone tip jack and screw top half of barrel on to the latter. Then screw the two sections of the pencil together. If desired, the external lead-wire may be run directly in to the mechanism (through a smaller hole), thereby leaving no part of the circuit exposed to contact at this point.

Diagram B shows a prod made from a 15c type pencil. In this one a needle, suitably filed down, is inserted in the end and may be retracted, when not in use, in the same way as a lead. At the other end the original top is removed and the lead-wire soldered directly to the end of the propelling mechanism. A slip-over type eraser slips over the top to insulate this exposed portion from external contact. For this prod the propelling mechanism should work rather stiffly for best results.—*Gordon Soderlund.*

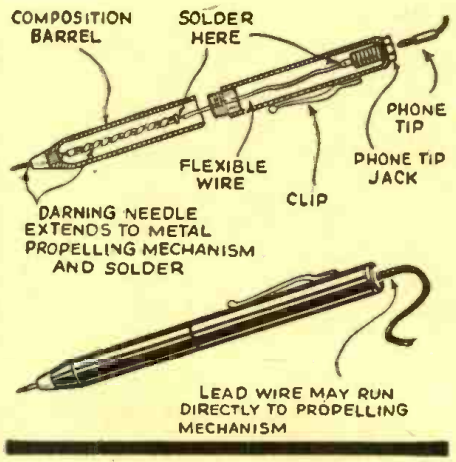
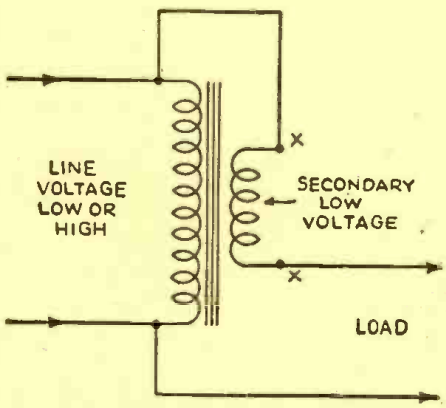


Fig. B—Top; Fig. A—Below.



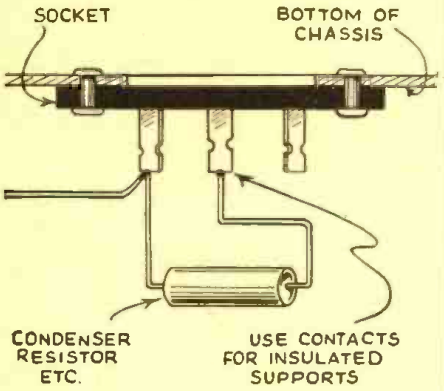
VOLTAGE BOOSTER

Here is a kink that may save some of the boys from embarrassment. I had a P.A. job to set up and for some reason the amplifier did not work. As there was juice in the wires and the tubes lit up and all connections were OK I finally decided to test the line voltages. Sure enough it was way below normal. To fix this I dashed home, raked amongst the junk and uncovered an old bell transformer with numerous taps in the secondary. (A toy-train transformer does the job swell.) I connected this with the secondary, boosting the line voltages to bring it up to 115 volts, *with the load on.* The P.A. system worked like a top. This system can also be used to lower the line voltage by reversing the connections at X. Make sure X is connected the right way, because one connection boosts the voltage and the other bucks it.—*Burleigh Jackson.*

RADIO KINKS published on these pages will win their senders 6 months' subscription to RADIO & TELEVISION. The *best* kink published each month will win a *2 years'* subscription. Read these kinks; they will be of real use to you, besides indicating what is wanted. Send a typewritten or ink description with sketch of favorite to the Kink Editor

USE FOR OLD SOCKETS

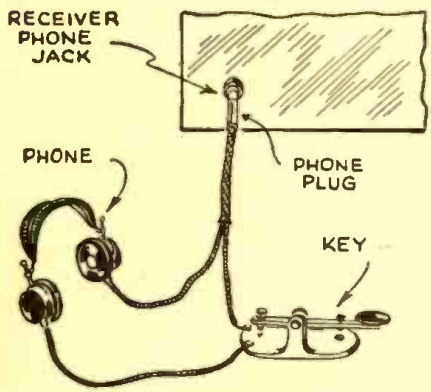
Old tube sockets which cannot be used on account of a missing contact can be used as a "terminal strip" by bolting it, inverted, to the bottom of the chassis. Another use for old sockets is to employ them in connection with a multi-prong plug as a "switch." Some experimenters use several sockets and plugs in this fashion with "tie" cables. —*Dixon Deemer.*



"Terminal strip" made from old socket.

CODE PRACTICE KINK

As most amateur receivers have a beat-note oscillator and phone jack, a practice code signal can be obtained by using the beat oscillator tuned in with the Government frequency standard station, which is on the air most of the time, with a steady signal or with the signal alone, if the receiver does not have the beat-note oscillator. Merely hook a key in series with the phones and plug into the receiver's phone jack. On regenerative receivers it is very easy to have the set oscillate slightly and get a steady signal. There are many ways to obtain a suitable signal from most receivers.—*W. E. McClain.*



A simple code practice set-up.

CARBON GRANULES FOR MIKE

Here is my kink for making carbon granules for an experimental microphone. I tried several methods before this, but never succeeded in making them work.

Here is the kink. Split an ordinary lead pencil to obtain the lead. Cut the lead into lengths of about 1/16 of an inch. Then take two pieces of wood and glue fine sandpaper to *one* side of both of the pieces. When this is done, put a few lengths of the lead (that has been cut) in between the boards and rub with a circular motion. Then to polish, rub (in circular motion) on reverse side of board. These granules are superior to some that I have bought.—*William Pederson.*

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Dry Recording Paper

Makes Facsimile Easy

H. W. Secor

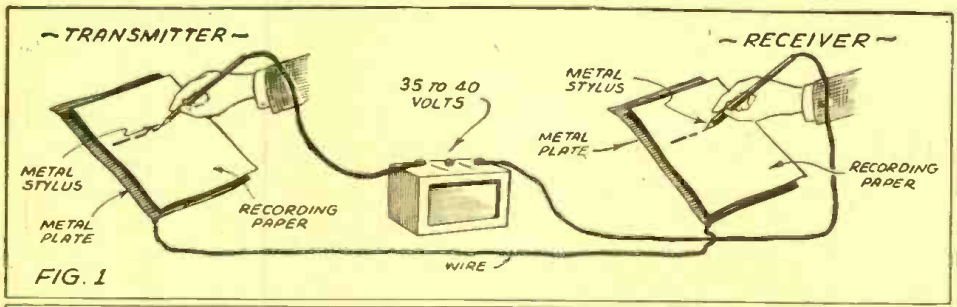


FIG. 1

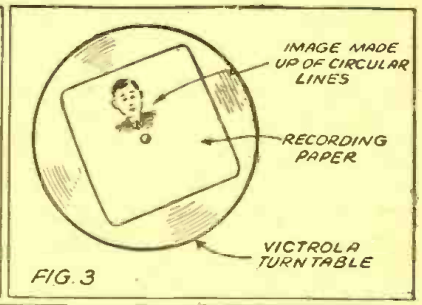


FIG. 3

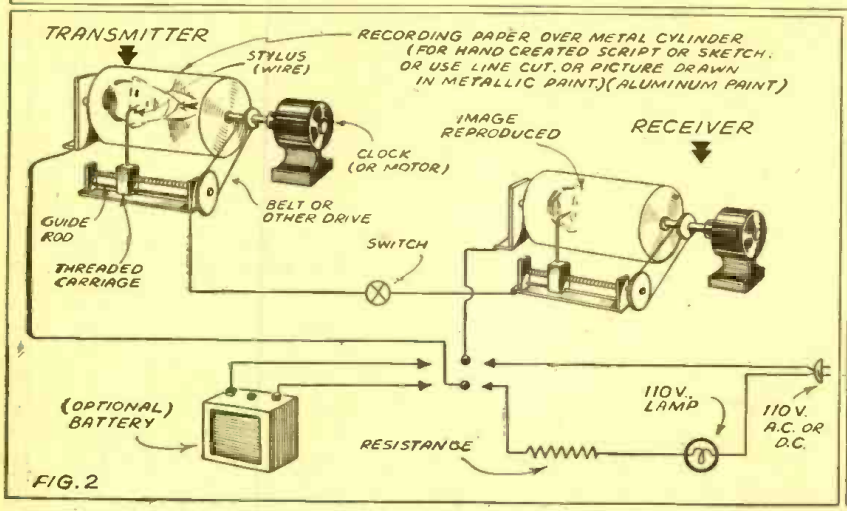


FIG. 2

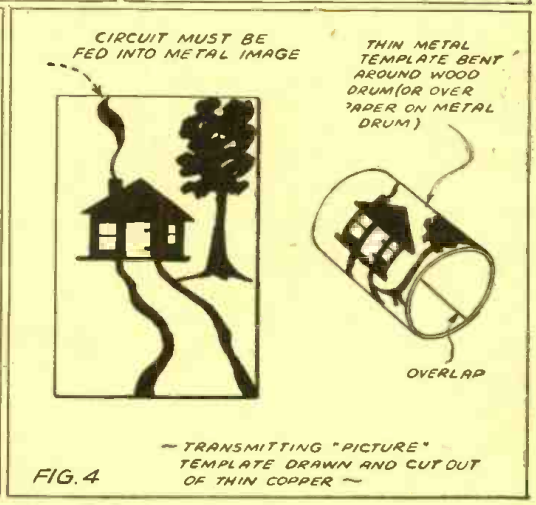


FIG. 4

Several methods of carrying ouf simple facsimile experiments are illustrated herewith.

● THE radio experimental world has long awaited a dry recording paper which can be purchased at a fair price, and with which many simple and interesting experiments in facsimile can be carried on. Such a paper is now available and has been developed through extensive research by the Western Union Telegraph Company. A number of commercial recording apparatus of various types are already using this remarkable paper, which is known by the name of Teledeltos. *Teledeltos* is an electrically conducting sheet, covered with a material which presents a permanent change in color at any point where an electrical current passes through the composite sheet. Neither the coating nor the record is affected by light or atmospheric conditions.

In our experiments with samples of the paper, which comes in high and low resistance grades—known as grade H and grade L, respectively—a number of interesting samples of writing, as well as drawings and sketches were made with various voltages and kinds of current. Some of the best electric writing on this new recording paper was made with 35 volts D.C. obtained from a 45 Vt. "B" battery. The voltage in any case should be regulated with a variable resistance, such as a potentiometer.

The recording is made practically instantly. Thus the lines composing written script or a drawing of a building, ship, etc., can

Interesting "facsimile" experiments may be carried on with batteries and simple home-made apparatus.

be made at any speed which the experimenter might care to use. Another interesting point is that high-frequency modulation carrier signals may be applied directly to the stylus and platen for radio recording.

One of the simplest experiments (which proves very interesting and also represents the basis of present-day facsimile picture transmission) is shown in Fig. 1. Here the person at the transmitting stylus moves the stylus (or metal pencil) over the paper at an even speed, from left to right, down the page; if the person at the receiving station also moves the metal stylus (or pencil) over the paper at the same approximate speed, whenever the transmitting operator makes contact with the paper, the person at the receiving end will see dots and dashes appear, as if by magic, on the paper before him. It will be readily conceived of course that with a little practice, simple sketches and even crude hand-writing may be reproduced in this manner.

The next step of course is to put our "experimental facsimile" on a more scientific basis, so as to get a regular methodical scanning of the paper. In Fig. 2 we give a suggestion of how this may be done. A couple of old clocks can easily be rigged up to rotate drums made of old tin cans (or else round wood forms) around which sheets of the recording paper are placed. If wood or cardboard drums are used, then a piece of thin metal or even tin-foil should be placed over the drum first, and the *teledeltos* recording paper placed over the metal platen. The recording paper may be held in place by rubber bands or clips.

For short distances such as between rooms or adjacent houses, a voltage of about 40 to 50 is sufficient to record the images. The necessary voltage may be obtained by connecting a suitable resistance in series with 110 volt A.C. or D.C. circuits, but an ordinary 110 volt lamp is not sufficient, as our experiments proved. The Western Union engineers, in fact, recommend that a resistance of 6,000 to 10,000 ohms be used in series with 110 volt A.C. or D.C. circuits, where relatively low speeds such as 1 inch per second is employed. At a speed of 24 inches per second for the moving paper, the voltage supply should be at least 400, the same engineers recommend, and the current through the recording paper should reach approximately 30 ma. to produce marks of maximum contrast.

The experimenter will discover some method of getting the drums at the receiver and the transmitter to revolve at the same

speed, using old phonograph motors with their attached governors, etc. Old clocks can be rigged up to do the work, with a little experimenting; some of the gears or the escapement will have to be eliminated to get the desired power and speed from the clock. Electric motors can also be used, especially those of the synchronous type.

The simplest way to transmit a design (or dots and dashes) with the drum type machines, is for the transmitting operator to open and close the circuit by means of a key or switch, or simply pull the stylus away from the metallic paper, whenever the line is to be interrupted.

An old line cut, obtainable from a printer, may be bent to fit on the drum, heating the plate so it will bend easily.

Another way to get the picture in line form is to draw it with aluminum or other metallic paint, allowing the paint to dry. How's this? Draw the sketch on a piece of thin metal, and then cut out all the metal except that needed to form the lines of the picture. (See sketch.)

Afterward the metal skeleton or template of the picture is curved around the drum, taking care that the template is connected to one side of the circuit of course. Still another idea for the experimenter is to draw the picture with heavy ink lines and while the ink (or paint) is still wet, metal powder (or powdered carbon or graphite) can be sprinkled on the wet lines. When dry, you will have a metallic line picture that can be transmitted by facsimile as here described.

For mounting and rotating the sending and recording elements, two old Victrolas may be used. In this case the pictures would be made up of circular lines. The machines may be the ones most handy, however, and they can be regulated to rotate at the same speed quite easily.

The Western Union experts mentioned that if an amplifier is used, best results are obtained if the output transformer provides an approximate impedance match to the paper. Marks made on this new dry recording paper will accurately represent the relative movement of the stylus, as there is no appreciable spreading. With proper paper speed, distinct marks representing 1/10,000 of a second can readily be recorded. The resistance of the conducting sheet as well as the thickness of the coating may be varied to meet special requirements.

Where a slow moving record is employed it may be desirable to also move the stylus. The *teledeltos* recording paper is available in rolls, as well as in large and small sheets. The rolls at present come in 25 inch and 30 inch widths; minimum length supplied 100 ft. The large sheets measure 25 inches wide by 23½ inches long and the small sheets come in sizes as small as 8 inch by 5⅜ inches. The minimum amount supplied of the small size sheets is 500 sheets. The grade H high impedance paper, which is ordinarily used in facsimile work, has an impedance of about 8,000 ohms when scanned with a .01 inch stylus, under 15 grams pressure, and recording 2500 cycles per second carrier signals. The recording paper can be supplied in widths other than the stock sizes by slitting.

The Editors are looking for good *"Electrical"* articles! Send 'em along!

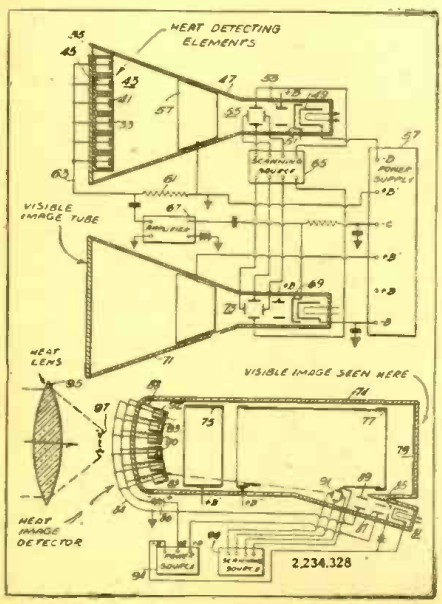
Interesting Radio Patents Issued Recently

DETECTS AIRPLANE BY HEAT WAVES

2,234,328—issued to Irving Wolff, Merchantville, N. J.

● THIS invention covers a device for receiving radiant energy, or for producing a visible image of an invisible body radiating heat waves, such as an airplane hidden by fog. The heat being radiated in the form of smoke from the stacks of a vessel in a fog (or at night) can likewise be detected with this apparatus (or an iceburg can also be detected, due to the radiation from the berg). Another practical use is for landing aircraft, where the field is marked with suitable heat radiators, and the receiving device located on the plane. Likewise the position of the plane above the obscured field could be checked by such a device on the ground, checking on the heat radiated from the plane's engine or exhaust. Changes in current are utilized (as produced by changes in the capacity between the plates mounted in the end of a special tube) when radiant energy (heat waves) is impressed on the heat-receiving elements mounted in the tube.

In one form of the device, the second tube is used to reproduce the visible image of the invisible object, while a second form (described in the patent) obviates this and makes use of but one tube. The cathode-ray from the electric gun assembly is focused on the heat detecting elements. The end of the tube instead of being made of glass in the usual way, is made of rock salt, fluorite, sylvite, or other suitable heat-transferring material. The changes in current establish voltage fluctuations which are impressed on the input of an amplifier, whose output is connected to the control grid of a conventional cathode-ray (image reproducing) tube. The section of the diagram in the lower part of the picture, shows the suggested single form of dual tube, which picks up the heat ray image of the invisible object, and translates it into a visible object at the other end of the same tube.

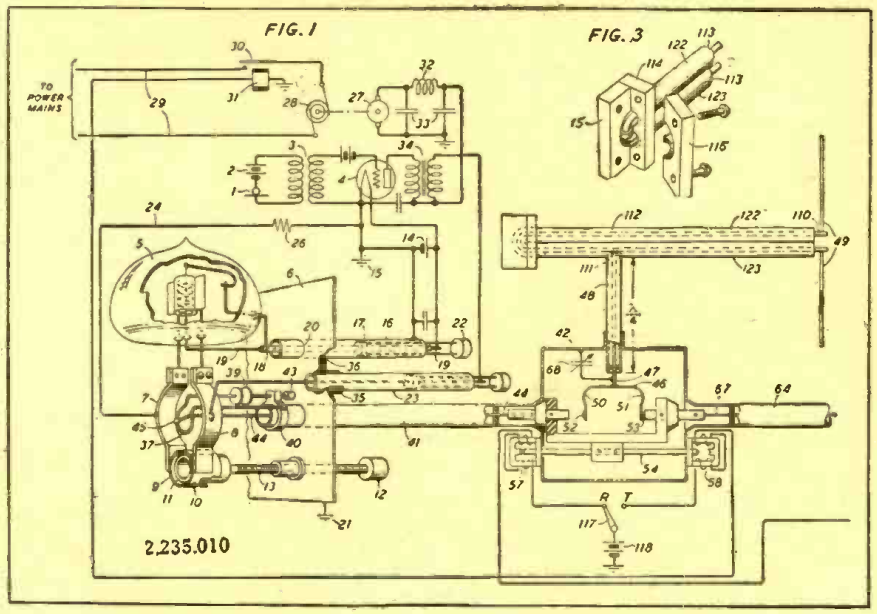


ULTRA SHORT WAVE SYSTEM

2,235,010—issued to Joseph G. Chaffee, Hackensack, N. J.

● THIS patent provides a switching system for alternately connecting a transmitter and a receiver for ultra short waves to a common antenna. One object is to avoid producing clicks or sounds in a receiver, and also to improve the control over the gain of a super-regenerative radio receiver. Further, one of the points in this patent, is the reduction of reflections at a switching point for the co-axial conductors which lead from the transmitter and the receiver to the antenna; also to reduce undesired radiation from an ultra high frequency transmitting oscillator. The device may comprise a transmitter and receiver, each enclosed in a shielded container, and connected by individual co-axial lines; also a dipole antenna joined to a third shielded antenna, enclosing a *transmit-receive* antenna switch.

To enable tuning of the oscillator at the very short wave-lengths involved, the variable tuning capacity of the frequency determining circuit, is connected in series with the internal grid-anode tube capacity, and is provided with a movable element which is not conductively connected with either the anode or grid of the oscillator tube. The receiver may be of the super-regenerative type, and is provided with a co-axial line system for introducing cathode heating currents, and adjusted to secure optimum operation of the receiver. Energy loss in the circuits between the receiver and transmitter, and also the antenna, are minimized by the special design of the antenna switch housing; and also by the switch itself, which electrically closes the contiguous end of one co-axial line whenever it connects the other to the antenna. A patent worth careful study by all radio students.

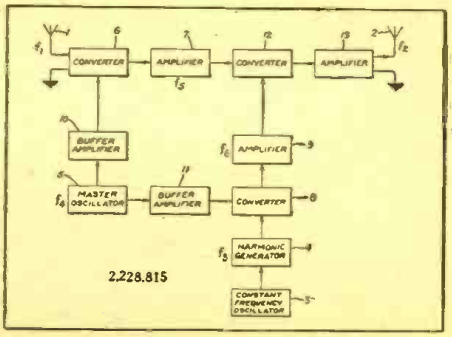


FREQUENCY CONVERSION SYSTEM

2,228,815—issued to Franklin M. Deerhake, New York.

● THE advantages of the double heterodyne conversion system, which comprises a first heterodyne conversion to an intermediate frequency at which the signal-modulated wave is readily amplified, followed by a second heterodyne conversion to the desired resultant frequency, are well known. Such a system requires two locally generated waves of different frequencies for effecting the consecutive conversions. Two independent oscillators may be employed or the two waves may comprise different harmonics of a particular frequency derived from a single oscillator. The former case permits greater flexibility in the choice of frequencies than the latter, but ordinarily the frequency of the resultant output wave is affected by any fluctuations in the frequencies of the two locally generated waves in a random manner. Consequently, the advantages of greater flexibility may be offset either by decreased frequency stability of the output wave or by the expense of providing oscillators of closely controlled frequency.

It is an object of my invention to provide an improved double heterodyne conversion system, which employs two separate oscillators and which has both flexibility and desirable characteristics.

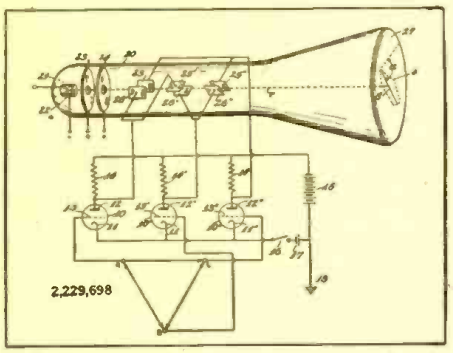


ELECTROCARDIOGRAPH

2,229,698—issued to Hans Erich Hollman, Germany.

● AS is well known, electrocardiographs depend for their action upon the fact that the action of the heart in the human or animal body is accompanied by voltage impulses known as biological action voltages or potentials of the order of about .001 volt between the limbs, such as between the right and left arms or between the arms and legs. By studying the characteristics of such impulses when they are recorded as continuous waves by an electric oscillograph on a light-sensitive surface, such as the luminescent screen of a cathode ray oscillograph or a photographic film or paper strip, physicians are enabled to determine certain facts concerning the function and condition of the heart.

For the practising physician, it is highly inconvenient and cumbersome to carry out separately for each patient the vectorial summation (triple measurement) of definite instantaneous values obtained from the three Einthoven leads connected to the patient. To overcome this inconvenience it has been proposed to apply two of the action voltages to separate deflecting systems of a cathode ray oscillograph, arranged with their axis at a right-angle, whereby a kind of Lissajou figure is obtained upon the viewing or recording screen, whose shape depends on the phase displacement between the action voltages being recorded. From the main axis of this figure certain conclusions may be drawn on the anatomical orientation of the heart. In order to fully complete the analogy with the Einthoven system, the coordinates of the recording system should form angles similar to those of the equilateral lead triangle.

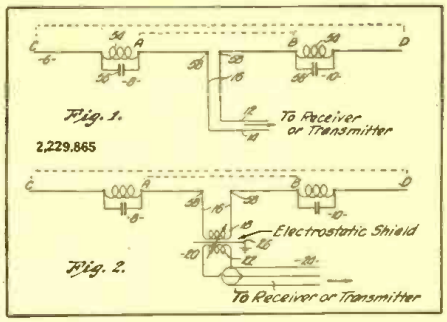


Cathode ray tube used to measure heart currents.

RADIO ANTENNAS

2,229,865—issued to Howard K. Morgan of Missouri.

● THE primary object of this invention is to provide an antenna system, the antenna of which is divided into a plurality of sections, between which is connected tuned anti-resonant circuits that serve as electrical insulators for currents having frequencies for which the circuits are resonated. Also to eliminate standing waves on the transmission line feeding or receiving energy from the antenna, so that efficient transfer of such energy will automatically occur without the necessity of employing compensating circuits; and that serve as means for presenting a constant impedance from the antenna.



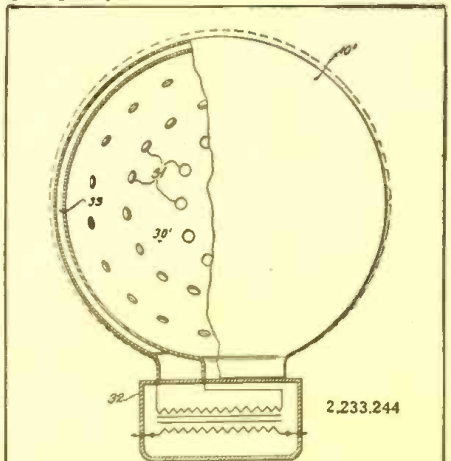
Antenna System

A further important object of the invention is the provision of an antenna system having a single wire antenna, with a two-wire antenna feeder, which feeder is electrically connected to the transmission line leading to a remotely positioned receiver or transmitter by a transformer, between the coils of which is disposed an electrostatic shield for the purpose of preventing any vertically polarized disturbance, or other radiation, from being conveyed down the concentric line with the signal. This shield is used to a greater advantage with radio receivers than with radio transmitters, but its presence does not lower the efficiency in the antenna system and therefore, it is desirable to include the shield whenever the aforesaid transformer is used as a means for connecting the antenna feeder or lead to a concentric transmission line.

SOUND REPRODUCER

2,233,244—issued to Manrico Compare, Milan, Italy.

● THIS loud speaker may comprise a spheroidal or curviform structure, adapted to vibrate at sound frequencies and to assume a swelling and subsiding at each vibration, the outer surface of which radiates sound in all directions. The air contained within the spheroid sections has no communication with the outer air, hence the elimination of a baffle or screen as employed in the present day cabinet. Accordingly, the invention broadly comprises a sound reproducer substantially spheroidal in conformation and combined with sound modifying means. One form of this arrangement is characterized by adjacent curviform diaphragms, such as spheres, spheroids or sections of same, one of which has the function of producing and emitting sound waves and the other the function of making said diaphragm aperiodic.



Novel Loud speaker

One of the features of the present invention comprises the positioning of elements within the vibratory structure, which elements have the function of making the same perfectly aperiodic. The elasticity of the air contained inside the spheroid or sections of it, while allowing structure itself to expand and contract freely at all acoustical frequencies, also acts as a resilience to cause resonance at certain frequencies. It is therefore desirable to incorporate the damping elements which may consist of spongy materials, labyrinths or other elements. The vibratory spheroid may be actuated by a moving coil, a moving armature, or by a piezo-electric system, instead of employing an electromagnet for vibrating it.

Please turn to page 127 for complete details on another FREE book given with subscription.

Short Wave DX Tips

Joe Miller

"DX" Editor

All Times E.S.T.

● A YEAR has passed since our last DX column in R. & T., and now, with this mention of some of the recent high-lights in foreign reception, we return. This is being written to ascertain the general response to such a column, and, should there be sufficient interest evinced by readers' letters, we will continue a DX column on full scale. It's up to you. Write in, even a card, and let us know. Greetings to all of our old DX friends here. Now for DX:

Africa

FZI, 11.97 mc., at Brazzaville, French Equatorial Africa, is well heard through U. S., and should be tried for by all, as they now verify. Sked is 1-1:30, 8:30-9:30 A.M., 2:45-2:55 and 10-11 P.M. Well heard on all but 2nd Xmsn, and has been heard well after 3 P.M. Recently, at 3 P.M., a steady heterodyne was placed in the center of FZI's signal, no doubt an enemy signal intentionally ruining the program, as this is a Free French station. Address reports to: Mon. C. Desjardins, Radio Française Libre, Brazzaville, French Equatorial Africa. Also operating, probably as comm. phones, are FZI2, 11.67 mc., and FZI4, 6.677 mc., also at Brazzaville, all using 5 kw.

CUQ2, Madeira, on 5.03 mc., heard phoning Lisbon 5-6 P.M., may yet be heard from Eastern U. S. during spring. A new country to most, this catch can be verified by writing Co. Port. Radio Marconi, Rua de S. Juliao 131, Lisbon, Portugal.

SUV, 10.055 mc., Cairo, Egypt, along with SUX, 7.865 mc., broadcasts news in Italian, 12:50-1:10 P.M. These may also be heard phoning from early afternoon (SUV) to evenings (SUX). Then SUZ, 13.82 mc., often phones from late A.M. to about 2 P.M. All use 10 kw., along with SUR, 6.784 mc.

TPZ, 12.12 mc., Radio Algiers, on reg. sked of 7-8 A.M., 1:30-3 P.M., and 4-6 P.M., with good signal. TPZ2, 8.96 mc., with same sked.

OPL, 20.04 mc., OPM, 10.14 mc., and OQ2AA, which operates on 15.175 mc., and may be heard also on foll. freqs., 11.73, 9.55, and 6.01 mc., may be heard as follows: OPL and OQ2AA from 5:55-7 A.M.; OPM and OQ2AA from 1:55-2:45 P.M. QRA for all is: Service de l'Information, Cabinet du Gov. General, Leopoldville, Belgian Congo.

CR6RB, 10.953 mc., Benguela, Angola, using only 50 w., is reported from 2:30-3:30 P.M., and may be identified by the woman announcer, and signs off with native drums and Port. Anthem.

Asia

ZNR, 12.115 mc., Aden, Arabia, is a new country for all, operating daily from 12-1 or 1:30 P.M. English, Italian and French are among the languages used and reports can be sent to Cable and Wireless, Ltd., Aden Ras Boradli, Aden, Arabia. Power used is 500 w.

"Radio Levant," Beirut, Syria, heard between 8.025-8.035 mc., still another new country on phone, Xmits daily 12-12:20 A.M., and reports are to be mailed to: Service de la Radiodifusion, Haut-Commissiarat de la Republique Française, Beirut, Grand Liban, Syria.

HSP5, 11.715 mc., Bangkok, Thailand, Xmits daily near 8:30 A.M., with American dance records and English announcements. Is this HSP4, 11.72 mc., 8-10 A.M., ex. Mon?

"Radio Khabarovsk," on 4.273, 6.115 and 9.565 mc., in Siberia, formerly heard surprisingly strong in afts., 4-7 P.M., is now better rec'd on the A.M. Best, 6-8 A.M. Several months ago 6.115 was heard up to R9 at 5 P.M., and from Asia!

XOZS, 10.04 mc., is a new Chinese station opening at 6 A.M., and easily spotted on this freq.

PLG, 15.945 mc., and PLY, 9.415 mc., Bandoeng, Java, Xmits Sats. 11 A.M.-noon with English program. PLJ, 14.63 mc., is broadcasting native programs with fine sigs from about 7-9 A.M.

EQB, 6.155 mc., Teheran, Iran (formerly Persia), is on 8:45-11:45 A.M. and noon-3 P.M. May be tried for near 3 P.M.

Closing this brief outline with regrets, as space limitations prevent a much more complete resumé of interesting DX, we would appreciate hearing from all interested DXers as to whether this DX news should continue, of course on a larger scale. Please write c/o R. & T.

Our sincere appreciation to G. C. Gallagher, Roger Legge, Larry Lundberg, Murray Buitekant, and to the I.D.A. For a FB station list and complete DX news, write the I.D.A., Bloomington, Ill., enclosing 15c, and the latest copy of the *Globe Circler* will promptly be mailed. Our personal recommendation for this great monthly.

TELEVISION GOES COMMERCIAL

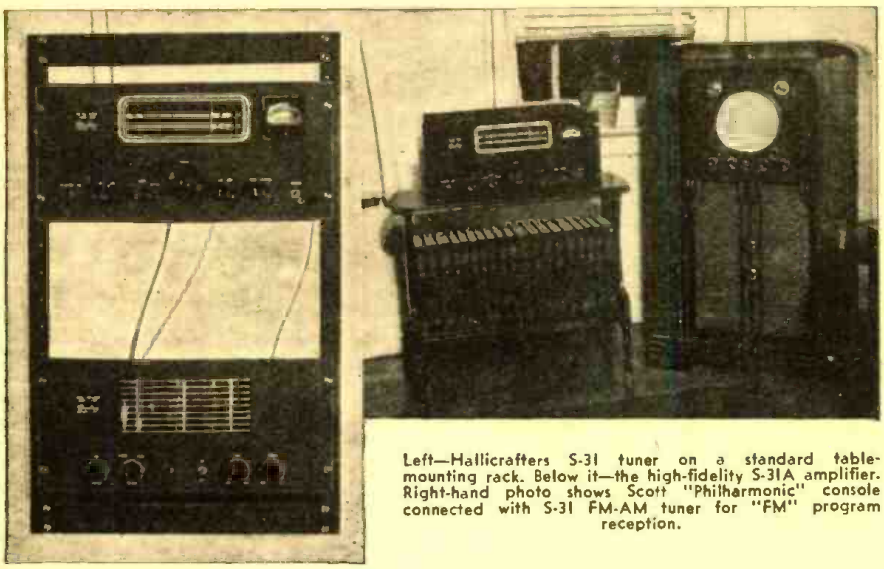
● FULL commercialization of television broadcasting, beginning July 1, has been authorized by the Federal Communications Commission.

Operation of the new service will be in conformity with standards which were substantially those proposed by the National Television System Committee on March 20, and which "represent, with but few exceptions, the undivided engineering opinion of the industry," the commission stated.

Provision for future developments is made in commission recommendation that the standards adopted today be accorded six months of practical tests, at the conclusion of which further changes may be considered, with particular reference to color television. Program stations are encouraged to engage in experimental color work, says the *New York Times*.

F.M.-A.M. Tuner Thoughts

S. Gordon Taylor



Left—Hallicrafters S-31 tuner on a standard table-mounting rack. Below it—the high-fidelity S-31A amplifier. Right-hand photo shows Scott "Philharmonic" console connected with S-31 FM-AM tuner for "FM" program reception.

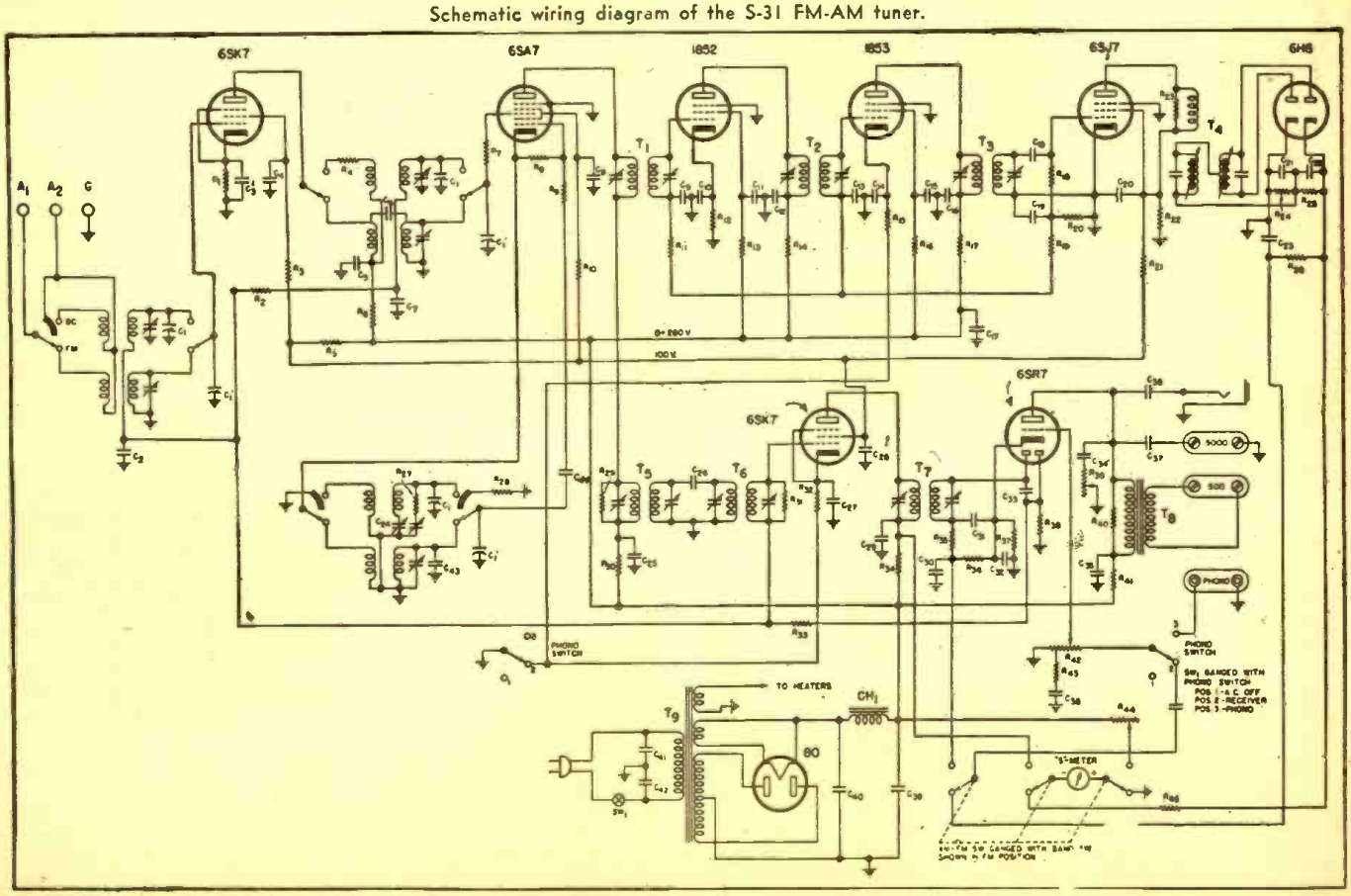
● WITH commercial operation of FM stations sanctioned by the F.C.C. and with applications for FM station construction permits literally pouring into the offices of the F.C.C., FM broadcasting has gotten off to a flying start. The stations now operating, plus those scheduled to begin operations in the very near future, will make FM programs available to the public in the more important urban areas of fifteen states. Only forty in number, these stations will serve areas populated by 40,000,000 people and the greater part of this population will be within the service areas of two or more stations.

As a result of all this activity there are right now hundreds of thousands of broadcast listeners giving thought to the matter of FM receiver equipment in order that they, too, may be able to enjoy the unparalleled advantages offered by this new type of broadcasting. For the average broadcast listener the answer will probably be found in a complete new receiver which provides for both FM and AM reception. But for the appreciative listener whose present equipment includes a really good audio system and loudspeaker, provision for FM reception is more economical. A good FM/AM tuner to work into this audio system solves the problem nicely. It not only saves the cost of duplicating the good audio equipment which he already possesses, but were he to purchase a whole new receiver there would also be an appreciable item of cabinet cost involved, particularly if it is one of the console type.

Some technically skilled listeners will undertake to build their own FM tuners. Others, recognizing certain inherent difficulties involved will prefer to purchase this equipment ready for use. In either case a discussion of a standard FM/AM tuner which has found wide acceptance among broadcast stations, engineers and sound installation men will be of interest.

This tuner, the Hallicrafters Model S-31, is available in the form of a rack-mounting unit because this form lends itself best to most technical applications. For the home it has certain advantages too. Such a unit

Schematic wiring diagram of the S-31 FM-AM tuner.



is readily mounted in a bookcase, existing console or other furniture, or may even be set into a wall.

This tuner has a dual tuning range of 540 to 1650 kc. and 40 to 51 mc. Thus it covers the entire standard broadcast and FM bands, each of which is fully calibrated on the large "slide-rule" type dial. The output of the tuner is 130 milliwatts. Connected directly to a good loudspeaker, programs are distinctly audible throughout an ordinary room but not loud enough for realistic reproduction of music. But this 130 milliwatts is ample for use with even a low-gain amplifier. Output connections provide for matching loads of either 500 or 5000 ohms.

The complete circuit of the S-31 is shown in Figure 1. From this it will be noted that nine tubes are employed, including the rectifier in the built-in power supply. The 6SK7 R.F. stage, 6SA7 converter and the triode section of the 6SR7 output tube are utilized for both FM and AM reception. The converter output is fed simultaneously to the separate FM and AM I.F. amplifiers and both of these are in operation at all times when the tuner is in use. This does not involve either losses in the converter plate circuit or interaction between the amplifiers because of their wide frequency difference—4.3 mc. for the FM amplifier and 455 kc. for the AM I.F. channel.

The FM/AM bandswitch shifts R.F. tuned circuits, and selects the desired I.F. channel by switching the grid of the 6SR7 output tube to one or the other. At the same time it switches the panel meter so that this functions as a standard "S" meter during AM reception and as a carrier centering tuning indicator during FM reception. This latter is extremely important because it is only when the receiver is tuned to the exact center of the FM signal that the maximum quality and noise freedom are obtained. In the FM position this meter functions as a voltmeter connected across the discriminator load resistors R24 and R25. When the signal is exactly centered the voltages across these two resistors balance and the meter shows no reading. Detuned in one direction the meter will show a positive voltage and in the other direction a negative voltage. It is the zero point between these positive and negative meter indications that shows precisely centered tuning. To make this possible the zero position of the meter is part way up its scale rather than at the left end.

The high intermediate frequency of the FM channel permits advantage to be taken of the excellent high-frequency characteristics of the 1852 and 1853 and thus high gain is obtained—something which is far more difficult at 4.3 mc. than at the conventional I.F. range below 500 kc. A single 6SK7 serves for the AM I.F. amplifier but it will be noted that this amplifier includes 6 tuned circuits. Four of these constitute a band-pass input circuit which helps to combine good selectivity with freedom from excessive cutting of sidebands.

As a matter of operating convenience phono connections are provided at the rear of the tuner. This permits the choice of radio or phono by means of a control on the front panel. Because the pick-up works through the output stage of the tuner, the tone and volume controls of the latter provide for complete regulation of phono as well as radio operation. The advantage of this centralized phono-radio control is appreciated where the amplifier is located at some distance from the tuner.

A headphone jack is provided primarily for monitoring purposes. Its principal use is found when the tuner is used as the input to a P.A. system with loudspeakers located at points remote from the tuner location. It is likewise useful when recording programs from the air, or when "re-recording" records.

For use with sound systems and in other technical applications it is oftentimes convenient to mount the tuner on a rack with a separate amplifier. Such an arrangement, on a table mounting rack, is shown in the accompanying photo. Here the amplifier shown at the bottom of the rack is the Hallicrafters 25-watt, Model S-31A, high-fidelity unit. Designed especially for use with the FM/AM tuner, it likewise will serve to excellent advantage as a general P.A. amplifier. For this purpose it has input connections for microphone, radio and phono and output connections for loads of 500, 8 and 4 ohms. Its frequency response characteristic is flat within plus or minus 1 db. from 40 to 15,000 cycles. It provides 90 db. gain from the microphone input, 50 db. from the phono input.

When the S-31 tuner is employed with the audio system of a standard receiver it is only necessary to connect its output to the phono terminals of the broadcast receiver chassis; or to the "Television sound" or "FM" terminals if the receiver is one of the modern type that boasts such refinements. Ordinary twisted pair will usually serve for the connecting leads even where the 5,000 ohm terminals of the tuner are employed.

Parts List S-31

Condensers

No.	Capacity	Voltage	Type
C 1	Tuning Condenser		6 Section.
C 2	.05 mfd.	200	Paper
C 3	.05 mfd.	200	Paper
C 4	.02 mfd.	400	Paper
C 5	.02 mfd.	400	Paper
C 6	25 mmf.		Mica
C 7	.05 mfd.	200	Paper
C 8	.02 mfd.	400	Paper
C 9	.01 mfd.	400	Paper
C10	.05 mfd.	200	Paper
C11	.02 mfd.	400	Paper
C12	.02 mfd.	400	Paper
C13	.01 mfd.	400	Paper
C14	.05 mfd.	200	Paper
C15	.02 mfd.	400	Paper
C16	.02 mfd.	400	Paper
C17	.1 mfd.	400	Paper
C18	50 mmf.		Mica
C19	2000 mmf.		Mica
C20	.02 mfd.	400	Paper
C21	75 mmf.		Mica
C22	100 mmf.		Mica
C23	500 mmf.		Mica
C24	Pad Band No. 1		
C25	.02 mfd.	400	Paper
C26	2.5 mmf.		Twisted Pair
C27	.05 mfd.	200	Paper
C28	.1	400	Paper
C29	.02	400	Paper
C30	25 mmf.		Mica
C31	25 mmf.		Mica
C32	10 mfd.	25	Elect.
C33	25 mmf.		Mica
C34	.05 mfd.	400	Paper
C35	10 mfd.	350	Elect.
C36	.02 mfd.	400	Paper
C37	.1 mfd.	400	Paper
C38	.05 mfd.	200	Paper
C39	10 mfd.	350	Elect.
C40	30 mfd.	350	Elect.
C41	.01 mfd.	600	Paper
C42	.01 mfd.	600	Paper
C43	Oscillator drift compensator		
C44	50 mmf.		Mica

Resistors

No.	Ohms	Wattage
R1	150	1/3
R2	100,000	1/3
R3	1,000	1/3
R4	500	1/3
R5	7,500	3
R6	1,000	1/3
R7	35	1/3
R8	20,000	1/3
R9	8	1/3
R10	1,000	1/3
R11	100,000	1/3
R12	150	1/3
R13	40,000	1/2
R14	500	1/3
R15	150	1/3
R16	25,000	1/2
R17	500	1/3
R18	50,000	1/3
R19	100,000	1/3
R20	200,000	1/3
R21	4,000	1/2
R22	15,000	1/2
R23	15,000	1/3
R24	100,000	1/3
R25	100,000	1/3
R26	200,000	1/3
R27	300	1/3
R28	8	1/3
R29	200,000	1/3
R30	1,000	1/3
R31	200,000	1/3
R32	300	1/3
R33	2,000,000	1/3
R34	35	1/3
R35	50,000	1/3
R36	250,000	1/3
R37	1,000	1/3
R38	1,000,000	1/3
R39	100,000	Tone Control
R40	100,000	1/3
R41	2,000	1/3
R42	1,000,000	Vol. Cont. tap at 20,000 Ohms
R43	4,000	1/3
R44	1,500	"S" meter adjustment Band No. 1
R45	250,000	1/3

Answers to Puzzle Diagram on page 110

1—In this circuit the position of the voltmeter and ammeter should be reversed.

2—It is impossible to have a wattmeter connected in the manner shown; at least three connections must be made, the third post or terminal of the wattmeter being connected to the opposite side of the circuit, the negative in this case.

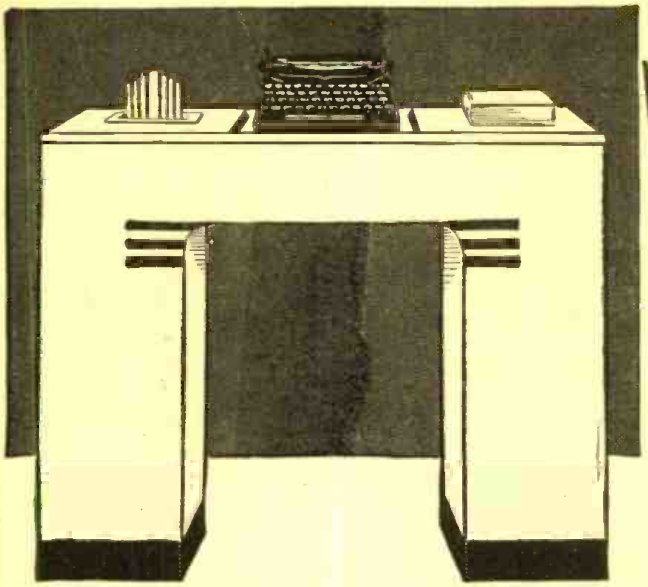
3—The connections to the milliammeter should be reversed, because even though the electron flow is positive, with respect to the plate of the tube, the current flow through the circuit is positive with respect to the battery. (Using the common nomenclature.)

4—To measure the true drop in volts across the resistance R, requires that the terminals from the voltmeter be connected directly across the resistance terminals 2 and 3.

5—The circuit for the thermo-couple meter is incomplete; an R.F. choke should be connected in series with the meter at X and a condenser should he connected in series with the circuit at X1; the choke to prevent the flow of R.F. current and the condenser to prevent the flow of generated D.C. through the external circuit.

6—This circuit for a thermo-couple meter is correct, even though the thermo junction does not touch the wire, the thermo-couple being heated indirectly by the heating coil H.

7—Watts—in an alternating current circuit containing an inductive load—such as a transformer, choke coil or motor, cannot be found by simply multiplying the volts times the amperes. To find the true watts in an A.C. circuit, the power-factor must be taken into consideration. The true watts may be measured by using a proper type A.C. wattmeter or the true watts equals volts times amperes times power factor. For an ordinary non-inductive resistance load such as incandescent lamps, the power-factor is unity or one. An average value for transformers and motor loads is 80%.



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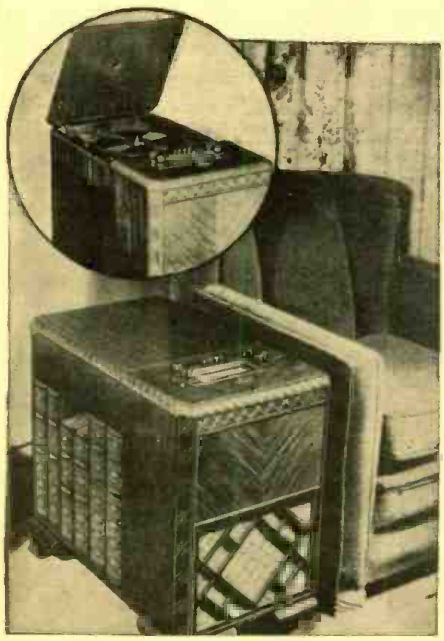
New Radio Apparatus of Interest

A "Chair-Side" Recorder

● THE new "Chum" Recorder featured by the Howard Radio Co., is a 7-tube radio that tunes 2 bands, standard broadcast and foreign short wave from 540 to 1700 kc. and 5.5 to 18 mc. It records radio programs direct from the air, through microphone, or radio and microphone can be mixed. Magic eye acts as resonance indicator when radio is on "receive" position, and becomes output level indicator when switched to "record." Mute switch



on speaker cuts volume to prevent feed-back, yet is sufficiently loud for monitoring. Record changer plays twelve 10" or ten 12" records. Cabinet available in three finishes, walnut, mahogany or blonde mahogany. Convenient place for storing records in side of cabinet. Has 12" Jensen electrodynamic speaker and Astatic Crystal Microphone. Same cabinet can be supplied with an 8 tube phono-radio without recorder.

Receiver Provides for Code Practice

● TO budding hams, scouts and others desirous of learning the code the "Echophone Commercial" communications receiver, Model EC-1, will be of special interest. Not only does it provide for reception of both 'phone and code throughout its range of 545 kc. to 30.5 megacycles but in addition has self-contained facilities for *keying* and *code-reading* practice.

With a standard telegraph key connected in series with the headphone the output of the receiver to the headphones will be broken up into dots and dashes as the circuit is keyed. If the receiver is tuned to a broadcast or other steady carrier, and its beat-frequency oscillator turned on, this output will be in the form of a heterodyne whistle. When keyed the result is a perfect imitation of the sound of regular radio telegraph transmissions.

Group "copying" practice is possible if the headphones are placed on the table and the receiver volume turned up to make their sound audible over a reasonable range. Or by connecting two keys in parallel it is possible to carry on 2-way communication with either participant breaking in at will.

When some degre of speed has been achieved in code copying then the regular code transmissions of commercial stations can be tuned in for actual on-the-air practice.

In this receiver the headphone circuit is completely isolated from the line and high voltage supplies by an output transformer. Thus the possibility of shock while handling the key is completely avoided.

In addition to its code practice feature this 6-tube model, a product of the Echophone Radio Corp., provides many other advantages. Among these are electrical bandspread; A.V.C. off-on switch, stand-by switch, headphone-speaker switch, built-in speaker, B.F.O. switch, B.F.O. pitch adjustment, tuning coverage of 545 kc. to 30.5 mc. in three bands (each fully calibrated on the main dial), separate band-spread scale of the slide-rule type, A.C./D.C. line operation, antenna connections for standard or doublet antennas, etc.

De Luxe Recorder with Automatic Record Changer

● ONE of the latest products of the Allied Radio Corporation is this combination recorder, a playback system with record changer and portable PA system, housed in a single airplane-type luggage case. A useful combination for home use and entertainment, it is well suited for use by schools, churches, and similar groups also. Plays manually at 78 r.p.m. all acetate home recordings or commercial records up to 12" diameter. Automatically plays without interruption twelve 10" or ten 12" records. Will record at 78 r.p.m. on composition and acetate blanks up to 10" diameter. Built-in amplifier delivers 3 watts output. Uses the following tubes: 1—6J7GT, 1—6Q7GT, 1—6K6GT, 1—5W4 and 1—6U5 Electric Eye Volume Indicator. Speaker is 6½" PM dynamic type. Crystal recording head is adjustable for depth of cut. Crystal pickup is latest true-tracking type. Turntable operates at 78 r.p.m. from constant-speed self-starting A.C. motor. Has volume and tone controls; selector switch for "Record," "Playback," or "PA" functions. Acces-

sories include tubes, crystal mike, desk stand, six 6" recording blanks, cutting needle and package of playback needles. Operates on 110 volts, 60 cycles.

New RCA Miniature Tubes

● THE RCA Mfg. Co., has made available two new miniature receiving tubes—RCA-45Z3 and 3Q4—for use in compact portable receivers.

The RCA-45Z3 is a miniature, half-wave high-vacuum rectifier, of the heater-cathode type. Designed specifically for service in A.C.-D.C. battery-operated portable receivers it offers the advantages of small size and low heat dissipation. Its heater requires only 0.075 ampere at 45 volts and its output rating makes it capable of supplying rectified power for both filament and plate circuits in lightweight A.C.-D.C. battery-operated receivers utilizing the miniature type tubes. Tube size 2⅛" overall length; dia. ¾". Base—min. button 7-pin, mounting position—any one desired.

The RCA-3Q4 is a new, miniature type, power amplifier pentode suitable for operation with 90 volts on plate and screen. It has a power output of 270 milliwatts with 7 per cent distortion. The filament of the RCA-3Q4 has a center tap, which permits economical usage of this tube in series-filament arrangements with other miniature tubes. The advent of the RCA-3Q4 makes possible the use of miniature tubes throughout in all classes of battery receivers.

Use of the RCA-6SF7

● THE 6SF7 is a new single-ended metal tube containing a remote cut-off R-F pentode and a diode in the same envelope. Its grid-plate capacitance and its grid-diode capacitance have been kept low, partly by utilizing a suitable arrangement of terminal leads, and partly by the shielding action of the metal shell.

For receivers utilizing single-ended metal tubes, the 6SF7 is particularly useful as an I-F amplifier and detector. In this use, the pentode plate of the 6SF7 is coupled to the diode plate through a tuned transformer; the A-F output circuit of the diode detector is conventional.

This arrangement has the important advantage, among others, of eliminating the familiar problem of "play-through," a condition encountered when the diode detector and the first A-F amplifier are in the same envelope and have a common cathode. "Play-through" ordinarily results from capacitive or electronic coupling between the diode plate and the first A-F amplifier. It occurs, regardless of the volume-control setting, because the internal coupling may transfer either the I-F voltage or the A-F voltage present at the plate of the diode to the A-F circuit. If the A-F system can feed back to the R-F or I-F circuits, the presence of I-F currents in the A-F system may result in other spurious effects such as regeneration or oscillation, and may produce "birdies" when the R-F signal frequency is a multiple of the intermediate frequency. When the 6SF7 is used as the I-F amplifier and the detector, the fundamental cause of such spurious effects is eliminated because I-F voltage cannot reach the A-F tube and because the A-F voltage delivered to the A-F tube can be only that delivered by the volume control. The elimination of "play-through" effects also makes it possible to use the A-F system for phonograph reproduction or similar services without the necessity of making the R-F system inoperative by detuning it or by removing voltages from it.

When the 6SF7 is used as the I-F amplifier and diode detector, a desirable tube complement for a receiver with push-pull, power-output stage could be: a 5Y3-G rectifier, a 6SA7 converter, a 6SF7 I-F amplifier and diode detector, a 6SC7 phase inverter, and a push-pull 6K6-GT power amplifier.

Another use of the 6SF7 as the I-F amplifier and the diode detector is found in receivers employing a degenerative audio-output stage. In these, a separate first A-F tube can be used which may be either a 6SJ7 or a 6SK7. This arrangement permits the use of a desirable method of inverse feed-back, known as the "constant-voltage type." It is accomplished by connecting a suitable resistor from the plate of the output stage to the plate of the first A-F stage. The success of this method is much enhanced when the first A-F stage utilizes a pentode having high plate impedance, instead of a triode with its relatively low plate impedance, because the plate impedance shunts the plate load. A low effective value of plate load leads to difficulties in obtaining an adequate degree of feed-back.

The 6SF7 has optional use as a resistance-coupled A-F amplifier. In this service, its remote-cut-off characteristic makes it suitable for audio automatic-volume-control. Receiver tests have shown that this use of the 6SF7 need not materially increase the over-all distortion.

More New Tubes

● THE RCA Mfg. Co. recently announced the following new tubes: RCA-6SG7 Triple-Grid Super-Control Amplifier; RCA-12SG7 Triple-Grid Super-Control Amplifier; RCA-930 Gas Phototube.

The 6SG7 and 12SG7 are R-F amplifier pentodes of the metal type particularly recommended for use in high-frequency receivers. They feature high transconductance, very low grid-plate capacitance, and two separate cathode terminals. Because of these features, the 6SG7 and 12SG7 offer receiver engineers new facilities for improving the stage gain of receivers, particularly those designed for high-frequency and/or wide-band operation. At higher frequencies, the use of two cathode terminals permits of greater isolation of input and output circuits through elimination of the coupling inductance of a common cathode return. As a result, the input conductance can be maintained at a high value at high frequencies. The low value of grid-plate capacitance minimizes regenerative effects, while the high transconductance makes possible a high signal-to-noise ratio. Furthermore, the single-ended metal construction with its self-shielding shell and short internal leads is a practical consideration in obtaining high gain with stability.

The 6SG7 and 12SG7 are alike except for heater rating. The heater of the 6SG7 is designed so that it can be operated in series with other 6.3-volt, 0.3-ampere types; likewise, the heater of the 12SG7 can be operated in series with other 12.6-volt, 0.15-ampere types.

The new gas phototube RCA-930 is recommended for use in sound reproduction and relay applications. Electrically, the 930 is like the type 923 with its high sensitivity and large response to red and near infra-red radiation. Physically, the 930 is like the type 929 with its simple, rugged, short construction and octal base. This combination makes the RCA-930 an outstanding phototube of particular interest to designers of new equipment utilizing phototubes.

For further information on the apparatus here described, write to Service Department, Radio & Television Magazine, 20 Vesey St., New York City. If you wish new catalogs from leading radio companies just write us.

6-Tube A.C.-D.C. Superhet

● THE Allied Radio Corporation announces a new, low-cost 6-tube table model radio, Model No. B17100. A 2-band tuning range incorporates a domestic band from 535 to 1650 kc. and a short-wave band from 5.7 to 18.3 mc. Outstanding features include: high-gain "Magna-Beam" loop aerial (also contains provisions for outside aerial, if desired); big Slide-Rule Dial; 5-inch dynamic speaker; full A.V.C., etc. Two watts beam power output is fully developed by this superhet. An advanced 1941 circuit, licensed by RCA and Hazeltine, provides the latest tubes as follows: 12SA7GT, 12SK7GT, 2—12SQ7GT, 35L6GT, 35Z5GT. The cabinet, housing the Knight 6, is of the new Continental type design. Cabinet measures 13" x 6⅝" x 7½". Operation is from 110-120 volts, 40-60 cycles A.C., or 110-120 volts D.C.

NEW CATALOGS

Commercial Radio Institute

● A VERY informative catalog, in outline form, has just been released by the Commercial Radio Institute.

This interesting booklet explains in detail the courses that can be studied at the Institute, some of which are: Commercial Operating Course, Broadcast Course, Service Course, Studio Technique Course, Television Course, and Aeronautical Course. Everyone interested in becoming a radio operator should have a copy of this catalog in his possession.

New Crowe Catalog

● THE Crowe Name Plate & Mfg. Co. has issued a bulletin, No. 242, covering items for jobbers and manufacturers in radio components, including precision tuning devices, plates of all sorts for transmitters, radio receivers, phonographs, etc., in different metals and finishes. Knobs in bakelite and tenite for instruments, transmitter panels and other special uses, in various styles and colors and other specialties.

On one of the precision tuning dials illustrated and described in the new Crowe Bulletin, the combined reading of the two scales splits 180 degrees of condenser travel into 600 parts for close reading. In other words this remarkable dial gives a tuning ratio of about 72 to 1. A fly-wheel is provided to speed up the tuning when large jumps are to be made from one station to another. A number of interesting styles of modern slide rule dials are also shown and described.

The Crowe Company has also issued a bulletin, No. 237, covering remote controls and kits for automobile radios. The various kits and controls illustrated may be used in connection with most auto radio sets. The No. 700 controls are interchangeable on all cars and with the proper panel kits as described in bulletin when the set is to be moved from one car to another. Special consideration is given to proper installation with Arvin, Delco, and Philco auto radios. This bulletin should be studied by all servicemen, distributors and installers of auto radios.

RCA Transmitting Tube Catalog

● A NEW 16-page booklet illustrates and describes RCA Transmitting and Special Purpose Tubes (Form TT-100/3-41).

This booklet catalogues all RCA non-receiving types—Transmitting Tubes, Transmitting Rectifiers, Television Tubes, Oscillograph Tubes, Phototubes, Acorn Tubes, Gas-Tubes, Voltage Regulators, and Special Amplifier Tubes. On pages 10-16, the charts of phototubes and transmitting tubes facilitate selection of a tube type for a particular service or application.

Tube types especially suited for UHF uses at frequencies of 100 megacycles and above have been indicated in red for convenient reference. Similarly, types of special interest to radio amateurs have been indicated in bold face.

This new booklet, 8½" x 11" in size, is strikingly printed in red and black and is copiously illustrated with photographs of different tube types.

Readers can obtain a copy of this new booklet from their nearest RCA distributor, or by sending 10 cents to cover handling costs to Service Dept., Radio & Television, 20 Vesey St., New York City.

New Howard Bulletins

● THE Radio Co. announces two new folders—No. 105 listing a complete line of replacement chassis, including Frequency Modulation and Home Recorders; No. 106 listing metal and paper base recording discs and needles. Bulletins are available to servicemen and dealers without charge. This firm also has a folder, No. 104, listing a complete line of communication receivers.

Antenna Catalog

● THE Vertrod Manufacturing Co. announces the release of a new catalog for general distribution, describing a specialized list of five antennae. The aerials described are the Broadcast, Broadcast-Short Wave, Broadcast Short Wave-FM, a special Communications Type, and a new type of FM-AM combination.

Telechron Labs.

The Telechron Laboratories of New York City, a recently formed organization, will shortly enter the television receiver manufacturing field. Mr. Gordon Burroughs, the chief engineer, recently returned from Washington, where he testified before the Federal Communications Commission at the television hearing. Mr. Burroughs was formerly Chief Engineer of the Cath-Ray Laboratories. Since the disbanding of the Cath-Ray Labs., Mr. Burroughs has perfected a circuit making possible a television set with only a single control knob, rather than the confusing array usually used. The Telechron Laboratories intends to market a receiver of this type, including a frequency modulation and broadcast receiver, at a popular price. It is felt a receiver of this type and price is all that is needed to place television within the reach of the average family.

National Bulletin for 1941

● THE latest additions to the well-known National radio products line for 1941 are illustrated and described in catalog No. 400. In this catalog, pictures and descriptions are given for various types of dials and knobs, condensers, coils and chokes, plate and grid grips, shields, cabinets, sockets, insulators, etc. Also the National receivers—including the HRO, SW3 and the NC100 series, the NC44, the One-Ten, the type NHU and others are described and pictured. This catalog should be in the hands of everyone interested in up-to-date high-grade radio apparatus.

AUSTRALIA AUGMENTS RADIO SERVICE

Before the outbreak of war, short-wave radio in Australia was mainly for the benefit of listeners in the far outback country and in the islands around the coast of the Continent. Since the war, however, Australia's short-wave radio activities have grown until ten transmissions are now broadcast daily in English, French, Dutch and Spanish.

Summaries of Australian and Pacific news are heard morning and evening daily throughout America, separate transmissions being directed to Eastern and Western regions of the United States. There are two morning sessions, the first from VLQ5 on 30.99 meters at 7:20 a.m. EST, and the second from VLQ7 on 25.25 meters at 7:20 a.m. Pacific time. In addition to news summaries, special discussions of significant phases of the news are carried.

Evening transmissions are from VLQ7 on 25.25 meters, 11.88 mc/s at 4:55 to 5:45 p.m. EST, and 9:55 to 10:45 p.m. Pacific time. Talks and commentaries following the news bulletins on the evening programs are intended to give American listeners a clear picture of Australian war effort and potentialities, and her feelings about the course of the war and the trend of events in the South Pacific.

TECHNICAL DATA ON AUSTRALIAN SHORT-WAVE BROADCASTS TO NO. AMERICA

MORNING

Time	*Wave Length*	*Frequency*	*Station*
7:20 EST	30.99 meters	9.680 mc/s	VLQ5 (Sydney)
7:20 Pacific	25.25 meters	11.88 mc/s	VLQ7 (Sydney)

Monday:	News, 7:30; Richard Qua, Canadian newspaperman, on unusual aspects of Australian life.
Tuesday:	News, 7:30; Discussion of significant phases of the news.
Wednesday:	News, 7:30; Questions answered.
Thursday:	News, 7:30; Significant phases of the news.
Friday:	News, 7:30; Richard Qua.
Saturday:	News, 7:30; Significant phases.
Sunday:	News, 7:30; Questions answered.

EVENING

Time	*Wave Length*	*Frequency*	*Station*
4:55 EST	25.25 meters	11.88 mc/s	VLQ7 (Sydney)
9:55 Pacific	25.25 meters	11.88 mc/s	VLQ7 (Sydney)

Monday:	News; "Economic Warfare"—the part of oil, munitions, labor, transport and trade in the war.
Tuesday:	News; "Around Australia"—Australians in all walks of life talk about colorful aspects of Australia.
Wednesday:	News; Talk on latest war developments.
Thursday:	News; "Australian War Effort"—war workers describe their work.
Friday:	News; "The Truth of it is . . ."—a critical analysis of German and Italian war propaganda.
Saturday:	News; "Women at War"—women talk about aspects of their work of special interest to women overseas.
Sunday:	News; "Australia looks at the War"—the war week by week, as Australians see it.

Friday night's program, under the title "The Truth of it is . . ." is a critical analysis of German and Italian broadcast propaganda. American listeners who have heard this broadcast say that the Australian commentaries are probably the "saltiest" in the world. When they really "go to town" they are even more pungent than the Germans.

Australia has a special function within the British Commonwealth as representative and interpreter of the Western Pacific. These broadcasts bring to America the news and views of the British Commonwealth in that important area.

The object of these broadcasts, which are received clearly and with good strength in the United States, is to strengthen and extend the existing bonds of interest and friendship between the United States and its fellow democracy in the South-Western Pacific. First steps in this direction have already been taken in the exchange of ministers, Mr. Richard G. Casey having been appointed Australian Minister to Washington and Mr. Clarence E. Gauss, United States Minister to Australia.

Joseph D. R. Freed

● DURING the past month one of the best known radio pioneers in the field of broadcast receiver design and construction, Joseph D. R. Freed, passed away. A relatively young man, Mr. Freed became famous in the early days of radio broadcasting. In fact, so famous, that it was considered a mark of distinction to have in your home a Freed-Eisemann neutrodyne receiver, the first set that provided improved selectivity and absolutely quiet reception, without the blood-curdling squeals and yells that the regenerative receivers made.

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The 1940 RADIO-TELEVISION REFERENCE ANNUAL has 68 pages, large size 8½ x 11½, with over 170 illustrations. The contents of this book has never appeared before in handy book form. Its pages cover practically every branch of radio sound, public address, servicing, television, construction articles for advanced radio men and technicians, time and money-saving kinks, wrinkles, useful circuit information, "ham" transmitters and receivers, and a host of other data.

The Annuals have always been regarded as a standard reference work for every practical branch of radio operation and service. This 1940 edition ably sustains this reputation. Every radio man wants a copy of this valuable book. Just as this book will be of unquestionable value to you, so, too, will every monthly issue of RADIO & TELEVISION. This magazine brings you big value every month. It keeps you intelligently informed about new developments in radio and television. You want the news, want it fully but concisely, want it first—that is why you should read RADIO & TELEVISION regularly.

This very special offer is made for just one purpose—we want you as a regular subscriber. The Annual, whose contents appears at the right, is not sold, but a copy is FREE to you if you subscribe now.

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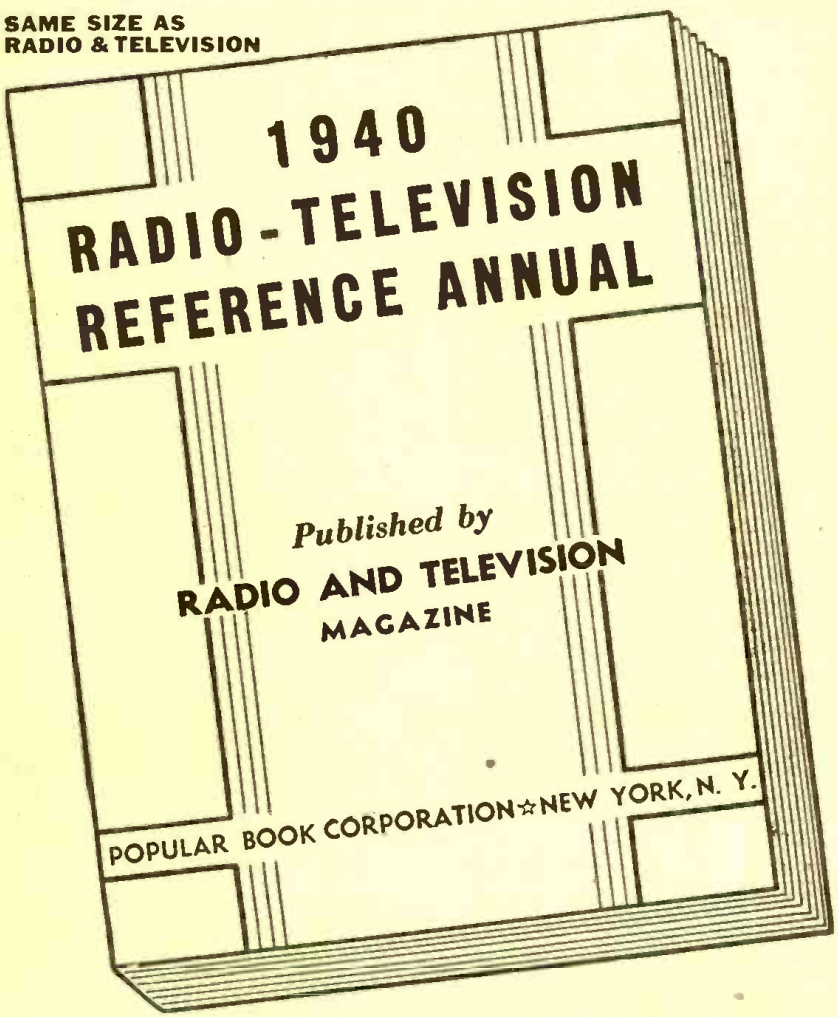

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Beginner's Breadboard Special - a 1-Tube High-Gain All-Wave Receiver—Wiring Pointers for Radio Beginners—A Watch Charm Size 1-Tube Set—Beginner's Simple Volt-Milliammeter—Making a 1-Tube Broadcast Loop Receiver—A.C.-D.C. Power Supply for Battery Portables—A 1-Tube Short-Waver with Band Coil Switching.

MORE ADVANCED SET CONSTRUCTION

The "High-Seas 4" Broadcast Lamp Radio—How to Build a 6 Tube 1.4-Volt Short-Wave Superhet for the "Ham" or Short-Wave Fan—Build the "Lunch Box 5" Super Set - a Broadcast Battery Portable—How to Build a Plug-Together 8 Tube Broadcast Set—The "5-in-4" All-Wave Radio for A.C. Operation—An Easily-Built 3-Tube Midget Broadcast Superheterodyne Receiver.

THE SERVICEMEN'S SECTION

Bass Tone Control—Simplified Variable Selectivity—Practical Servicing Pointers—Servicing Universal A.C.-D.C. Receivers—Killing the "Intermittent" Bug—A Service Shop A.C. to D.C. Power Supply—Sideline Money for Servicemen—Adding A.V.C. to any Screen-Grid T.R.F. Receiver—Iron Particles in Speaker Air Gap.

TEST INSTRUMENTS

A Useful Neon Lamp Tester—An Inexpensive Output Meter—Making Milliammeter Multipliers—Home-Made Frequency Modulator—The Busy Servicemen's V.T. Volt-Meter.

PUBLIC ADDRESS AND AMPLIFIERS

Build this Combination A.C.-D.C. Radio and Inter-Communicator—Speaker Placement in P.A. Work—The Design and Construction of an Inexpensive All-Push-Pull 10-Watt Amplifier—Obscure Sources of Hum in High-Gain Amplifiers—How to Build a High-Fidelity 5-Watt Versatile Amplifier.

"HAM" SECTION

Ultra-High Frequency Antennas—The Beginner's Low-Cost Xmitter—Modulator Meter—Phone Monitor—The Beginner's "Ham" Receiver—2½ Meter Acorn Transceiver.

TELEVISION

How to Build a 441 Line T.R.F. Television Receiver—Useful Notes on Television Antennas.

MISCELLANEOUS

Simple Photo-Cell Relay Set Up—Making a Burglar Alarm—How to Build A.C.-D.C. Capacity Relay—How to Make a Modern Radio Treasure Locator.

USEFUL KINKS, CIRCUITS AND WRINKLES

Making a Flexible Coupler—Two-Timing Chime—A Simple Portable Aerial—An Improvised Non-Slip Screw-Driver. NOTE: The book contains numerous other useful Kinks, Circuits and Wrinkles, not listed here.

(approximately)

45 ARTICLES

(approximately)

170 ILLUSTRATIONS

68 BIG PAGES

RADIO & TELEVISION
20 VESEY STREET
NEW YORK, N. Y.

Index to Advertisers

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

Readers' Editorials

(Continued from page 69)

increasing your ability to copy code solid on a mill and handle traffic efficiently. Make yourself a veritable civilian operator—if the time ever arises, which I hope, like others, it does not!

If you are not an amateur radio operator, become one—now! Learn your code. Learn your theory cold. Amateur radio operators, besides making good civilian operators when properly trained, make good instructors in code and theory.

Start now! Become an expert in your knowledge of code and radio—*and let the government know that you are standing by!*

WALTER HORIZNY, W2KVL,
503 East 6th Street,
New York, N. Y.

A PLEA TO "HAMS" FROM AN "SWL"

● MR. "HAM," the next time you receive an SWL card from a listener, stop a moment and think what you are doing to someone by laying that card aside and forgetting all about it.

In most cases, the SWL who sent you that card is a young fellow trying to get a start in amateur radio, just as you too were once trying to do, or he may be an older person (or, as in many, many cases) a bed-ridden invalid, whose only pleasure in life is his or her QSL card collection.

The SWL sent you that card not with the idea of "sponging" a QSL card, but with the intention of doing you a favor, by submitting a report of your signals, and courteously asks you to QSL. He does not demand it but merely requests it as a return favor for his report.

By disregarding his report, think what you are doing to his feelings; the one-cent stamp which you must "sacrifice" to send him your QSL card is nothing at all when compared with the smile of satisfaction and hope that card brings to the face of many a "shut-in" SWL.

Now the very next time you receive an SWL card, remember this little phrase, "One good turn deserves another"; then sit right down and fill out that QSL card!

ROBERT STOLBERG (SWL)
322 Superior Avenue,
Crystal Falls, Michigan.

WHY NOT LEARN RADIO NOW?

● I HAVE been reading RADIO & TELEVISION for one year and have gained a fair knowledge of radio. A friend of mine started me reading R. & T. by giving me some 1938 copies.

I believe radio is something everyone should know something about—especially in war times. When war is at hand there is no time to prepare. As you all know from the experiences of other nations, radio is used in the Army and Navy and particularly in the home front. The people at home can learn what is happening by short waves and standard broadcasts, almost as soon as it happens.

As you will realize, there must be more radio operators and service men in every branch of the service. Why not begin now and prepare for the Army, Navy and Air Forces? Don't wait or waste time thinking about radio, but be prepared as your time to serve may come sooner than expected, and you will miss out on higher pay and an interesting career.

FREDERICK H. HAWKINS,
Bancroft, Ontario, Canada.

PLENTY OF CHEAP APPARATUS FOR EXPERIMENTERS

● IT is really appalling to realize how much useable radio equipment is discarded each day in this country of ours. Many of us who are anxious to get started in the radio game, but cannot—due to financial difficulties—can really get started if they will just take the trouble to visit the nearest local dump. A trip through your local dump is a trip through a radio experimenter's paradise, with equipment on all sides just begging to be put into active service again. This discarded material which may be old is, nevertheless, suitable both mechanically and electrically for experimenting. Take it from me, you will get a bigger "kick" out of making projects from junk than if you went and "splurged" on the most modern equipment.

Since the financial obstacle is done away with, you will not hesitate to use this apparatus in new schemes and circuits. By doing this you will of course gain valuable experience, which cannot be had by just reading books and magazines, regardless of how educational they be. You who read this far will realize by this time, that all that is necessary to get in on the radio game, is *not* money but ambition and a bite from the radio bug.

JOSEPH JANCER,
1001 Home Street,
Bronx, New York.

Set Given As Prize

Prize receiver for best editorial this month—latest type RCA Radiola, model 515. This set operates on 110 volts A.C. or D.C. and gives two-band reception—both domestic and foreign stations. Set has extra large built-in loop antenna, one stage R.F., tone control, A.V.C. and is a six-tube superhet. Tuning range, two bands—535 to 1,720, 5800 to 19,000 kc. Awarded to Hector M. Irigoyen, Calle 62, No. 562, Merida, Yucatan, Mexico, for this month's prize-winning readers' editorial—see page 69.

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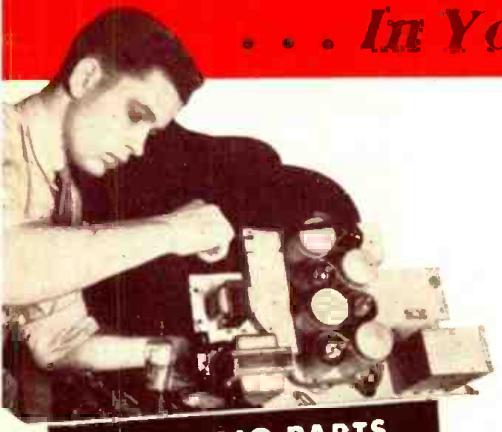

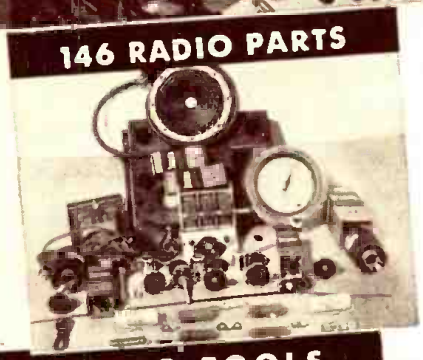

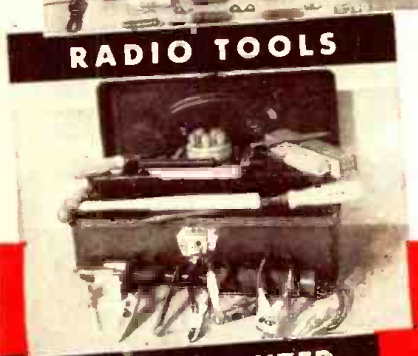

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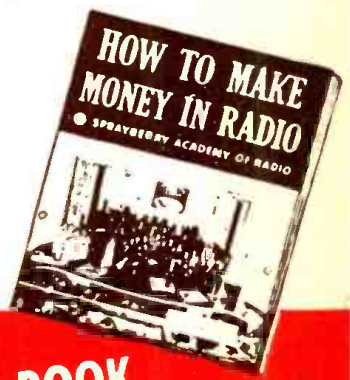

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