RADIO'S *Complete* MAGAZINE

RADIO & TELEVISION

MARCH OF RADIO Department

RADIO CONSTRUCTION Department

TELEVISION NEWS Department

ELECTRICAL EXPERIMENTS Depart...

RADIO Dep...

VALUABLE RADIO SETS FOR YOUR LETTERS !

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RADIO KINKS Department

RADIO BEGINNER Department

AMATEUR RADIO Department

RADIO HOOK-UPS Department

25¢
CANADA 30¢

HUGO GERNSBACK
EDITOR

AMATEUR & EXPERIMENTAL RADIO

CONSTRUCTIVE RADIO ARTICLES

MAY
1941

NATIONAL RECEIVERS

HRO

NC 200

NC 100 X A

NC 44

National Receivers give maximum performance in every price range, at all frequencies. There is the HRO which has become the standard of comparison among fine communication receivers for performance, versatility and reliability. There is the little SW-3 which is still a favorite after ten years, noted for three-tube simplicity combined with proven capability.

There is the brand new NC-200, which is making a reputation for itself week by week. There are older favorites like the NC-100 and the NC-44, each bringing top performance to its price class.

For ultra high frequencies, the One-Ten with coverage from one to ten meters, is still the receiver for work at 112 Mc. and 224 Mc. The de luxe NHU brings communication receiver performance to the 5-meter band as well as 10 and 20 meters.

This is the roll call of National Receivers for amateur use. Different models in each of the above types make a total of more than twenty receivers to choose from. Regardless of your needs, you will find a National Receiver to fill them.

NATIONAL COMPANY, INC.

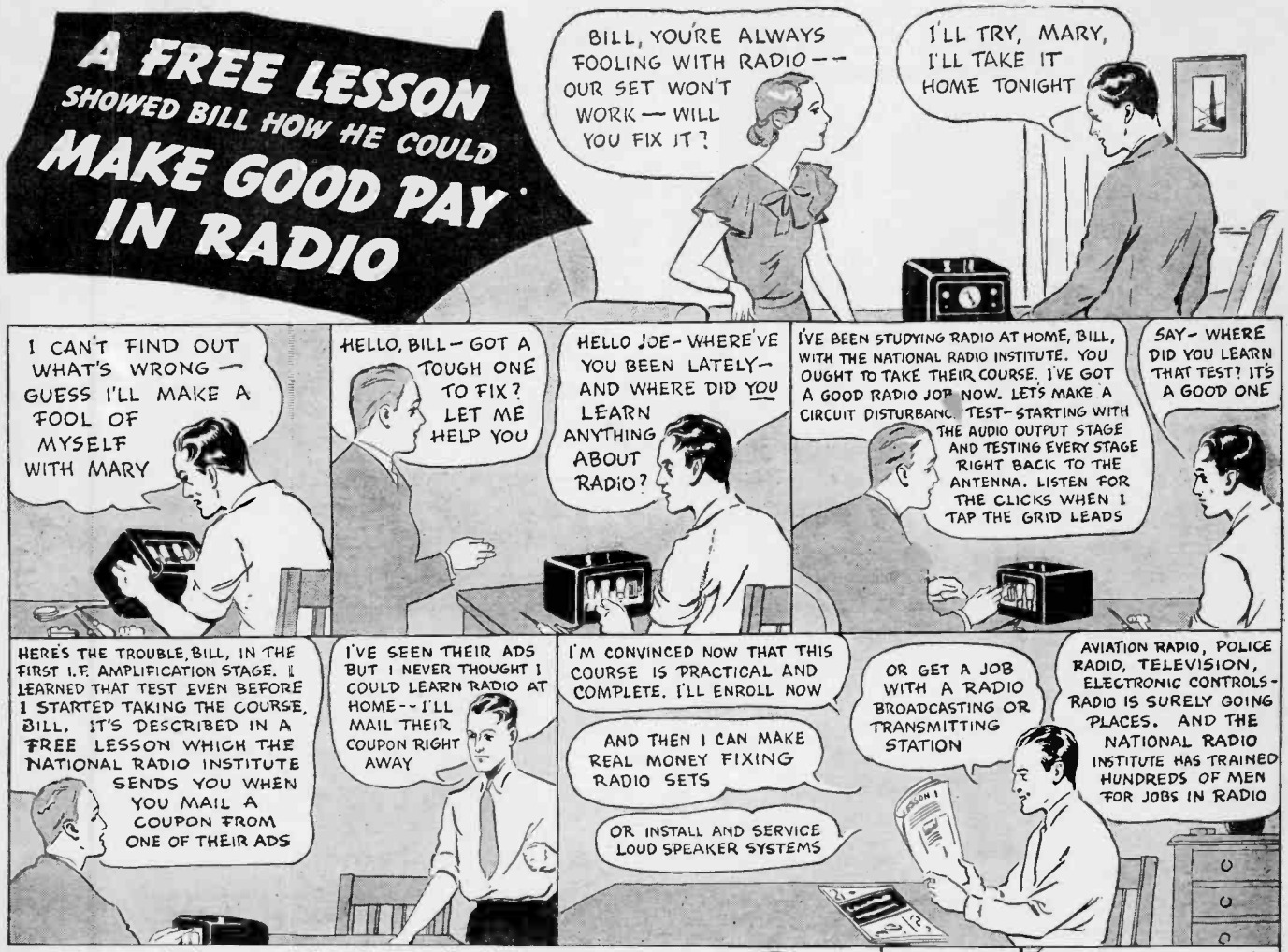
MALDEN, MASSACHUSETTS

SW-3

ONE-TEN

NHU

A FREE LESSON SHOWED BILL HOW HE COULD MAKE GOOD PAY IN RADIO



I will send you a Lesson on Radio Servicing Tips FREE

TO SHOW HOW PRACTICAL IT IS TO TRAIN AT HOME FOR

GOOD JOBS IN RADIO

Even if you have only a slight interest in Radio, get this sample Lesson. It is a catalog of common Radio receiver troubles, their causes and remedies. Mail the coupon. Learn how practical N. R. I.'s 50-50 method makes learning Radio at home. Discover the many opportunities the N. R. I. Course opens for well-paying full time jobs.

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

Millions of dollars in defense orders on top of a record year for Radio are opening new opportunities for trained men. Radio Technicians are well paid because they use their minds as well as their hands. It takes both to repair a home or auto Radio set; to operate and maintain a Broadcast or Commercial transmitting station; to install, operate and repair Police, Aviation, Experimental Radio and Television equipment. That's why so many fellows who become Radio Technicians are able to jump their pay; why others operate their own full time Radio Service Businesses. Many fix Radios in spare time while holding other jobs because of the extra money in this work.

Beginners Quickly Learn to Earn $5 to $10 a Week in Spare Time

Find out how N. R. I. trains you to make extra money quickly. Many N. R. I. students report making extra money in spare time within a few months. Many pay for their entire Course with extra money made in spare time while learning.

You Get This Professional Servicing Instrument

This instrument makes practically any test you will be called upon to make in your Radio 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 as part of your N. R. I. Course.

Mail the Coupon

Get our SAMPLE LESSON and a copy of "Rich Rewards in Radio" FREE. You'll see letters from men who got into Radio this way, telling what Radio means to them; what they are doing and earning. You'll see why the N. R. I. Course is easy to study, fascinating to learn, practical to use. You'll get facts on Television and other fast-growing branches of Radio. Act NOW. Write your name and address on the coupon below. Paste it on a penny postcard or mail it in an envelope—RIGHT NOW.

J. E. SMITH, President
Dept. 1EB3, National Radio Institute
Washington, D. C.

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.

DRAFT REGISTRANTS!

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!

J. E. SMITH, President, Dept. 1EB3
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Mail me FREE, without obligation, your Sample Lesson and 64-page book "Rich Rewards in Radio" which tells about Radio's spare-time and full-time opportunities and explains your 50-50 method of training men at home to be Radio Technicians. (No salesman will call. Write Plainly.)

Age.....

Name .....

Address .....

City ..... *State* .....

14X1

RADIO & TELEVISION

The Popular Radio Magazine

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

May — 1941
Vol. XII No. 1

In June Issue

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The W8KPX Modulator for a 400-Watt Transmitter — Harry D. Hooton, W8KPX
Portable Radio—Phono Oscillator—Lee Garrison
A High-Fidelity Receiver with "Ear Appeal"—Ralph Heikila, W9MNF
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MISCELLANEOUS

Cover Composition by Hugo Gernsback and Thomas D. Pentz

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.

Published by Popular Book Corporation. Publication Office—29 Worthington St., Springfield, Mass. **Editorial and Executive Offices**—20 Vesey St., New York, N. Y. HUGO GERNSBACK, President; EMIL GROSSMAN, Director of Advertising. **European Agents:** Atlas Publishing and Distributing Co., Ltd., 18 Bride Lane, Fleet St., London, England; Brentano's—London and Paris. **Australian Agents:** McGill's Agency, 179 Elizabeth St., Melbourne.

There's Only One Way to Learn Anything . . . . DO IT!

SPRAYBERRY RADIO TRAINING Gives You FULL EQUIPMENT to Do Over 100 Practice-Giving Experiments!

You Get PRE-EXPERIENCE . . . . Right At HOME!

Sprayberry Training is specially designed to help you make fast progress. It starts right at the beginning of Radio . . . unfolds each subject in a simplified, logical, understandable style. You easily learn Television, Frequency Modulation, Signal Tracing, Mobile Radio (Auto-Tank), Aviation Radio, Electronics, Facsimile Radio, Radio Set Repair and Installation Work. You learn quickly in your spare hours . . . AT HOME OR AT CAMP.

Training Prepares You for a Business of Your Own . . . or Good Radio Jobs at Excellent Pay!

The great, fascinating and progressive field of Radio and Television offers limitless opportunities to the man who wants to get ahead. There is good money to be made. My Training is designed to give you quick access to these opportunities. SPRAYBERRY Methods are thorough and practical. Your Training will not interfere with your present work.

YOU GET PROFESSIONAL TEST EQUIPMENT ... *PLUS* EXPERIMENTAL OUTFITS

. . . Includes 146 RADIO PARTS for building a complete Receiver, RADIO TOOLS and a modern TESTER-ANALYZER. You also receive 8 BIG SHIPMENTS OF RADIO EQUIPMENT for conducting actual experiments with your own hands. I show you how to create Radio defects . . . how to correct them. ALL EQUIPMENT BECOMES YOUR PERSONAL PROPERTY!

NO PREVIOUS EXPERIENCE NEEDED . . . EARN WHILE YOU LEARN

It makes no difference what your education has been. I can fit you quickly for a good-paying Radio job. I make it easy for you to grasp Radio principles and remember them. Your success is my full responsibility. My BUSINESS BUILDERS will show you how to put your Equipment to actual use in handling money-making Radio Service Jobs shortly after you begin Training.

REMEMBER— THE SPRAYBERRY COURSE IS SOLD UNDER MONEY-BACK AGREEMENT

LEARN MORE ABOUT THE SPRAYBERRY METHOD . . . complete details of my Fundamental Course and Advanced Training Course —all features are fully described in my new, valuable 52-page FREE Book. Send for your copy. No obligation.

READ What These Fellows Say About the Practical Sprayberry Training!

"GROSSED BETWEEN $150 AND $200"

"Since finishing your training I've started in the Radio repair business. I have about all the work I can take care of. I have grossed between $150 and $200 in the last few months in my spare time. I think your Course is 'tops'." W. Francis Waseka, Fountain City, Wisconsin.

"SALARY HAS INCREASED"

"Your Radio training has made it possible for me to make more money. My salary has increased from $40.00 to around $50.00 per week. I now have about all the Radio repair work I can handle." Asa Smith, P. O. Box 528, Fort Leavenworth, Ky.

RUSH THIS COUPON for BIG FREE BOOK

SPRAYBERRY ACADEMY OF RADIO
F. L. Sprayberry, Pres.
445-E University Place, N. W.
Washington, D. C.

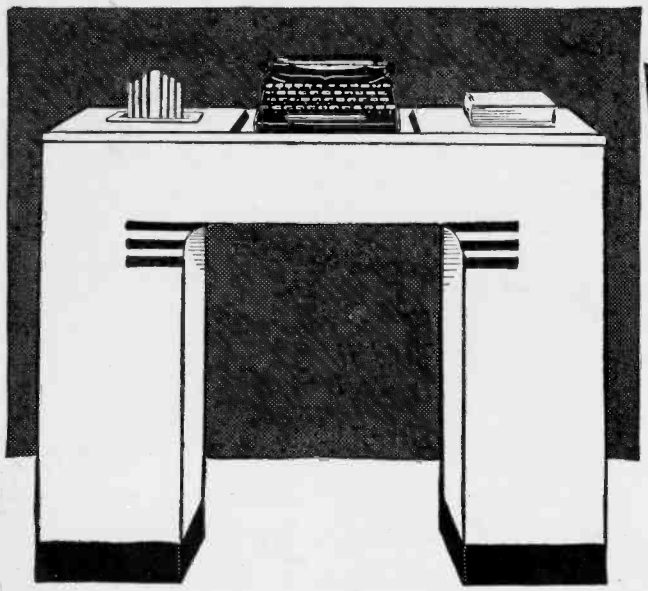
Please send me FREE copy of "HOW TO MAKE MONEY IN RADIO."

Name ..... Age .....

Address .....

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

Tear off this coupon, mail in envelope or paste on penny postcard.



THIS BEAUTIFUL DESK for only $1.00 EXTRA

WITH ANY REMINGTON PORTABLE TYPEWRITER

A beautiful desk in a neutral blue-green which will fit into the decorations of any home—trimmed in black and silver—and made of sturdy fibre board—is now available for only one dollar ($1.00 extra) to purchasers of a Remington Noiseless Portable Typewriter. The desk is so light that it can be moved anywhere without trouble—it is so strong that it will hold six hundred (600) pounds. With this combination of desk and Noiseless Deluxe Portable Typewriter, you will have a miniature office at home. Learn the complete details of this offer. Mail the coupon today.

The

COMBINATION

FOR AS LITTLE AS 10c A DAY

How easy it is to pay for this combination of desk and Remington Deluxe Noiseless Portable Typewriter! Just imagine, a small good will deposit with terms as low as 10c a day to get this combination at once! You will never miss 10c a day. Yet this small sum can actually make you immediately the possessor of this amazing office at home combination. You assume no obligations by sending the coupon.

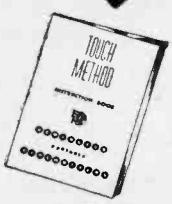
MONEY BACK GUARANTEE

The Remington Noiseless Portable Typewriter is sold on a trial basis with a money back guarantee. If, after ten days trial, you do not wish to keep the typewriter, we will take it back, paying all shipping charges. You risk nothing in buying a Remington Portable Typewriter on terms as low as 10c a day.

THESE TWO EXTRA FOR YOU

LEARN TYPING FREE

To help you even further, you get free with this special offer a 32-page booklet, prepared by experts, to teach you quickly how to typewrite by the touch method. When you buy a Noiseless you get this free Remington Rand gift that increases the pleasure of using your Remington Noiseless Deluxe Portable. Remember, the touch typing book is sent free while this offer holds.



SPECIAL CARRYING CASE

The Remington Deluxe Noiseless Portable is light in weight, easily carried about. With this offer Remington supplies a sturdy, beautiful carrying case which rivals in beauty and utility the most attractive luggage you can buy.

SPECIFICATIONS

ALL ESSENTIAL FEATURES of large standard office machines appear in the Noiseless Portable—standard 4-row keyboard; back spacer; margin stops and margin release; double shift key and shift lock; two color ribbon and automatic ribbon reverse; variable line spacer; paper fingers; makes as many as seven carbons; takes paper 9.5″ wide; writes lines 8.2″ wide. There are also extra features like the card writing attachment, black key cards and white letters, touch regulator, rubber cushioned feet. These make typing on a Remington Deluxe Noiseless Portable a distinct pleasure. Thousands of families now using the Remington Deluxe Noiseless Portable know from experience how wonderful it is!

MAIL COUPON NOW!

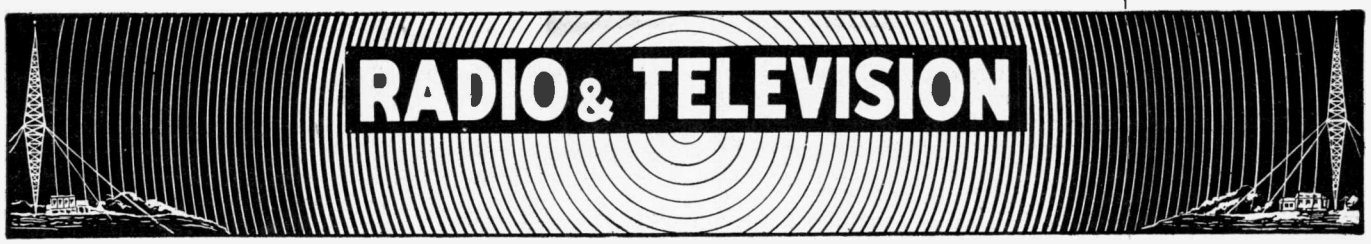
Remington Rand Inc., Dept. 300-5
465 Washington St., Buffalo, N. Y.

Tell me, without obligation, how to get a Free Trial of a new Remington Deluxe Noiseless Portable, including Carrying Case and Free 32-page Typing Instruction Booklet on terms as low as 10c a day. Send Catalogue.

Name.....

Address.....

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



Readers' Editorials

What Amateurs Can Do

This Month's Prize Winner

● *WE amateurs, beginners, and radio-likers should now tighten up our belts and plunge into the "defense" of aiding our defense program. Now, more than ever before, communication is one of the most vital factors confronting our ever-increasing problems. Let us devote as much of our time as we can to perfecting our code-speed and accuracy, our knowledge of the endless radio theory. Let us work every day to attain our goal as close to perfection as possible, so that if we are ever called we can step into any part of the vast communication system of the Army and Navy and utilize our knowledge to aid in the Defense of America.*

Let us make our sacrifices, too, wholeheartedly and cheerfully, so that our Government may make full use of our knowledge and capabilities in the communication field.

Let us prepare ourselves diligently and confidently, so if the time does come we will be ready to accept the toughest assignments given us, and be in a position to handle them immediately and unquestionably in an expert and efficient manner.

HARRY M. GANS,
7660 Fountain Avenue,
Hollywood, California.

Prize Award

HALLICRAFTER "SKY BUDDY" S-19R

44 mc. to 545 kc.
Value $29.50
Awarded to Harry M. Gans for his Guest Editorial
All others receive a year's subscription

ABOUT THAT RADIO CLUB

● IT is the writer's opinion that every Ham or SWL who does not belong to a radio club because there is no club near at hand has, at one time or another, thought of forming one, but immediately was discouraged as there did not seem to be anyone around interested.

That was the predicament the author had to face. He knew three others, and they might have formed a club—but they were always together anyway, and they wanted to get acquainted with some other "radio bugs." They went to a summer camp and met two others who were interested, and the band had grown 50 per cent. Back in the city, they put a notice in the school bulletin a few days after classes started at the local high school. Soon they met others and discovered latent interest in some they already knew.

Meanwhile they asked a local men's club for a room on the second story of their building. Two rooms were gladly offered, permission to put aerials on the roof was given and the men's club members started to donate equipment. Most of it was old, dilapidated, or considered useless, but it worked and good use was made of it. Because of winter conditions, making it difficult for the boys (who are scattered all over the city) to attend meetings, there was a momentary lull, but things are picking up again.

The original four believed that it was useless to organize a club. But just look at it now! Local Boy Scout authorities (many of the members are Scouts) co-operated, as did Hams, notably W1BQB, who donated much equipment; W1LGW, whose shack is often visited by club members; W1IBO with advice, encouragement and information; W1EER, and others. This goes to show that Hams will, when they see a group of really interested fellows around, spring to help, instruct, advise, etc.

Now the club, whose founders were sure it was going to flop, is thriving and becoming known around the city. Soon the club hopes to boast of two Hams, with others following as fast as possible, and when enough members are Hams, a club station will be organized and built. I didn't think "the club" would get anywhere, but a little work, some easily-acquired publicity and real enthusiasm will work wonders. So go ahead. You'll be surprised.

NICHOLAS ROSA,
Stamford Short-Wave Radio Club,
Stamford, Connecticut.

HOW TO MAKE RADIO ATTRACTIVE TO STUDENTS

● IN consideration of the forty million radios in thirty-four million homes in the United States, it is appalling to realize the extremely small percentage of these owners who possess any fundamental knowledge of the basic principles upon which their sets operate.

Since the thermionic vacuum tube is recognized as one of the greatest inventions of the past fifty years, it seems that its potentialities should attract more hobbyists. The number of radio hobbyists, among the youthful, in any given community is negligible compared to those actively interested in photography, model airplanes, wood-working, target shooting, etc.

For this situation there must be a reason. The financial expense cannot possibly be responsible, since any of the equipment just mentioned exceeds both in first cost and the cost of operation, the outlay for comparable radio essentials. Neither can the lack of available information on the subject be blamed when the books and periodicals devoted to the radio field are considered. Furthermore, radio is no more technical than many other hobbies, when pursued to the limit of the average amateur's enjoyment.

In the opinion of this writer, the fault lies directly in the technique of instruction offered in our secondary schools. The method of instruction employs an approach that is unattractive to the would-be experimenter. Our high school physics instructors and text-books introduce the subject of radio (if they do so at all) with complicated terminology and mathematical formulae, thereby destroying interest by absolutely *frightening* the embryonic radio "Ham."

An introduction to radio principles involving electrons, neutrons, positrons, gain factors, and formulae for resonance is as absurd as a requirement in a wood-working shop that would necessitate an understanding of cell structure, stress analysis, and photo-synthesis before the student could start making a neck-tie rack. If a consuming interest is motivated, these advanced and allied theories, laws, and hypotheses will come later if needed.

Apparently the remedy lies in demonstrating at the very outset some of the more spectacular capabilities of simple circuits utilizing thermionic vacuum tubes. For instance, a single triode could be arranged to control a lamp or motor by bringing a statically charged hard rubber rod or comb near the grid lead. This simple

(Continued on page 64)

NEW THRILLS—BROADCASTING FROM A SLED

The thrills that go with riding one of the racing sleds down the zig-zag Olympic bob run at Mount Van Hoevenberg, Lake Placid, which at times reached a speed of 70 miles an hour, were vividly described over WGY by Howard Tupper, using a portable short-wave transmitter or "pack set." Piloting the bob was Alexis Thompson, veteran racer, next, Mrs. Billy Fiske, widow of one of the bob run's greatest drivers, Mr. Tupper, and Tuffield Le Tour, the brakeman. See photo below.

Tupper's words were picked up at the bottom of the bob run, retransmitted by a more powerful short-wave set, a distance of 9 miles to Lake Placid, and there fed into a wire line to the studio in Schenectady.

Although this "stunt" has been tried before, this was the first time a successful broadcast has ever been given from a racing bob sled.

COMMISSION'S WOES PILE UP AS MAIL DOES SAME

The Federal Communications Commission has received the following resolution from the Greenwich (Conn.) Council of Women:

"Resolved, That the Greenwich Council of Women commend the increased policing of radio by the Federal Communications Commission, to guard against subversive activity, and the Council also notes with gratification the special appropriation of $1,600,000 authorized for this purpose by the President, and $175,000 from Congress with which to reallocate six of its seven main monitoring stations to detect unlicensed transmitters."

The Commission, which functions largely as a licensing authority, informs a Canadian professor that it is unable to confirm a radio announcement concerning the capture of a member of the British R.A.F. as a prisoner of war, but suggests that the inquirer communicate direct with the management of the station over which the announcement was made.

An advertising agency which wants the broadcast industry to observe standard time throughout the year as a solution to the time change problem is informed that the matter is one for determination by the industry itself.

A Yonkers, N. Y., man would ban from the air continuities of finance companies on the ground that they have a tendency to undermine stability of those not in a position to borrow money. He is advised that complaints relative to misrepresentation and unfair methods of competition in interstate commerce should more properly be addressed to the Federal Trade Commission.

A Long Island man opines that certain news commentators "are alarmists and should be held in restraint." His attention is invited to that section of the Communications Act which prohibits censorship of radio programs.

A woman protests the cancellation of a certain radio contract and a manufacturer complains of the refusal of a station to broadcast an advertising announcement with respect to a patent medicine. The Commission is without authority to require that a station transmit a particular program against the will and judgment of the licensee. The Communications Act specifically states that a person engaged in radio broadcasting shall not be considered a common carrier. Any business contract between a station and a sponsor is private in nature.

A New Yorker who applied for a license to do "radio servicing" is told that this is not a Commission function.

A Providence, R. I., inquirer is informed that as of February 1 of the current year there were 294 standard broadcast stations owned or controlled by newspapers or affiliated with newspapers.

To frequent requests for a copy of the International Morse Code, the Commission advises that the same appears in its printed booklet, "Study Guide and Reference Material for Commercial Radio Operator Examinations," which is sold by the Superintendent of Documents, Government Printing Office, Washington, at 15 cents a copy.

KGEI SHORTWAVES LETTERS TO AMERICANS IN ORIENT

The unrest in the Orient and the evacuation of American women and children from the Far East have increased interest in the Missionary Mail Bag programs of KGEI, a powerful short-wave broadcasting station in San Francisco.

Each Sunday morning from 5 to 6 o'clock, P.S.T., KGEI broadcasts messages from loved ones at home to missionaries in the Far East and Africa. Occasionally the sender broadcasts his own letter. Among the places to which oral "mail" has been "sent" are Borneo, Sumatra, Java, Shanghai, French Indo-China, Siam, Malaya, the Philippines, New Guinea, Angola and India.

"You are a God-send for lonely husbands of all of us who have had to evacuate from the Orient and we thank you," wrote one woman in submitting a "letter" to be sent to her husband at St. John's University, Shanghai.

Another user of the service, Mrs. Elizabeth B. Hall of Sanitarium, Cal., in requesting the broadcast of a letter to her husband in Shanghai, said: "We often listened to your mailbag broadcast and enjoyed it very much. Now as I am an 'evacuee,' I'm sure he would greatly appreciate it if he could get this word from me over the air."

The messages are simple but mean much to the receiver: "All are well here and we hope everything is going well with you;" "The kiddies are in school and settling in nicely;" "Everyone is wonderfully kind to us but we miss you and are counting on seeing you before very long;" "I have been too busy to be homesick but I do wish you were here," are typical.

The joy of a distant listener is expressed in the following letter received at KGEI from Mrs. J. G. McPherson in Shanghai:

"We were thrilled with joy beyond description. It was just so wonderful to hear Jim's voice and all of his news. Radio is just wonderful, isn't it? We always will be indebted to you for giving us such joy as we experienced last night. I am sure every one in foreign lands who hears you over the radio feels the same way about you."

Early morning in San Francisco is evening in the Far East, and the transmitting schedule for the U.S. is 8:00 to 9:00 A.M. E.S.T., 7:00 to 8:00 A.M. C.S.T., and 6:00 to 7:00 A.M. M.S.T.

PHILIPPINES GET FIRST COMMERCIAL

The first American commercial program to be heard in the Philippine Islands was transmitted on April 4th, when Xavier Cugat and his singer Yvette were heard over stations XZRH, Manila, and KZRC, of Cebu. The short wave affiliates of these stations rebroadcast the program to the entire South Pacific area, China, Borneo, Singapore and Indo-China.

No long remote relays were used in the transmission. The technique was simple; a transcription was made of a previous program, and was shipped to the Islands. This procedure will be followed regularly in the future, the NBC states.

It is estimated that there are 100,000 licensed radio sets in the Philippines alone and a survey has shown that each set has an average of 12.8 persons listening to it.

CLAIMS NEW TECHNIQUE

According to Philco publicity releases, Frazier Hunt, radio commentator and foreign correspondent, originated a new technique when broadcasting a news report over W3XE, Philco's television station in Philadelphia. While Hunt's script was done in the style characteristic of his regular broadcasts, video features were synchronized to show charts, maps, slides and movies.

While Philco believes this to be a television *first,* observers in the New York area will recall that a certain gasoline company sponsored a news broadcast one night per week over W2XBS more than a year ago. This used virtually the same technique as that employed by Hunt, who doubtlessly evolved his system without any knowledge of what had previously been done.

An examination of NBC records will show that an idea of this sort was suggested to program production men by the Television Editor of this magazine in the summer of 1939.

NORWAY SENDS GOOD WILL

A *memorandum* from the Royal Norwegian Legation in Washington tells that Norway has been sending out "good will" programs over 50 kw. short wave station WRUL in Boston. Among those who have appeared were Crown Princess Martha of Norway, the Norwegian Minister; Sigrid Undset, famous novelist; Dr. Albert Einstein, the scientist, and many others, including a large number of native Americans. The station also transmits Norwegian news programs.

Designed especially for the people of Norway, the programs are also heard throughout Scandinavia, England, West Africa, South Africa, and some South American locations. Ships on practically all the seas have also been points of reception.

From the caliber of the speakers one would judge this to be a "Free Norway" enterprise, for they did not appear to be the type that could be controlled by propagandists.

RESTORES VOICE TO DUMB

When John J. Smith had his entire vocal cords removed nearly nine years ago, he, of course, lost the power of speech. While he was able to move his tongue and lips in the same way as always no sound vibrations could be generated.

Then Gilbert Wright, an inventor, hit upon the idea of supplying an artificial voice to persons who had lost their own. His instrument, known as the *Sonovox,* makes a buzzing sound which is impressed upon the throat of the user. Were this person merely to breathe out when the sound modulations impressed are upon his respiration, he would emit a monotone. However, by moving his tongue and lips in the usual manner he is able to transform the buzzing sound into natural sounding words and phrases. Thus, John Smith regained his voice.

TELEVISION RECOMMENDATIONS MADE

As this issue goes to press, the Federal Communications Commission is considering recommendations made by the National Television Standards Committee. Industry experts predict that new standards will be 525 lines at 30 frames, with the sound on FM, and some think vertical polarization will be adopted. They believe that full commercialization will be permitted by fall.

CHINA WANTS TO KNOW HOW YOU HEAR MTCY

If you hear programs originating at Hsinking Central Broadcasting Station, MTCY, "The Voice of Manchoukuo," which operate on 11.775, 9.545, and 6.125 mc. using 20 kw., the director would like to know about it. He has sent many United States listeners the questionnaire below.

Listeners to MTCY are urged to fill in the information and send it to the station, the address of which is 601 Daido-Taigai, Hsinking, Manchoukuo. Should you have heard its signals and not have received a questionnaire, the one shown herewith can be copied.

QUESTIONNAIRE

Short-Wave System, Central Broadcasting Station, Hsinking, Manchoukuo

Name ..... Type of Receiver .....

Address ..... Manufactured by .....

..... Type of Antenna .....

..... Type of Ground .....

In answering the questions in the left hand column, kindly encircle the word nearest your answer, or fill in the blank space, on the right.

QUESTIONS	ANSWERS
1. How often do you listen-in on MTCY?	1. Daily; every other day; twice a week; once a week; only rarely.
2. On what wavelength?	2. 25.48m. (11.775 kc.); 31.43m. (9.545 kc.); 48.98m. (6.125 kc.)
3. At what time of day?	3. .....
4. At what time of day do you listen most to short wave broadcasts?	4. .....
5. On which day or days of the week do you listen most to short wave programs?	5. .....
6. Which Far Eastern short wave station do you like best, and why?	6. .....
7. What is the quality of the programs from MTCY on the whole?	7. Excellent; very good; good; fair; poor.
8. Which type of radio feature do you like best?	8. Talks; news reports; music; eye-witness accounts .....
9. Which type of music do you like best?	9. Manchou music; dance music; light music; classics; semi-classics.
10. What short wave stations in the Far East come in stronger than MTCY?	10. .....
11. Are the programs from MTCY interfered with by other stations?	11. Yes; no.
12. If so, kindly name station or stations.	12. .....

Remarks: .....

.....

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.....

LATIN AMERICAN IDOL GETS U. S. CONTRACT

Juan Arvizu, who is to all Latin Americans what Clark Gable is to impressionable feminine movie-goers, has been signed to a long-term contract by the Columbia Broadcasting System. Arvizu, a singer of ballads and folk songs, is the first major artist acquisition for the system's new Latin American network, to be inaugurated early in September when the two new 50 kw. transmitters are expected to be complete. Until then the Latin American star will be heard on American stations.

"The tenor of the silken voice," as he is called South of the Rio Grande, was born in Mexico.

LISTENING FOR PUERTO RICO

Two stations in Puerto Rico have applied for permission to broadcast on 580 kilocycles and it looks as though one of them is going to be out of luck! Enrique Abarca Sanfeliz applied for this channel, to be used for unlimited time with 5 kilowatts during the day and 1 kilowatt at night. At the same time, United Theaters, Inc., also of San Juan, asked to use it for unlimited time on 1 kilowatt. The F.C.C. found that Sanfeliz not only is better qualified financially than the theaters, but that the station which he proposes would provide superior technical service. Therefore they plan to give Sanfeliz a construction permit. Maybe we'll be hearing his station on the air waves soon.

AIDS TELEPHOTO TRANSMISSION

A *new coupling* unit which enables pictures to be transmitted from remote points to newspaper offices, etc., has been developed by the engineers of Bell Laboratories and is described in *"The Record."* Using this apparatus, the cameraman out on the assignment, having developed his picture, goes to the nearest telephone booth,

drops his nickel in the slot and proceeds to send the picture image over the lines to the point of reception.

The engineers have devised this new coupling to permit greater fidelity in the images sent and to prevent interference with other telephone lines. The apparatus pictured herewith consists basically of a transformer with three windings. The first is connected to the apparatus, a second to the line, and a third to a vacuum tube circuit. The tube is a gas-filled unit which has nearly infinite resistance at potentials below about 75 volts. At approximately this point the gas in the tube ionizes, reducing the internal resistance to a very low value. These peaks, which might cause the telephoto signals to leak in the neighboring lines, are suppressed at the source. The apparatus is made small and equipped with a handle to secure extreme portability.

WHO STARTED PUSH-BUTTONS?

The United States Circuit Court of Appeals for the Seventh Circuit has ruled that the Heath Patent, owned by the Zenith Radio Corporation, represents the earliest invention covering the modern form of automatic tuning, in which the pressing of a single button mechanically tunes the radio directly to the desired station.

This same court of appeals has just denied a petition for a rehearing of the case. This famous radio automatic tuning controversy was technically known as Jacke vs. Heath, but the real principals were the Philco Company, who owns the Jacke Application, and Zenith Radio, who owns the Heath Patent, according to E. F. McDonald, Jr., president of Zenith.

Zenith originally introduced Push-button automatic radio tuning in 1928; and quite recently introduced Safety Automatic Foot Control for automobile radios, which development is used today on the Lincoln, Nash, Ford, Mercury and Zephyr automobiles.

FCC's ANNUAL REPORT SUMMARIZES RADIO PROGRESS

In its annual report, which incorporates important developments since the close of the fiscal year, the Federal Communications Commission chronicles new milestones in the advancement of broadcasting, and cites augmented duties in supervising radio, telephone, telegraph, and cable in connection with the national defense program.

This streamlined report is almost half the size of the one last year. To summarize some of its highlights:

National Defense—The Commission's particular role in the preparedness program is to "police" radio communications. In consequence, it has added to its monitoring and other field facilities. Also, it must keep tab on the many persons who operate electrical apparatus capable of farflung and almost instantaneous communication. So it is requiring all radio operators (about 100,000 licensees including *commercial* and *amateur*) to prove their citizenship. Common carriers are compiling similar data with respect to employees who engage in international communication. The Commission has banned amateur communication with foreign countries, and, further, prohibits the use of portable long-distance transmitters by amateurs. Individuals and industries concerned are collaborating in this common contribution toward the national security. The relationship of radio, wire, and cable facilities to the preparedness picture is being further coordinated in planning by the Defense Communications Board, created by Executive order in September.

Broadcasting (FM)—Last year, which marked the 20th anniversary of broadcasting, was notable for the acceptance of frequency modulation, popularly known as "FM" or "staticless radio." By utilizing the high frequencies, FM promises to relieve the long congested standard broadcast band. Business will benefit by the new equipment, sets, and servicing which FM requires. And, by being generally limited to local coverage, this new service should have a stimulating effect on local programming. Distinctive call letters have been assigned.

Broadcasting (Standard) — This older type of broadcast (which uses amplitude modulation) should experience a marked improvement in service by reason of the North American Regional Broadcasting Agreement, effective March 29th next. Mutual interference problems are expected to be eliminated or minimized as a result of this compact between Canada, Cuba, Mexico, and the United States. To make agreement possible, the Commission is effecting an orderly shift of frequencies without disturbing the general broadcast structure. A total of 846 standard broadcast stations were operating or under construction during the fiscal year. There were 79 new authorizations and 10 deletions. Increased use of directional antennas is necessary in coping with the interference problem. The report of the Commission's special committee on chain broadcasting was the subject of oral argument in December in connection with its consideration by the full Commission. Commission inquiry revealed some 200 domestic stations broadcasting in about 30 foreign languages. Commission action in five broadcast cases was upheld by the United States Supreme Court.

Broadcast (International) — Broadcast service to Latin America was improved by reason of the Commission requiring power of at least 50 kilowatts for international program service. In this country 13 international broadcast stations were operative.

Television—Television is now making substantial progress with the cooperative assistance of that industry and the Commission. More than a score of stations geographically distributed throughout the nation have been licensed to experiment with various types of transmission with a view to reaching early accord on uniform standards which will enable television to move forward on a full commercial basis. Participating stations have budgeted a total of $8,000,000 for this practical experimental work. In conjunction with such effort, a National Television Systems Committee, jointly sponsored by the Radio Manufacturers' Association and the Commission, has made a thorough study of the engineering phases of the situation which should be helpful in arriving at a general agreement. The continued rapid evolution of television is attested by developments in color reproduction, large-screen projection, and new service demonstrations.

Miscellaneous Radio Services—Increased use of radio for miscellaneous services is noted. Police radio stations have increased to 6,300, aviation stations to nearly 2,000, and more than 1,000 stations are employed for forest conservation work. The Commission clarified its rules with respect to more than 450 special emergency stations. The Commission completed its final report on a special study of radio requirements for safety purposes on the Great Lakes and Inland Waters, and gathered information with respect to possible like need on the Mississippi River system. *There are 56,300 amateur stations in operation.* Some 40,000 commercial operator licenses were handled during the year. Inspection was made of radio installation on more than 14,000 ships and at some 8,600 land stations.

Telegraph, telephone, cable and accounting were other categories covered in the FCC report.

NBC MARKS DECADE OF SHORTWAVE BROADCAST

With the inauguration on March 24 of two new short wave transmitters having a combined power of 100,000 watts, the National Broadcasting Company observed the 10th Anniversary of the Inter-American network which it pioneered in cooperation with standard broadcasting stations in the other Americas.

The two new transmitters are WRCA and WNBI, and are heard on the three following frequencies: 9.67, 11.89 and 17.78 mc. Three other frequencies, 61, 21.63 and 15.15 mc. have also been assigned.

The anniversary celebration featured an exchange of programs between NBC stations in the United States and leading broadcasters of the Republics south of the Rio Grande.

NBC was the first to undertake regular broadcasts to South and Central America and the programs sent out by short wave and picked up by affiliated long and short wave stations have become part of the everyday life of the radio listeners in the other Americas.

WORLD'S LARGEST RADIO LABORATORIES TO BE BUILT AT PRINCETON, N. J.

The world's largest radio research laboratories will be built by the Radio Corporation of America, at Princeton, N. J., David Sarnoff, the company's president, announced recently. It will be known as "RCA Laboratories," and will be the headquarters for all research and original development work of the organization, and for its patent and licensing activities. The new laboratory is planned to promote the growth of radio as an art and industry, and to meet the expanding demands of national defense.

A further purpose, Mr. Sarnoff said, will be to facilitate the creation and development of new radio products and services which will provide new business and new employment for the post-war period. Under the impetus of emergencies intensive research creates new instrumentalities, and further research and development are necessary to adapt them to use by the public.

"We will erect a laboratory building which will include a lecture auditorium and the combined technical and patent libraries of the RCA organization," said Mr. Sarnoff.

"Such important fields as television, facsimile, electron optics, wave propagation and ultra-high frequencies open to radio a future even greater than its past. The developments in these fields will contribute to the creation of new industries and to the improvement of existing services."

"More and more of our research work is being concentrated on problems of national defense. The new laboratories will make it possible to increase these efforts and to insure the maximum use of our research facilities for defense.

"The achievements of modern radio," continued Mr. Sarnoff, "are also capable of increasing and improving our industrial output in many lines. By the application of electronic devices to industrial processes, the Radio Age promises to electronize modern industry, just as the application of electrical devices to industry at the beginning of this century created the Electrical Age.

"By the establishment of the new laboratories, radio quickens its pace alongside the older industries—electrical, steel, automobile, wire communications, chemical, metallurgical and others—which, through research, have contributed to the industrial leadership and progress of this country. It is through invention and the practical applications of research, that American ingenuity has raised the standards of living in the United States above those of any other nation.

"No new industry in the history of this country has made greater strides than radio, or contributed more extensive benefits to people in all walks of life."

AN OPEN LETTER TO THE F.C.C.

John Shepard, 3rd, president of FM Broadcasters, Inc., and The Yankee Network, has written an open letter to Chairman James Lawrence Fly of the Federal Communications Commission outlining a number of topics pertinent to FM. His letter may be summarized as follows:

1. He urges changing over the present FM stations to their new frequency assignments, assigning them permanent call letters *and permitting them to operate on a regular commercial basis.*

2. He suggests that new FM stations be permitted to commence operation on a regular commercial basis *without requiring at the beginning that they cover their ultimate service area.*

3. He asks that the Commission relax requirements calling for the filing of voluminous technical data with FM applications.

4. He requests permission for FM stations *to use the present bands above 100 mc.* assigned to relay stations for the purpose of feeding programs from studios to FM transmitters and from one FM transmitter to another. He states that this will avoid difficulties entailed in getting high fidelity telephone lines at moderate cost.

5. He suggests that FM stations *be given one year* to submit proof of audio performance during tests as a complete station rather than making such proof be furnished before the license is granted.

6. He does not believe that the call signals embodying numerals (which indicate the channel on which the station is operating) are desirable *due to the fact that radio listeners are unfamiliar with such listings.* However, he proposes an alternative system which is that if numerals are used, the second letter should follow the numeral instead of preceding it.

HUGE S.W. STATION FOR BRAZIL

One of the largest and most powerful short-wave radio stations in the world is being erected at Rio de Janeiro for the Brazilian Government under the terms of a contract signed by RCA-Victor Brasileira, RCA Mfg. Co. subsidiary.

The 50,000 watt short-wave station will have eight antennas for serving the principal countries of the world. Two antennas will be beamed on the United States, two on Europe, one on Asia, and three nondirectional antennas for South American coverage.

The contract also calls for the equipment of three large studios and several smaller ones. The station is to be turned over to the Brazilian Government in operating condition by January, 1942.

GIRLS, ARE YOU BEAUTIFUL? JACK WANTS TO KNOW

That genial young man, Jack Eigen of WMCA, is now searching for the most beautiful listener within the service area of that station. The winner will be escorted by the hard-working Eigen through a round of New York night-life, presented over the radio and introduced to a movie talent scout. After that she is "on her own!"

Listeners will be requested to mail in photos of themselves with data on age, weight, color of hair and eyes. The overworked Mr. Eigen will be the sole judge of the contest and while he has had previous experience in such arduous labors, he has no prejudice against brunettes. *(What was that famous saying of Anita Loos'?)*

COOLER TELEVISION FLOODLIGHT

New television floodlights that will produce the same illumination with but one-quarter the heat of the present incandescent lamps have been developed by General Electric's laboratory engineers.

The new type floodlights use three water-cooled, 1000-watt mercury lamps and will produce an illumination over 100 square

feet equal to that of daylight on a reasonably clear day, it was announced today by A. F. Dickerson, lighting division manager.

Each of the mercury lamps is smaller than a cigaret. Combined in the floodlight, the three lamps produce 195,000 lumens of light, an amount equivalent to that produced by 225 of the 60-watt incandescent lamps commonly used in the home.

The new floodlight is equipped with motors and gears for remote control operation. The light can be turned to follow the movements of the studio performers, thereby providing adequate general lighting at all times for the television camera.

U.S. RADIO BOOSTS MORALE

The morale of the English remains high despite the intensity of German bombardment.

This is the tenor of scores of letters received from England at WGEO, a short-wave broadcasting station at Schenectady.

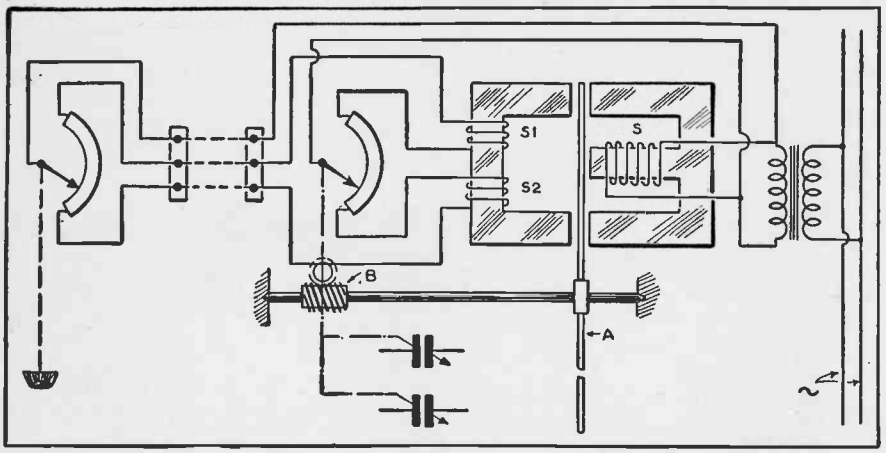
Broadcasts from America continue to provide one of the chief sources of entertainment in Britain.

Typical of the letters received at WGEO is that from Charles J. Holdeman, an American in Glasgow, who is serving as a wireless operator and rear gunner in the Royal Air Force. He writes:

"I still listen to your cheery station and reception is perfect. It is very good to feel that we have such great friends as you in this world of hate and massacre. We are making history over here and I am proud to be part and parcel of that history."

From "somewhere in Cornwall," Donald Roberts writes: "I feel that I must write and thank you for singing those beautiful hymns. They give us more confidence that we are going to win this war than anything else in the world."

Danes Use Eddy Current Motor in Remote Tuning Idea



Variable resistors (arrows) control motor's direction.

● A CIRCUIT for a remote tuning unit is described in *Popular Radio* of Denmark. Remote unit connects by a 3-wire cable to the motor-driven control in the receiver. By using a potentiometer, the solenoids S1 and S2 can be energized in varying degrees so the position of the arm working on the potentiometer in the receiver will determine the degree of rotation of the eddy current motor disc *A*. This disc is mounted on a shaft which also carries worm gear *B*. This drives a spur mounted on the end of the condenser shaft which also carries the arm of the potentiometer in the drive mechanism in the receiver. The device appears to be simple and positive in action, and though not as complex as the push-button tuners used in American sets, might be expected to tune with slightly less precision.

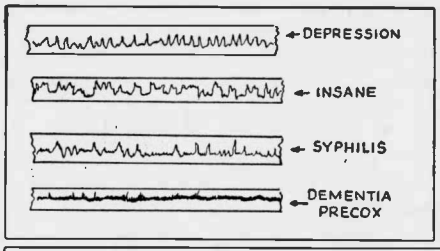
BRAIN WAVE RECORDER

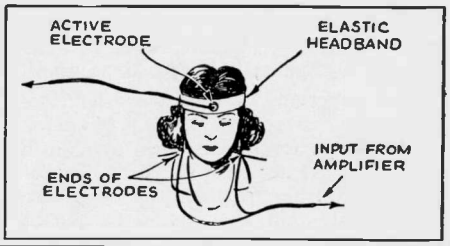
● A VACUUM tube device for registering the radio active waves emitted from the human brain is described in *Radio Revista* of the Argentine. The circuit is pictured herewith. The output may be fed into a meter, or an oscillograph, or a recording device such as shown in outline in the sketch. The circuit is simply a high gain multi-tube amplifier with a sensitivity control and push-pull output.

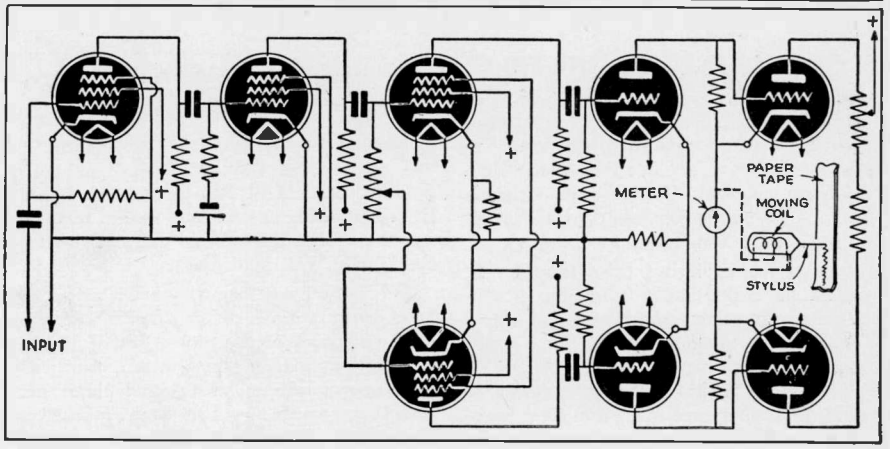
The second picture shows how the electrodes are attached to the head of a subject undergoing examination.

The output pulsations vary in accordance with the subject's state of mind, a highly irregular line indicating insanity, a rather regular line showing mental depression, etc.

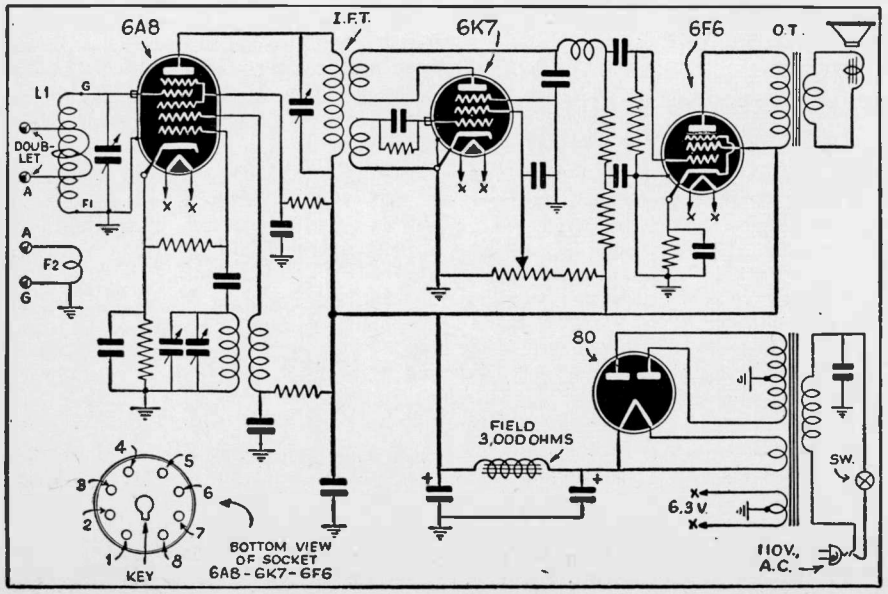
The inventor of the device, Dr. Frederick Lamere, is said to believe that it can also be used to diagnose certain diseases. Such apparatus has been demonstrated in the U. S., but the medical profession here has never become very enthusiastic about it.







Any Novice Can Build Argentine's Compact A.C. Portable



● A SIMPLE receiver for use on A.C. is described in *Radio Revista* of the Argentine. This set makes use of one 6A8, one 6K7 and one 6F6 in the receiving circuit, and employs an 80 as rectifier. It was designed particularly to be constructed at low cost and employs the popular superheterodyne circuit. If desired a series of coils may be used with a tap switch provided to permit reception on several bands.

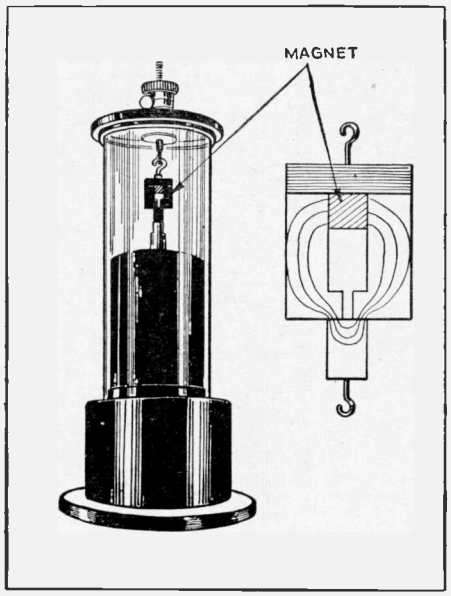
The 6A8 is employed as the R.F. stage, the 6K7 as I.F., and the 6F6 as detector and audio. A small permanent magnet dynamic speaker can be used or one having a field of about 3000 ohms can be substituted, the field being used as a choke in the positive B lead.

As the circuit shows, one primary is provided for a doublet and another primary is also furnished so that antenna and ground may be used if preferred. By omitting both these primaries and their secondary, a tuned loop can be used, making the set self-contained.

MAGNET LIFTS 3500 TIMES OWN WEIGHT

● A NEWLY designed permanent magnet capable of lifting 3500 times its own weight is described in *Philips Technical Review,* a Dutch publication. The accompanying picture shows how the magnet is designed to form a path which intensifies the flux. Only the shaded portion of the diagram is the magnet proper, the rest being a special armature which is attached to it.

In order to supply its great power, the pole surfaces must be ground perfectly smooth to avoid the introduction of air gaps, no matter how minute. The magnet portion is made of a special kind of steel known as "Ticonal 3.8." The pole pieces are an alloy, half cobalt and half iron. The magnet is only 4 millimeters square (about 1/6"). As will be seen from the diagram, the magnet steel itself bears no load, the entire weight being supported by the armature which concentrates the flux, thus avoiding extra mechanical stress. ➤



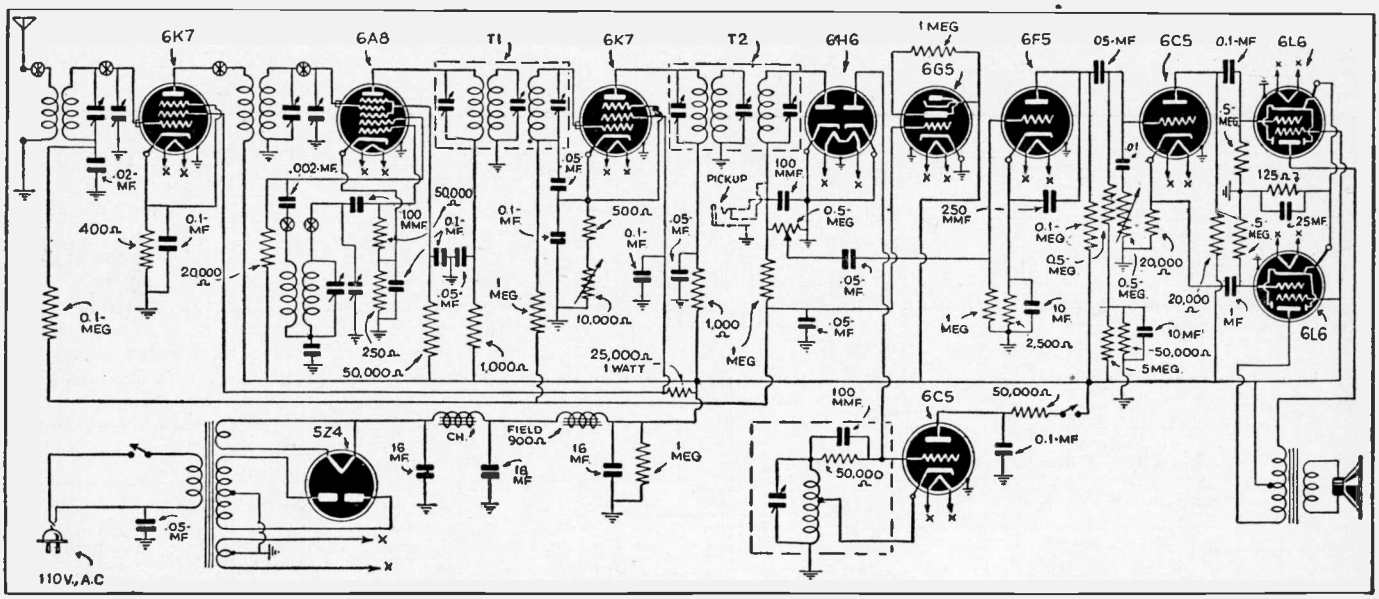
A HIGH FIDELITY RECEIVER

● A HIGH fidelity receiver for use in getting the utmost from modern excellent transmissions is described in *Control,* an Argentine radio magazine. Not shown in the diagram, switch coils may be employed for reception of broadcast and short waves, and the set is also designed so that a phono unit may readily be plugged in.

Values of all parts are given on the diagram. There are no particular items to watch in constructing a receiver of this sort, for the circuits are all simple and straight-forward.

The transformer T3 provides 770 volts at 200 ma. and also has filament windings of 5 volts at 3 amps., and 6.3 volts at 5 amps. The choke has an impedance of approximately 100 henries at 105 ohms and must be sufficiently heavy to pass 200 ma. The speaker field has 900 ohms resistance and is also used as a choke.

Tuning coils of the plug-in type may be used if simplicity and economy are desired, at some sacrifice of convenience. ▼



Radio Sales Tax Waived on Second Hand British Sets

● A RECENT announcement by H. M. Customs and Excise, reported in *Wireless World* of Britain, defines the position of second-hand or reconditioned receivers. No tax is chargeable on such sets where transactions are between retailers and their customers. Where a retail branch of a registered firm of manufacturers "acquires a set from a customer, reconditions it to an extent not involving manufacture, and resells it retail," no liability for tax is involved.

Any chargeable parts or materials used in the reconditioning will normally have been taxed at an earlier stage.

(EDITOR'S NOTE: As this item from Britain shows, few sources of revenue are being neglected. This may foreshadow coming events in our own country.)

Can YOU Answer These Radio Questions?

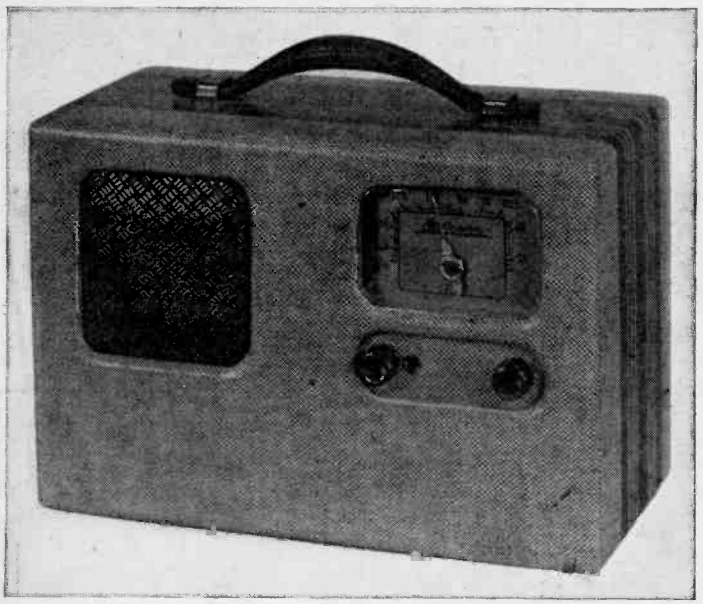
1. **Where is short wave broadcast station MTCY located?** *(See page 7)*
2. **When was the first "push-button" tuned radio set introduced?** *(See page 8)*
3. **Why should a good portable battery receiver have an R.F. stage?** *(See page 12)*
4. **How can interference from a Diathermy apparatus be curtailed?** *(See page 17)*
5. **Can you explain briefly what is meant by a high-fidelity audio amplifier?** *(See page 20)*
6. **What are the benefits of a good antenna tuner in a Ham station?** *(See page 35)*
7. **What is the action taking place in a superhet receiver?** *(See page 38)*
8. **What is a "Musicaster" and how does it work?** *(See page 42)*
9. **What is a simple method of preventing the cuttings from piling up around a recording needle when making records?** *(See page 45)*
10. **What is the Kerr cell and how does it work?** *(See page 50)*
11. **If the spring governor from a phonograph or other motor broke, how would you make a simple emergency repair?** *(See page 52)*
12. **How can a simple yet very effective testing device be made with an ordinary lamp bulb?** *(See page 54)*

How to Build the

Meissner A.C.-D.C. Battery 3-Way Portable

Henry Townsend

This portable works on 110 volts A.C.-D.C. and also on batteries when desired. It uses 6 tubes, has a "built-in" loop antenna and works a loudspeaker. It packs a good wallop and has an R.F. amplifier to boost weak signals.



This portable receiver is well designed and will appeal to the average set-builder, as it is available in kit form, complete with speaker and cabinet.

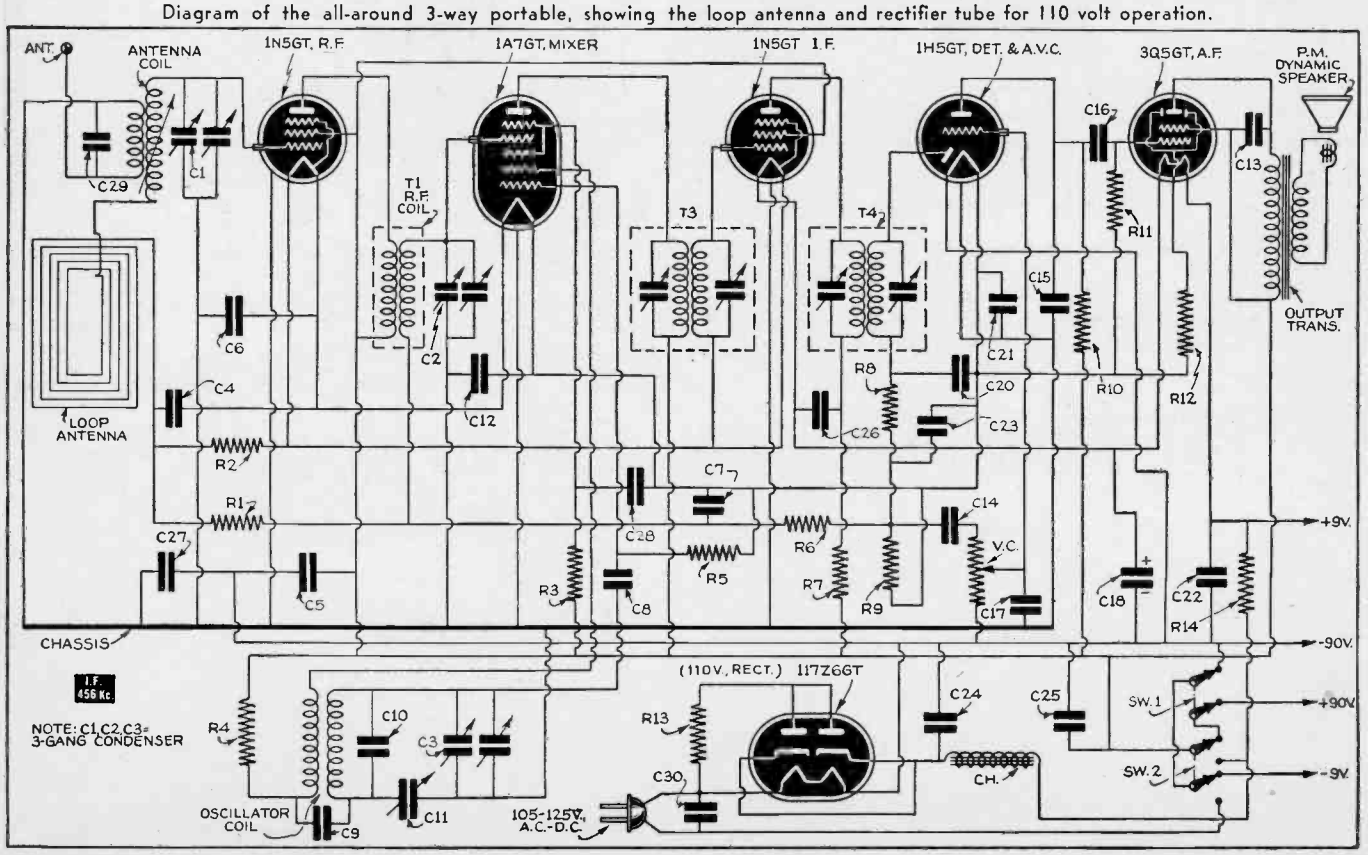
● AS the summer season approaches, portable radio receivers are in great demand. The one here illustrated is a very efficient one, sufficient amplification of the signals being provided, so that even the weaker stations can be picked up on the loop antenna provided in the set. The trouble with a great many portable receivers is that there is insufficient amplification of the signal picked up in the loop aerial; the consequence is that the average station is barely audible on the loudspeaker. An R.F. amplifying stage to boost these weak signals, before they are passed into the mixer stage, is here provided.

A 1N5GT tube is used in the R.F. booster stage, and an optional antenna coupling circuit is provided, so that where it is desirable and convenient, an antenna wire (simply a 20 ft. piece of wire laid on the ground) will bring in excellent results, whether the wire is bare or insulated. The mixer tube is a 1A7GT followed by an I.F. amplifier, an 1N5GT. The second detector and AVC tube, is a 1H5GT, and the final audio amplifier stage utilizes a 3Q5GT. For 110 volt A.C. or D.C. operation a rectifier tube, a 117Z6GT tube is employed, with a suitable filtering circuit, comprising an iron core choke and good size condensers.

All of the parts for building the set are available in kit form. Many readers will probably prefer this method whereby to build up this portable superhet receiver.

The loudspeaker used is a 5-inch diameter permanent-magnet dynamic type, with a suitable output transformer to feed into it.

Diagram of the all-around 3-way portable, showing the loop antenna and rectifier tube for 110 volt operation.



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Amateur Net, Less Speaker, $159.50
$15.95 Down, $12.68 Monthly for 12 Months

THE SKY BUDDY MODEL S-19R

The Sky Buddy covers everything on the air from 44 mc. to 545 kc. including the 10, 20, 40, 80 and 160 meter amateur bands. Employs the same electrical bandspread system used in higher priced Hallicrafters Models. Controls are arranged for maximum performance with minimum effort.

Amateur Net, $29.50
$4.43 Down, $4.43 Monthly for 6 Months

THE SKY CHAMPION MODEL S-20R

The best value ever offered in the communications field. 9 tubes—4 bands—tunes from 540 kc. to 44 mc.—has all the essential controls for good amateur reception—built-in speaker—provision for operation from batteries or vibrapack.

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NAME .....

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CITY ..... STATE .....

All of the resistors and condensers used are of standard type.

In order to obtain the most satisfactory results in construction and operation of this receiver the following instructions should be carefully followed, placing each part in the position shown and arranging the wiring as indicated in the pictorial wiring diagram.

Assembly

1. Mount the six tube sockets with ¼" screws and nuts. Use a lockwasher under each nut in the assembly. Be sure to turn each socket so that the key-way in the central hole points in the direction shown in the pictorial diagram.

2. Take the 3-gang tuning condenser and place a nut on each of the three mounting studs. Then place the condenser on the chassis and fasten in place with three nuts and lockwashers. The three nuts placed on the studs first will serve as spacers to raise the condenser slightly above the chassis.

3. Solder a four-inch length of green stranded wire to the top terminal on the *front* section of the tuning condenser and a two-inch length of the same wire to the corresponding terminal of the *rear* section.

4. Mount the antenna coil on the gang condenser shield in accordance with the illustration in the lower left hand corner of the schematic diagram, then mount the condenser shield on the gang condenser.

5. Prepare the R.F. coil, 01606, for mounting. First remove the coil by taking out the screw in the top of the can. Then solder a 4" piece of stranded green wire to the lug which in the pictorial diagram has no wire attached below the chassis. Reassemble the coil in the shield, running the green lead out through the hole in the top of the can and at the same time mount the tin shield as shown in the top view of the chassis illustration in the lower left corner of the schematic diagram. There is a locking pin in the bracket that holds the coil in the can. This pin should engage the small hole in the top of the can for the purpose of properly locating the coil.

6. Place the five rubber grommets in the chassis openings at the places shown in the pictorial diagram.

7. Mount the two I.F. transformers (T3 and T4) bringing the wire leads out through the holes in the chassis, observing the color code shown in the pictorial diagram. Place two of the tie-point strips on the mounting studs of T3 before applying the lockwashers and nuts.

8. Mount the long terminal strip on the back of the gang condenser as shown in the rear view of the receiver illustrated on the schematic diagram. The method of mounting is to solder the two mounting feet directly to the end plate of the gang condenser. A very hot iron facilitates this operation. Then mount the remaining terminal strips as shown in the pictorial diagram.

9. Mount the oscillator coil (T2) exercising care to *see that the lug with green dot is located in the upper left hand corner as shown.* Mount the padder condenser (C11) on the rear of the chassis as shown.

10. Remove the large nut and lockwasher from the volume control and mount this unit on the front of the chassis. The projecting metal tip fits into a small hole in the chassis to locate the control and prevent it from rotating.

11. Mount the electrolytic filter condenser on the bakelite mounting strip, twisting the 3 mounting lugs about ⅛ turn to make a tight fastening. Exercise care to see that the position of the condenser corresponds to that shown in the pictorial diagram. Mount the above assembly *on top* of the chassis and cover the electrolytic condenser with the black cardboard cover provided. Mount the filter choke 19341 and the change-over switch (S2).

Wiring

Having completed the assembly of all the parts which are fastened to the chassis, the wiring of the set may be started. The assembly of the "Off-On" indicator disc and the tuning dial will be left until after the wiring has been completed.

Have the soldering iron clean and hot. Solder one point on each socket-mounting to the chassis. A small spot of solder applied near one of the mounting screws on each socket and sweated to the chassis with the soldering iron will do this job nicely.

The #1 pin on four sockets should be connected to the nearest lug on the socket mounting-saddle by means of a short piece of bare wire. Locate, install and solder these connections. Next wire the filament circuit according to the pictorial diagram. (The filament circuit appears on pins #2 and #7 on every socket.)

Cut the wires from the I.F. transformers (T3 and T4) to the proper length and solder them to the terminals indicated. Follow the color code carefully.

Place and connect all other wiring as shown, in any convenient order. The battery and speaker wires which extend through the grommet at the rear of the chassis should be left a foot or more long. A piece of shielded wire about eight inches long is connected to the middle terminal on the volume control and brought up to the top of the chassis through the rectangular opening. This wire will provide a top grid connection for the 1H5GT tube.

Connect the .00001 mica condenser (color code brown, black, black) on the oscillator coil as shown. *If the wrong condenser is used in this place the radio will not work.*

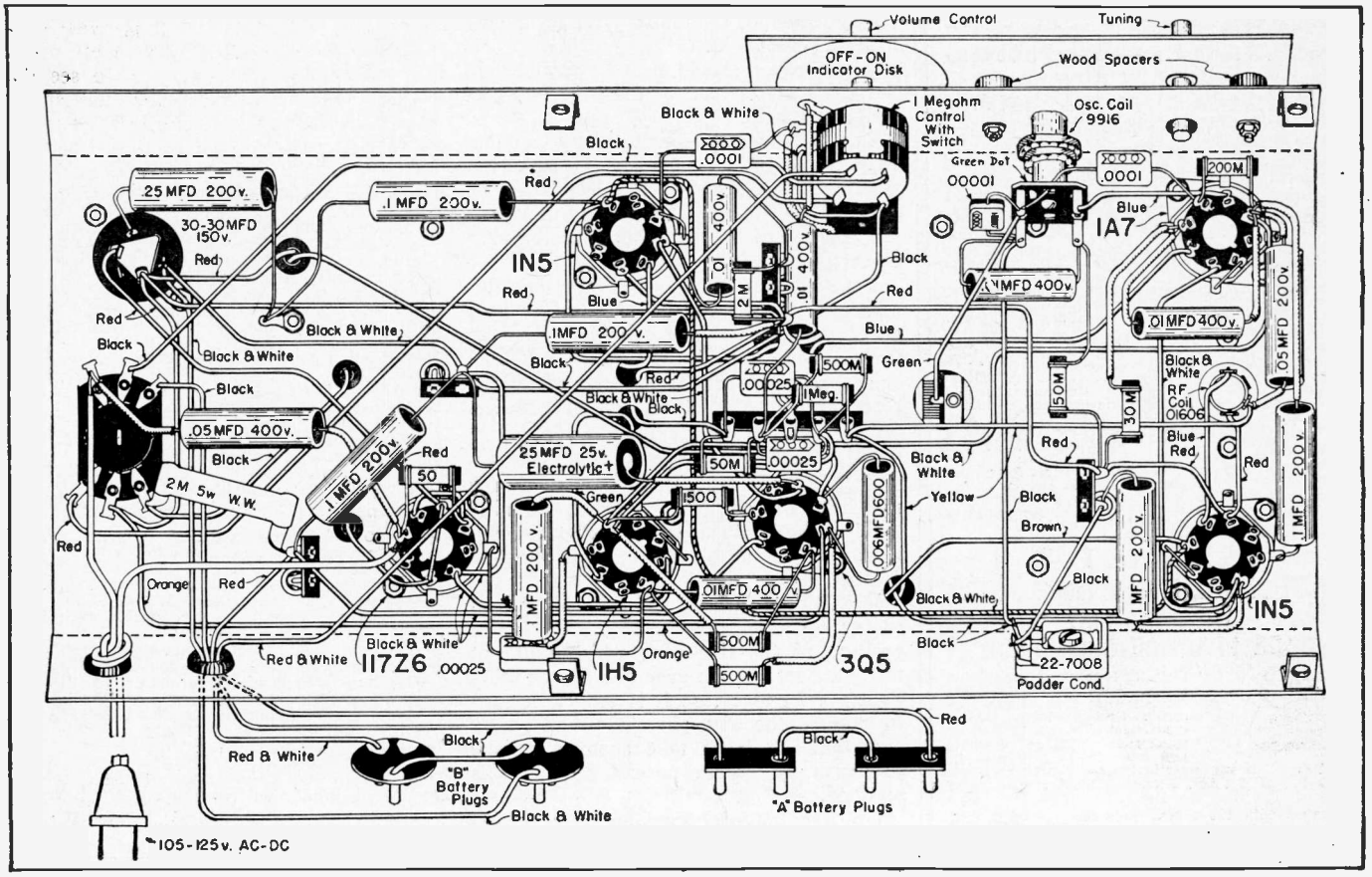
Connect the condensers and resistors as shown on the pictorial wiring diagram. Use the braided insulating sleeving on bare wires where indicated or wherever else it may seem necessary to prevent such wires from touching each other or the chassis.

Insert tubes in the sockets and determine the proper length of grid leads for top connections. Solder the four grid clips to the grid wires as shown. Note that two wires are connected to one clip on the 1A7GT tube.

Complete the wiring of the antenna coil and of the terminal strip that appears on the rear of the gang condenser.

Check all wiring and connections very carefully.

Place the red and white "Off-On" indicator disc on the volume control shaft and then mount the dial. Use the two black wood spacers between the dial plate and the front of the chassis. See that the tuning condenser plates are completely open. Place the pulley on the shaft in such a position that the hole in the rim of the pulley points where 7 appears on a clock face when the set is viewed from the front, right side up. Tighten the set screw. Close the gang condenser and slide the pointer until it coin-



Picturized wiring diagram for the 3-way portable, looking at the bottom of the chassis.

cides with the last line at the low frequency end of the dial.

Connect the battery plugs paying special attention to the pins to see that the wires are connected as shown. On the plugs with only two pins each, one is considerably larger than the others so that the plugs can be inserted in the batteries only one way. Be sure the wires are connected to the pins of proper size.

- Place the grid clips on the top grid connections of each tube and bend the metal grid shield (mounted on top of the R.F. coil) so that it lies close to the grid wire coming out of the top of the coil, but not touching the grid clip.

Testing Preparations

Since it is impossible to adjust the set in the cabinet it is necessary to make a temporary set up in which the receiver, loop and batteries occupy approximately the same position with respect to each other as they would if assembled in the cabinet.

First, remove the sliding shelf from the cabinet and mount the set thereon. Temporarily connect the loud speaker to the terminal strip on top of the chassis and the loop to the terminals indicated in the partial pictorial diagram shown in the lower right hand corner of the schematic diagram. The loop should be so connected that the turn nearest to the set is attached to the terminal strip on the gang condenser. The other loop terminal connects to a lug on the antenna coil. The batteries should be placed under the set and the loop should be stood up behind the set so that the set, batteries, and loop bear the same relation to each other as if they were mounted in the cabinet in the normal manner.

Alignment

For alignment purposes, a good service oscillator will be very helpful and is recommended if available. Satisfactory results may be obtained, however, by tuning in strong broadcast signals near the alignment frequencies specified.

Turn the change-over switch on the top of the chassis to the "battery" position (counter clockwise position viewed from above). *Do not connect the line cord to the power line.*

Connect the output of the service oscillator to the top grid of the 1A7GT tube through a .01 to 1.0-mf. condenser and the low side of the generator to chassis. Connect a suitable output meter to the voice-coil of the speaker. If no output meter is available, the variation in volume of sound from the speaker may be used as an indication of maximum signal for each adjustment. Set the oscillator output to 456 kilocycles and the receiver dial to 600 kc.; then adjust the trimmers in the top of each I.F. transformer for maximum output. Use only enough output from the oscillator to obtain a satisfactory reading on the output meter or an audible note in the speaker. Best results will be obtained on the lowest possible signal input to the receiver. Repeat the adjustment of these trimmers several times to make sure that the best possible adjustment has been obtained.

Remove the service oscillator connections from the receiver. Connect to the generator output terminals one or two turns of wire about one foot in diameter and place this loop close and parallel to the loop on the receiver.

Check the pointer position to see that it coincides with the last line at the low frequency end of the dial.

Set the generator to 1400 kc. Adjust the tuning knob of the receiver so that the pointer indicates the same frequency. Adjust the oscillator trimmer (middle) on the gang condenser until a signal is heard. Adjust the other two trimmers for maximum response, moving the generator and attached loop away from the receiver to reduce signal as the receiver becomes progressively more sensitive, during alignment. Reduce the generator output if necessary to keep the sound output low, but this should be done only after the generator and attached loop have been moved some distance from the receiver loop, for example one foot or more.

Set the generator at 600 kc. and attempt to tune in the 600 kc. signal from the generator. It may be necessary to move the generator and attached loop closer to the receiver during preliminary padding adjustments, but the generator should be moved away from the receiver as soon as increased sensitivity of the receiver permits. Adjust the padding condenser on the rear of the chassis in the conventional manner, while rocking the gang condenser. When this operation is complete, adjust the antenna circuit by turning the screw which projects from the base end of the antenna coil. When maximum sensitivity is reached, a lock nut should be run down on the screw to preserve the adjustment.

The generator should now be reset to 1400 kc., the receiver again set to the same frequency, and the 1400 kc. aligning and 600 kc. padding repeated for maximum sensitivity.

The cabinet should be prepared for the

set by fastening the dial crystal (window) in the cabinet with tacks.

The speaker should now be mounted in the cabinet followed by the receiver, batteries and loop.

The 600 kc. adjustment of the antenna circuit should be repeated because the effective inductance of the loop may be changed by slightly different positions of the loop with respect to adjacent metal objects.

Before assembling the back onto the cabinet, solder the lead to the external antenna connector which should be mounted on the back directly behind the round hole.

The receiver should now be ready for reception of broadcast stations on batteries.

A.C.-D.C. Operation

For A.C. operation turn the change-over switch to the clockwise position and plug the line cord into a power receptacle furnishing power at 105-125 volts at 50 to 60 cycles.

For D.C. operation the same directions as for A.C. apply except that there is one position of the line plug which will not make the set operate even though the tubes light up. In that case it is only necessary to reverse the line plug. On line power operation the tubes take about a minute to warm up before normal operation is attained.

On line power operation it is recommended that the door on the back of the set be allowed to remain open to prevent deterioration of the batteries which rapidly lose their efficiency if held at high temperatures for long periods of time.

Complete Parts List

NO. 12-1031 ESSENTIAL KIT
1—Punched steel chassis, 11-8256, 11¾" x 4½" x 1 3/16"
1—Dial plate assembly, broadcast band, 19531
1—Rectangular Cro-glass dial crystal, 19535
1—3-gang, 365 mmf. tuning condenser, 21-5215, C1-C2-C3
1—Cadmium steel condenser shield, 25-7831
1—Complete loop antenna, 01607, L
1—Unshielded antenna coil, 01608, T6
1—Shielded R.F. coil, 01606, T1
1—Unshielded oscillator coil, 9916, T2
1—Adjustable padder condenser, 22-7008, C11
1—456 kc. input I.F. transformer, 16-5741, T3
1—456 kc. output I.F. transformer, 16-5743, T4

NO. 10-1190 COMPLETE KIT (less cabinet)
All parts listed above plus the following:
1—Filter choke, 19341, Ch
1—5" PM dynamic speaker with transformer, 19532
1—1 meg. volume control with switch, 19533, VC & S1
1—DP-DT switch, 19639, S2
1—Red and white "off-on" indicator disc, 19534
6—.1 mf., 200-volt paper condensers, C5-C6-C12-C19-C21-C22
2—.05 mf., 200-volt paper condensers, C4-C7
5—.01 mf., 400-volt paper condensers, C9-C14-C16-C26-C28
1—.25 mf., 200-volt paper condenser, C27
1—.05 mc., 400 volt paper condenser, C30
1—.006 mf., 600-volt paper condenser, C13
3—250 mmf., mica condensers, C15-C20-C23
2—100 mmf., mica condensers, C8-C17
1—50 mmf., mica condenser, C29
1—10 mmf., mica condenser, C10
1—25 mf., 25-volt electrolytic condenser, C18
1—30-30 mf., 150-volt electrolytic condenser, C24-C25
1—Insulating paper cover for above condenser
1—Bakelite mounting plate for filter condenser
1—50 ohm, ¼-watt fixed resistor, R13
1—1500 ohm, ¼-watt fixed resistor, R12
1—2000 ohm, ¼-watt fixed resistor, R7
1—2000 ohm, 5-watt wire-wound resistor, R14
1—30,000 ohm, ¼-watt fixed resistor, R3
2—50,000 ohm, ¼-watt fixed resistors, R4-R8
1—200,000-ohm, ¼-watt fixed resistor, R5
4—500,000-ohm ¼-watt fixed resistors, R1-R9-R10-R11
1—1-megohm, ¼-watt fixed resistor, R6
1—5-megohm, ¼-watt fixed resistor, R2
6—Molded bakelite octal tube sockets, 23-8209
1—Socket and plug for external antenna connection
1—Type G1222K tube shield, 19637
1—Special shield fin to mount on R.F. coil, 9925
1—Shakeproof ground lug, 11422
2—Tie lugs, single insulated terminal, 25-5732
2—Tie lugs, two insulated terminals, 25-5731
1—Tie lug, three insulated terminals, 25-6715
1—Tie lug, four insulated terminals, 25-6716
1—Tie lug, five insulated terminals, 25-6717
2—¼" rubber grommets, 14217
1—5/16" rubber grommet, 19216
2—⅜" rubber grommets, 14211
1—Line cord and plug assembly, 12434
2—Special connection plugs for "A" batteries, 19641
2—Special connection plugs for "B" batteries, 19642
4—Grid clips for top grid connections on tubes
1—Lever-type switch knob, 19640
2—Round bakelite control knobs, 19275
2—Black wood spacers for dial mounting
2—6/32 x ⅞"—long screws for dial mounting
3—8/32 x ¼"—long screws for condenser shield
2—No. 2 x ⅜"—long wood screws for antenna socket
4—No. 3 cut tacks for mounting dial crystal
25—6/32 x ¼"—long steel machine screws
43—6/32 x ¼" hexagon steel nuts
44—No. 6 steel lockwashers
1—Length green stranded wire for grid connections
5—Lengths stranded wire, assorted colors
7—Lengths solid wire, assorted colors
1—Length braided insulating sleeving
1—Length rosin-core solder

No. 10-1189 COMPLETE KIT (with cabinet)
All parts listed above plus the following:
1—Portable cabinet with removable back, 11-8257
4—No. 6 x ¾"—long wood screws for back cover
4—6/32 x ¼" hex nuts for speaker mounting

ACCESSORIES REQUIRED: 2 1N5GT tubes, 1 1A7GT tube, 1 1H5GT tube, 1 3Q5GT tube, 1 117Z6GT tube, 2 45-volt "B" batteries (Burgess A30M or equivalent) and 2 4½-volt "A" batteries (Burgess G3 or equivalent).

REMOVING RECORDING THREAD

● ONE of the most difficult problems confronting the recorder is the removal of the continuous line of thread from the revolving disc while cutting those instantaneous blanks.

Most recording mechanisms have a center spindle for the thread to wind around but the problem is to get the thread over to it, wound around it and keep it off the remaining surface of the uncut disc.

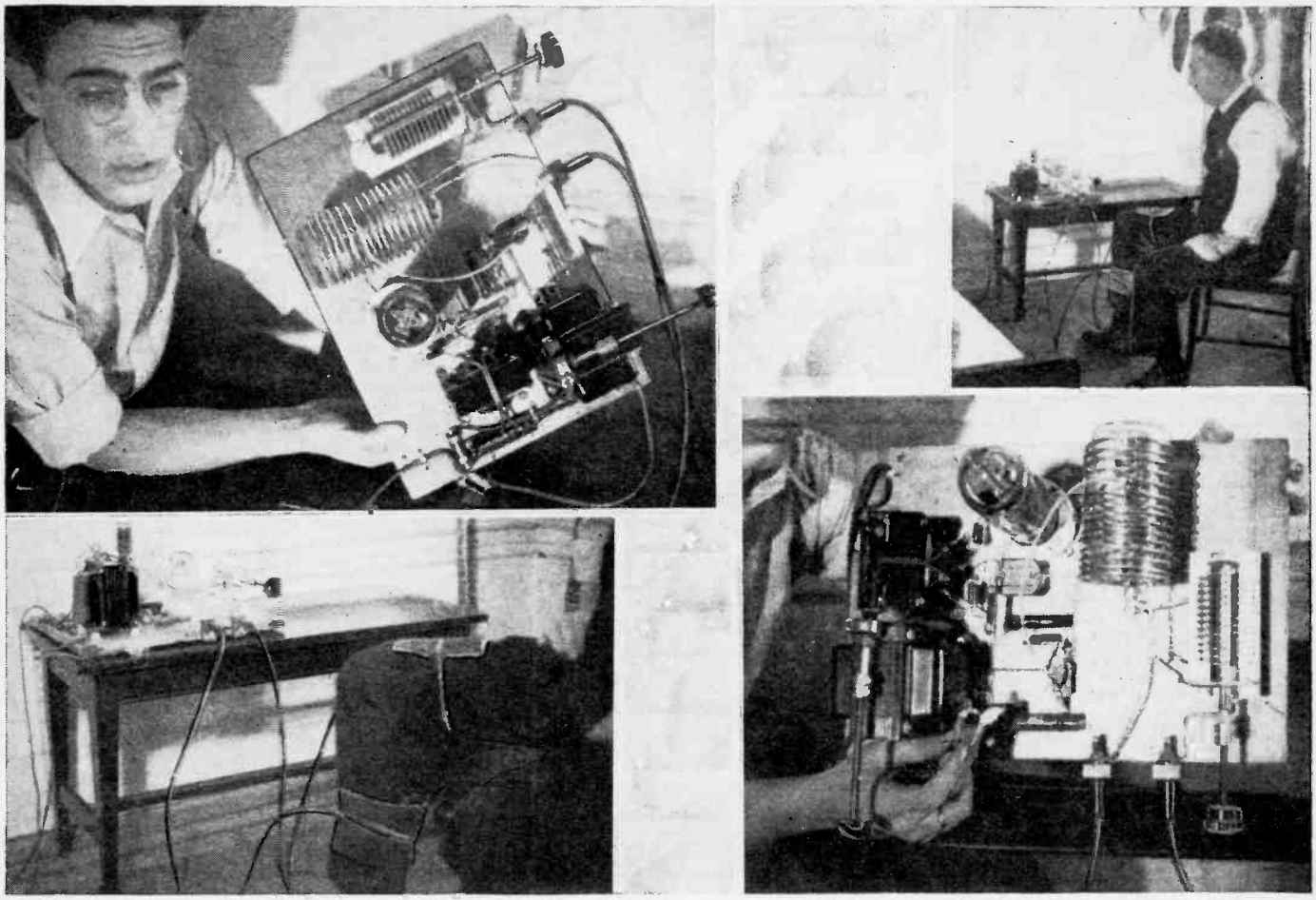
Some machines have air blowers to accomplish this, while others use felt or other soft cloth to brush the thread toward the center. And most recorders will notice that the air blower is not strong enough or that it is not easy to move the thread with felt or other soft cloth, due to the static electricity absorbed by the thread.

But quite by accident I found that by using an ordinary 10 cent paint brush and by lightly brushing the thread toward the center that the problem is completely overcome.

The soft bristles of the brush tangle up in the thread and easily carry it to the center spindle where the brush is held for a few seconds until the thread winds around the shaft, then the process is repeated. This keeps the uncut surface clean and the cutting needle free from entanglements; and the softness of the bristles will in no way mar even the most mirror-finished recording blank. The brush should be held at an angle in order to pick up the threads.

I'm sure that there are many radio men who will or have taken up recording, either as a hobby or as a business, and would like helpful hints and articles on recording. How about some?—*A. H. Davison.*

Fine—send 'em along.—EDITOR.



Several views of the "home-type" short-wave diathermy apparatus here described are illustrated above, some showing the apparatus in use.

Home Diathermy Apparatus

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

With the simple home-type short-wave diathermy machine here illustrated and described, excellent heating effects have been produced in various parts of the body. The apparatus, while of nominal size and cost, will produce a heating effect of surprising magnitude.

● THE short wave diathermy machine has come to be an accepted part of the equipment in the progressive doctor's office. In the short space of ten years (since its introduction into this country) it has convinced most of the sceptics and conservatives in the medical profession that it is not "quackery." The heating produced deep down in the tissue by the high frequency currents induced into the patient stimulate the capillaries, we are told, and assist nature in its work of clearing the waste products out of the tissues.

The machine described in this article was designed and built for *home* use. More and more, since diathermy treatments have become an accepted aid in certain cases, patients have been purchasing these machines for home use. This saves the time, trouble and expense of frequent trips to the doctor's office. The authors built this one for use by a patient having sciatica who had been making numerous visits for treatment.

The machine was constructed on a shelf. It is expected to mount it in a radio-type cabinet. No meters are used on the machine because experience has shown that once the proper adjustments have been made to the grid bias, feed-back tap, etc., a neon bulb held near the treatment "pad" during "tuning" in of the patient serves as a perfect indicator of resonance. The total cost for parts was $13.32, exclusive of the tube. The tube, a 203-A, was bought second-hand for $2.00 from an amateur friend.

The machine consists of a self-excited oscillator with A.C. plate and filament voltage supply, and a patient coupling circuit. The plate voltage is obtained from an amateur type 1,200 volt 200 mil c.t. (center-tap) transformer with a 6.3 volt winding (used for pilot) which cost $2.95. The filament voltage is obtained from a separate filament transformer delivering 10 volts, 4 amps., and suitably insulated. Using the tube in question it was found that the best operation was obtained with no bias on the grid. However, a grid-leak and condenser is shown in the circuit because some tubes will operate better when biased. The feed-back adjusting tap should be set for maximum output of the machine as described later. *Fractions of a turn* are important in making this adjustment. Ours was best 5½ turns from the plate end of the coil.

The Patient Circuit: This circuit must provide means of coupling the output of the oscillator to the patient efficiently and safely. It will be noted in the sketch that the patient coil is mounted inside the oscillator "tank" coil. This was found to yield maximum output. A glass pickle jar was put around the patient coil to assure the safety of the patient; it prevents the patient coil from touching the "tank" coil which has high voltage on it (enough to KILL you instantly).

A tuning condenser is provided which is adjusted until the patient is in resonance. This is indicated by a neon bulb held near the pad. Connection is made to the patient by means of insulated electrodes. These act

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**S. Morton Decker, Senior Student, B. T. H. S.; Pres., Television Club, B. T. H. S.

as the plates of a condenser—the patient "sandwiched" between them acts as the dielectric. Heating of the patient is partly by induced current and partly by dielectric hysteresis.

In setting the feedback tap previously referred to, in order to obtain maximum output—an incandescent lamp is coupled to the pads, by attaching small metal plates to the connections of the lamp, and placing these each near one pad. Thus the lamp replaced the patient. Use a 100 watt bulb.

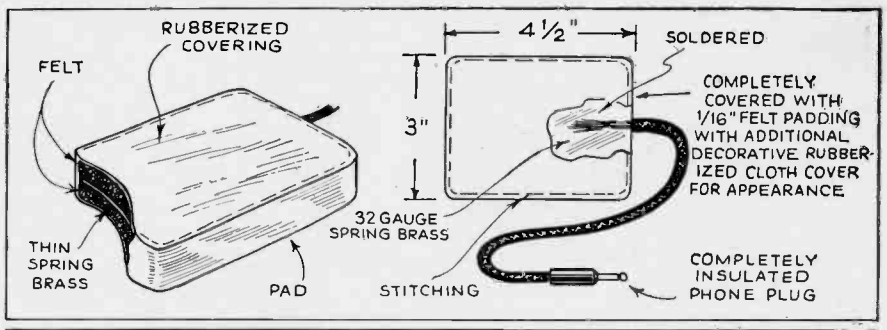
The pads are made of spring brass covered with 1/16" thick white felt (sewed) this being covered with rubberized cloth (also sewed). Plugs are provided at the end of 4 ft. rubber-insulated cords, which connect to jacks which are *completely insulated* from their mounting panel. This insulation is important to avoid an R.F. burn when plugging in or out. Various sized and shaped pads can be made for different treatments if desired. The pads shown in the sketch are good for general work. Heat will be less intense when using large pads.

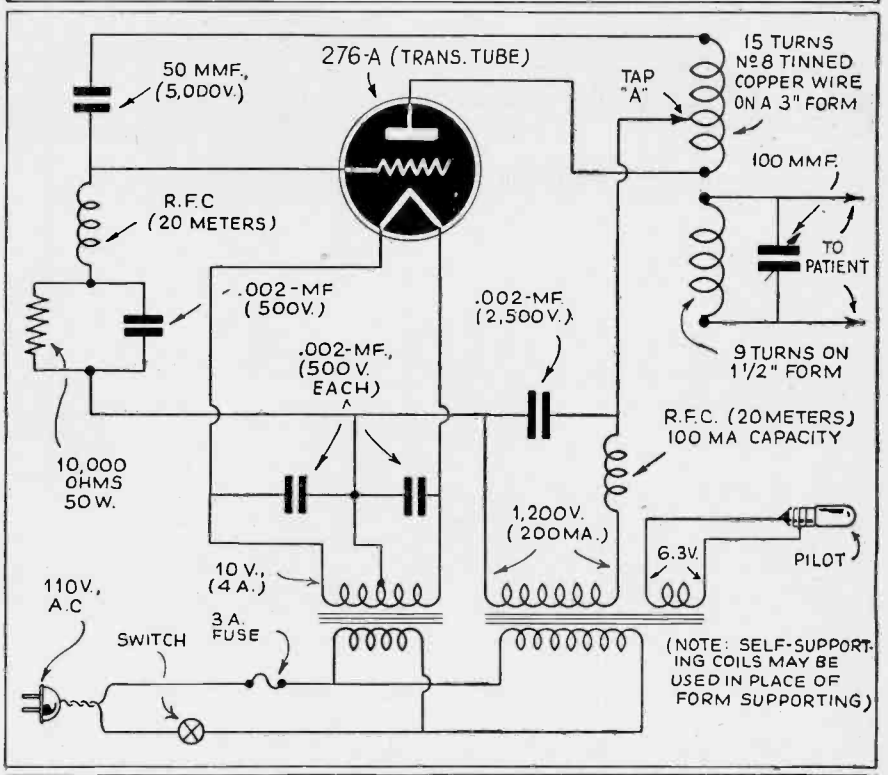
Diathermy machines have a tendency to interfere with short-wave reception in their immediate vicinity. This one does not have any effect whatever on the *broadcast* bands. If it is found that interference is being caused, put an R.F. filter choke in the power cord input at the machine. (Ohmite makes one especially for this job.) If some interference is still found to be caused it will be necessary to *shield* the room in which the machine is used, by covering the walls with well-bonded copper screening on all six sides, *grounded* at one point. The F.C.C. is *considering* legislation to govern standards and use of diathermy equipment.

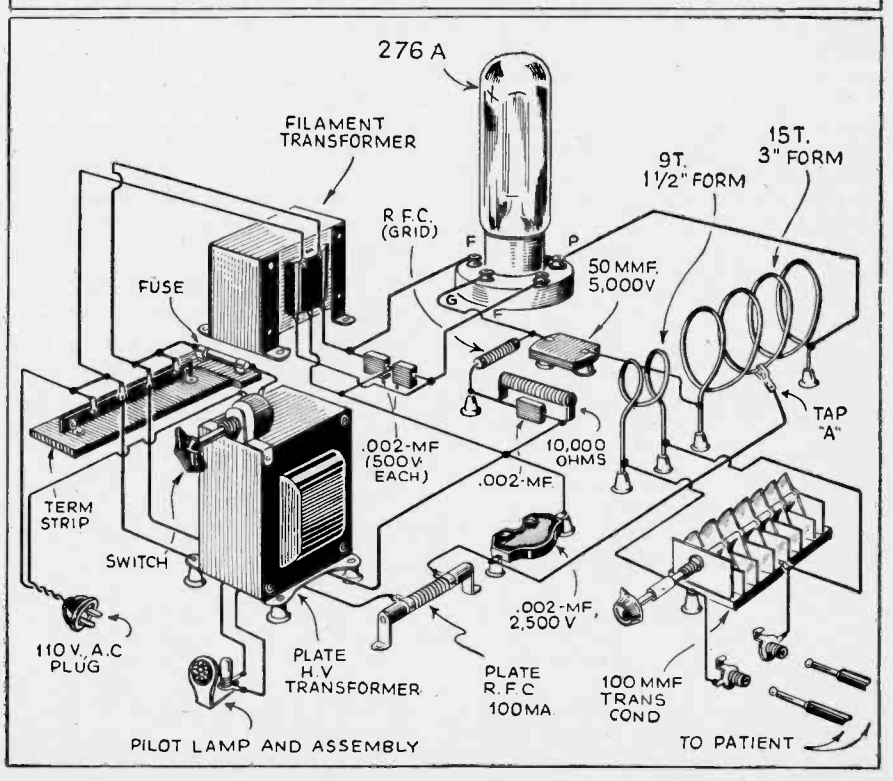
Parts List for Diathermy Apparatus

1—Filament transformer 10 vts., at 4 amps.
1—Plate transf. 1200 vts., at 200 ma. (with filament winding for pilot light)
1—.00005 mf. condenser at 5000 vts.
3—.002 mf. at 500 vts.
1—.002 mf. at 2500 vts.
1—100 mmf. transmitting type condenser
1—10,000 ohm 50 w. resistor
1—50 watt socket (and 276-A transmitting tube $10.00 list); [203A or 211 transm. type tubes may be substituted.]
1—10-20 meter RFC for grid (R.F. choke)
1—10-20 meter RFC for plate (R.F. choke)
1—Pilot lamp assembly
1—Pilot lamp 6-8 vts.
1—S.P.S.T. (rotary) line switch
6 ft. line cord
1—Attachment plug
1—3 amp. fuse
1—fuse mount
1—4 point terminal tie point, mounted on a piece of bakelite
1—Battery clip
1—Bar knob
1—2" round knob
2—Shaft connectors
2—Insulated phone jacks
2—Insulated phone plugs
6—⅝" stand-off insulators
6—1" stand-off insulators
10 ft. diathermy (heavy insulation) cable
2—Thin aluminum plates (3½" x 5")
2—3" bakelite shafts (¼ dia.)
10 ft. No. 8 tinned copper wire
1—Board 17 x 12 x ¾.

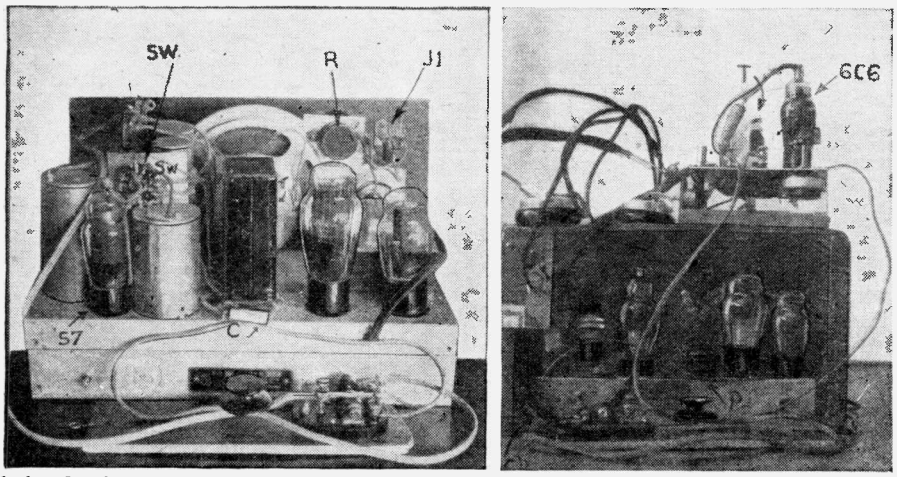
● THOSE interested in more elaborate and powerful short-wave diathermy apparatus may refer to a number of back issues of this magazine, notably the February, 1940, issue, in which an article by Alan Stuart appeared, with complete diagrams, photos, etc. That set employed rectified high-voltage current for the powerful oscillator tubes, two of which were used in "push-pull."







Top picture shows detail of diathermy treatment pad or electrode, two of which are required. Both schematic and picture diagrams are shown, so that it becomes an easy matter to wire up the few parts comprising the short-wave diathermy apparatus.



Left—Combination radio receiver and audio oscillator as described by the author; right—oscillator built as separate unit and resting on top of receiver cabinet.

Combination Radio Receiver and Audio Oscillator

G. Soderlund

● DESIRING a code practice set with plenty of power for operating a speaker or several pair of earphones, without the trouble of frequent battery renewals or the expense of a specially constructed A.C. rig, I worked out this idea, which may solve the same problem for others. It can be assembled inexpensively from parts most anyone may find around the lab.

An ordinary superheterodyne or T.R.F. receiver is adapted for the purpose: I have used both with equal success—in one case a five-tube T.R.F. Northern Electric and in the other, a five-tube superheterodyne (Northern Electric).

The second detector tube of the receiver is used in conjunction with an ordinary audio transformer of about 3½:1 ratio, to form the audio oscillator circuit. The audio amplifier section following the 2nd detector furnishes sufficient amplification. A flip of the D.P.D.T. switch throws the circuit from normal receiver operation, to code oscillator operation.

A few precautions must be observed to make the circuit work properly. The switch should be mounted close to the detector tube, so that the grid lead may be kept as *short* as possible; otherwise receiver operation will be impaired. An extension shaft may be used if necessary to bring control of the switch out to the front of the receiver. The F- terminal of the audio transformer must be connected to the negative end (usually the chassis) of the grid bias resistor—so that the normal grid bias is applied to the tube. In the receiver employing a type 224 detector, it was found necessary to connect a .0002 mf. mica condenser in series with the F- lead to eliminate "motorboating": same was unnecessary in receiver using a type 57 detector. It is also necessary to shunt the primary of the audio transformer with a condenser of about .003 mf. capacitance; otherwise the signal will "motorboat." The value of capacitance used here is not critical and will vary with different transformers and tubes. In general, the higher the capacitance (within certain limits), the lower the pitch of the signal. Use the "cut and try" method to determine which value gives best results.

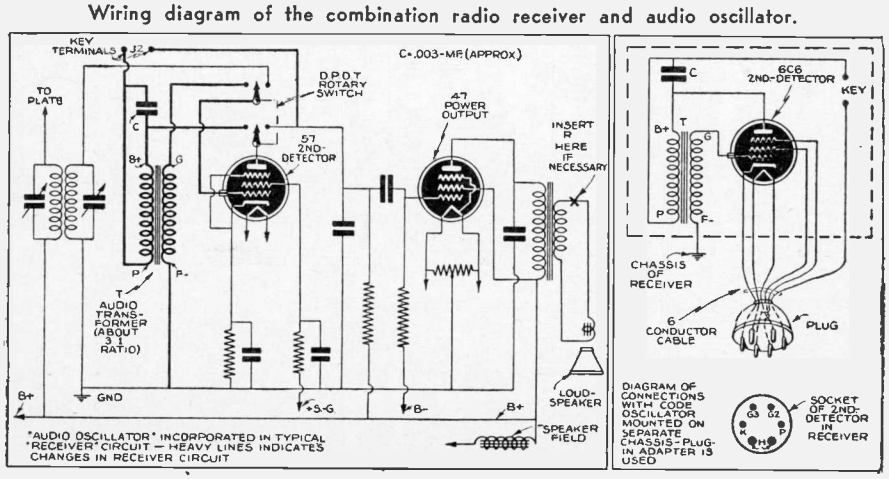
The key is inserted in series with the primary of the transformer, plug and jack or phones tip jacks providing outlets. The audio stage volume control (if the receiver has one), may be used to control the volume output; otherwise, a volume control of about one megohm resistance in series with the voice coil will serve the purpose, although this tends to overload the power output tube—causing heating of one of the grids when the volume is attenuated.

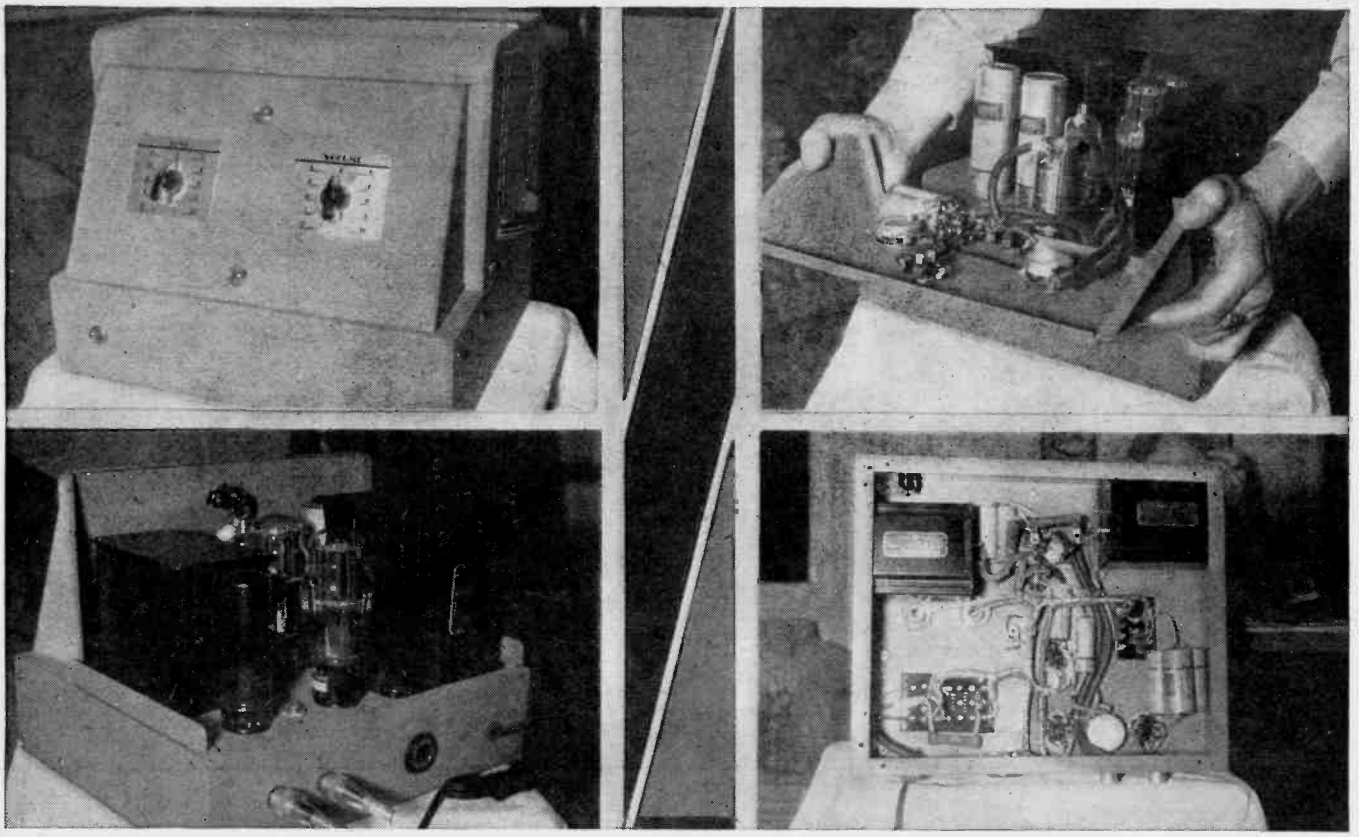
If it is not desirable or convenient to incorporate this code oscillator directly in the receiver, it may be assembled on a separate chassis, the detector tube being plugged into a socket on the latter, and an adapter plug inserted in the socket of the receiver to bring out the necessary lead to the separate chassis. Obviously, no switch will then be necessary. Diagram No. 2 and illustration No. 2 illustrate this hook-up.

T—Audio transformer.
R—Volume control.
J_1—Phone jack.
J_2—Key jack.
Sw—P.P.D.T. switch (illustration shows 4P.D.T. with two sections used).
57—2nd detector tube.
C—Transformer shunt condenser.

The two switches and the condenser visible on separate chassis of illustration No. 2 are not part of the oscillator circuit but were added by the constructor for other purposes.

Wiring diagram of the combination radio receiver and audio oscillator.





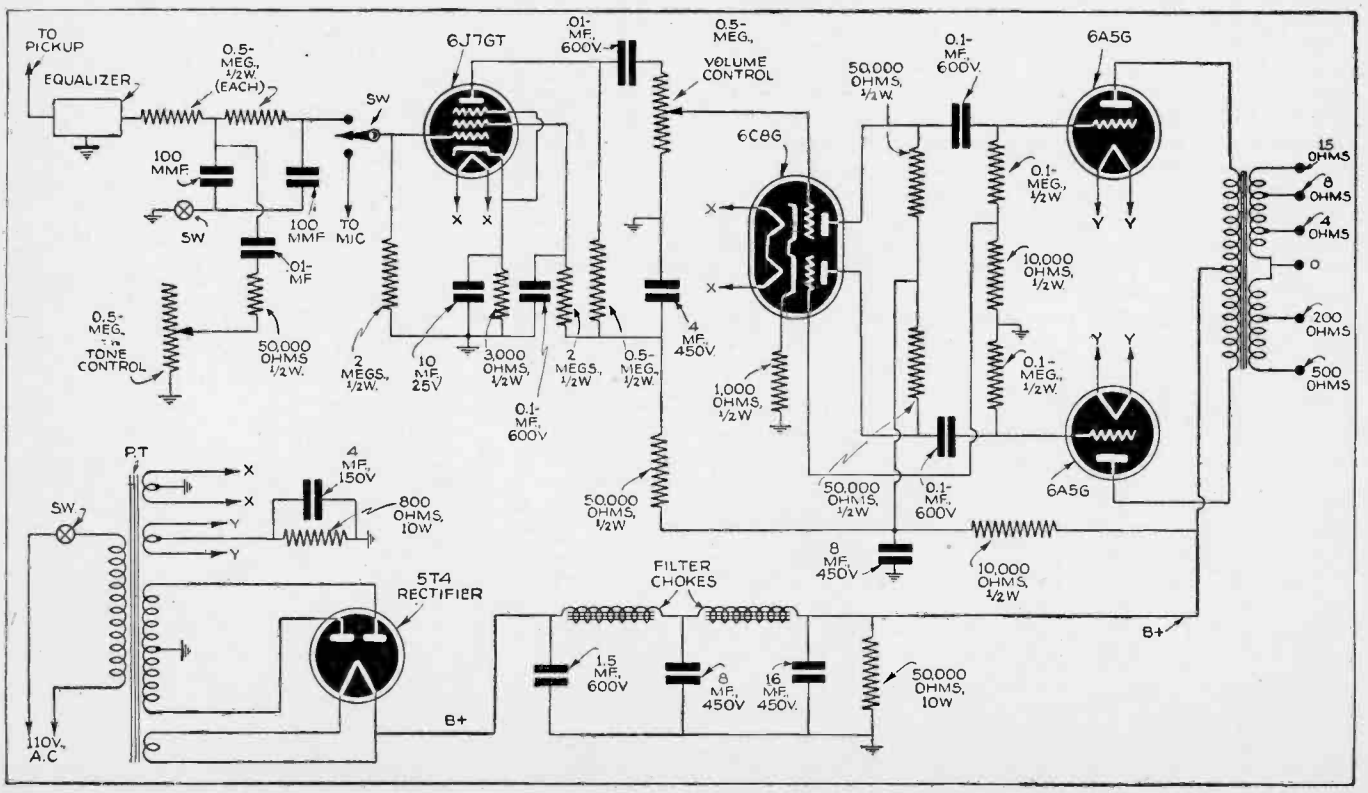
Photos show—Front view of the audio amplifier as described, also inside view of the amplifier. Rear view shows the compact layout. Diagram of amplifier appears below.

High-Fidelity Audio Amplifiers

Part 1

Larry LeKashman, W2IOP

● AMPLIFIER articles are more or less variations of oft-tried and used designs. It would be beyond the scope of the average technical magazine such as RADIO & TELEVISION to even attempt the introduction of new *audio* methods. It is no reflection on the average set-builder to imply that even such commonly discussed audio improvements as inverse feedback, automatic modu-



lation control, expansion, and the like are too advanced for anyone but an engineer to attempt to handle. This article is divided into three parts, the first of which treats the individual unit illustrated. The second article is a de luxe version, involving the last word in amplifier design. It is a semi-professional utility amplifier and as such should only be considered by the experienced builder. Both of the amplifiers described may be utilized by selecting the correct output tap, as an audio amplifier, cathode modulator or speech amplifier. The third article in the series will deal with the various accessories that carry to a successful conclusion the amplifiers described. To get away from these particular units for a moment, let us consider any audio amplifier. Up to this point we have purposely omitted any reference to the expression *high fidelity*. Most individuals, including qualified engineers, do not know exactly what high fidelity is. The fact that a unit (and when we say unit we are referring to any audio component) will pass good sounding frequencies does *not* make it high fidelity.

At the present time there is not an accepted standard in high fidelity. True, the Radio Manufacturers Association has adopted its own specifications and other groups have taken similar action. For our purposes, we shall consider any characteristics within three DB from 50 to 10,000 cycles as high fidelity. Here again we are brought face to face with such claims as frequency response from 30 to 15,000 cycles. While these frequencies are simple to obtain in almost any amplifier, they are in the realm of improbability with average equipment. Allowing that your amplifier is satisfactory from the standpoint of frequency response and distortion, more important factors are frequency response and distortion of input signals.

It is fairly definite that no A.M. broadcast nor available record will have a frequency range above 10,000 cycles. Furthermore, it is often necessary to eliminate high frequency ranges because of their tendency to amplify objectionable noise, such as needle scratch, electrical interference, 10 kc. heterodyne in broadcast receivers, etc. Incidentally, it is at this point that one of the main advantages of F-M (Frequency Modulation) becomes apparent.

In order to give the reader a more concrete idea as to what the various frequency ranges are, the human voice is almost the perfect illustration. The "S" sound starts to appear in the frequency spectrum of approximately 2,000 cycles and continues to approximately 7,000 cycles. The "F" sound commences at approximately 4,000 cycles and continues on to approximately 8,000 cycles. The *TH* sound runs between 6,000 cycles and 10 to 12,000 cycles. There are also certain transients in the human voice that may require frequency response to perhaps 15 kc. in order to be reproduced faithfully. The best readily available test of amplifier equipment is its ability to reproduce without distortion and perfectly distinctly the entire human voice range.

With these points in mind, lack of high fidelity becomes annoying and obvious in the average radio and amplifier equipment. If the frequency response of a piece of audio equipment was continually cut down, the final product would deliver speech which would sound much like a human being without teeth. Radio sets and amplifiers that can reproduce faithfully the F, S and TH sound are in an unhappy minority. One final point is the frequency of the average phonograph record, which until recently was never higher than 5,500 kc. Today, with modern advancement in the art of recording, it is possible to obtain records with frequency response as high as 8,500 cycles. However, the latter characteristics have little practical value because of scratch filters, poor speakers, tone controls, etc.

Some novel features are the incorporation of a scratch-filter, which may be cut in and out at will, a slightly unusual tone control and a pick-up tone equalizer inserted in the *phono* channel.

The common practice of using a condenser in series with the tone control is followed conventionally with the exception of a 50,000 ohm resistor which is added in the circuit. When the tone control is on all the way, the resistor prevents the condenser from attenuating the "highs" (high frequency notes) completely. In constructing, the builder should be careful to return all ground circuits to one point on the chassis. This is important to prevent *ground hum.* All shielded grid leads should be kept as short as possible, and be run with crystal type cable capable of keeping the grid to ground capacity as low as possible. This low capacity prevents loss of high frequency response. It may be desirable for the builder to install a Meissner 10 kc. filter if a broad tuning broadcast receiver is used. The author was bothered by 10 kc. heterodyne; the filter eliminates this trouble. An equalizer (or information on how to make one) is supplied with most good pick-ups on the market. This equalizer is for the purpose of boosting the high frequency response. Complete details on this and other similar accessories will be covered in separate articles. A scratch-filter is useful in eliminating needle-scratch, which is really bothersome above 6,000 cycles. In home recordings, on acetate, scratch should be negligible and at that time the filter may be removed, giving complete overall frequency coverage.

(Next month the de luxe model, including DB meter, expansion, etc., will be covered, followed by full treatment on the installation of such high-fidelity accessories as the Brush PL-20 pick-up and Jensen co-axial speaker.)

Parts List—Audio Amplifier (Part 1)

I.R.C.
(All resistors—BT½ indicates ½ watt type)

PAR-METAL
1—F10120
(Comes complete with bottom plate)

CORNELL-DUBILIER
(All condensers—Values as indicated)
(Can filter Type EB)
1—EB 8800
1—EB 9160
1—BR445

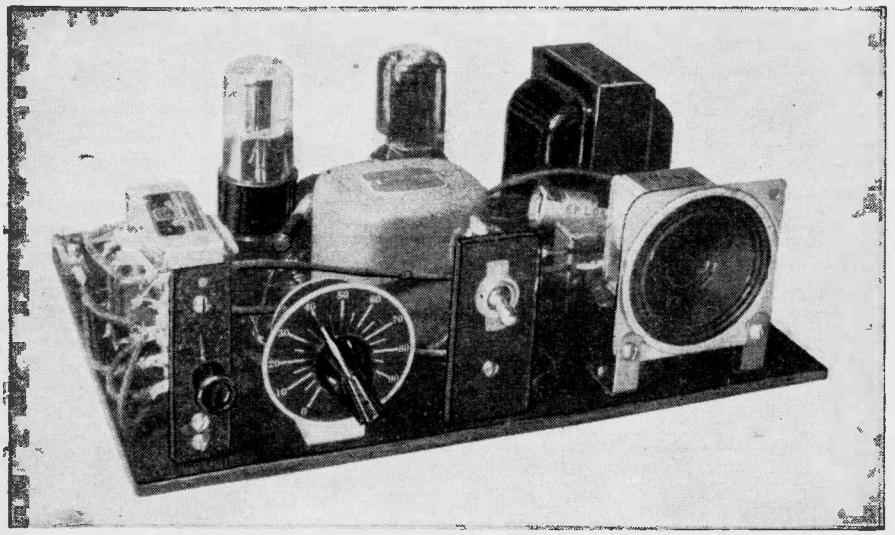
NATIONAL UNION (Tubes)
1—5T4
1—6J7GT
1—6C8G
2—6A5G

AMPHENOL (Type S sockets)
2—CL-PC1M
2—MC1F
1—PM5

KENYON (Transformers & Chokes)
1—T301 output transformer
1—T206 power transformer
2—T153 filter chokes

A "Breadboard" Inter-Com Unit

William D. Hayes, W6MNU



The breadboard Inter-Com unit built by the writer.

This handy Inter-Com unit will find many applications—it uses a few radio parts specially arranged. Additional units at remote points may be readily connected through suitable switches.

● THERE comes a time in the lives of most of us when it seems desirable to communicate between two points separated by a few hundred or perhaps a few thousand feet. When such a situation arises, there are two alternatives: either to take up Swiss yodeling (known in this country as hog-calling), or to install some sort of communication system. Unless you live in an isolated section of the country, and possess unusually hardy vocal chords, the latter is preferable.

Of course there are many kinds of communication systems, including jungle drums, the U.S. mails, and mental telepathy. Even tapping on the plumbing has given good results, especially at ham convention hotels. However, since jungle drums, the U.S. mails, mental telepathy, and pipe-tapping are frowned upon by the Radio Manufacturers Association, we shall eliminate them from this discussion.

It is the purpose of this article to describe a simple little inter-com unit using two of those mysterious electronic devices known as "toobs".

A four-pole, double-throw, lever-action, anti-capacity switch is used for converting the unit from "talk" to "listen". This switch is not nearly so expensive as all the hyphens might indicate. When the switch is in the "listen" position, the 500 ohm line from the remote PM speaker is stepped up to the grid of the 12J5GT by transformer T_1. A gain control is incorporated in this stage, and the 12J5GT operates at zero bias, thereby cutting the number of parts required. A conventional 1:3 audio transformer couples the 12J5GT to the beam power section of the 70L7GT, and the output impedance of the latter is dropped to 500 ohms by T_3. A small 500 ohm to voice-coil transformer is the final link to the two-inch speaker mounted on the unit itself.

When the control switch is in the "talk" position, the action is obvious. The local speaker is used as a microphone and fed to the input of the amplifier. The output of the 70L7GT is connected to the 500 ohm line leading to the remote speaker. In actual tests the remote speaker used was a Jensen 5-inch, and it was found that the person at that end of the line could speak in a normal conversational voice at distances up to 15 feet from the speaker and still be heard with satisfactory volume at the amplifier end of the line.

The unit will operate on either AC or DC, half-wave rectification being obtained from the diode section of the 70L7GT. Plate voltage for the beam section of the 70L7GT is obtained from the input side of the resistance-capacity filter in order to eliminate the substantial IR drop which would exist if the comparatively large plate current flowed through the filter resistor. The filtering is adequate since the small speakers used are not very responsive to the hum frequencies.

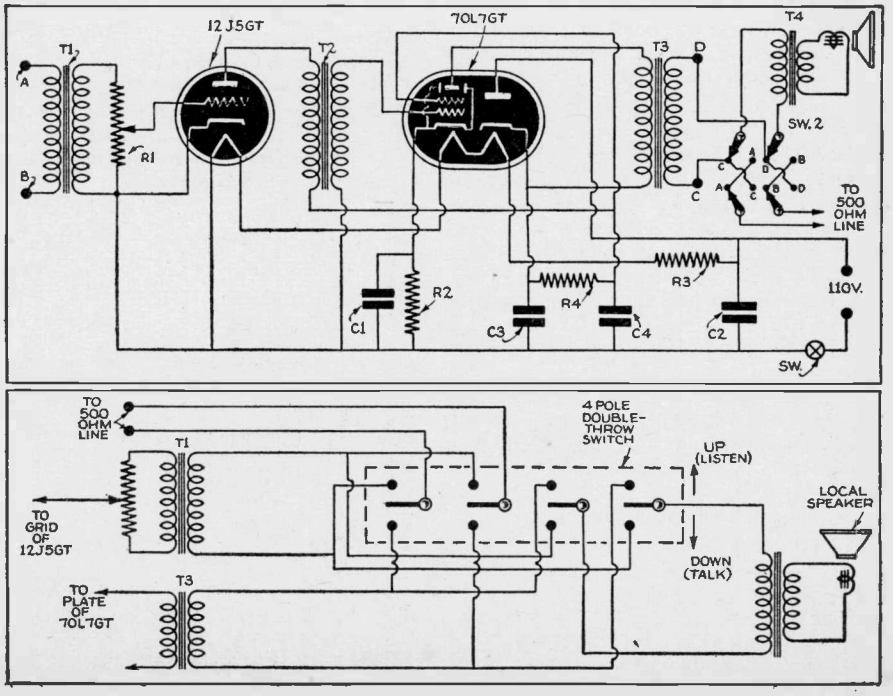
The unit can easily be built in less than two hours, and the reason for this is the very simple construction used. A piece of 7" x 10" Masonite is used as a baseboard, and all the parts are mounted above the surface. Masonite is so extremely easy to work with that the parts are mounted before you know it. Placement of the various components is not at all critical and the constructor can arrange things to suit himself.

However, there are three precautions which deserve mention:

(1) Connect the shaft of the gain control to "B" negative; otherwise there may be some instability when the control is adjusted.

(2) Pin #2 of the 70L7GT should be

Simple wiring diagram of the Inter-Com unit. The simple operation for "talk" or "listen" is apparent from the diagram.



negative with respect to pin #7. In other words, pin #7 should connect to the 200 ohm dropping resistor, and pin #2 to either heater terminal of the 12J5GT.

(3) As is usual in AC-DC equipment, the "B" negative lead should not be grounded unless you feel like blowing yourself to a few fuses.

When the movable arms of the four-pole, double-throw switch are in the "up" position, the remote speaker acts as a microphone and feeds into the grid of the 12J5GT through T_1. The words of the person talking into the remote speaker pass through the two-stage amplifier, through T_3, through another part of the switch, and into the local speaker. This would be called the "listen" position.

On the other hand, when the movable arms of the switch are in the "down" position, the local speaker acts as a mike and feeds into the grid of the 12J5GT through T_1. The words of the person talking into the local speaker pass through the amplifier, through T_3, through the switch, and out over the 500 ohm line to the remote speaker, where they are heard by the person at that end. This would be the "talk" position.

The diode section of the 70L7GT serves the purpose of half-wave rectifier in the power supply.

Parts List—Inter-Com Unit

RCA (Tubes)
1—70L7GT
1—12J5GT

THORDARSON
T3—2500 ohm to 500 ohm output transformer, T-17S10

AEROVOX (Condensers)
C1—25 mf. 25 v. electrolytic (Dandee)
C2—.01 mf. 400 v. paper
C3—24 mf. 150 v. electrolytic (Dandee)
C4—12 mf. 150 v. electrolytic (Dandee)

CONTINENTAL CARBON (Resistors)
R2—200 ohms 1 watt
R4—2000 ohms, 1 watt

CENTRALAB
R1—250,000 ohm potentiometer, No. 72-121
S2—4-Pole D. T. lever switch, No. 1458

OHMITE
R3—200 ohms, 10 watts

STANCOR
T1—500 ohm to grid transformer, No. A-4351

UNITED TRANSFORMER
T2—1:3 audio transformer Type S-1

OXFORD-TARTAK
T4—500 ohm to voice-coil transformer (L-21); Speaker, "Little General" 2-inch PM

ARROW
S1—S.P.S.T. toggle switch

QUIETING SCRATCHY RECORDS

Old phonograph records, if not broken, may be made quieter by a very simple stunt. Take a very soft lead pencil and sharpen it to a very sharp point. With the record on the turntable, and the motor running, allow the point of this pencil to ride the groove, clear to the end of the record. Then, when played, you will find that the graphite in the pencil has lubricated the groove, making the needle ride smoothly with less scratch and hiss. Repeat when the record shows signs of again becoming noisy.—*Wm. J. Vette.*

COLORING BULBS

A swell substitute for colored paint, used in coloring pilot lamp bulbs, can be had by obtaining an assortment of colored pencils capable of writing on glazed surfaces. I have used this idea with great success.—*W2MPT.*

In May 1941 Radio-Craft

How to Build a Modern 30/15-Watt P.A.-Radio-Recording Console, Part I

Measuring Distortion in Audio Frequency Amplifiers

How to Make Dynamic Tests on Audio Amplifiers

Ultra-Mobile P.A. System

Adding an "Eye" to A.F. Amplifiers—and Other Practical Ideas

Modern Circuit Features of a Semi-Professional Recording and Playback Amplifier

Microphones—and How They Work

Sound Engineering—No. 17

2 Radio Service Data Sheets

Operating Notes

New Circuits in Modern Radio Receivers—No. 44

Servicing Record Players

F.M. Receiver I.F. Channel Design

Latest Radio Apparatus

Classified Radio Directory—Section II (Revised)

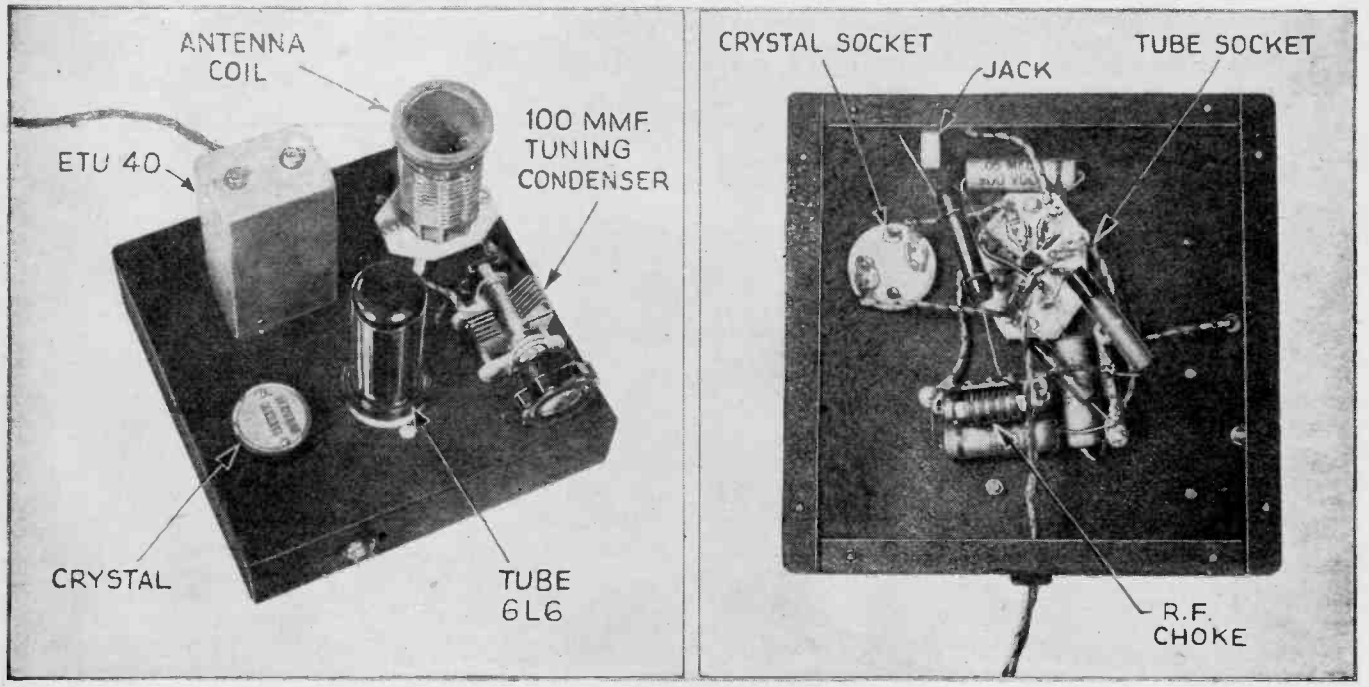
Shop Notes—Kinks—Circuits

1-Tube

Beginner's Transmitter

George W. Shuart, W2AMN*

Every Ham beginner will appreciate this simple transmitter—it may be built from standard parts available on the market, even to the chassis. The author is one of the leading Ham designers and this transmitter has plenty of Zip!



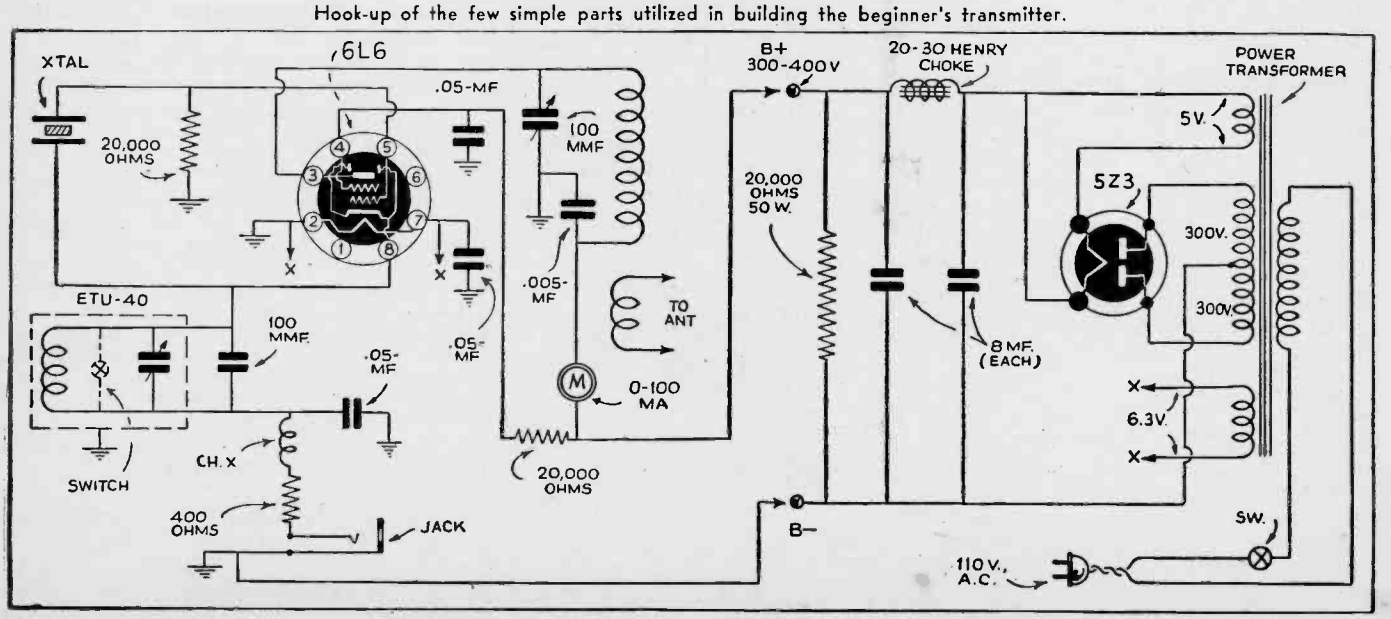
Top and bottom views of Mr. Shuart's design for a 1-tube beginner's transmitter.

● ONE need not have a lot of money to get started in amateur radio. All that is necessary is a conscientious desire to be a Ham and the ability to use one's hands.

We assume the reader already has some kind of receiver suitable for operation in the amateur bands. Many simple receivers have been described in this and other magazines. We also assume the reader (if he contemplates building this transmitter) already has a license, or will obtain one before he attempts to use a transmitter. The simplest form of transmitter is the one-tube tri-tet, which is crystal controlled, and operates on two bands with a single crystal. There is nothing home-made about this transmitter. Every part is available through your favorite Ham parts dealer. A few of the parts could be made at home, but if you are a newcomer, it's safe to bet you don't have a lot of junk or paraphernalia from which you would be able to make the parts if I were to provide sufficient information. Besides, standard parts are available at fairly low prices and, needless to say, they are superior to any even the most expe-

*Hammarlund Mfg. Co.

Hook-up of the few simple parts utilized in building the beginner's transmitter.



rienced Ham might build or have built.

The chassis is a 7" x 7" x 2" steel unit with black crackle finish. A wood base could be used here, but the few cents saved would be of little importance. The tube is a 6L6 metal tube, not the glass variety. In the cathode circuit we find a standard single-circuit tuning unit which is intended to tune to 40 meters. We have connected an additional fixed condenser across it, so that it will tune slightly lower in frequency and enable the crystal to oscillate. In the plate circuit, we have standard plug-in coils and tuning condensers. This circuit may be tuned to either the crystal frequency which is between 3500 kc. and 3650 kc.; or to the second harmonic which falls between 7000 and 7300 kc. (the 40 meter band). When the plate, or output circuit is tuned to the crystal frequency, the cathode coil should be *short-circuited* by the switch marked "SX". Under some conditions, using a tube with better internal shielding, the cathode circuit could be left operated. We mention this so that the reader will not be confused by information in other articles where this circuit is left in operation. With the 6L6, however, this circuit should be *shorted* to protect the crystal when the output circuit is tuned to the fundamental.

Tuning and adjusting should be done at a reduced voltage. Use 250 volts or less, or connect a large resistor, 10,000 ohms 25 watts, in series with the B-plus to the plate and screen. Set the plate condenser at mid-scale and adjust the cathode tuning condenser for maximum plate current. Then, adjust the plate condenser for minimum current. This indicates resonance. You can now apply the full plate and screen voltage and connect the antenna.

For best all-around results, use a *doublet* with twisted pair feeders. If a good grade of twisted pair is used, this antenna performs excellently and is very simple. It will, however, only work on *one* band. The single wire fed Hertz will work on 80 and 40 meters with fair success, but is slightly more complicated. In either case, after the antenna is connected, the plate circuit should be retuned for the *lowest* plate current. If this value is found to be too low, increase the antenna coupling. This can be accomplished by winding the antenna coil on top of the plate coil near the B-plus end. In this case, use wire with good insulation. In the case of the Hertz antenna, increased coupling is accomplished by moving the tap nearer the plate end of the output coil.

Parts List

HAMMARLUND
1—40 meter coil, No. 42
1—80 meter coil, No. 43
1—MC-100-S variable condenser
1—ETU-40 tuning unit
1—XS-2 crystal socket
1—S-8 tube socket
1—S-4 coil socket
1—CHX R.F. choke

I.R.C.
1—400 ohm 20 watt resistor
1—20,000 ohm 1 watt resistor
1—20,000 ohm 2 watt resistor

BLILEY
1—3.5 mc. crystal

RCA
1—6L6 tube

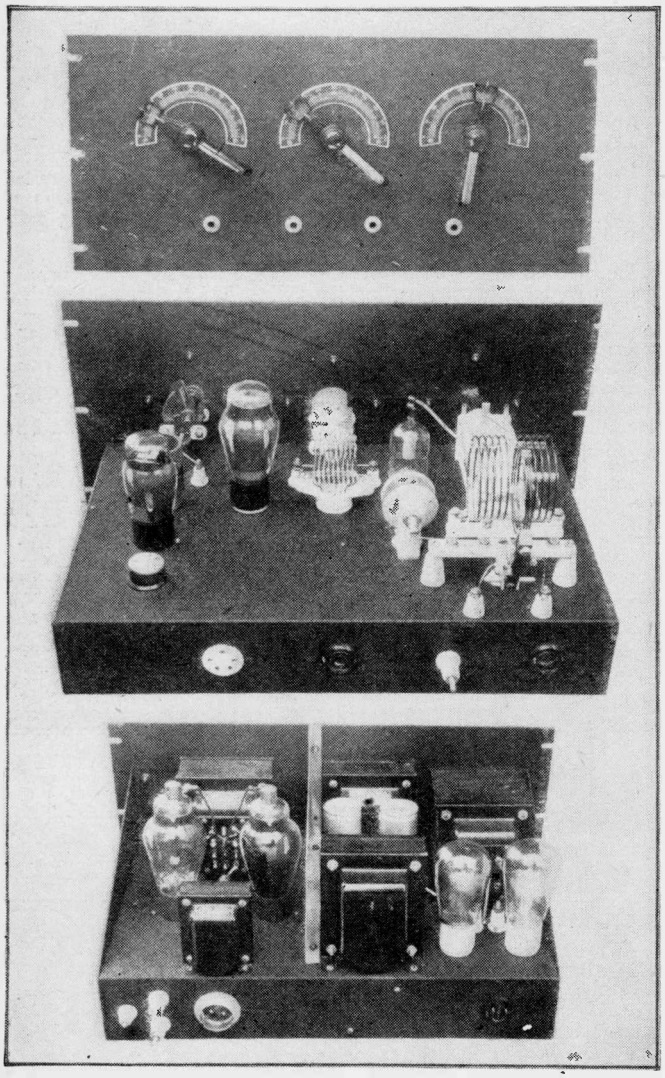
PARMETAL
1—7" x 7" x 2" black chassis

CORNELL-DUBILIER
1—.0001 mf. mica condenser
3—.05 mf. 500 V. paper condensers
1—.005" 500 V. mica condensers

A Simple 100-Watt Exciter or Transmitter

Harry D. Hooton, W8KPX

Mr. Hooton here describes an excellent design for apparatus flexible enough to be used either as a 100-watt exciter for a 500-watt final amplifier—or with slight modifications, it may be used as a 100-watt phone or code transmitter. The details of tuning and neutralizing are given.



The three photos at the left show front and rear views of the 100-watt exciter, while the lower photo shows the power supply unit.

● THE 100-watt exciter or transmitter unit to be described is the result of extensive experimental work in an effort to find the proper combination of tubes, parts, circuits and physical layout which would give at least 50 watts of R.F. *output* on all bands from 160 down to and including 10 meters, with the utmost in operating flexibility. Designed especially as an exciter for a 500-watt final amplifier, this unit, with slight modifications, will make an excellent 100-watt phone or code transmitter.

As Fig. 1 shows, the circuit line-up consists of a 6V6G "grid-plate" type crystal oscillator, a 6L6G or 807 buffer-doubler and an HK-24 final. The tube arrangement is especially good for 20, 40 and 80 meter operation and will operate on 160 and 10 meters with only slight changes in the design. The photograph shows the coils in the proper combination for operation on 20 meters. A 40 meter crystal is used, the plate circuit of the 6V6G being tuned to resonance with the crystal frequency. The 6L6G is used as a frequency multiplier, its plate circuit being tuned to twice the crystal frequency or 20 meters. The HK-24 is operated as a "straight-through" neutralized final amplifier. For operation on 80 or 40 meters the same procedure is carried out except that 160 or 80 meter crystals and the proper coils for the plate circuits would be used. The 6L6G is always operated as a doubler tuned to the second harmonic of the crystal frequency.

If much operation on 160 meters is desired, the 6L6G tube should be replaced with an 807 or an RK-39 which does not require neutralization. This will permit operating the entire transmitter straight through on the *crystal frequency*, without danger of feedback or parasitic oscillations being encountered. For 10 meters a 40 meter crystal is used, doubling in the 6V6G oscillator plate circuit and again in the 6L6G or 807 stage. The HK-24 final amplifier always operates straight through on all bands. The final tank condenser shown in the photographs is a 100 mmf. single-section type, which operates satisfactorily on the 160, 80, 40 and 20 meter bands but barely tunes up on 10 meters. If much 10 meter operation is contemplated, it would be wise to use a split-stator condenser of about 100 mmf. per section for working the 10, 20, 40 and 80 meter bands, with a 50 mmf. *padder* across the final tank coil on 160 meters alone.

Although a home-wound coil is shown in the oscillator plate circuit, all of the coils used in this transmitter are of the manufactured type. Barker and Williamson 25-watt "babies" are used in both the oscillator and doubler stages. The final tank coil is also of the same manufacture and is a "swinging-link" type which gives precise control of loading the antenna or following amplifier. The final tank coil is tapped at the center and "grounded" through a .005 mf., 5000 volt mica condenser in order to obtain the proper out-of-phase neutralizing voltage for the grid of the HK-24.

Construction Details

The construction of the unit is quite simple. Lay out the chassis as shown in Fig. 2. Do not make allowances or deviate from the arrangement shown as we have left plenty of space for any necessary changes. It is not necessary to alter any part of the layout, even though it is desired to use such tubes as the HK-54 or 812 in place of the HK-24 shown in the photograph. The placement of the final tank coil and the neutralizing condenser is extremely important. The doubler plate coil should be turned so that its magnetic field will be at right-angles with that of the final amplifier tank coil. Otherwise it may be difficult to completely neutralize the HK-24 stage.

It will be noticed that no provision for placing meters in the front panel has been made. In the author's installation, using this unit as an exciter for a higher power final amplifier, a separate meter panel is used, the readings being taken through the four closed-circuit jacks at the lower portion of the exciter panel. At least two milliammeters will be required, one of 150 ma. maximum and one of about 50 ma. maximum for reading the plate and grid currents, respectively.

Two power supply units will be required—one supplying 450 volts D.C. at approximately 250 milliamperes for the plates and screens of the oscillator and buffer-doubler tubes and the other supplying from 750 to 1,000 volts D.C. at 150 milliamperes for the HK-24. In our transmitter power units of exactly this size are not used inasmuch as various voltages for other portions of the circuit are taken from the same power supplies. However, if this unit is used as a complete transmitter in itself the values given above will be correct. Complete data on the power supplies

for the entire W8KPX transmitter will be given in next month's article.

Tuning: Adjust the plate voltage on the 6V6G to about 300 volts by means of the sliding clip on the bleeder resistor of the 400 volt power unit and the screen voltage to approximately 200 volts. These values are correct for "straight through" operation on the crystal frequency; for doubling in the oscillator circuit, the plate voltage may be raised to 375 and the screen voltage adjusted to about 250. This will give slightly increased output when doubling, but may cause the crystal to heat up when working straight through. The 6V6G cathode current will vary somewhat with different crystals, but will dip to about 15 or 20 milliamperes from a maximum of 60 to 70 milliamperes. When operating on the crystal frequency, the 6V6G plate circuit should *not be tuned for minimum plate current;* with the current values given above, detune the plate circuit slightly on the *high-frequency* side so that the current goes up to about 25 milliamperes. This will give increased stability and the crystal is not so likely to "kick out" of oscillation when keying or switching the power on or off in the following stages. The 6L6G is always tuned for maximum grid current to the HK-24, adjusting the coupling to the final until the desired value is obtained. In the arrangement shown, maximum grid current occurs at minimum plate current to the 6L6G, due to the better impedance match which is obtained by connecting the 6L6G plate to the center tap on the coil rather than to the "hot" end as is common practice.

It will be necessary to neutralize the HK-24 stage before plate voltage can be applied. The procedure is quite simple. Unscrew the neutralizing condenser until it is at minimum capacity setting. Apply excitation to the grid of the HK-24 and adjust the coupling from the 6L6G plate coil until a milliammeter placed in the grid circuit jack reads about 25 milliamperes of current. It may be necessary to adjust the fixed or battery bias on the HK-24 grid before the proper grid current value can be obtained. Usually, however, 90 volts will be sufficient for all practical purposes. Now, watching the grid milliammeter closely, slowly swing the final tank tuning condenser through resonance, which will be indicated by a sharp fluctuation or dip in the grid current. Simply adjust the neutralizing condenser carefully *until there is no change in the grid current as the plate condenser passes through resonance.* Apply the plate voltage to the HK-24 and tune the final tank circuit for minimum plate current. It will be noticed that the grid current to the Gammatron will drop to about 20 milliamperes when the plate voltage is applied and the stage loaded which is approximately the proper value.

This is the first of a series of two articles on the W8KPX all-band transmitter using the new system of "peak power" plate modulation.

GEORGE J. EDER, 128 So. 36th St., Philadelphia is "HAM" Editor of WDXA and GCDXC, member Radex Club, and of the Short Wave League. His layout comprises a 20 meter ½ wave doublet, an RSR-Clipper Receiver, an SX-16 receiver, and a 12 PM Hallicrafter's Speaker. On phone, he has heard 103 Countries, of which 50 are verified. Forty-five states are also verified on 20 m. fone, out of 48 heard. He has been DXing on the broadcast band since 1920, the Amateur band since 1935, and QSLing Ham stations since 1937. He has 230 cards, and wants to QSL all states of U. S. and all countries heard on 20 meter fone, all states on 10 meter and 75 meter phone.

Parts List

BARKER AND WILLIAMSON
2—Type "MC" baby inductors (see text)
1—Type BVL swinging link coil (for desired band)
1—Type BVL swinging link base assembly

BUD RADIO, INC.
1—Black crackle steel relay rack panel, 10½ x 19 inches
1—Black crackle steel chassis, 11 x 17 x 3 inches

HAMMARLUND
2—100 mmf. midget tuning condensers, single spaced
1—Variable transmitting condenser, 100 mmf., type HFB-100-E
1—Neutralizing condenser, 1-10 mmf., type NC-10
1—Adjustable "padding" condenser, 100 mmf., Isolantite base

P. R. MALLORY CO., INC.
4—Closed-circuit jacks, long-frame type

R.C.A.
1—6V6G tube
1—6L6G tube

HEINTZ AND KAUFMAN
1—HK-24 tube

In the Next Issue

Mr. Hooton will describe the W8KPX Modulator for a 400-watt transmitter.

•

Other articles of value to the advanced Ham, as well as the Beginner, will appear. Don't miss them.

I.R.C.
1—Fixed resistor, 20,000 ohms, 1 watt
1—Fixed resistor, 50,000 ohms, 1 watt
1—Wire-wound, 300 ohms, 10 watts
1—Wire-wound, 15,000 ohms, 10 watts
1—Wire-wound, 400 ohms, 10 watts
1—Wire-wound, 1,000 ohms, 10 watts

CORNELL-DUBILIER
1—Mica fixed condenser, .0001 mf., 500 volts
4—Mica fixed condensers, .006 mf., 1,000 volts
1—Mica fixed condenser, .004 mf., 5,000 volts

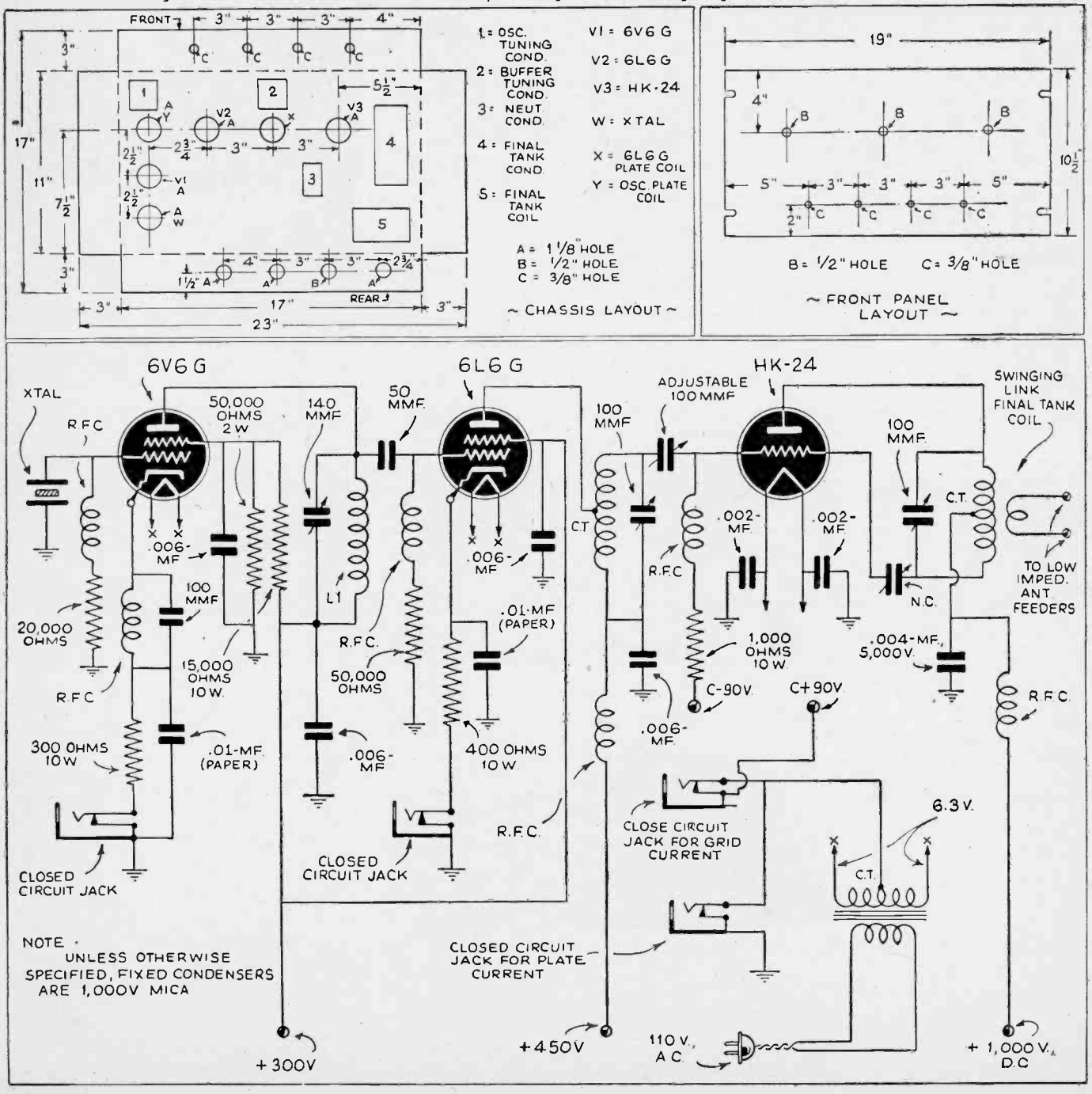
NATIONAL
5—R.F. chokes, 2.5 mh., 125 ma., type R-100
1—R.F. choke, 2.5 mh., 300 ma., type R-300

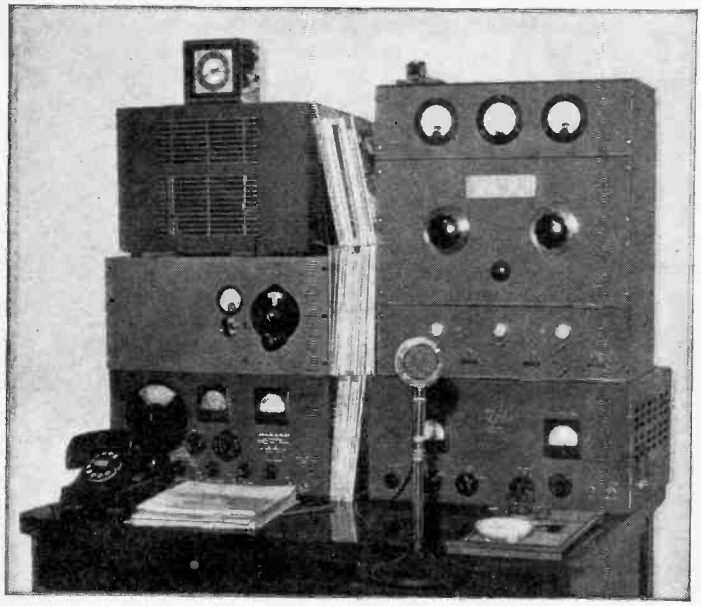
E. F. JOHNSON CO.
3—Type 204 handle indicator dials

AMPHENOL
2—Isolantite, "cliptite" type sockets, octal base
3—Isolantite, "cliptite" type sockets, 5-prong base
1—Isolantite, "cliptite" type socket, 4-prong base

STANDARD TRANSFORMER CORP.
1—Filament transformer, with two 6.3 volts, 5 amp. windings, separate center-taps

Drawings below show details of chassis and front panel, together with wiring diagram for the 100-watt exciter unit.





At the right on the desk is a Hallicrafter HT6. On top of it stand a self-built control panel and above it the final. Atop that, the output is a HK54 125-watt outfit, which embodies a lot of John's own work. On the left side of the table is a Hallicrafter SX24 receiver and, sitting upon it, a 40-meter, 100 watt home-made transmitter using 6L6's. A loudspeaker and clock are on the 40 meter rig. The feed was through a Barker-Williamson link to a 2-element beam antenna. John has made a few changes, replacing the HT6 with a streamlined job the same width as the other components, and has put in tuned antenna coupling. When he and Kitty get on the air, they have so much fun that a large number of local Hams shut down just to listen to them!

"Honor" Plaque Awarded

To John Curry, W2MJU

For Best HAM Station Photo

● THE accompanying photo shows the Ham station operated by John Curry, W2MNJ, New York City. Dozens of Hams know the owner and his wife from hearing them on the air waves as "Kitty and Jack." They have made hundreds of friends through their sparkling dialogue and friendly chatter.

The receiver is a Hallicrafter SX24. Some idea of the activity on station W2MJU can be obtained by referring to the article on page 228 of the August 1940 issue of RADIO & TELEVISION. This station is operated in an apartment in the uptown section of New York City. Like many of the more active amateur stations, it is on the air principally at night. Phone contacts with stations all over the country have been established. The station is owned and operated by John Curry, W2MJU.

864 West End Ave.,
New York City

●

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

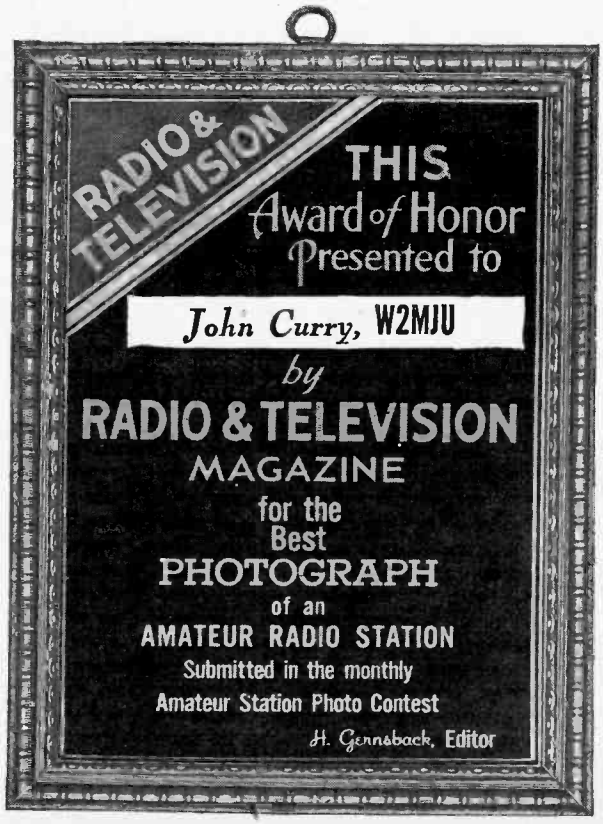
Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name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

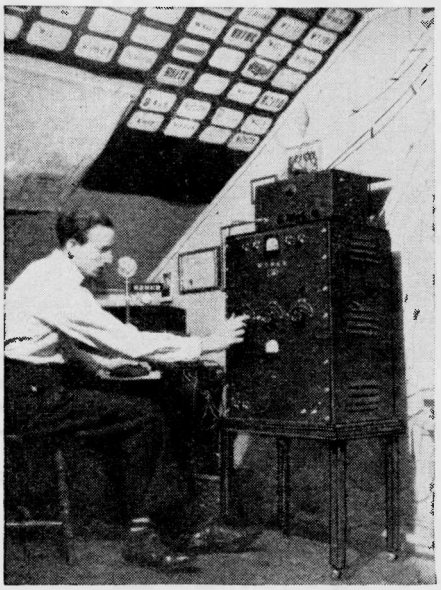
You do not have to be a reader of RADIO & TELEVISION in order to enter the contest.

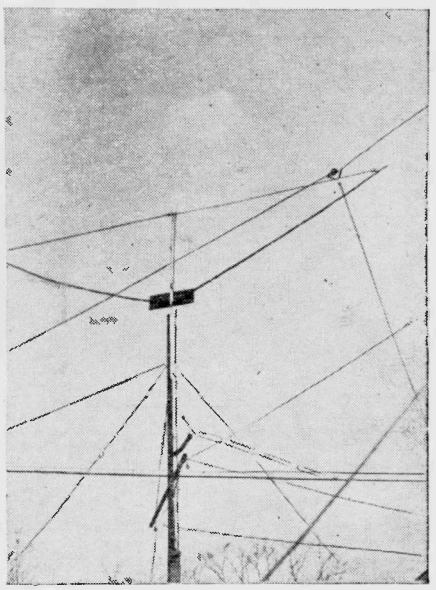
Address all photos and station descriptions to Editor, Ham Station Photo Contest, c/o RADIO & TELEVISION, 20 Vesey Street, New York, N. Y.



"CQ"

Larry LeKashman, W2IOP





Left—W2NKB at his shack. Both phone and CW are used on all bands.
Right—A rotary Johnson "Q" used at W2NKB and described in Feb. RADIO & TELEVISION.

● MATERIAL for CQ seems to be as fickle as the wind. Some months we are on the verge of tears because of none, and others I'm running from the editor for trying to make CQ an article instead of a column.

We promised you an insight into amateur radio abroad, and the opportunity to make good recently presented itself in the form of an uncensored letter from Bill Solder, G5FA. Parts of the letter are of a personal nature, therefore I am going to quote only the paragraphs which I believe are of universal interest.

"The *Radio Society of Great Britain* has kept things going fairly successfully, in fact it was their best financial year ever. Over a thousand members are now in the Services doing their bit and they have 'Hamfeasts' now and again in camp where, of course, there are often hams from overseas as well. One thing this war has done has been to make it possible for some of us to meet some of the amateur ops from stations that we have worked in the good old days. For instance, I had the good fortune to meet Bill Wadesworth, VE5ZM, who was my first VE5 contact. Both he and ZB2B from Gibraltar came to dinner at my home early this year and you may be sure we had a good rag-chew. Bill has now transferred from the Canadian Army and has a commission in the R. A. F. I have also met one or two other VE hams and VK2ADE and many others. One I was more than pleased to see was GM3TR from the Orkneys, who you know I worked so often on 7 mc. He left there when the war started and is now in Belfast, where he will probably settle even after the war. G6ZO, whom you know fairly well, is in the Army and is a second lieutenant, while Ham Whyte (G6WY) is a Squad Leader in the R. A. F. on the radio side.

"As I said, I have not had a lot of time to listen on the ham-bands lately, but last spring the W6's and 7's and also K6's were coming through well on 7 mc. with conditions on 14 and 28 mc. rather poor. In fact, I have not heard a single signal on the 10 meter band this fall. If only this blinking war had not been on, I could probably have worked the rest of the States that I wanted on 7 mc. with conditions so good. Still, wait until we get going again. I still have Q.S.T. regularly and have renewed my subscription to the A.R.R.L., so I am able to keep my eye on your activity on amateur radio. One thing I have found interesting is a letter budget which has been passed around to a few of us in the R. S. G. B. About a dozen or so members who have been in the habit of receiving letters from old friends in the States, and for that matter, other places in the world, have been collected by G2MI and passed round to all of us in turn to read every so often. We have still been keeping the local meetings in the various districts going, holding them at one or another's home, and have had the pleasure of meeting a great many provincial amateurs who have been passing through London on leave and who are in the services. We had 2CNC come to live in the district—he managed to get away from the Channel Islands before the German occupation, but had to leave behind all his gear and QSL cards. He told me that 2AOU, who had a magnificent collection of cards, lost them all. G3GS got away, too, but 4LI stayed behind in Jersey.

"If I can get any time to spare at all in the near future, I am thinking of building a high-class Frequency Meter which

was described in the last issue of the R. S. G. B. 'Bulletin.' It uses 4 tubes and two stabilizing lamps for the power supply and a 100 kc. bar."

Besides this interesting account concerning radio, Bill has gone into considerable detail regarding bombing, etc. Since CQ is essentially a radio column, we are forced to omit those details.

Amateur radio in South Africa has all but stopped, but Edward Tanner of Wynberg, South Africa, has sent the following interesting data concerning *short wave* broadcast stations. Further information may be obtained by writing Edward Tanner, "Riverside," Malton Road, Wynberg, C. P., South Africa.

ZS1SWL
Key to South African Stations

Cape Town A: 500 meters (600 kc.).

Cape Town B: 31.23 meters (9,606 kc.) and 341 meters by day and 49.2 meters (6,097 kc.) and 341 meters by night.

Johannesburg: Uses the following wavelengths: 465, 449, 315, 536, 222, 31.5, 384 and 371 meters.

Durban uses 400. 48.75 and 30.75 meters.

Maritzburg (relays Durban) on 430 meters.

Grahamstown is on 535 meters.

ZUP8 (Police Station testing) is on 110 meters.

Bulawayo (Southern Rhodesia) on 485 meters (618.5 kc.), 48.8 meters (6,147 kc.) and 44.4 meters (6,755 kc.).

Salisbury (Southern Rhodesia) on 121.7 meters (2,465 kc.), 43 meters (6,965 kc.) and are on the air throughout the day.

ZNB (Mafeking) operates on 50 meters (6.00 mc.) from 11 a.m. to 12 noon and 6 p.m. to 7:30 p.m. (G.M.T.).

Lourenco Marques (Portuguese East Africa): CR7BD operates on 19.68 meters (15.240 mc.), CR7BE operates on 31.09 meters (9.650 mc.), CR7AA operates on 48.87 meters (6.137 mc.).

Aerials, etc.

Cape Town, Johannesburg, etc., not on hand.

Bulawayo and *Salisbury* (Southern Rhodesia): Aerial power of the transmitter is 175 watts 100% modulation using a center-fed half-wave doublet aerial on 44.4 meters. The maximum radiation from the aerial is north and south.

ZNB (Mafeking): Transmitter, Collins 30 FXC. Output, 200 watts. Antenna, Matched impedance, running N to S.

Lourenco Marques: Transmitter, Collins 300 BA. Crystal controlled. Output, 250 watts. Antenna, Zeppelin ½ wave.

Further information on the above stations on programs, transmitting hours, QRA's, etc., can be sent to you if required. Just drop a letter or post card to ZS1SWL.

Another letter from Britain includes, among other things, a list of *calls heard.* E. J. Roberts of London writes that during his SW listening he found that the U. S. A. hams are the best QSL'ers. "Give them an honest report and they usually answer, but send 'em a report like some SWL's do (hrd ur sigs pse QSL) and you can't blame any ham for ignoring it." That's an idea well worth thinking about, and it might go for lots of active amateurs also. Best W's heard at OM Roberts include:

W1DQ, KSK, FH, APQ, HKK, LFO, CH, EHF, JFG, MCF, LYH, LTX, ARE

W2KUD, IXY, EGG, CLS, FFZ, EOZ, USA, GL, DQV, HCW

W3BAG, CZJ, HQJ, EOZ, BET, EDJ, DRN

W4DSY, DJA, EP, BCR, CYU, EWY, DLW, AVH

W8FHO

W9KFX, IXI, REB, YQN, KYC, DNL, BLY, FKW

If you're interested in swapping cards you can reach E. J. Roberts at 179 Whittington Road, B. P., London, N22, England.

Last month Edward Tanner sent in a

list of SW stations he was hearing in South Africa. Part of it is reproduced to give you an idea of what's being heard outside the States. We don't plan on making such items a regular feature of the column, but with conditions as spotty as they are at the present time, the "heard" report is timely and interesting.

Short Wave Stations Heard in South Africa
(All Times South African Standard Time)

FIQA, Tananarive, Madagascar, on 30.95 meters (9.96 mc.). Announcements are made by a woman and a man in French. The station closes down with the French National Anthem.

CXA-19 on 25.64 meters (11.70 mc.) relays CX-14 "El Espectador," a medium wave station. Programs consist mostly of relays of sporting events and tangoes. Heard nightly.

CXA6, Radio Electrica, Montevideo, Uruguay, on 31.19 meters (9.62 mc.), were heard relaying the Metropolitan Opera, New York.

ZNR, Aden, Arabia, on 24.76 meters (12.11 mc.). Announcements are made by a man in Italian at 8:00 p.m.

PSE, Rio de Janeiro, Brazil, on 20.08 meters (14.93 mc.), comes on the air every Saturday at 10:00 p.m. with a special program for French listeners. Consists mostly of talks. Occasionally a dance program is put over. The call is put over at 10:12 p.m. as "Ici Rio de Janeiro, Brazil."

TPZ, Radio Algiers, on 33.48 meters (8.96 mc.), in conjunction with TPZ-2 (Algiers) on 24.75 meters (12.12 mc.), is heard very well nightly from 9:00 p.m. Station entertains listeners with a really good dance program. The French program in Arabic is also to be heard. The announcement, which is often given in French, is "Hullo, Hullo, Ici Radio Algiers."

HVJ, Vatican City, Italy, on 48.47 meters (6.19 mc.), is heard on Tuesday nights with talks in Italian at 9:00 p.m. The station closes with the words "Laudetur Jesus Cristus."

LRA5, State Radio, Buenos Aires, on 16.82 meters (17.83 mc.), is to be heard nightly with talks in Spanish and English.

JZJ and JZI, Tokyo, Japan, 25.42 and 31.4 meters, respectively, are the clearest stations on the air these days. They give an excellent English news service at 5:45 p.m.

Radio Center, Moscow, on 49.1 meters (6.11 mc.), operates on a new wavelength. News is given by a man and a woman in Russian. Their physical jerks session starts at 11.00 p.m.

LKQ, Oslo, Norway, on 25.26 meters (11.73 mc.), is heard occasionally broadcasting nightly.

MTCY, the Voice of Manchukuo, on 25.47 meters (11.78 mc.), is heard nightly from 11:00 p.m. All reports are verified promptly.

VLQ2, Sydney, on 25.27 meters (11.80 mc.), is on the air from 8:10 p.m. to 8:45 p.m. for South Africa.

VLW5, Perth, W. Australia, on 48.54 meters (6.18 mc.). Same sked as above, also for South Africa. Promptly at 8:10 p.m. the kookaburra bird's laughter is heard.

WLWO on 16.85 meters, WGEA on 19.56 meters, WGEO on 31.4 meters, WBOS on 19.67 meters, etc., are all heard very well nightly, from 9:30 p.m. to 7:00 a.m. They are too numerous to mention.

The above are the most active stations on the air at the moment. There are many more and they can be had if you are interested.

The above stations have been heard at my shack in Wynberg, C.P.—*Edward Tanner.*

There is plenty of domestic news, although we have to curtail it a bit after taking up so much space with foreign correspondence. Another QSL club has been formed in N. J. SWL's interested are invited to write Walter L. Holoob, 15 Chrome Avenue, Carteret, New Jersey, for details on the QSL'ers Club. W1CUP of Stamford, Conn., has been called into active service as 2nd class radioman. W1LGW is getting ready to answer the call. W1KVV is increasing power.

W5JET, official public relations man, has sent us an interesting list of information from the Quoshito Valley Amateur Radio Club, located in Monroe, Louisiana.

W5JCV, ex W8ORY, has left Delta Airlines in Monroe for a new job with an airways company in Pittsburgh.

W9WVY is a newcomer to Monroe. Is radiop for Delta Airlines, and is on 40 c.w. with fifty watts.

W5NI and W5IIH helped put on a show in Bastrop to aid in financing the Delta Division convention.

W5DXL got himself an XYL late in February. Congratulations, Junior!

Transformer trouble has kept W5JET off 40 meters for several weeks.

W5CNG has moved to Lafayette to take on a new job.

W5IIG, who has been working in Oklahoma, has returned to Monroe to take over the job vacated by W5CNG.

W5IVF joined the 160 meter gang recently and is fighting it out with W5IDK on 1825 kc.

On his way home to Texas, W5IVG stopped in Monroe long enough to say hello to W5JET. The two still haven't met, though, as greetings were exchanged on the telephone.

Guess Monroe is due for a few new Hams: Thomas Holden has a new Sky Champion; Red May, a new SX24, and Arthur Grant, a new Sky Buddy.

Heard W5GMR on 160 c.w. say he was getting back on fone. Just can't get used to talking with his hands (or fist).

W5HUZ from Shreveport attends practically every meeting of the OVARC in Monroe.

Ouachita Valley Amateur Radio Club sponsored a variety show in West Monroe to promote funds for the Delta Division Convention.

W5IPX has changed jobs and now has more time to devote to 160 meters.

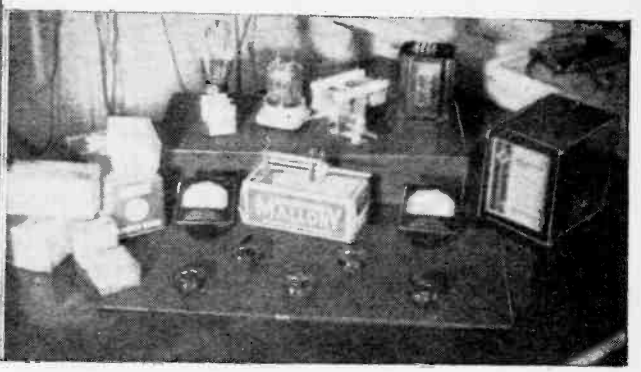
W5HEJ is another Monroe Ham who has recently changed jobs. Hope they are all for the better!

W5HOS is keeping 160 fone occupied.

Jack Welsh, Jr., W9MXW, has taken up arms with W9BRD in giving us some good ninth district dope. W9MXW is using a pair of 6L6's in the final and runs about 60 watts input of 160. Using CW, during the WAS party 20 states were worked in all districts except the seventh. Along with many others, 9MXW is now boosting 160 meter CW. W2NMR held a tongue twisting QSL not so long ago with W2MNR. W2NMR is using an NC200 with a Stancor 1OP. That's one fellow who believes the old adage you can work anything you hear. Illinois is the best DX so far. W2MUT has an FB 750 watt 160 meter rig. However, Ed has gotten into the spirit of national defense and is going on 20 meter CW. With a new three element rotary he is working on, and lots of power, W2MUT should make a big splash on 20. Living in a private house, but nevertheless in the heart of NYC, we believe that BCL trouble might have been an incentive to his move—so BCL's evidently serve their purpose.

W2MVJ has QRO'd to 750 watts using a pair of 813's in the final. W2MUO worked KD4GYM just before he left Swan Island. W2IOP is singing a swan song after missing the same station.

KD4HHS is now on regularly from Swan Island, taking the place of GYM, who has returned to the States. HHS may be found on all GYM's old frequencies for those who want a new country.



Picture at left shows test laboratory where the R. & T. "pull-swing" F-M system has been developed. Below—close-up of the parts used in building the amplifier here described. A high frequency amplifier, to operate efficiently on 59.2 mc., requires carefully selected parts. The Hallicrafter S27 receiver used in checking the R. & T. "pull-swing" apparatus is shown at the extreme left.

A "Pull-Swing"

Frequency Modulation System for the Amateur

Part 4 — High Frequency Amplifier

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

● THE three preceding articles were concerned principally with the modulation process of our new system. In article four we wish to describe an amplifier chassis suitable for any medium power A.M. or F.M. station in the ultra-high frequency spectrum.

Design Considerations: To build an amplifier which is to operate efficiently at a frequency of 59.2 mc. requires some forethought and careful preliminary calculation. It is useless to select random "bargain" parts for reasons which will be discussed later. If a "commercial" appearing job is desired, a great deal of extra work may have to be done. Layouts must be changed over and over again—parts must be selected to meet not only electrical but space considerations as well. Finally—poor or indifferent operation of the final setup may not be tolerated. Nothing short of maximum performance should be accepted. Efficiency and quality on the ultra-highs have too long been neglected by the average experimenter.

Selection of Components: Amplifier Tube —The heart of any electronic device is the vacuum tube. An amplifier, for instance, can be no better than its tubes. For this reason we used great care in choosing this critical part of our amplifier.

For quite awhile there have been available tubes designed especially for ultra-high frequency work. However, these have almost all been triodes and incapable of efficient operation at low plate voltage—a condition which virtually precludes really compact construction. Recently R.C.A. developed a new method of construction which embodies the following characteristics:

1. Insulation reduced to a minimum consistent with mechanical stability.

2. Beam power principle, permitting remarkable efficiency and almost insignificant driving power at plate voltages in the order of 500.

3. Internal capacitances and resonances reduced so far that full input of 120 watts may be used up to 200 mc.

4. Small size—the tube is as small as a baseball.

These considerations make the R.C.A. 829 the ideal tube for an ultra-high frequency amplifier.

Circuit Components: If one wishes to design a high frequency amplifier that is reliable, efficient and compact, a great deal of care must be taken in selecting the circuit components—chokes and condensers especially. In the photograph accompanying this article is a group of the principal parts used by the authors. The parts were selected with great care to do their jobs in practice as well as on paper.

Final Tank Condenser: In the photograph you will recognize the James Millen condenser that was chosen. The D.C. voltage rating of this unit is, of course, above the requirements. However, the excellent insulation due to the large spacing and the minimum of solid dielectric in the field, together with the excellent mechanical adaptability of this condenser to balanced amplifier construction made it the ideal choice.

Variable Condensers: The Cardwell variable condensers were chosen for several reasons. They are compact, mechanically strong, well designed and insulated and due to the arrangement of terminals, are highly adaptable to high frequency circuits.

Fixed Condensers: Fixed condensers are among the most critical of high frequency equipment. There is no compromise with quality. A cheap condenser may have resonances below the operating frequency and this means that if it were used for by-passing a lead its reactance would be inductive instead of capacitive and might be very high. Since coupling between various tube elements is quite probable at high frequencies the by-pass condensers may play an important part in the characteristics of an amplifier. Temperature stability is therefore important and for this reason we chose Cornell-Dubilier silver-micas for this service.

R.F. Chokes: R.F. chokes can be a nuisance in the ultra-high frequency transmitter. Only those of the highest quality may be relied upon at all and it is always well to either eliminate them entirely or to place them at points of low R.F. potential. If they must be used, they should be the first component suspected if the circuit is erratic. The chokes designed especially for H.F. service should not be bypassed unless the designer carefully considers the resonant circuit which is formed by the choke and condenser. (It may have very low impedance at the operating frequency.)

Resistors: Resistors, when used at high frequencies, often show great variations from their D.C. resistance. The effect is not very pronounced for values below 100,000

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

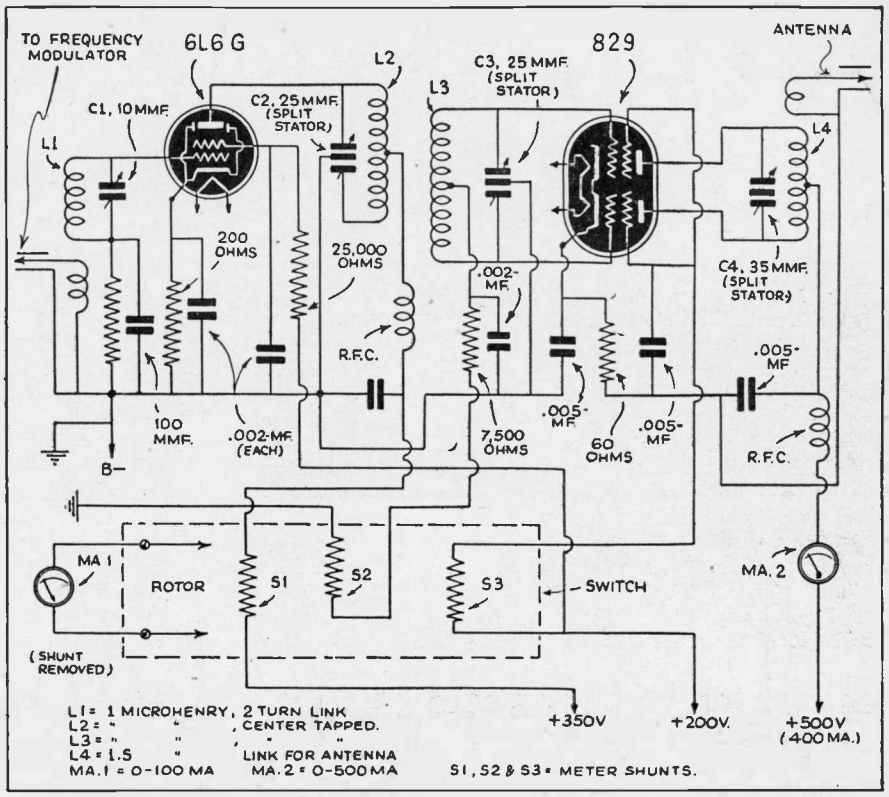


Diagram of the high-frequency amplifier here described.

ohms but may be over 50% for a 1 megohm resistor. Consideration of this effect should enter into design calculations and all resistors should be specified above their D.C. values. (Above discussion is for carbon resistors.)

Wiring: In wiring high frequency circuits it is well to take the following precautions:

1. Filament wires should be run through shielding braid. This serves also as by-pass capacity for the filaments.

2. Wiring at high R.F. potentials should be dispensed with if possible. If long leads are necessary they must be straight and away from the chassis.

3. Grounds for common circuits should be made to common points. The distributed inductance and capacitance of a chassis may greatly affect operation if the distance between grounds becomes comparable to ⅛ of the wave length.

4. All wire should have large surface area. Stranded wire is preferred but care should be taken that all strands are continuous and well soldered. Shielding braid makes an excellent R.F. conductor for heavy currents.

Coil Design

Insulation: There are few types of insulation which may be relied upon at ultra-high frequencies. Therefore most coils are wound self-supporting. Any insulation which must be used should be one of the dense ceramics or, for experimental work, one of the excellent bakelite derivatives such as Amphenol 912B or mica filled bakelite (also obtainable from Amphenol).

Windings: If large wire is used, spaced less than one diameter, the intense fields concentrated in the "skin" layer will beat the coil and reduce efficiency. It is best to keep spacing to a minimum of two diameters. In the low power stages, where the loss of a few per cent of power is relatively unimportant, we have used No. 18 tinned wire. The final tank is wound with heavy tubing, well-spaced.

The design for band-pass circuits will be covered in the following article on construction.

The above considerations were mentioned in order that the reader might be aware of the care and planning that have gone into the construction of the R. & T. F.M. transmitter. These facts are but a small part of the information gathered during research in all sources of information, but a careful perusal of them and use of them in your work may save you a good many headaches during ultra-high frequency work.

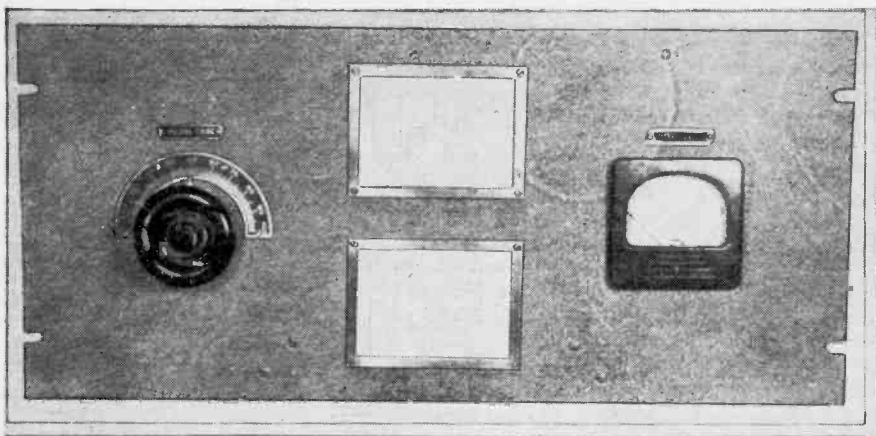
The next article will give complete construction data for a 100 watt, high-quality, 56 megacycle amplifier, suitable for the F.M. transmitter and adaptable to any ultra-high frequency use.

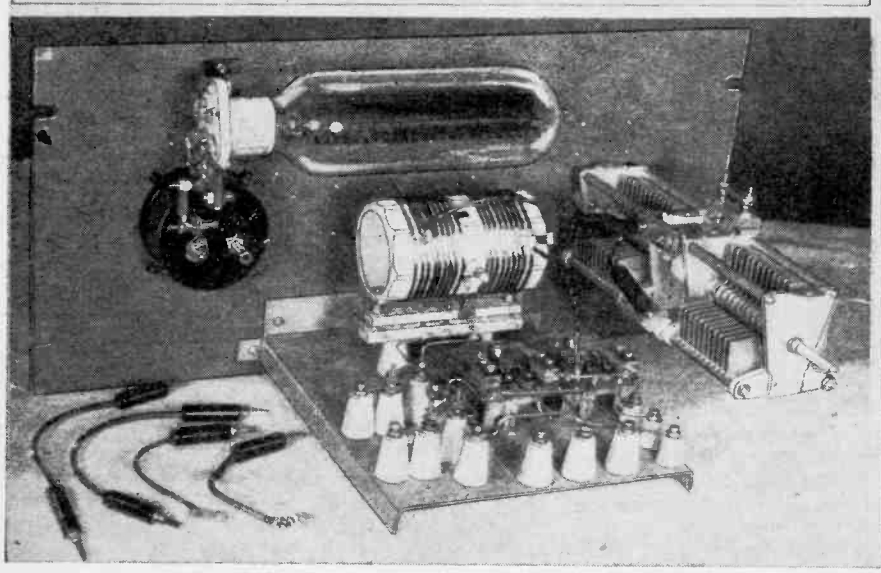
CORNELL-DUBILIER
(All bypass condensers)
TRIPLETT
MA1—0-100 ma., MA2—0-500 ma. meters
CARDWELL
C1—ZR-10-AS (10 mmf.)
C2—ER-25-AD
C3—ER-25-AD (25 mmf. split stator)
JAMES MILLEN MFG. CO.
C4—11035 (35 mmf. split stator)
MALLORY
SW1—"Hamswitch" 151L
MISCELLANEOUS
S1, S2, S3—meter shunts

More on Frequency Modulation in the coming issues—further research is being carried on by Mr. Muniz and his associates.

A Universal ANTENNA TUNER

Herman Yellin, W2AJL





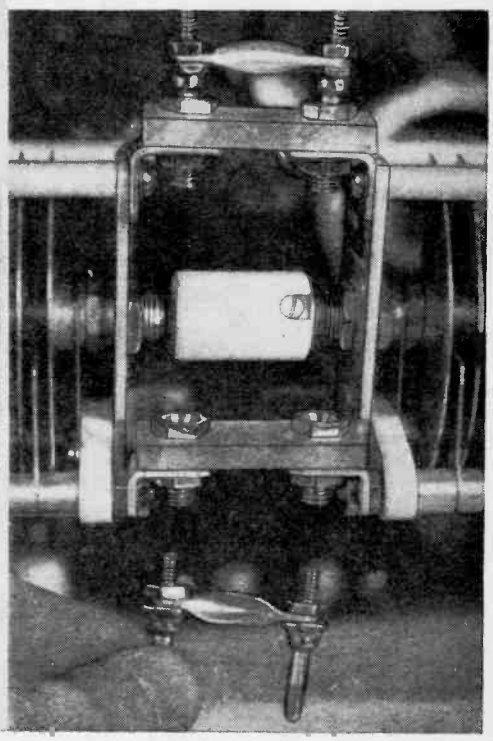


Photo at left shows front panel of the antenna tuner unit, with radiation meter and condenser control. Calibration curves are mounted in the two square frames at the center of the panel. Lower left picture shows rear of antenna tuner; the large bulb contains the dummy antenna. Below—photo shows special coupling arrangement between the two antenna condensers.

SHUNNED by many amateurs because of mistaken notions of their complexity, antenna couplers are conspicuous by their absence in all but a few ham "rigs." Many a ham with a kilowatt rig has quailed at the thought of an antenna network, and compromised with some inefficient method of transferring power from his final stage to his antenna.

Actually, antenna tuners are merely simple tuned circuits used for matching the impedance of the final plate tank circuit to the antenna transmission line. It is also extremely valuable when used as a means for eliminating harmonic radiation. The average plate tank circuit averages about two to five thousand ohms impedance, while antenna transmission lines may vary from seventy to several thousand ohms. In order to get the maximum transfer of power from final tank to antenna, the two impedances must be properly matched, and this is accomplished by the *antenna network* which is really an impedance transformer.

Probably the simplest type of antenna tuner while at the same time capable of the greatest universality can be constructed from a coil and condenser. By using several lengths of flexible wire terminated in "banana" plugs and inductor clips, and stationing several jacks at strategic points, it is possible to connect up the coil and condenser in any one of several ways, in order to accommodate different types of transmission lines.

In the author's tuning unit, described herein, two separate 150 mmf. tuning condensers were "tied together" by means of polystyrene blocks, to form a dual condenser operated from a single dial. This allows us to place a condenser in each lead of a pair of Zepp feeders requiring series tuning, while also giving us a wide range of capacity values, since the two condensers can be placed in series or parallel. With the two condensers connected in series, the voltage rating of the unit as a whole is double the rating of the individual condensers, which is a great convenience, since greater voltages frequently appear across the condenser at the lower capacities.

The minimum parts for this tuner are shown in Fig. 1. The manner of connecting up the coil and condensers will depend on the type of transmission line. However, for greater convenience in changing over from one antenna to another, and thereby promoting operating ease, the writer has included a number of convenient gadgets to the fundamental coil and condensers—as Fig. 2 will show. The constructor may add all or only those which he believes will be necessary for his purposes.

First, a few more words about the two

The importance of a good antenna "balancing" network is frequently lost sight of by the average Ham. A very excellent design for a moderate-priced antenna tuning unit is here described. By means of this layout the antenna tuning condensers can be quickly connected in series or parallel, to suit different aerial arrangements. For checking purposes a radiation meter and also a "dummy antenna" are included, and their use is carefully explained. This unit will aid in eliminating harmonic radiation.

condensers. The object in having two condensers is to be able to use either one alone or both in series, or both in parallel, thereby achieving a wide range of capacity. For this purpose, a split-stator condenser would be adequate; however, in some cases, especially in series tuning of Zepp antennas, it is desirable to have one condenser in series with each leg of the transmission line. Both of these are varied simultaneously, so that it is possible to "gang" the two condensers. Since a two-unit double-spaced condenser with both stators and rotors insulated from each other was not available, one was built up from two 150 mmf. condensers. As the photo shows, the two units are connected end-to-end by means of four blocks of 912A polystyrene and short angle-brackets with an insulated coupling ganging up the two rotors. Instead of using ordinary bolts for fastening the polystyrene blocks to the angle brackets, banana plug jacks are used, so that a convenient means of connecting the condensers is readily available. A pair of special plug-in jumpers affords a convenient method of paralleling the two condensers. These jumpers are made up from 1¼ inch lengths of ¼ inch diameter copper tubing, with the ends flattened out and drilled for banana plugs at each end. The mounting centers for these plugs were made 1 inch apart, as were the other jumpers needed for purposes to be described later.

Of course, the constructor can use two individual tuning condensers, but the slight added work involved in ganging the two will amply repay the ham in simplified tuning.

The coil is a standard Johnson 350 watt, 40 meter plug-in inductor. So far, the writer has found this single coil adequate for operation on all bands from 10 to 80 meters. For 160 meter operation, a larger coil such as the 80 meter coil can be easily plugged into the jack base. The 40 meter coil consists of 18 turns (center-tapped) of No. 12 enameled wire, wound on a 2½ inch diameter ceramic form, with the turns spaced to a length of 3 inches. A rotary link coil is built into the inside of the coil form, and is useful in certain applications of the tuner.

Since not all the turns in the coil will always be used, it will be necessary to scrape the enamel from about a one-half inch on each turn, so that inductor clips can make contact with the desired number of turns.

In the writer's present installation, two antennas are in use, one a 20 meter doublet, with "twisted-pair" transmission line, and the other an 80 meter off-center fed antenna using a single wire transmission line. For any particular band, only one antenna is used for transmission and until recently, a four-pole double-throw switch was employed to connect either antenna to the transmitter, while at the same time transferring the unused antenna to the receiver. Frequently, however, it was found that the best receiving antenna for *weak signal* reception was the antenna being used for transmitting, so the switch was used to transfer the desired antenna from transmitting to *receiving*, with the attendant danger of receiving R.F. burns, if the key should be depressed during the switching operation. So when the antenna tuner was built, a pair of two-pole, double-throw R.F. relays were added to make the antenna changeover as rapid and *safe* as possible! Two pilot lights and a toggle switch can be mounted on a small panel on the operating table for switching purposes, and indicating which way the antenna relay is connected at any particular time. While the diagram shows the relay wired up for the two antennas used at the writer's station, other types of antennas can also be accommodated by a similar system.

Ordinarily supplied for 110 volt operation, the relay coils are also available for operation on other voltages, and the pilot light voltage should correspond with the relay coil voltage.

The antenna condensers, radiation meter and dummy antenna were all mounted on an 8½ inch relay rack panel. A pair of home-made chart frames, 3 by 4 inches, was made out of sheet brass and nickel-plated, giving quite a professional touch to the unit, besides affording a convenient means of recording tuning data.

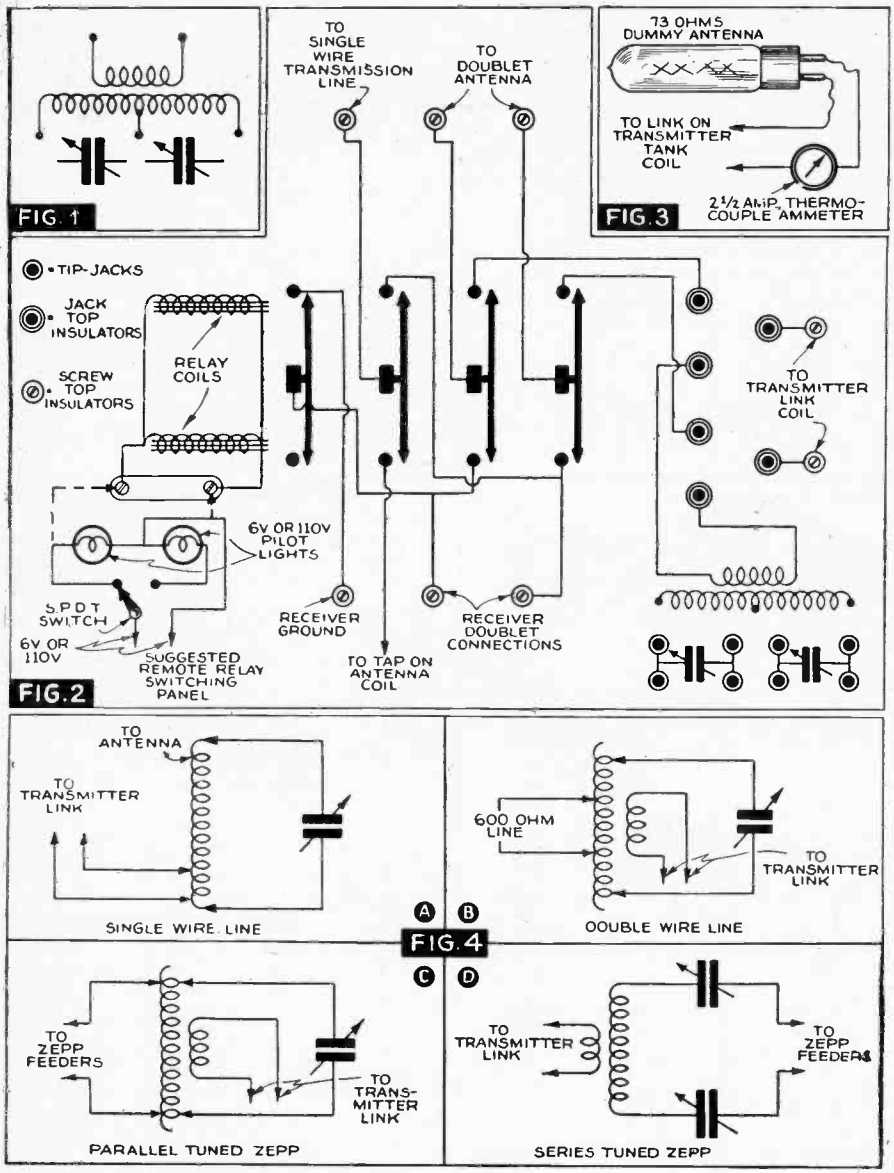
The coil, relays and ceramic screw type and jack type insulators were mounted on an aluminum sub-panel, measuring 9 inches deep by 8 inches wide, with one-half inch lips, bent at the sides for rigidity. After bending and drilling all the holes, the sub-panel was given a coat of grey Prismlac, an air-drying crystalline lacquer. Incidentally, this Prismlac is the only air-drying crystalline lacquer the writer has seen, which will really cover a surface without leaving bare patches of metal. It gives a real commercial appearance to the panel and should prove a boon to the home builder of equipment.

Another feature of this tuning unit is the inclusion of a 2½ ampere thermo-coupled R.F. ammeter and a 250 watt Ohmite "dummy antenna." The ammeter can be used for measuring antenna or line current, or it can be used in conjunction with the dummy antenna for measuring antenna power as well as transmitter efficiency.

Figure 3 shows how the ammeter and "dummy load" are connected in series with the link coil of the transmitter final. The output power will equal P (watts) $= I^2R = I^273$ (since dummy load is 73 ohms). This output power, divided by the input power to the final, will give the percentage efficiency of that stage. These Ohmite dummy antennas are made in two wattages —100 and 250 watts—use whichever is needed for your particular transmitter. They are also made in impedances other than 73 ohms.

Reference to figure 2 and one of the photos will show that the two posts which are connected to the transmitter final link can be connected either directly to a low-impedance antenna line, or to the link coil of the antenna coil. This is accomplished by using jack type ceramic insulators and jumpers, such as were described before. Not only can the transmitter link be connected to either the antenna link coil or directly to the antenna line, but it can also be tapped across a few turns of the antenna coil at either the center or end of that coil.

In figure 4 we see the coil and condenser combination set up for several different types of antennas. (a) shows the setup for coupling to a high impedance single-wire feeder, such as might be used with an end-fed Hertz or off-center fed antenna. The coil-condenser combination must resonate to the desired frequency—which might mean



Wiring diagram for the Universal antenna tuner here described.

the use of all or part of the coil, and the use of only one condenser or of both condensers connected either in series or in parallel. Similarly with (b), which shows how to connect up a medium impedance 2-wire transmission line, such as a 400 or 600 ohm line. Figures 4c and 4d show connections to the feeders of a Zepp antenna, requiring parallel and series tuning, respectively. Here the amount of coil and condenser used will be determined by the length of the feeders.

Tuning of the antenna tuner will be somewhat determined by the type of antenna used, but is relatively simple. It is fundamentally necessary to tune the antenna condenser for maximum plate current to the final stage, while the final plate tank condenser is adjusted for minimum plate current. The antenna ammeter can be placed in series with the transmission line to indicate output power.

Elimination of *harmonic radiation* is an important use for the *antenna tuner*. For this use the center tap of the antenna coil should be *grounded*, as well as one side of the low impedance transmission line between transmitter and antenna coil. Incidentally, the antenna coil must be coupled to the transmitter through the antenna link coil at the center of the antenna coil. This results in elimination of both capacitive and inductive coupling between antenna and transmitter with the attendant elimination of odd and even harmonics.

Parts List

E. F. JOHNSON CO.
2—150 mmf. double spaced condensers, No. 150E30
1—40 meter coil, No. 662
1—Mounting base for coil, No. 669
1—¼ inch steatite shaft coupling, No. 252
7—1 inch steatite cone insulators, No. 501
6—⅝ inch steatite cone insulators, No. 500
6—1 inch jack type porcelain insulators, No. 601J
12—Banana spring jacks, No. 74
8—Banana plugs, No. 75
8—Banana plugs with handles, No. 75BB
4—Inductor clips, No. 860
1—4 prong socket (for dummy antenna), No. 224

PAR-METAL PRODUCTS CO.
1—8¾ inch grey aluminum rack panel, No. G-6679

TRIPLETT ELECTRICAL INSTRUMENT CO.
1—2½ ampere thermo-ammeter, No. 347A

NEW ENGLAND RADIOCRAFTERS
Marine grey Prismlac

GUARDIAN ELECTRIC CO.
2—DPDT R.F. relays, No. R-100G

GORDON SPECIALTIES CO.
1—2¼ inch hand wheel and scale, No. 301
1—Standard name plate "ANTENNA TUNING"
1—Standard name plate "ANTENNA CURRENT"

OHMITE MFG. CO.
1—250 watt, 73 ohm dummy antenna, No. D-250-73

AMERICAN PHENOLIC
1—Sheet of 3/16 inch polystyrene, No. 912A

How Superhets Work

● THE supersonic heterodyne receiver, called colloquially the "superhet," is not a recent development and in fact dates back to the beginning of the century so far as the fundamental principles are concerned. The first practical superhets were a product of the last war when the need arose for greater amplification of the radio frequencies and the tubes available were limited in performance compared with present-day products.

The amplification of radio frequencies has always been a problem, and the higher the frequency the more difficult the problem becomes. The stray capacities in the wiring and the tube capacities are effectively in parallel with the output of an R.F. amplifier stage and their low impedance to high frequency reduces the gain of the stage considerably. In some television frequency circuits the gain per stage with the best of the modern tubes is less than 5, so the difficulty of amplification with the cruder tubes of 1917-1918 can be imagined.

The development of the superheterodyne method of reception was due to the attempts to overcome the difficulties of high-frequency amplification, and the obvious line of attack was to reduce the frequency as much as possible to overcome the shunting effect of the circuit capacities. It occurred to Armstrong in America, and, independently, to Schottky in Germany, that if the radio frequency from the aerial could be combined with a locally generated oscillation which differed slightly in frequency the resultant "beats" could be amplified more easily than the original signal.

The "beats" would still convey the modulation forming the speech or music and could be rectified after amplification in the usual way. This is the principle on which the superheterodyne is designed, and its operation can be understood by following a signal through the various stages as given in the diagrams.

Beats

The phenomenon known as "beating" occurs whenever two oscillations which are fairly close together in frequency combine to produce an output. The effect is shown in Fig. 1, and can be studied by drawing a series of waves differing slightly in frequency and adding them together graphically. The resulting wave will be seen to consist of a series of high and low amplitude peaks, the maximum amplitude occurring when the combining waves are in step and the minimum when they are out of step ("phase" would be a more scientific term). If the original frequencies were audible, say C and C sharp, the combined wave would be audible as a series of throbs or beats, each beat corresponding to a rise in amplitude of the resulting wave. Students who have access to a piano which can be tampered with can try the effect of slightly detuning one of the two strings which form each note in the base register. On striking the key the beat between the two frequencies will be heard clearly, its frequency depending on the difference between the frequencies of the two strings. Lower C is approximately 128 cycles per sec. and if the second string of the pair is detuned to vibrate at 120 cycles per second, a beat note having a frequency of 128-120 or 8 per second can be heard and counted.

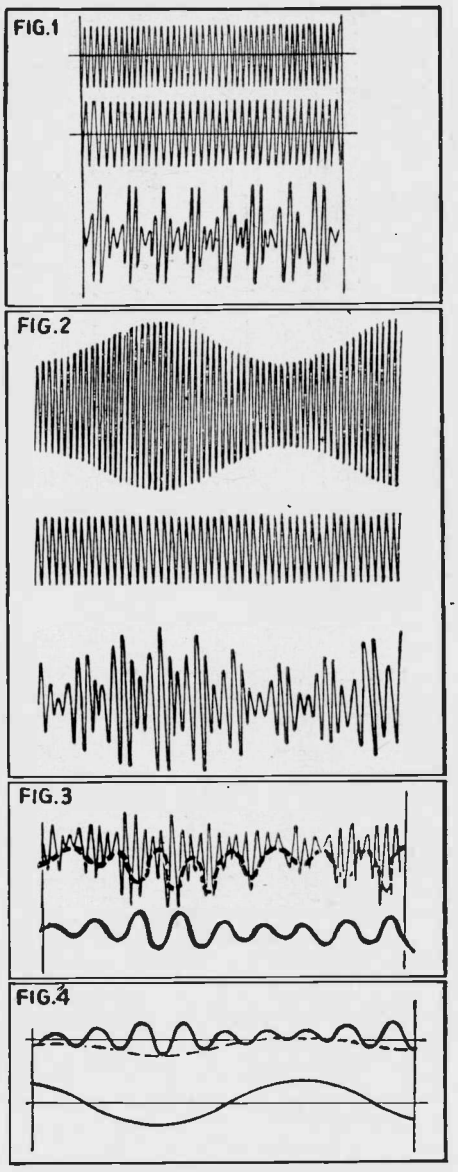


Fig. 1 Showing how two notes of slightly different frequency combine to produce "beats." Fig. 2 A modulated carrier wave combined with a local oscillation frequency reproduces the modulation in the beat frequency. Fig. 3 The modulated beat frequency, after rectification, showing the plate current fluctuations following the modulation. Fig. 4 The modulated beat frequency after detection a second time, leaving the audio frequency component.

The effect is exactly the same if the frequency of the note is raised, or if two oscillatory circuits are used. Suppose one is oscillating at 128,000 cycles per second (increasing the original figures a thousandfold) and the other at 120,000. The beat frequency will then be 8,000 cycles, which will be audible as a whistle. Increase the frequencies another tenfold and the resultant beat note will then be 80,000 cycles, which will be as it is above the range of the human ear. Frequencies above audibility are termed "supersonic." We have now got into the working region of the superhet. 1,280 kilocycles per second corresponds to a frequency in the broadcast band and if it is combined with a wave generated by a local oscillator at 1,200 kc., the resultant beat frequency is 80 kc., which is easier to amplify than the original 1,280 kc. signal.

The incoming frequency in the case of a radio receiver is modulated at audio frequency and instead of being the continuous oscillation of Fig. 1, will be more like the upper curve of Fig. 2. The fluctuations in amplitude produced by the audio frequency modulation appear in the beat waveform, which should be compared with that of Fig. 1.

In combining the incoming signal with a locally generated signal we have not lost the modulation, which is, of course, a most important point.

Detection

If the modulated beat frequency is passed through a detector in the usual way the anode current of the detector will follow the average height of the complex wave of Fig. 2 and will be of the form of Fig. 3—top. Note that the anode current fluctuation follows two influences: the main fluctuation frequency is that of the beat, the current rising with each pulse of increased amplitude and falling with the troughs of the waves. At the same time the general level of the anode current peaks follows the waveform of the modulating frequency. The fluctuation due to the beats is seen more clearly in the lower diagram of Fig. 3 which has had the high frequency component taken away. This wave is then amplified by successive stages of tuned circuit and tubes until it is of sufficient amplitude to be rectified a second time leaving the audio frequency component only. The diagram of Fig. 4 shows the beat frequency modulated by the signal and its rectification to produce the final audio frequency wave which is of the same form as the original modulation.

A superhet, therefore, requires two detector stages—the first immediately following the local oscillator, which rectifies the modulated beat frequency, and the second, which removed the beat frequency to leave the original modulating frequency.

Instead of the term "beat frequency" we can use the more common one, "intermediate frequency," abbreviated to "I.F.," denoting the frequency between the original radio frequency and the audio frequency produced after detection for the second time.

The most important difference between the performance of the superhet and that of an ordinary tuned circuit radio frequency amplifier is that in the superhet all the amplification is done at a fixed frequency, that of the beat, while in a "straight" R.F.

amplifier the circuits have all to be tuned to the frequency of the incoming signal. Once the tuned circuits of the superhet have been adjusted they need no alteration, and this makes for a neat and reliable form of construction of the amplifying stages.

It is also possible to design the I.F. tuned circuits for maximum efficiency at the frequency chosen, whereas it is impossible to obtain maximum efficiency from tuned circuits over a wide range of frequencies without some adjustment.

Selectivity

One of the difficulties of present-day reception is to keep unwanted stations from interfering with the one to which the receiver is tuned. The higher the frequency to which a circuit is tuned, the more difficult it is to keep out unwanted frequencies as the percentage difference between the two may be very small. As an example, if a circuit is tuned to 120 kc., a frequency of 125 kc. will be passed as the percentage difference is only 5 in 120 or 4 per cent approximately. Now suppose that the frequency of 120 kc. is combined with an oscillation at 200 kc. to produce an I.F. of 80 kc. The unwanted signal will produce a beat frequency of 200-125 or 75 kc. and the difference between this and the I.F. of 80 kc. is 5 in 80 or nearly 7 per cent. These figures are taken at random and the actual results obtained show much wider differences.

It should be noted that there are two incoming signals which will produce the same beat frequency with a local oscillator. If the oscillator frequency is 450 kc., a signal of 500 kc. will give a beat frequency of 50, but so will a signal of 400 kc. This effect produced by a second unwanted frequency is known as *second channel interference*, and can be very troublesome if the local oscillator frequency is chosen so that there are two stations beating with it at the same time.

The frequency of the local oscillator is always chosen with regard to the frequencies in the broadcast band and is not taken at random. It has been found that the most satisfactory frequencies are round 100 kc. and 450 kc. and most superhets use one or other in this region. The selectivity of the tuned circuits can then be designed so that there is minimum interference from adjacent frequencies in the band.

Superhet Circuits

The circuit of the superhet may be said to be built round the oscillator, as the performance of the receiver depends on the constancy of the oscillator frequency. If this alters, the I.F. alters and the tuned circuits of the I.F. amplifier are thrown out.

Frequency Changing

In the early superhets the local oscillations were produced by a separate tube which was inductively coupled to the detector circuit, but later developments simplified the circuit and tubes were designed to combine the functions of oscillator and detector. Separate oscillators are still used, however, in television and short-wave receivers.

The incoming signal is usually passed through one stage of radio frequency amplification before being "mixed" with the local

oscillation. The tube performing this is often referred to as the "mixer tube."

A simple mixer circuit is shown in the diagram of Fig. 5 in which a screen grid (or tetrode) tube combines the function of detector and oscillator.

The incoming radio signal is applied to the grid in the usual way and the tube is biased by a resistance in the cathode circuit to act as an anode bend detector. An oscillatory circuit is connected between anode and cathode and coupled back to the grid through the coil in the cathode circuit. The anode circuit thus contains three frequencies —the radio signal and the sum and difference of the oscillator and the radio frequencies. The difference of the frequencies only is required and this is obtained by coupling a tuned circuit to the anode coil as shown. This is the "I.F." transformer and feeds the I.F. to the next tube.

The method of applying the oscillation frequency to the circuit is by coupling in the cathode and for this reason the method is known as *cathode injection.*

Some receivers use a separate tube for the oscillator, but combined with the detector in the same bulb—the triode-pentode.

In these the triode portion is the local oscillator and the pentode the detector, the injection being in the cathode circuit as in Fig. 5.

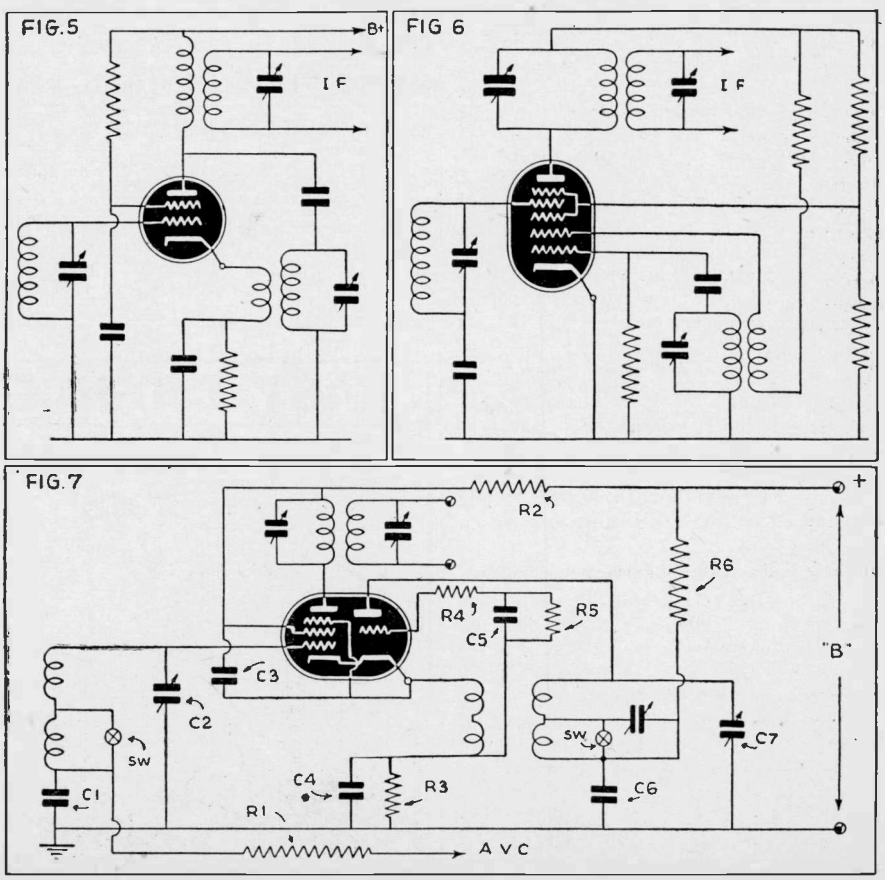
A more complicated form of combined oscillator and detector which is widely used is the one shown in Fig. 6. The valve has seven electrodes and is therefore a *heptode,* and the coupling between the oscillator portion and the detector is in the electron stream itself. It is as though the oscillations modulated the detector current flowing to the anode and this form of mixing is very efficient and stable owing to the absence of stray coupling between components outside the tube. Fig. 7 shows the circuit arrangement. Note that the signal is not applied to the grid to the first grid (the one nearest the cathode), but the first and second grids form an oscillatory circuit in which the second grid acts as an anode. The electrons pass through this "anode" and are controlled by the fourth grid to which the input signal is applied. The fifth grid acts as the screen in an analogous way to that in a tetrode, while the output is taken from the anode circuit in the usual way. Electrons from the cathode are thus modulated twice on their way to the anode—first by the oscillatory circuit and then by the radio input.

Another variation of the "one man band" type of tube is the triode hexode, in which the pentode portion of Fig. 6 has an extra grid added which is directly connected to the oscillator grid. The principle of most of these multi-electrode mixers is the same—combined modulation of the electron stream and a further diagram is unnecessary here.

The remainder of the superhet circuit is on standard lines. The I.F. amplifier valves are of the screened pentode type with high mutual conductance and the second detector is usually a diode, which, as will be remembered, works well with a high signal input.

Further study of the action of superhet circuits can be found in the radio textbooks now available.—Courtesy *Electronics* and *Television & Short Wave World,* London.

Fig. 5 A simple circuit for injecting an oscillation into the first detector. Fig. 6 A tube used as a combined oscillator and detector. Fig. 7 A heptode tube in which the coupling is by electron stream.



A Simple Signal Tracer

H. L. Carpenter

Photos show—at left—panel view of the Signalometer or signal tracer; at right—the test instrument in use by the author for locating a fault in a receiver chassis.

The simple signal tracer here described by Mr. Carpenter, a practical radio serviceman, which he calls a Signalometer, permits making the simple tests found necessary in service work. In fact the Signalometer will do practically anything that the commercial signal tracers will do, the author states, except measuring R.F. gain. The set builder and radio experimenter will find this signal tracer very interesting, as it can be easily made from odd parts or an old set lying around the home "lab" or shop.

● THE *Signalometer* was designed especially to help the great majority of servicemen who are in limited financial circumstances. The instrument described here was built, with few exceptions, from parts found in the "junk-box." Many servicemen have been slow to break into the signal-tracing method of servicing, because of the high prices of equipment. The *Signalometer* will solve this part of the problem for all who are willing to put forth a little effort, plus a small cash outlay. Only a knowledge of radio circuit operation is needed to make it a time-saving and money-making piece of equipment.

The first consideration in the construction is whether it shall be portable or on a panel. The accompanying photograph shows the panel type of construction. This unit was installed several months ago and has saved the writer many hours of fruitless searching and head-scratching. The panel is made of black, tempered, masonite, lettered with white ink. Tubes used may be of any similar type that the constructor has on hand, although some of the resistor values may have to be changed, if different types are substituted. The circuit is not critical as to placement of components, even though the gain is rather high.

All resistors are ½ watt, except the 5000 ohm detector bias, which is a 2 watt carbon and the 220 ohm output bias, which is a 2½ watt wire-wound. The test lead is from a Radiart C-31 auto antenna. The input and output jacks are mounting connections from the same antenna. The input switch, SW2 in the diagram, is a SP/4T Centralab. SW3, or output switch, is a revamped tone control from a 1936 Philco. This control has six contacts and a three fingered pole. The condensers are removed first, then the outside finger is cut from the pole. Next, turn the solder lugs around to act as stops for the pole. This gives us a switch having six contacts, which may be *connected in pairs* to close one of three circuits separately. The speaker voice coil is connected to the two center contacts, so that the speaker is disconnected when either output stage is in use. The Ant. switch, SW1, is a SP/DT and opens the antenna connection to the R.F. coil when using the input section.

The experienced serviceman will need no instruction as to the proper use of the *Signalometer;* however, there are many newcomers to the field who have no practical experience to back up the knowledge they have derived from books and lessons. For these beginners we will outline our method of signal-tracing. This procedure will quickly locate any signal fault, in any part of a receiver, whether it be distortion, hum, squeals, "birdies" or complete absence of signal.

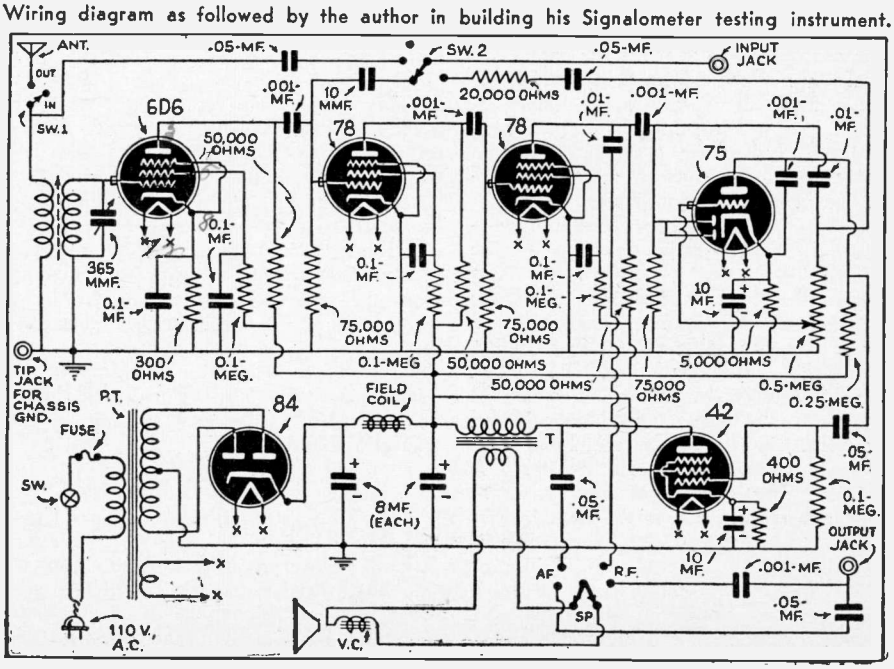
Connect the receiver to power source and allow the tubes to warm up. Tune in a station on the *Signalometer* with input switch turned to R.F., Ant. switch to OUT, and output switch to *speaker.* Tune the receiver dial to this frequency. Insert test lead in output jack, turn output switch to A.F. and touch prod end to grids of tubes, starting at the output tube and continuing towards the antenna, turning the output switch to R.F. as the detector is reached.

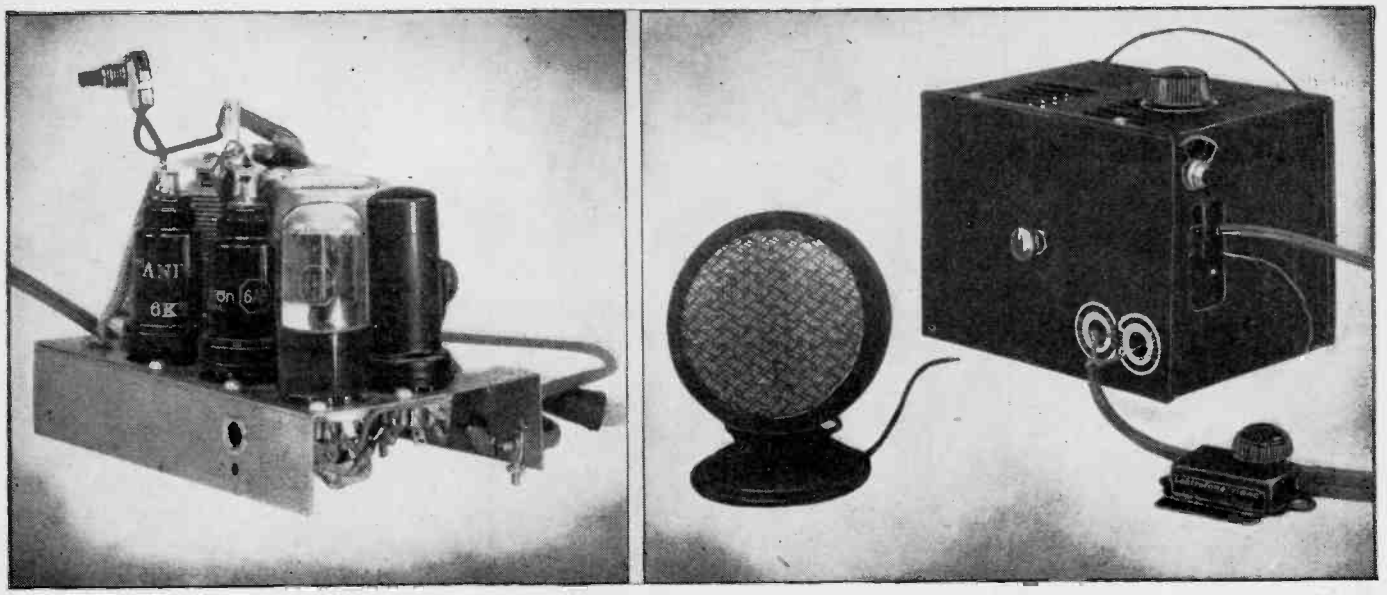
Assuming that the signal comes through the set speaker at the output tube's grid, but fails at the first A.F. tube's grid, we would find the fault in the first A.F. stage.

To use the input section of the tester, the Ant. switch is turned to IN, which disconnects the antenna from the *Signalometer.* The antenna is connected to the receiver and the test lead to the input jack. We then proceed from antenna to speaker, touching the probe to the tube plates, instead of to the grids, as in the previous test. The presence or quality of the signal present in the set is then heard in the test speaker.

It is our sincere hope that many servicemen and experimenters will find some satisfaction from this article, and will use it to the furtherance of competent and profitable servicing. All questions as to its use or construction will be answered if addressed to the author, in care of this publication.

Wiring diagram as followed by the author in building his Signalometer testing instrument.





View of the chassis and also the complete set-up with "contact" and usual type mikes.

The "MUSICASTER"—

Electronic Music Through Your Radio Set

H. G. Cisin, M. E.

● ELECTRONICALLY amplified music offers an entertaining and highly interesting field for the radio experimenter. Through the use of the *Musicaster,* a separate amplifier is no longer needed for such experimentation. Anyone who owns a radio set, regardless of its type, is all set to go ahead, as soon as he has completed the construction of the easily-built Musicaster here described. This device permits the substitution of the radio set for the amplifier, so that sounds made by the experimenter on almost any type of musical instrument, will be heard coming from the radio loud-speaker with increased volume and improved tone quality.

Of course, if one is fortunate enough to possess a modern high-fidelity radio receiver, extra fine results are possible. A set equipped with a push-pull output stage, with a 12" dynamic speaker, automatic frequency control, automatic volume control and properly designed tone control, is ideal. However, for the average experimenter, almost any radio set will serve the purpose.

In addition to the radio receiver and the device here described, the experimenter will require a contact mike of excellent quality, such as the *Lectrofone Vibro.* The contact mike is fastened by means of a bridge clamp or by adhesive tape, to the bridge of a violin, banjo, guitar, mandolin, ukulele, viola, 'cello, bass viol, or harp. It may also be fastened on the sounding board of a piano or attached to the humble harmonica. In general, the contact mike is especially well adapted for use with any musical instrument employing a sounding board or other similar vibrating material. Wind instruments, such as the clarinet, oboe, flute, etc., which employ a vibrating column of air, usually require an ordinary microphone for best results.

The results obtainable are extremely gratifying. For example, a contact microphone attached to a stringed instrument, such as a guitar, picks up not only the fundamentals and the first and second harmonics, but also the overtones which are not usually audible to the unaided human ear. These are transmitted by means of the miniature transmitter described, to the radio receiver. When heard from the loud-speaker, the music is transformed from ordinary "thin" sounds to rich, full, mellow tones. Furthermore, if the set is equipped with a tone control, tone may be varied to accentuate either the treble or the bass, according to the desires of the experimenter. Since the music is amplified, volume may be varied to any extent required.

After fastening the contact mike to the musical instrument, the two leads coming from the mike are inserted in the jacks which connect to the input of the transmitter. One of the leads is a *ground* lead, since it is attached to the shielding of the microphone cable. This ground lead should be connected to the ground jack of the transmitter here shown.

Device Is a Miniature Transmitter

The Musicaster itself is essentially a low-powered modulated oscillator, with self-contained power supply, designed especially for the transmission of electronically amplified music. It consists of a high-gain microphone pre-amplifier stage utilizing a 6J7 tube, working into an oscillator employing a 6A8 tube. The amplified modulating signals from the plate circuit of the 6J7 are impressed on the oscillator grid No. 1 of the 6A8 tube. This tube is of the type known as a pentagrid converter, having an oscillator and a frequency mixer combined in the same envelope. Coupling between these two units is obtained by means of the electron stream within the tube. The name pentagrid is derived from the fact that five grids are used. The oscillatory circuit includes grid No. 4, plate and cathode. Grid No. 3 accelerates the electron stream and shields grid No. 4 electrostatically from the other electrodes.

The frequency of oscillation, or in other words the wavelength of the carrier, is determined by the constants of the tuned circuit, including the inductive winding "G-F" of L1, the variable condenser C8 and the fixed condenser C10. Hence, to increase the wavelength, it is necessary to employ a plug-in coil at L1 having more turns, or to add capacity by closing the variable condenser C8, or by closing the switch SW2 so as to add the capacity of C10 to that of C8.

The amplified signal applied to grid No. 1 affects the electron stream of the oscillatory circuit, varying the symmetrical wave form, making it conform to the vibrations picked up by the microphone. More simply stated, the signal applied to grid No. 1, modulates the oscillator, so that a modulated wave is transmitted in place of the unmodulated carrier wave. This modulated wave can then be tuned in by any radio receiver in the immediate vicinity, detected in the usual way, amplified and reproduced audibly on the loud-speaker of the radio set.

Two Mikes May Be Used

The circuit includes a number of special and desirable features. Optional jacks are shown, so that the conventional microphone may be used in conjunction with the contact mike. This feature permits one to sing into the microphone, while at the same time the contact mike picks up the accompaniment from a guitar, banjo, etc. The regular mike may also be used for announcing the names of the musical selections or for other announcements. With the circuit arrangement shown, it is necessary that both microphones have approximately *the same impedance*. However, where a very high impedance mike, such as a crystal microphone is to be used, it is very easy to provide a separate high impedance input for the crystal mike. The potentiometer R10 may be used to increase or decrease the gain of the pre-amplifier stage.

In certain instances, the experimenter may wish to play a musical instrument to the accompaniment of a phonograph record. For this purpose, "phono" connections are provided which lead directly to the oscillator grid No. 1. The electric phonograph does not require the pre-amplifier stage. This extra amplification is needed only for the microphones. The phonograph pickup may be either a magnetic or a crystal pick-up. Gain control for the phonograph is provided by the potentiometer R6. This control permits the phonograph selection to be faded out without disturbing the music picked up by the contact mike.

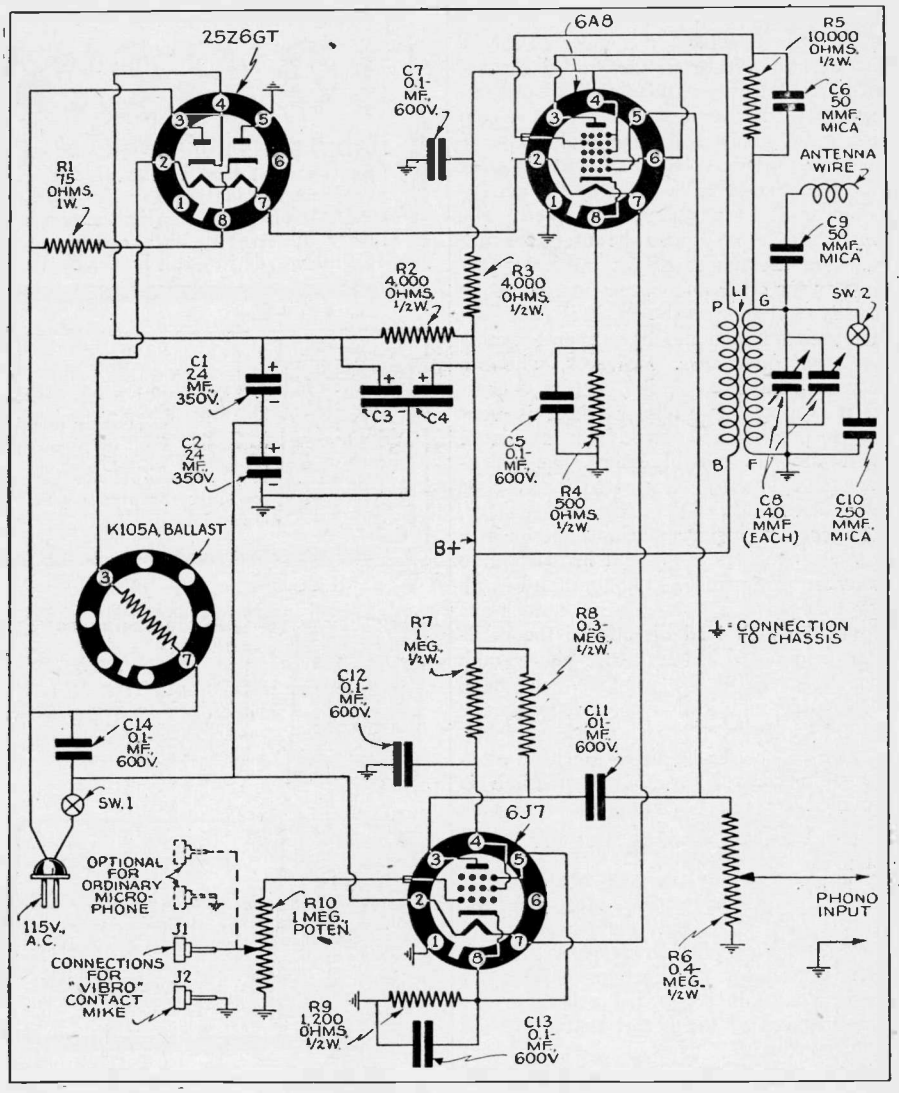
The circuit is adapted for A.C. use only, because of the fact that the power supply is of the *voltage-doubler type*. A 25Z6GT tube is used for rectification. All heaters are connected in series and a ballast tube serves to reduce the heater voltage to the required value.

The construction is straightforward and requires but few precautions. The condenser at C14 across the incoming line is used to reduce 60 cycle hum. Although a .1 mf. is specified, it may be necessary in certain cases to increase this value to ½ mf. The resistor R1 must be used in order to limit the peak plate current of the P2-K2 portion of the rectifier to the rated value, as an overload will spoil the tube.

It is important to note that the negative terminal of condenser C1 connects to the positive terminal of C2. Incidentally, this connection point must be insulated from the chassis. The best plan is to use an insulated mounting lug. The wires which connect to the caps of the 6A8 and the 6J7 should be kept as short as possible. If a long wire must be used, it is best to use a shielded wire, grounding the shield to the chassis.

The dual section Hammarlund variable condenser C8, has rotors and stators connected in parallel, so as to be able to tune over a greater portion of the broadcast band. For increased coverage, an additional fixed condenser C10 may be connected in parallel with C8 by means of the toggle switch SW2.

In most cases, the antenna wire which connects to C9, need not be over four or five feet long. This wire should *never be connected to an outside antenna,* since the Musicaster might then radiate sufficiently to disturb other neighboring radio sets and



Wiring diagram of the "Musicaster" as designed by Mr. Cisin.

this would constitute a violation of F.C.C. regulations. If, for any reason, difficulty is experienced in transmitting to the radio receiver, the best plan is to run a wire directly from the antenna wire at C9 to the antenna post of the radio set. However, such an expedient should hardly ever be necessary, since the device has sufficient power for all ordinary purposes within the home.

Those who have never experimented with this device will most certainly enjoy a new thrill.

Parts List

AEROVOX (Condensers)

2—24 mf., 350 volt electrolytic condensers, type PRS-350 (C1, C2)
1—Double section inverted mounting electrolytic condenser, type 2GL-450 (C3-16, C4-8)
5—.1 mf., 600 volt, type 684 tubular paper condenser (C5, C7, C12, C13, C14)
2—.00005 mf. mica condensers, type 1468 (C6, C9)
1—.00025 mf. mica condenser, type 1468 (C10)
1—.01 mf., 600 volt, type 684, tubular paper condenser (C11)

HAMMARLUND

1—Dual section split-stator micro condenser, 140 mmf. per section, type HFD-140 (C8)
1—Plug-in coil, type XP-53, No. 44 (L1)
1—Plug-in coil, type XP-53, code BCC-4 (L1)
1—4-prong coil socket, isolantite, type S-4
3—Octal sockets, isolantite, type S-8

I.R.C. (Resistors)

1—75 ohm, 1 watt, wire wound resistor (R1)
1—500 ohm, ½ watt carbon resistor (R4)
1—1,200 ohm, ½ watt carbon resistor (R9)
2—4,000 ohm, ½ watt carbon resistors (R2, R3)
1—10,000 ohm, ½ watt carbon resistor (R5)
1—300,000 ohm, ½ watt carbon resistor (R8)
1—400,000 ohm, ½ watt carbon resistor (R6)
1—1 meg. ohm, ½ watt carbon resistor (R7)
1—1 meg. potentiometer (R10)
1—500,000 ohm potentiometer (R6)
1—Lectrofone Vibro (contact mike to attach on stringed instruments)
1—High fidelity dynamic microphone, type B

TUBES
1—6J7
1—6A8
1—25Z6GT
1—K105A (ballast)

MISCELLANEOUS
1—Power "on-off" switch (SW1)
1—Toggle switch (SW2)
2—Insulated pin jacks (J1, J2)
1—Line cord and plug
2—Screen grid caps
1—Roll of hook-up wire
1—Metal chassis
1—Metal cabinet

In the next issue—
Latest Television News

Also an article by Thornton Chew—

How to Build a Fixed Frequency "Television Booster" Amplifier. (Also useful on ultra short waves for general purposes.)

Recording on Acetate Discs

A. A. Schmitt

● HERE is a method of recording which I have used successfully and which does not require "special" expensive parts. The diagrams explain everything. Any *good* phonograph motor can be used—the type used here was a G.I. 38 watt governor-controlled model—a good Rim Drive motor will also work. Get a magnetic high impedance pick-up—the kind mounted on a swivel base. Detach the reproducer head and re-mount it on the arm of the pickup with the two small springs as shown in diagram. Next mount the pickup on the phono cabinet so the arc of the cutter needle is in line with the center pin of the turntable. After this is securely mounted, place an additional lead weight on the counterbalance until the weight at the recording head is approximately 2 or 3 oz.

The next step will be the assembly of the guide device, which faithfully pushes the recorder head slowly across the acetate disc as the needle is cutting the groove and modulating it. Bend a small piece of brass in the shape of a "U" squared and mount same on the pick-up arm about 5/8" behind the recording head as per diagram. Next attach the 1/4" square brass guide arm to this bracket with the 6/32 screw (which is a loosely coupled joint) and with a small "L" shaped bracket at the other end of this piece (which is a tight joint) fasten the guide reproducer (old phonograph reproducer). You are now ready to try a recording, but first check the following:

1. The Guide Reproducer Head must be set at an angle of 55°. The needle used in this is the type of steel stylus used for playing back acetate records. (Gold Color Recoton) I.E.

2. Record Material. For the guide record get an RCA 12" unrecorded pre-grooved composition disc. The Recording Disc—the soft type acetate-coated disc is best for this method, although some of the slow-burning type discs, i.e., the "Howard" work very well. There is less needle scratch with the Rec-Or-Disc type.

3. Connections to Audio Amplifier. The Audio Amplifier in your radio receiver can be used for making records either "off the air" or for home recordings (using a crystal mike with a pre-amplifier). Coupling the recording head to the output tube or tubes through a .05 mf., 600 V. paper condenser will work out well, although different values of condensers up to 2 mf. can be tried for bass reproduction increase (this will vary with the type amplifier circuit used). If your receiver has a push-pull amplifier, you can substitute the condensers for resistors, varying same in values from 5,000 to 10,000 ohms—until the best quality is obtained. The resistor method cuts down the output to the recorder head somewhat, but will take out the "harshness," especially when recording banjo, guitar and violin solos.

4. The Recording Head must be set at an angle of 75°. The needle used in this can be the standard steel or better yet, alloy needle with the flat shank (cutting needles).

Operation Hints: Check the recorder—see that it is level and place the 12" guide record on the turntable. Then place the 6" or 8" recording disc over this, securely clamping down both with the clamping pin shown in diagram. Start motor, allowing same to gain proper speed and place guide reproducer and recorder head on records. The recording needle should cut a shaving about twice the thickness of a human hair. This can be adjusted by changing the weight on the counterbalance. The electrical connections are shown in the diagram.

Practical Notes on Recording: The pick-up recording head is attached by two pieces of spring brass to allow it freedom of movement, which compensates for any unevenness found in the turn-table; if this is not used you will have trouble cutting a continuous groove in the record. If the recorder head "vibrates" reduce the angle (bend springs). If the cutting needle "whistles" —too much weight on recorder head (add weight to counter-balance).

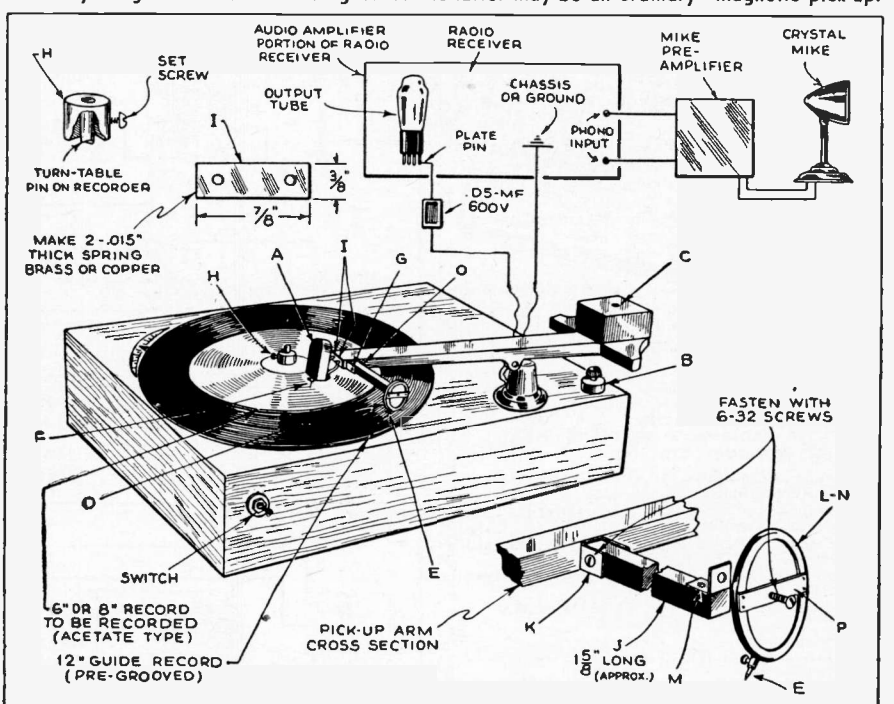
Bad vibrations or vibration pattern in record can be eliminated by above adjustments, or by using a weighted turn-table. (With a good motor weighting the turntable is not necessary.) Before recording, check speed of motor with a stroboscope disc. This should also be done while recording.

Coating the disc with a very light film of coal oil will prevent the cuttings from jamming around the cutting needle.

The addition of a small permanent magnet type horseshoe magnet to the cutter or recorder head magnet, which increases the magnetic flux of same, will greatly improve the recording if you find your records lacking in volume or brilliance. Remove case from recorder head and tape magnet to it. Be sure the two magnets repel, that is, the north legs of each magnet are together. If this is done, more weight must be added to counter-balance to maintain proper weight at recorder head again.

Life of Recordings: Since most record players have no special pin to keep the records from slipping, I have used the following idea: Procure a small rubber washer with a hole in the center, that will fit snugly over the center turn-table pin. This will hold the record firmly against the turntable.

Drawing below shows how the experimenter may build up an apparatus for recording voice, music, radio programs, etc. A fairly strong motor, either of the electric or spring type, is necessary—together with a recording head. The latter may be an ordinary "magnetic pick-up."



A - STANDARD MAGNETIC PICKUP 5,000 - 8,000 OHM IMPEDANCE SET AT 75° - 80° ANGLE
B - VOLUME CONTROL 20,000 OHMS.
C - LEAD WEIGHT ADDED TO COUNTERBALANCE (TO MAKE WEIGHT AT RECORDER HEAD 2-4 OZ
D - GUIDE REPRODUCER (FROM OLD PHONOGRAPH - SET AT 55° - 60° ANGLE
E - GUIDE NEEDLE (USE ACETATE TYPE PLAYBACK NEEDLE)
F - STEEL OR ALLOY RECORDING NEEDLE
G - GUIDE ARM BRACKET. (BEND IN SHAPE OF "U" SQUARED)
H - TURNTABLE CLAMPING PIN (KEEPS RECORDS FROM SLIPPING)
I - PICKUP HEAD HOLDERS (REMOVE PICKUP HEAD AND RE-MOUNT TO ARM WITH 2 STRIPS OF SPRING BRASS AS PER DIAGRAM

GUIDE RECORD - A 12" DIA PRE-GROOVED RCA COMPOSITION RECORD WAS USED FOR THIS

J - GUIDE ARM 1/4" SQ BRASS (MUST MOVE FREELY IN ALL DIRECTIONS)
K - GUIDE ARM BRACKET
L - GUIDE REPRODUCER HEAD
M - GUIDE ARM BRACKET SUPPORT (FASTENED TO REPRODUCER CROSS PIECE)
N - GUIDE REPRODUCER HEAD
O - COUPLING SCREW (PROVIDES LOOSE JOINT CONNECTING PICKUP ARM TO GUIDE ARM)
P - CROSS PIECE FOR FASTENING "HEAD" TO GUIDE ARM

NOTE - IN CASE OF PUSH-PULL OUTPUT TUBES - JUST CONNECT ANOTHER .05-MF, 600V COND. IN THE LEAD THAT ORIGINALLY GOES TO GROUND AND INSTEAD OF CONNECTING IT TO GROUND - CONNECT IT TO THE PLATE PIN OF THE OTHER PUSH-PULL OUTPUT TUBE

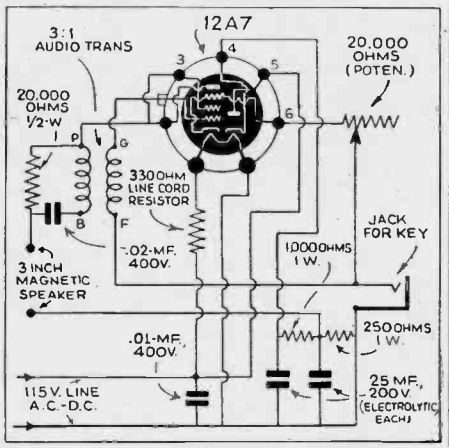
Please turn to page 53 for complete details on another FREE book given with subscriptions.

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.

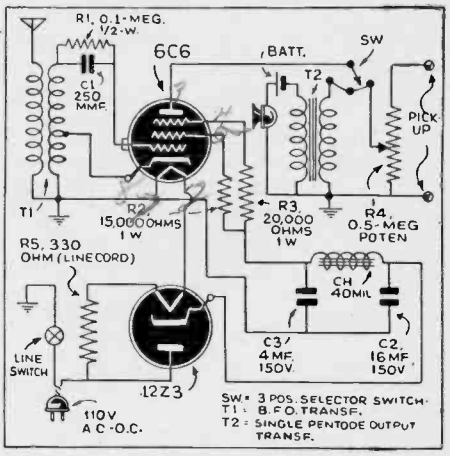
All diagrams and descriptions accepted and published will be awarded a year's subscription. Diagrams may be for receivers, adapters, amplifiers, etc. Send them to Hook-Up Editor, RADIO & TELEVISION, 20 Vesey Street, New York City.

CODE OSCILLATOR



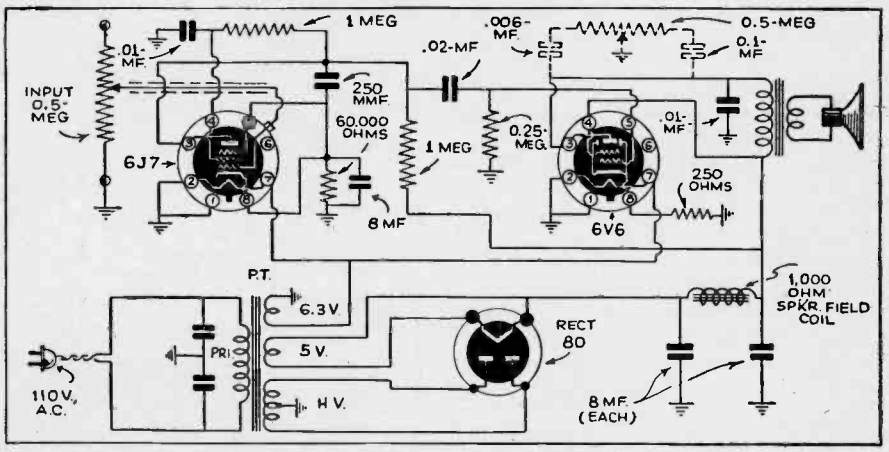
This diagram appears on the front cover also, and represents a simple and effective code oscillator hook-up. The two wires from the code practice oscillator are connected to a plug, which is inserted in the jack shown in the diagram.—Contributed by H. L. Jones, Springfield, Ill.

PHONO OSCILLATOR



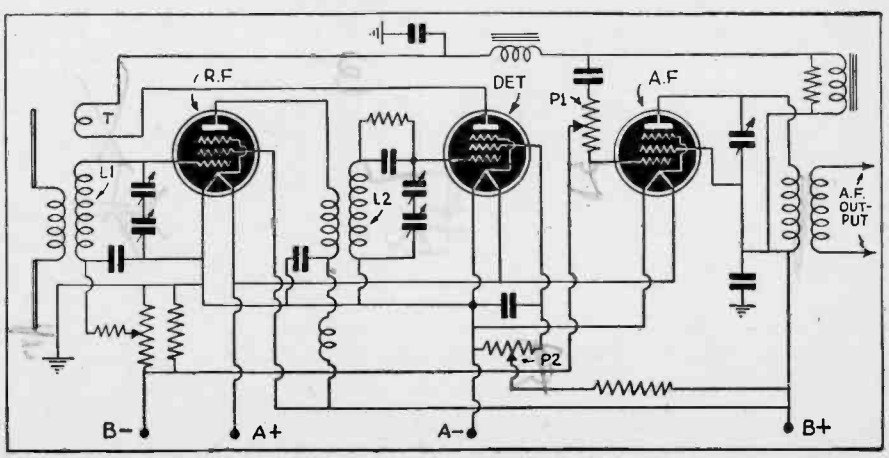
Phono oscillator hook-up, contributed by Warren Lintelman, Pittsburgh, Pa. The oscillator is plate modulated. The coil used is a Meissner BFO transformer No. 8175. Either mike or phono input may be used.

5 WATT PHONO AMPLIFIER



Five watt phonograph amplifier, contributed by Phil Loboy, Chicago, Ill., who used a high-impedance pick-up with this amplifier. Tone control is shown in dotted line.

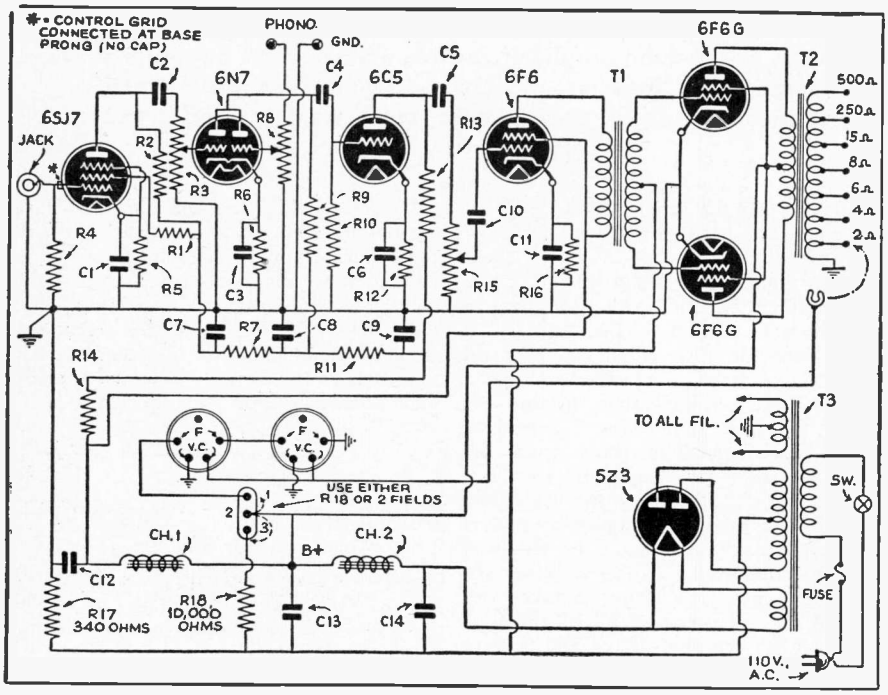
WHAT IS WRONG WITH THIS DIAGRAM?



Study this diagram at least three minutes before turning to the answer on page 57.

to the Radio Experimenter

20-WATT AUDIO AMPLIFIER



RESISTORS

R1 3 meg. ½ w.
R2 500,000 ohms ½ w.
R3 500,000 ohms pot. vol.
R4 5 meg. ½ w.
R5 3000 meg. ½ w.
R6 2500 ohms 1 w.
R7 5000 ohms 1 w.
R8 500,000 ohms pot. vol.
R9 200,000 ohms ½ w.
R10 500,000 ohms ½ w.
R11 2000 ohms 1 w.
R12 2500 ohms 1 w.
R13 50,000 ohms 1 w.
R14 20,000 ohms
R15 100,000 ohms (pot.)
R16 1000 ohms 1 w.
R17 340 ohms 25 w.
R18 10,000 ohms 25 w.

CONDENSERS

C1 25 mf. 25 v.
C2 .1 mf. 600 v.
C3 10 mf. 500 v.
C4 .01 mf. 600 v.
C5 .01 mf. 600 v.
C6 10 mf. 50 v.
C7 8 mf. 450 v.
C8 8 mf. 450 v.
C9 8 mf. 450 v.
C10 .01 mf. 600 v.
C11 10 mf. 50 v.
C12 8 mf. 450 v.
C13 16 mf. 450 v.
C14 8 mf. 450 v.

TUBES

1 6SJ7
1 6N7
1 6C5
1 6F6
2 6F6G's
1 5Z3

TRANSFORMERS

T1 Driver trans.
T2 Output trans.
T3 Power trans., 6.3 v. 5A, 5 v. 3A, 700 v. C.T. 150 ma.
CH1 choke 150 ma.
CH2 choke 50 ma.

SOCKETS

6 octal sockets
1 4-prong socket

TRANSFORMER WRINKLE AND SPEAKER TESTER

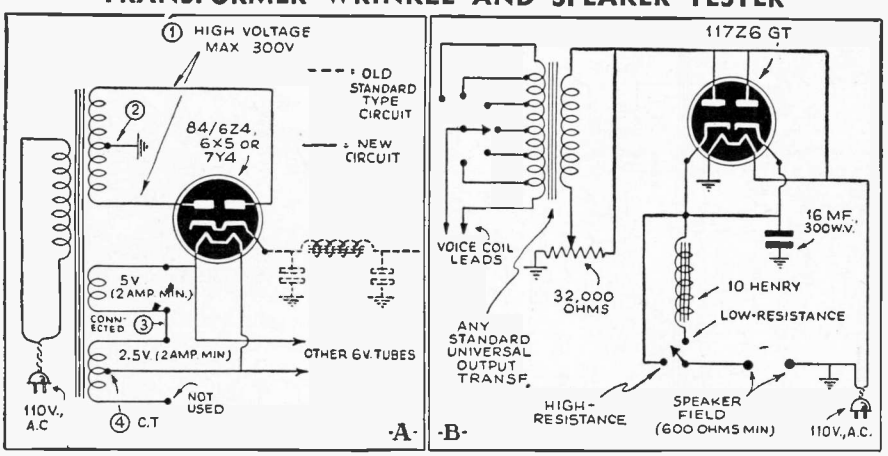


Diagram A—above shows how to use a 2.5 volt transformer to supply 6 volt tubes. The transformer windings (the five volt and 2.5 volt windings) are connected as shown to supply 6 volt tubes. The dotted lines show usual filter choke and condensers. Diagram B shows an A.C.-D.C. speaker tester. The speaker is disconnected from the set in making a test. The speaker field may be connected to the terminals indicated.—Contributed by A. E. Moulin, Jr., New Orleans, La.

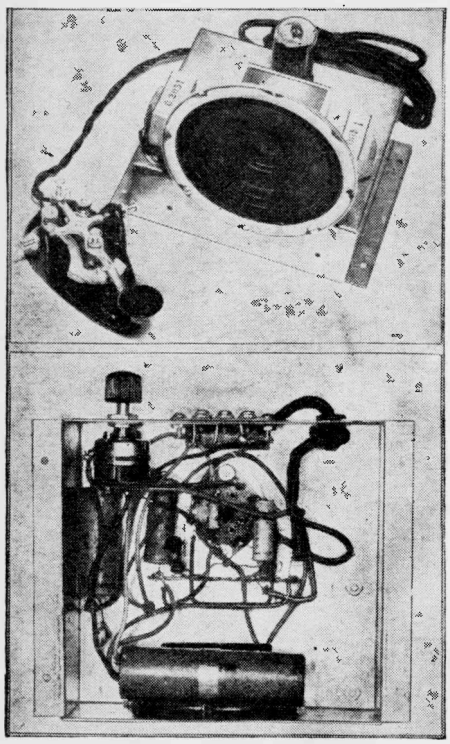
NOTICE TO CIRCUIT HOUNDS!!

● Come on fellows, send us along some of your interesting 1- 2- and 3-tube hookups, whether they are *Parlor-Transmitters, Receivers* or what not—just so long as they are good "working" circuits which you have tried out. The diagrams should be drawn in ink but do not have to be finished drawings as we redraw all circuits for publication purposes. Be sure to include a brief description, giving the good points about the circuit and what it does—100 to 150 words is usually sufficient, including your name, address, and in the event that it is not published please include a 3c stamp for return.—Editor

Code Practice Oscillator

L. M. Dezettel, W9SFW*

The editors have received many requests for a diagram of a one-tube amplifier for use with a small beginner's receiver. Here is a "one-tube" amplifier which may also be used for code practice work, as described in the article by Mr. Dezettel.



Two views of the one-tube amplifier and code practice unit; the top picture shows telegraph key connected with the oscillator.

● EXTREMELY versatile in application this circuit may be used to make a loudspeaker code-practice oscillator, a phonograph-amplifier for either crystal or magnetic pickups, or an audio amplifier to boost the volume of any 1 or 2 tube receiver.

The 6" x 5½" x 2" chassis used has ample room for the parts, making wiring easy. A 70L7GT type tube is used as the rectifier for "B" supply and beam power amplifier or oscillator. The 105-125 volt line voltage is dropped to 70 volts for the heater of the tube by means of a resistor in the line cord. This unit may be used on either A.C. or D.C. voltages.

Assembly of parts is the same for all three of the projects. Wiring is substantially the same, with but minor changes. In general, mount all of the parts on the chassis first. Follow the pictorial diagram for proper placement of parts. One of the machine screws which fastens the speaker is also used to mount the large tubular filter condenser. To protect the speaker cone against damage while assembling and wiring the kit, cut out a 5" circle of cardboard and fasten it over the speaker with a few pieces of tape. The chassis is available already formed and punched, ready for mounting.

Let us consider each of the three projects separately:

The schematic and pictorial diagrams show the wiring of the audio amplifier. The other two projects are variations of this one. Follow both diagrams while wiring and check off each wire as you make the connections. For operation with any 1 or 2 tube receiver now employing headphones, connect two pieces of wire one to each of the two outside screws on the terminal strip. Disconnect the headphones from your receiver and connect the two wires from the amplifier to the same binding posts or clips where the headphones were formerly connected.

For playing phonograph records, this little amplifier is ideal. You must have a turntable and electrical pickup arm.

If a magnetic type of pickup is used, connect the leads from it to the two outside screws on the terminal strip, leaving the circuit wired as shown for the general purpose amplifier. The leads from the ground side of the pick-up arm (usually a black wire) should go to the righthand screw. If a crystal type of pick-up arm is used, a slight change should be made to the input connections of the amplifier. In effect, the input transformer is taken out of the circuit. Disconnect all of the four input transformer leads from the lugs to which they were soldered. Unsolder the ground connection from the right-hand terminal screw. Solder a connection from the left terminal screw to the lug on the volume control from which a transformer lead was disconnected. Solder a connection from the upper lug on the potentiometer (as viewed on the pictorial diagram) to the right terminal strip screw. Now you may connect the pick-up arm in the same manner as the magnetic pick-up described above.

By connecting the .05 mf. condenser across the terminal strip, the leads from the condenser going to each of the outside screws, the circuit becomes a loudspeaker code-practice oscillator. It will produce a clear tone at about 1000 cycles per second. Connect the key leads to the terminal strip, one each to the center screw and the left-hand screw. Turn on the amplifier and "fire away."

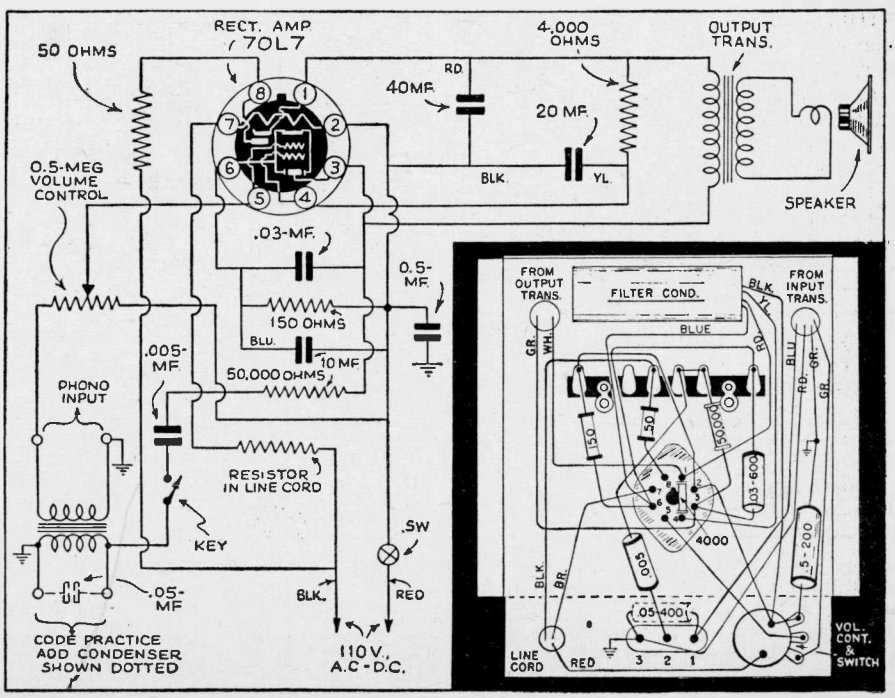
Complete Parts List

KNIGHT

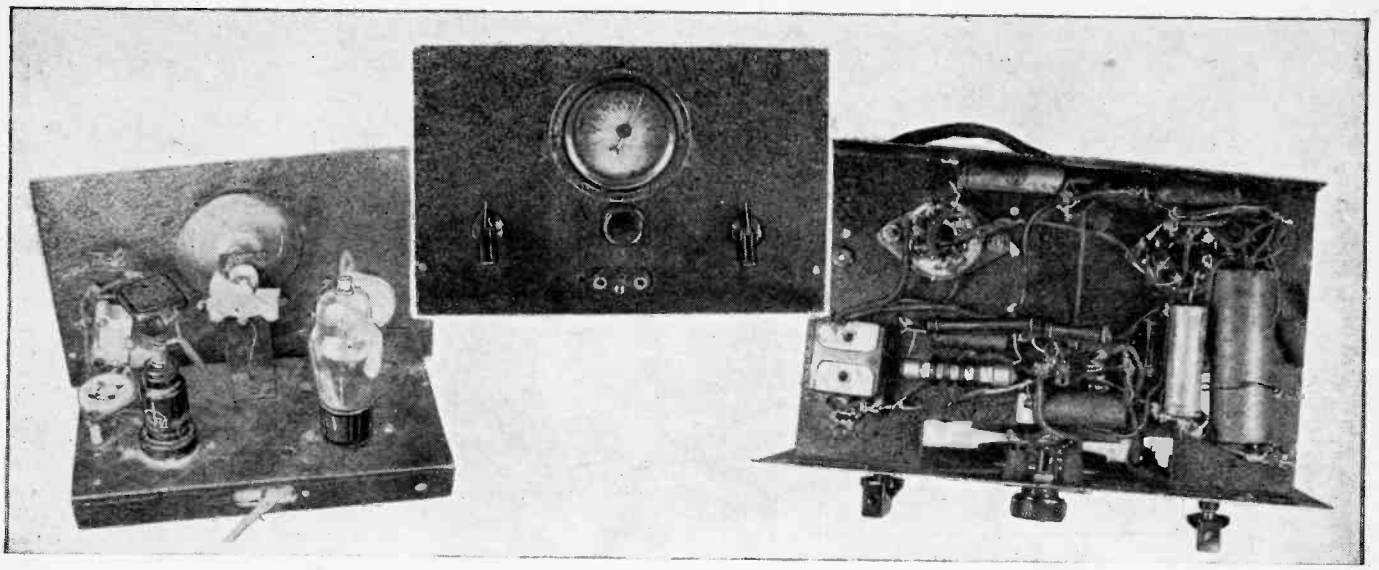
1—Special 3-section filter condenser
1—5" P.M. speaker
1—3:1 ratio audio transformer
1—Speaker matching transformer
1—Special formed and punched chassis
1—500,000 ohm volume control with switch
1—Octal wafer socket
1—3 terminal connection strip
1—Small volume control knob
1—.5 mf. 200 volt tubular condenser
1—.03 mf. 600 volt tubular condenser
1—.005 mf. 600 volt tubular condenser
1—.05 mf. 400 volt tubular condenser
1—50,000 ohm ½ watt resistor
1—50 ohm ½ watt resistor
1—4,000 ohm ½ watt resistor
1—150 ohm 1 watt resistor
1—6 terminal wiring tie-point
1—310 ohm line cord and plug
1—70L7GT tube
1—Hand (telegraph type) key

(Miscellaneous hardware, wire and solder)

It is quite simple to hook up this one-tube amplifier and it works on 110 volts A.C. or D.C. The signals are heard on a loudspeaker of the permanent magnet type, or a pair of phones may be substituted when desired. Just the job for use as an audio amplifier with small short wave or BC tuners.



*Engineering Staff, Allied Radio Corporation.



Several views of the easily built, two-tube short-wave receiver for beginners are shown above.

The E-Z Built 2

Homer L. Davidson

● FOR the beginner, a regenerative short-wave set is most likely his first goal. Inexpensiveness and good reception are required. The two-tube circuit here described has given good results and the cost is small.

Detector: The most common used tube for detection, which works on A.C. current, is the 6J7, a triple-grid detector. The supply voltage required for these tubes was taken from a 360 ohm line cord, with the current at .3 amp. It is well known that the 6.3 volt A.C.-D.C. tubes give more hum than the 2.5 volts, but the tube leads were twisted close to the chassis and the 6C8G's terminal No. 7 was grounded to the chassis, or buss wire, which was used in this case, and it was found the hum was very small.

Using a 50,000 ohm potentiometer as the regeneration control, connected in series a 50,000 ohm ½ watt resistor, with a bypass condenser of .1 mf., grounded to the buss wire, gave smooth operation.

Audio Amplifier and Rectifier: A twin-triode was used as first audio and low-power rectifier. For this purpose a 6C8G tube with separate triodes, one the rectifier and the other the audio amplifier, was installed. Terminals 5 and 6 were tied together on one side of the line and terminal 8, the cathode, was filtered with dual 16 mf. condensers, and a 1,000 ohm, one watt resistor. The other triode unit with terminals 3, 4, and grid cap was used for audio amplification.

Construction: This short-wave receiver was built on a chassis 5 x 9 inches. A chassis of masonite will do the trick, by using buss wire for all ground connections.

Two tube holes were cut into it and the chassis laid out before wiring. An airplane dial was mounted for band-spreading.

Operation: This small receiver is operated by regeneration. The 50,000 ohm potentiometer (with switch) is turned until a plop is heard; then rotate the tuning condenser until a squeal is heard. Slowly back up the regen. control until signal is clear. By experimenting with the cathode tap, one may find a better signal. Upon changing coils, the 15 mmf. trimmer condensers should be adjusted.

Coil Data

(All coils wound on 1½" dia. forms)

	Cathode Tap
160M—6QT, No. 24 enamel, 2 turns from ground end*	
80M—40T, No. 24 enamel, 1½ turns from ground end*	
40M—20T, No. 22 D.S.C., S.W. to 1½ turns	from tap,
20M—10T, No. 22 D.S.C., S.W. to 1½ turn	tap,

NOTE: S.W.—Space-wound.
*Close-wound.

CONDENSERS

Variable—
- 100 mmf.
- 15 mmf.
- 5—35 mmf. (trimmer)

Fixed—
- .0001 mf., mica
- .0005 mf., mica
- 3—.1 mf., paper
- .01 mf., paper, 400 volt
- 1—Dual 16 mf., elec. cond.
- 1—12 mf., elec. cond., single

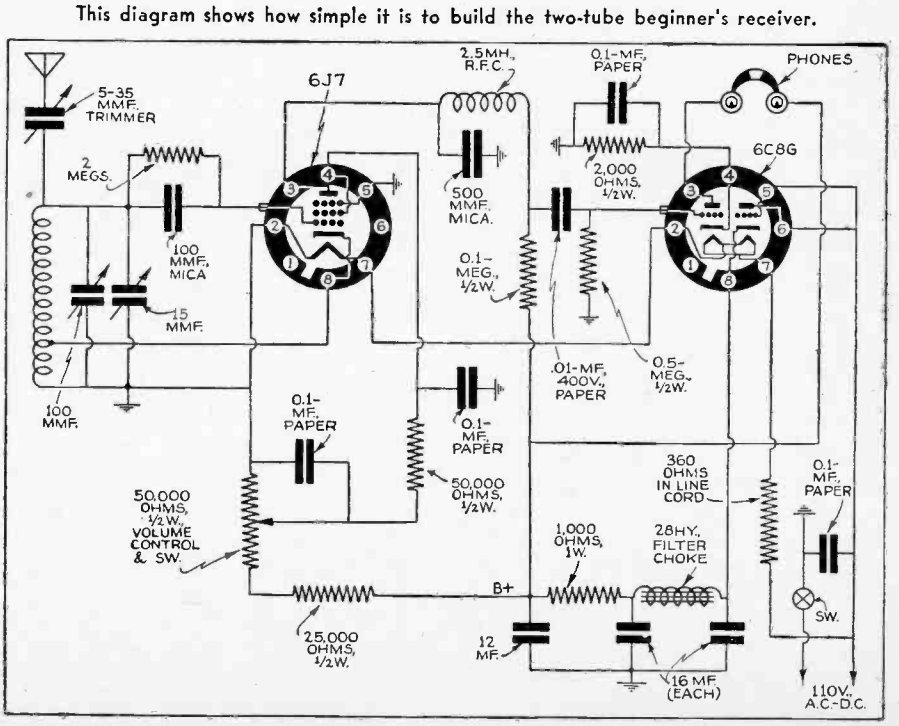
RESISTORS

- 1000 ohm, 1 watt
- 50,000 ohm, ½ watt
- 25,000 ohm, ½ watt
- 500,000 ohm, ½ watt
- 3 meg., ½ watt
- 28 henry filter choke
- 1—50,000 ohm. pot. (with sw.)

SOCKETS

- 1—Octal, 8 prong, bakelite
- 1—4 prong, steatite socket
- 1—Octal, 8 prong, steatite
- 1—6J7 metal tube
- 1—6C8-G glass tube

This diagram shows how simple it is to build the two-tube beginner's receiver.



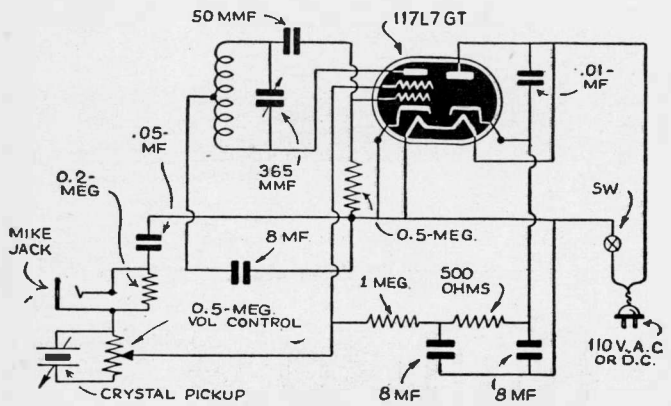
Question Box

Edited by Herman Yellin, W2AJL

Phono-Oscillator

Have you a diagram of a phono-oscillator using one of the new 117 volt filament tubes?—H. J., Brooklyn, N. Y.

A. We show diagram herewith of a phono-oscillator using a 117L7GT tube as a combined oscillator and rectifier. The center-tapped coil can be any of the standard phono oscillator coils now available. A loop can be coupled to the plate of the tube or a short length of wire used for pickup.



Hook-up for phono-oscillator using 117 volt tube. (No. 1250)

Flash-Unit

Can I get a diagram of a high speed flash-light outfit using an SN-4 Strobotron, but not using the FA-2 Argon tube?—F. Warner, Chicago, Ill.

A. Since the FA-2 tube furnishes the flash or light, you couldn't do any work without it. The SN-4 is merely a trigger tube for the Argon filled FA-2. You will have to use the FA-2 to get any light from the system.

Airplane Receiver

I would like a diagram of an airplane receiver to operate on the 200 to 400 kc. band.—H. Wayman, Indianapolis, Ind.

A. A diagram of a receiver suitable for this service is shown herewith. A standard 2-gang, 365 mmf. tuning condenser is used and the coils can be procured from any one of several manufacturers. If desired coil switching can also be used and several frequency bands accommodated. No power-supply has been shown because it will depend on what you have available. A small vibrator or generator power-pack, operated from either 6 or 12 volts, depending on which battery you have available, can be used to supply plate potential of 250 volts. The filaments can be wired in parallel for six volt operation, or in series-parallel for operation from a 12 volt battery.

Kerr Cell Light-Valve

What is a Kerr Cell?—S. Bristol, Owosso, Mich.

A. The Kerr cell is an electro-optical light-valve, consisting of parallel electrodes to which a modulating voltage can be applied, immersed in a solution of carbon disulphide or nitrobenzene. If a beam of polarized light of constant intensity is passed through the cell, the light beam will be varied in intensity in accordance with the variations in voltage applied to the electrodes, because the index of refraction of the liquid varies with the applied electric field. After passing through the cell the light is passed through a polarizing medium, which is at right-angles to the first polarizing medium, so that the cross-polarization will stop the light when no potential is applied to the electrodes. The cell is useful in conjunction with mechanical systems of television scanning, although rather high values of video power are required for its operation.

Filter for Dynamotor

I have a 24/750 volt dynamotor which I would like to use on a phone transmitter, but the output seems to provide the transmitter signal with a note like the proverbial "buzz-saw." Will you please advise me whether a filter system is needed?—E. E. Hagemeyer, Oregonia, Ohio.

A. Yes, a filter in the high voltage side of the dynamotor will be necessary, just as a filter is needed for any other type of power supply. However, the dynamotor does not require as heavy filtering and a 10-henry filter choke, flanked by one or two mf. condensers, will prove sufficient. The choke should be rated to carry the desired current and the condensers should have a rated working voltage of 1000 volts.

Direction of Current Flow

Does the current flow from positive to negative or vice versa?—F. Fuller, New York.

A. Many years ago, the old time physicists arbitrarily assumed that the current flow was always from positive to negative. However, when these matters could actually be determined, it was found that current really flowed from *negative to positive* in a circuit. From habit, we still speak of the current as flowing from positive to negative. Actually, of course, the electron (and current) flow is from negative to positive. A circuit cannot be either all positive or all negative.

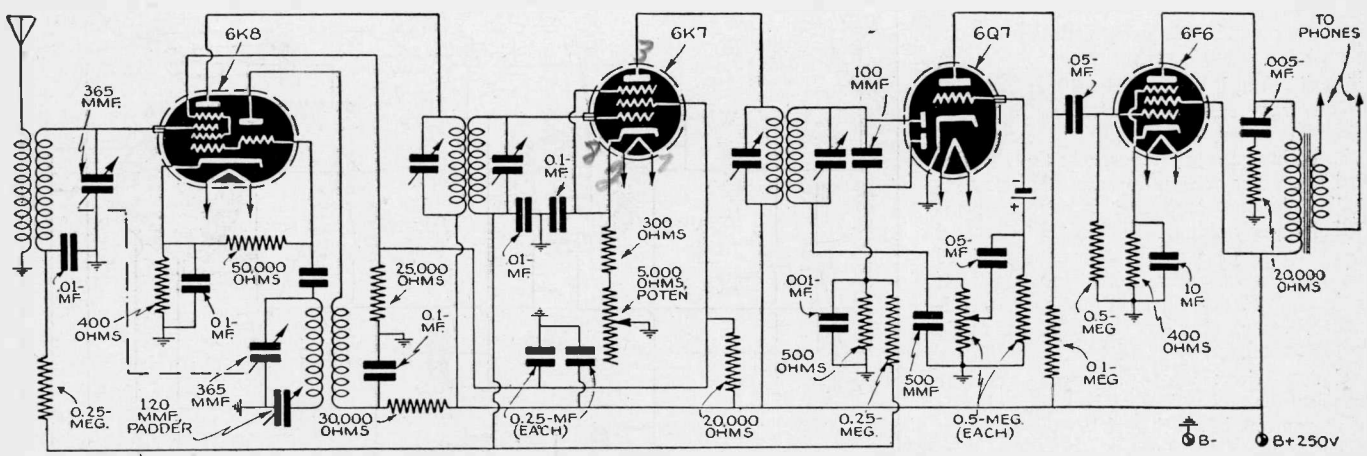


Diagram of an airplane receiver to operate on the 200-400 kc. band. (No. 1251)

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.*

Preselector Chokes

? *I wish to know what type of chokes are used in the regenerative preselector described on page 101 of the June issue?—R. C. Browning, Iron Mountain, Mich.*

A. The chokes used in this preselector were ordinary 2½ millihenry R.F. choke coils. In wiring them into the circuit, try to keep them separated from each other.

Power-Supply Trouble

? *I built the power-supply for portables described on page 368 of the October issue, but can't get it to work. I'm using one 1A7GT, two 1N5GT, one 1H5GT and a 1Q5GT, with all filaments in series.—A. Pare, Verdun, Quebec, Canada.*

A. Your 1Q5GT tube draws 100 ma. on the filament and so cannot be placed in series with the other tubes, which only draw 50 ma. I would suggest that you connect up the 50 ma. tubes in series-parallel and then connect this unit of four tubes in series with the 1Q5GT. Use an 1120 ohm resistor instead of the 2200 ohms specified in the diagram.

Short-Wave Receiver

? *For some time I have been reading in* RADIO & TELEVISION *magazine where some amateur tunes in stations from all parts of the world, ranging up to 10,000 miles. I, too, would like to do likewise. The only thing that keeps me from doing so, is that I am unable to secure a diagram whereby I could build a receiver to meet my demand. Therefore, can you in any way help me secure a diagram of a short-wave receiver that would tune in stations ranging from about 5 to 199 meters. I have no use for the broadcasting band. The receiver must be selective, good tone and have a reasonable amount of up-to-date tubes, using only standard parts, capable of bringing in distant stations with loud-speaker volume.—J. Smith, Ft. Wayne, Ind.*

A. An efficient but not too complicated short-wave receiver was described in the August, 1940, issue of RADIO & TELEVISION, page 209. You must realize that most amateur radio stations employ the Continental code and only a few of them use voice transmissions. Also, at the present time, almost all *foreign* amateur stations are forbidden to use their equipment. However, the few that are left on the air outside of the United States constitute a sufficient DX catch to make "listening-in" quite worthwhile.

Coupling Code Recorder

? *In your March issue there was a description of a* code recorder *in the "Kinks" section. What kind of matching transformer must be used between the recorder and the radio output?—E. Podgurski, Cleveland, Ohio.*

A. The transformer can be the regular output transformer, with the relay operating the pencil connected to the secondary of the output transformer. The relay must be capable of operating on A.C., however, since the transformer output delivers A.C.

Tape Recorder Trouble

? *I recently constructed a tape recorder for registering CW signals. I am having some difficulty however; if the receiver or amplifier is touched, the relay becomes erratic. Also where can I procure an old marine type of commercial receiver?—H. La Brachem, Queens Village, N. Y.*

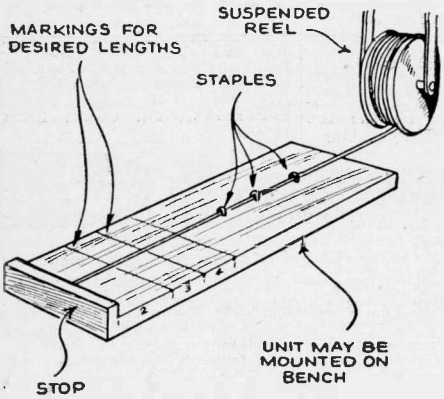
A. Your difficulty evidently lies in the fact that you have neglected to ground the amplifier unit at the B minus terminal. This will stop the amplifier from oscillating. In New York City (or other cities) you can get an old marine receiver in the radio store section.

The Cover Kink

First Prize Winner

Wire Gauge

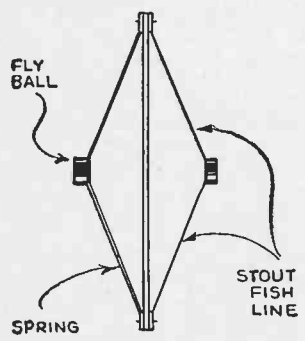
The accompanying sketch shows a simple marker or "cut-off" gauge, which proved very handy recently when I had to cut many pieces of wire of a certain length. A piece of wood and a few staples are all the materials you need to make this gauge, and by marking off the various lengths of wire required on the board with a lead pencil, your gauge is completed. The spool of wire may be arranged at one side of the gauge and the latter fastened securely on the workbench. The wire may be clipped off with a pair of nippers or a pair of tinsnips.—*Paul Winkler.*



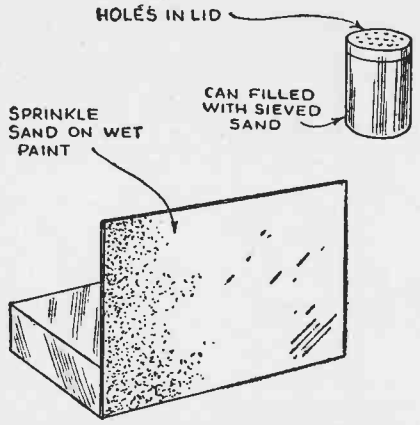
A useful marking board for use in cutting off a number of wires of the same length.

Governor Repairs

In using an Omnigraph code teaching machine one of the springs on the ball governor broke. Not wishing to have to wait until I could get new springs, I made temporary repairs as follows: I took a piece of strong fishing line, doubled it, and drew it around the broken spring as tightly as possible. It worked surprisingly well and I was able to go ahead with my code practice. Any type of ball governor, such as those found on the phonograph motors, could be repaired in an emergency in the same way.—*James E. Smith.*



How temporary repairs were made to a governor on a spring motor used for code practice, a piece of fish line strengthening the broken spring.



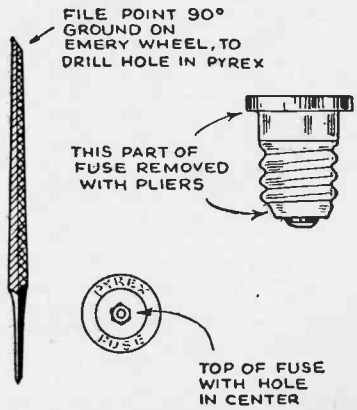
Novel effects in finishing up radio panels may be obtained by sifting sand, etc., over the paint while it is still wet.

Novel Panel Finish

Here is a kink that I have made frequent use of in my shack. The chassis is painted with whatever color of paint one fancies. While the paint is still wet the sifted sand is shaken on evenly and let dry. Then another coat of paint is applied over the sand. I use beach sand but any fine sand will do. I have used it on chassis and racks and it looks very professional if sand is spread evenly. Salt works very good too, but it will whiten if it becomes wet.—*J. T. Kelly.*

Feed-Through Insulator

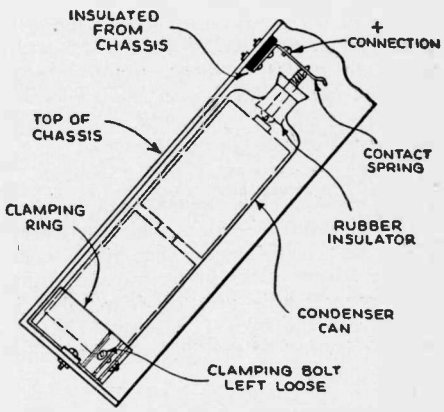
Here is a feed-through insulator for U.H.F. receivers or transmitters, also for high voltage tip jacks which I made out of blown screw-type pyrex fuses. I removed the bottom part of fuse with pliers and use only the pyrex glass shell. A hole to take a tip or banana jack is easily drilled through the center of the glass shell, using a broken off three-cornered file, inserted in a brace, and adding a few drops of turpentine while drilling the hole.—*Max Spies.*



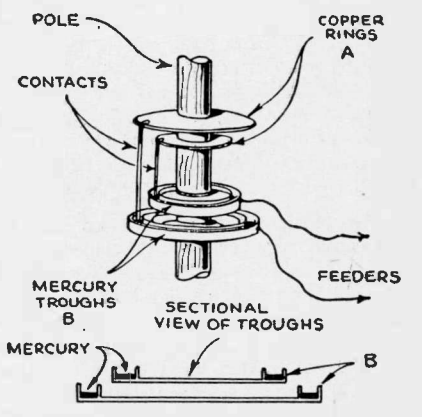
Old fuse plugs have been used for many purposes by radio and electrical experimenters. Here is an interesting application, wherein a feed-through insulator is made from a discarded fuse plug.

Battery Support

I have found this idea a good one for mounting flashlight cells in a portable radio set. The support is a can from an old electrolytic filter condenser. I found on cutting the top off, that the cells fitted perfectly. A screw was sharpened so that it would fit into a small hole, or heavy center-punch mark in the contact spring, which should be strong and springy enough to hold the unit in place. This bolt is screwed through the original rubber insulation in the neck of the can to make the "positive" connection. The "negative" connection is made by allowing the bottom of the cell, which projects slightly from the can, to rest on the chassis; the original clamping ring holds the can in place. The clamp bolt should be left loose or omitted.—*R. M. Fisher.*



A good method for mounting flashlight cells in portable radio sets is shown in the illustration.



One method of making contact to a rotary beam.

Rotary Beam Contacts

The beam elements are attached to copper rings (A) which rotate with the beam. The troughs (B) are at a fixed location and are filled with mercury. There are copper pieces attached to rings which rotate in mercury troughs and thus make the contact. The feeders are attached to the troughs.—*Clyde Moss, Jr.*

RADIO KINKS

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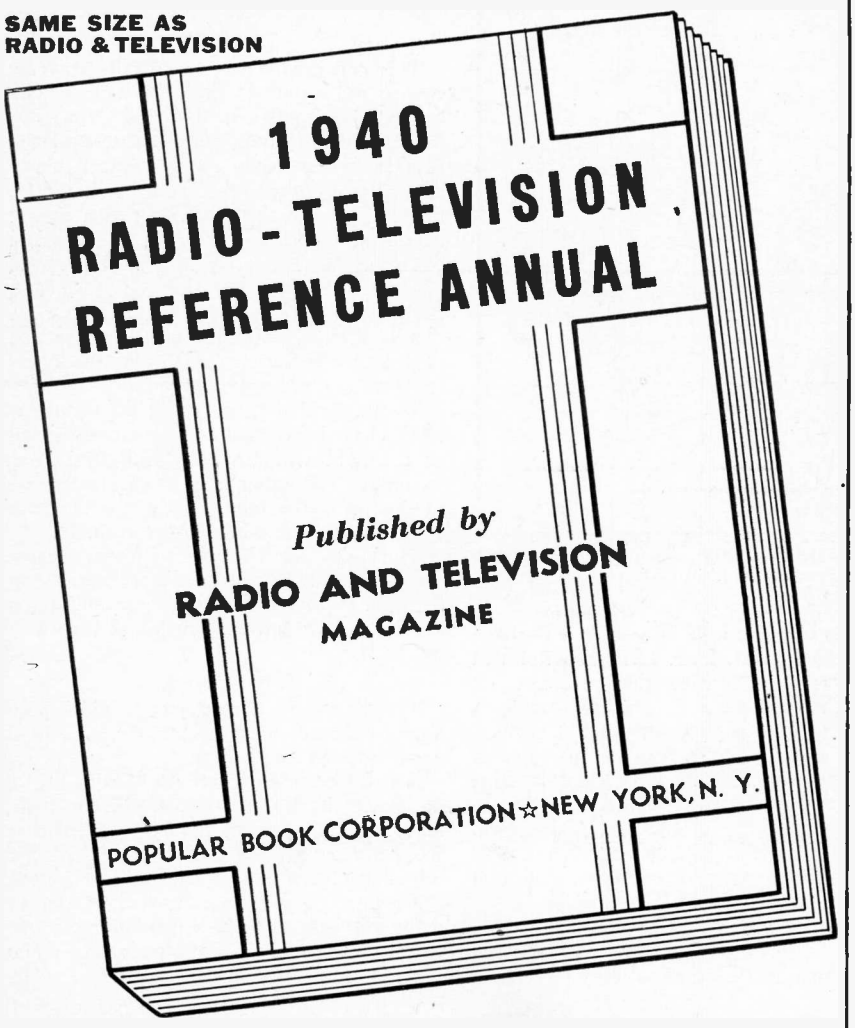

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Making a Flexible Coupler—Two-Timing Chime—A Simple Portable Aerial—An Improvised Non-Slip Screw-Driver. NOTE: The book contains numerous other useful Kinks, Circuits and Wrinkles, not listed here.

(approximately)

45 ARTICLES

(approximately)

170 ILLUSTRATIONS

68 BIG PAGES

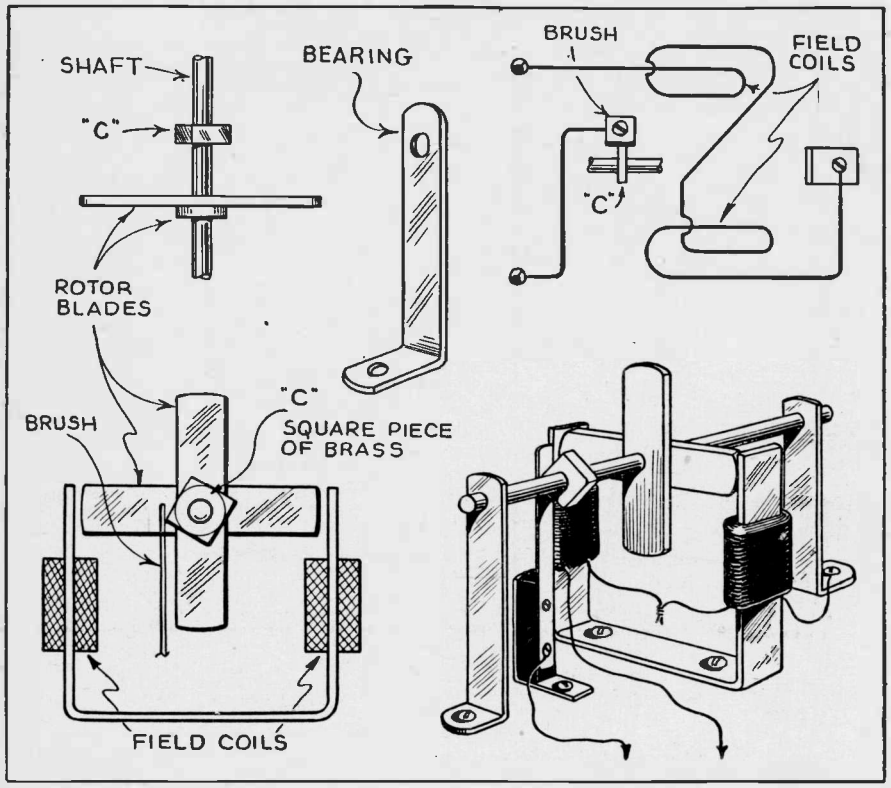
RADIO & TELEVISION
20 VESEY STREET
NEW YORK, N. Y.

A Simple Electric Motor

● THERE are many different types and sizes of electric motors, but they are all actuated by the forces set up when an electric current is passed through a coil of insulated wire.

Some motors are designed to deliver high power and yet revolve slowly. These are the big fellows with huge armatures or rotors carrying a large number of pole-pieces. At the other end of the scale we have the little chaps which, in order to deliver power, must rotate at a high speed, and their armatures, for direct current motors, or rotors for alternating current motors, carry comparatively few poles.

This little motor that we are describing is just about the simplest type possible, and although its design is not commercially usable, it is nevertheless an interesting job for the home constructor.



A simple electric motor can be made after the fashion here illustrated. The iron field member should be soft iron stock, and the two armature cross-members also. The bearings may be made of brass.

Material Required

7½ ins. x ¾ in. x ⅛ in. soft iron.
4½ ins. x ¼ in. x ⅛ in. soft iron.
One No. 10 steel knitting needle.
Odd pieces of sheet brass.
Wood block, terminals and screws.
2 ozs. 24 gauge D.C.C. wire.

Construction

Make and wind the field yoke first. Bend the strip of ¾ in. x ⅛ in. iron to a U-shape with legs 2¼ ins. long. Drill two holes in the bottom section to take short wood screws. Four layers of wire are wound on each leg, leaving ¾ in. of each leg clear.

The coils must be wound in opposite directions; that is, if the yoke were straightened out the two coils would be one continuous winding in the same direction. Finish off the windings by tucking the wire ends under two or three turns, and pull tight.

The rotor consists of two pieces of iron ¼ in. x ⅛ in. drilled centrally and soldered on the spindle (piece of needle). The ends of the rotor bars are slightly rounded and their length should just fit between the yoke bars with the smallest possible clearance. A contact sector consisting of ½ in. square piece of sheet brass is also soldered to the spindle in the position shown.

Bearing Brackets

Next we make the two bearing brackets from 16 gauge sheet brass. The holes through which the spindle passes should be countersunk in order to avoid friction and alignment troubles. The actual bearing surface is an almost sharp edge.

The field yoke may now be screwed to the wooden base and the rotor and bearing assembly placed in position. Make sure that the rotor spins freely and its pole-pieces do not foul the yoke.

The Brush

This consists of a strip of thin brass or copper foil about ¼ in. wide. One end is bent at right angles, drilled, and screwed to the base-board so that the corners of the contact sector each make contact every revolution. The point of contact should be timed by setting the brush so that a corner of the sector is touching the brush when one rotor bar is approaching the horizontal position. The current flow will then pull the rotor around for part of one turn, contact is broken, and the momentum gained repeats the sequence, and soon the rotor spins at a great speed.

To finish off the job, we fit the terminals to the base-board and connect up. One end of the field winding goes straight to one terminal. The other end connects to one of the rotor bearings. Lastly, the brush is connected to the remaining terminal.

Thus we see that the current passes through the field coil to the bearing, along the spindle to the contact sector and from the sector through the brush and thence to the battery.

Battery Power

Two or more wet or dry cells will supply ample current; more, of course, will give greater speed and power.

An interesting point about this little motor lies in the fact that it will run from an alternating current supply provided that the rotor is given a sufficiently energetic initial spin. We have set up in fact a non-self-starting synchronous motor, similar in many respects to those with which electric clocks are equipped.—Courtesy of *The Australasian Radio World.*

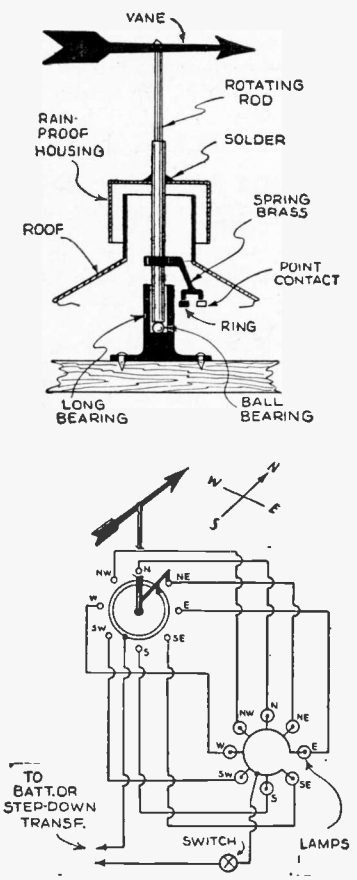
Lamp Bulbs Useful in Electrical Testing

● THE ordinary lamp bulb, of practically any wattage, is one of the most useful electrical testing devices known. In the electrical repair shop, lamps have been used for many years, and a bank of lamps is frequently very useful where a considerable amount of current is required. In some cases the lamps are connected in series-parallel groups by means of switches. One of the simplest electrical test circuits, and one which will not blow the house fuses, is to connect a 110 volt lamp in series with the two test leads. With such a test circuit you will be surprised how many pieces of apparatus can be successfully checked up. Even radio condensers of the tin-foil and paper type can be checked with this simple circuit. The higher the capacity, the brighter the lamp will glow (assuming that 110 volt alternating current is being used). For tests on the 220 volts circuits, two 110 volt lamps are connected in series; on 500 volts circuits, five 110 volt lamps are connected in series. To get more current, connect more lamps in parallel; to get a greater voltage drop connect more lamps in series. If you have a new test "set-up," send it along.

WIND DIRECTION INDICATOR

● MANY times it is useful to have an indicator inside the house which will show in which direction the wind is blowing. For example if you have a barometer then it is important to know the direction of the wind whenever you take a reading of the barometer. Radio experimenters will also find the device illustrated useful for indicating in which direction their radio antenna beam is directed at any given moment. Batteries or a step-down transformer may supply the current for the lamps used in the indicator box, these lamps being arranged in a circle and labelled with the various points of the compass—*North, East,* etc. A brass or phosphor bronze spring brush is fastened on the wind vane so as to move over a series of brass contact plates arranged in a circle as shown, according to *Ciencia Popular.* If the wind vane is in such a position for example as to indicate the wind is blowing from the *north,* then the contact plate is adjusted so that it will at that moment touch the stationary contact plate connected with the wire leading to the lamp and bull's-eye on the indicator box labelled N (north).

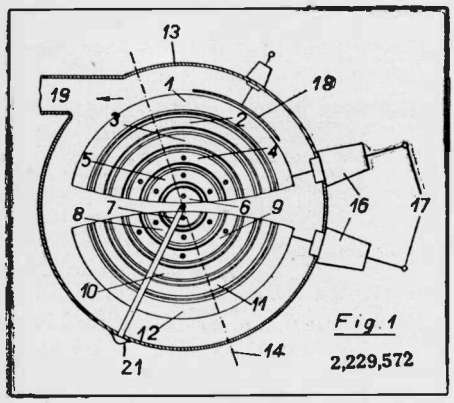
It is best to enclose the switch contact mechanism to protect it against rain, etc. In some cases the wind vane merely turns a rod or shaft leading down to a switch arm enclosed in a metal base (or even placed under the roof of the house or other building.) It is best to solder all wire connections to the contact plates.



Above—Arrangement of a simple "wind direction" indicating device.

Interesting Radio Patents Issued Recently

Cover Patent



CYCLOTRON

2,229,572—issued to Julius Jonas, Switzerland.

● ALTHOUGH it should be possible to obtain speeds of over 20 million volts with a cyclotron, up to the present, for some reason, it has not been possible to reach velocities higher than 4 million volts, says the inventor of this device.

These obvious disadvantages are mainly due to the fact that in the known construction of cyclotron the relativistic mass variability of the charge carriers has been neglected. In accordance with the invention in order to compensate the retardation in acceleration caused by the increase in mass of the charge carriers accelerated to very high speeds, measures are adopted whereby the electrical field increases from the center to the rim of the chamber to the extent necessary to obtain equal times for all revolutions of the accelerated charge carriers. A constructional example of a cyclotron, built according to the invention, will now be explained in greater detail. According to this constructional example both semi-circular surfaces of each half of the box are divided into semi-annular strips, insulated from one another, and subjected to such alternating electric potentials that their peak value increases from the center of the box towards the rim. For controlling the potential, condensers are connected between the insulated strips, the capacities being so selected that when the pole of the voltage source is connected to the outside strip of the box half, the voltage drop from the rim to the center of the box follows the desired course.

REPRODUCING INFRA-RED IMAGES

2,225,044—issued to Roscoe H. George.

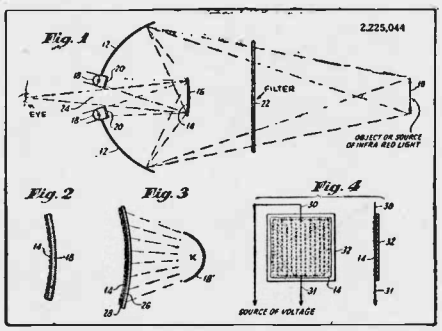
● IT is well known that infra-red radiations or radiations of a wavelength of 7,500 to 10,000 or more Angstrom units are more readily transmissible through fog conditions than are wavelengths in the visible range or in the ultra-violet range. Since infra-red radiations may be more readily transmitted through fog, and since infra-red radiations are not visible to the naked eye, some means must be provided whereby such radiations are rendered visible or some means whereby the presence of such infra-red radiations will cause phosphorescence or luminescence of some screen material. When such means has been provided it then becomes possible, through the use of appropriate infra-red radiators at an airport, for a pilot of an airplane to locate the landing field even under adverse fog conditions, or as another use, it is possible for ships at sea to be visible to one another when normally obscured by fog.

It is one purpose of the present invention therefore to utilize the above principle and phenomenon to convert infra-red images or radiations into visible radiations or images.

It is a further purpose of the present invention to provide means whereby infra-red radiations which originate at a remote point may, through the intermediary of ultra-violet light and appropriate phosphorescent materials, be made visible or be converted into wavelengths which lie within the visible spectrum.

It is a further purpose of the present invention to use ultra-violet light as a means for exciting a phosphorescent material so that the presence of infra-red light may effect the release of such excitative energy.

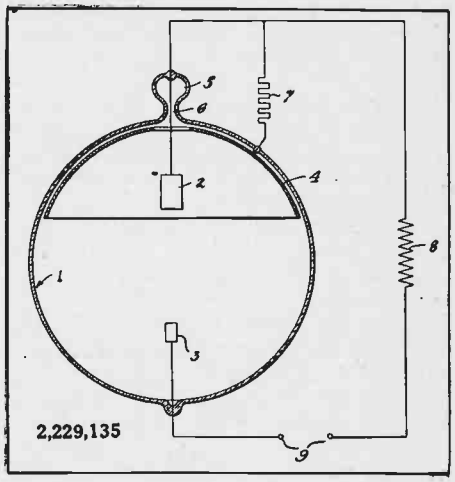
It is still another purpose of the present invention to provide electrical potential gradients for exciting a phosphorescent material whereby the energy absorbed from the potential gradients may be released in accordance with received infra-red radiations.



PHOTOGLOW TUBE

2,229,135—issued to Rudolf Schade, Germany.

● THE invention concerns a tube in which the photo-sensitive electrode is not included in the load circuit in operation. The photo-sensitive electrode merely serves for the liberation of electrons which are given off on the irradiation thereof by light and by which the ignition voltage between the electrodes of the main discharge is reduced. In particular, the anode is arranged opposite the main cathode for the photo-cathode at such a distance that the discharge in operation occurs only between the main cathode and the anode. The potential of the photo-electric layer is not changed by the irradiation of the light. The photo-electric layer on such irradiation of light merely yields the electrons lowering the ignition voltage



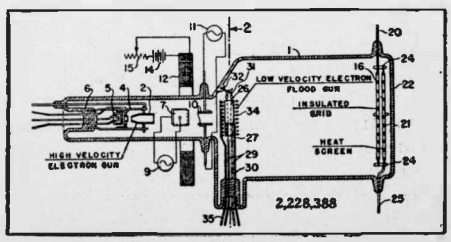
but in operation, the photo-sensitive layer does not take part in the main discharge and manifests no influence upon it.

The figure illustrates a preferred embodiment of the invention. The glass vessel 1 is filled with a rare gas at low pressure and has the main operating cathode 2 and the anode 3 arranged therein. A part of the vessel wall in the vicinity of the operating cathode is preferably provided with a photo-sensitive layer 4 thereon. Preferably, this photo-sensitive layer at least partially encloses the space containing the main operating cathode 2. This operating cathode 2 is connected through the power consuming apparatus or load 8 and the source of electromotive force 9 with the anode 3 of the discharge device.

CATHODE RAY AMPLIFIER

2,228,388—issued to Philo T. Farnsworth, California.

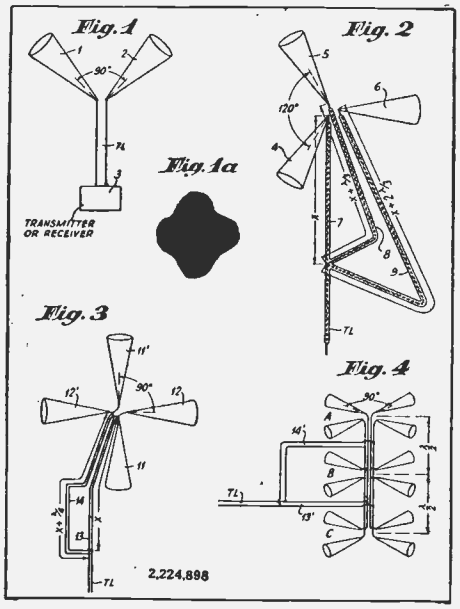
● THIS invention relates to cathode-ray amplifiers suitable for production of a brilliant optical image, very desirable in television reception. Among the several objects of the present invention are: To provide a cathode-ray tube having an electron gun of relatively low power, and to utilize the electrons to create a *charge image* which will control a much larger source of electrons, to form an electron image, which is then directed against a luminescent screen. A further object is to provide such a tube wherein an exceptionally brilliant optical image is formed; further to provide a return screen and to provide a new and unique method of combining electrons in two velocity categories, to produce a brilliant image.



WIDE-BAND SHORT-WAVE ANTENNA

2,224,898—Issued to Philip S. Carter, Port Jefferson, N. Y.

● A SHORT-WAVE non-directive antenna design having a wide frequency band characteristic, radiating a horizontally polarized wave substantially uniformly in the horizontal plane. Fig. 1A shows typical radiation pattern radiated in a horizontal plane from the antenna shown in Fig. 1. Figs. 2 and 3 show other forms of antenna design according to the patent and Fig. 4 shows a type of antenna array suitable for obtaining a concentration of energy in the vertical plane. The design at Fig. 1 shows an antenna system having two conductive radiating structures 1 and 2, which take the form of conical surfaces. Each cone has a length about .36 wavelength long at the mid-band frequency and may consist of a

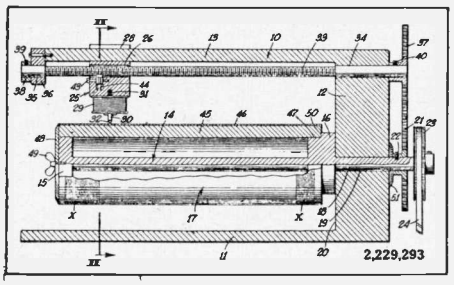


metallic sheet, or else a plurality of wires regularly distributed around and lying in the conical surface. The system shown in Fig. 1, the author states, yields a circular radiation pattern like that shown in Fig. 1A.

MAGNETIC RECORDING SYSTEM

2,229,293—issued to Walter P. Huntley, Ray M. Chenoweth and Emmet M. Irwin.

● MAGNETIC recording possesses many distinct advantages, among which are that magnetic records upon which sound or other vibration has been magnetically recorded are substantially permanent and are not consumable, being capable of being used repeatedly without the necessity of destroy-



ing any portion of the metal of the recording medium. Moreover, such metal records upon which sound vibrations have been recorded magnetically, will not be affected by temperature changes.

It is an object of this invention to provide a magnetic recording medium upon which a sound track may be magnetically recorded, along a spiral or helical or other convolute path, in which adjacent coils or convolutions of the path may be disposed in close juxtaposition, without interference between the sounds recorded upon such adjacent convolutions.

Also to provide a record medium of the magnetic type which substantially corresponds in form and shape to either cylindrical or disc records of the wax type now in common use, to permit the handling of such records in the usual manner.

Another object is to provide a record medium adapted for magnetic recording in which a compact, self-supporting but extremely *thin* recording surface is provided, adapted to be placed in a magnetic circuit of relatively low reluctance, whereby a stylus for passing magnetic flux into and through the thin skin surface may present to the recording surface a relatively small area, and yet pass relatively large quantities of magnetic flux through the recording medium to effect the necessary alteration of the molecular arrangement in the recording medium to permanently record sound or similar vibrations.

One of the illustrations shows a still further modified form of magnetic recording medium and machine, illustrating the manner in which the recording medium may be constructed in the shape of a *disc,* corresponding in size and shape to the wax disc records now employed in phonographic recording and reproduction.

Answers to Puzzle Diagram

On page 46.

(Hook-Up for Battery-Operated Short-Wave Receiver)

1. Tuning condensers across coils are shown connected in series instead of in parallel.
2. Tickler T is shown in position over secondary of R.F. (L1) antenna coil, instead of in inductive relation to the detector grid tuning coil, L2.
3. Tuning condensers in detector grid coil circuit are shown in series instead of in parallel; also they're connected to the wrong side of the grid-leak and condenser.
4. In the audio frequency stage the signal grid of the tube should be connected to the arm of the potentiometer P1, instead of to one end of it, as indicated.
5. Potentiometer P2 is incorrectly connected; the B plus should feed into one end of the potentiometer, and the arm should go to the screen grid of the detector.
6. The A.F. output transformer is shown without an iron core.
7. The antenna is shown as a doublet, whereas in this small battery-operated set it should be shown in connection with a ground and antenna system.

New Radio Apparatus of Interest

New 6-Tube, 2-Band Receiver

● THE Radiola 515 is a powerful 6-tube, 2-band instrument housed in a modern style wood cabinet.

The Radiola 515 provides excellent "foreign" short wave reception and unusual performance on the standard broadcast band. Its appearance is enhanced by the use of matched walnut veneers and horizontal grille rails across the front of the cabinet. The horizontal dial is placed at a 45 degree angle for easy reading.

It has two built-in antennas—one for domestic reception, and the other for "foreign" tunings. Its many other features include one stage of R.F. amplification for greater sensitivity and selectivity, a permanent magnet dynamic loudspeaker, 2-point tone control, automatic volume control, and a plug-in and switch for phonograph attachment.

New RCA two-band receiver—the Radiola 515. It has new large dial for easy tuning of "foreign" short wave stations.

New Cathode-Ray Intensifier Tube

● A NEW type high-vacuum cathode-ray tube designed for oscillographic applications where low deflection-plate capacitances are essential, is announced by Allen B. Du Mont Labs. This group of *teletrons*, having four different screen phosphors with identical electrical characteristics, is designated as the Type 2529 series. The deflection-plate leads are short and direct, terminating in caps on the glass walls of the tube rather than in the tube base. The intensifier electrode featured in this tube makes use of the principle of acceleration of the electron beam *after* deflection in order to increase deflection sensitivity. If the electron velocity during deflection is one-half of the final velocity, the corresponding deflection sensitivity is approximately 60% greater than in conventional tubes having the same final electron velocity. Thus for a given accelerating potential, the intensifier tube makes for economy in deflection-voltage and modulation-voltage amplifiers, and in power-supply designs. The tube is available with the Du Mont types A, B, C and D screens: namely, medium-persistence green (Type 2529A5), long-persistence green (Type 2529B5), highly-actinic short-persistence blue (Type 2529C5), and medium-persistence white (Type 2529D5).

New Station Locator

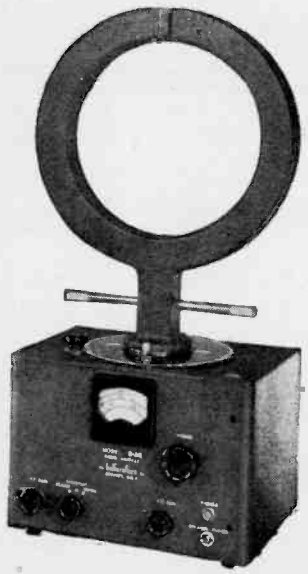
● THE heavy demand for resetting radio set push-buttons is met by a new low-priced *Knight* Station Locator, No. B10060, supplied by the Allied Radio Corp. Approximately 784 American stations have made a ten to forty kilocycle shift on March 29th, bringing an avalanche of calls for servicemen everywhere to reset receivers in accordance with these frequency changes. The especially designed

Station Locator easily solves the serviceman's problem even if the station should be off the air at the period of adjustment. No direct connection to the radio is necessary. A drift-free oscillator generates either a modulated or unmodulated signal at the flip of a switch. An easily read and simply calibrated dial identifies all stations; covers the entire broadcast band. This versatile unit may also be used to service auto radios. Operated from self-contained standard batteries, the Locator measures 3" x 4" x 5" and is housed in a portable black crackle-finished case.

Compact Radio Compass and Receiver

● THE Hallicrafters Model S-30 Radio Compass provides for the small boat not only means for taking accurate bearings but facilities for the reception of broadcast entertainment and marine information as well.

For direction finding it utilizes signals from regular beacon stations, broadcast stations or any other steady radio signals within its 3-band tuning range of 220-540 kc. (beacon band), 535-1340 kc. (broadcast band) and 1200-3000 kc. (marine band). Accurate null indications are provided both visually by a tuning eye and aurally by headphones. Further accuracy is assured through a "Sharpness" control and a switch-controlled "Static Filter."



The receiver is inclosed in a welded aluminum cabinet 11" wide, 10⅝" deep and 7½" high. The loop, mounted in an aluminum casting, brings the overall height to 23½". All operating power is drawn from a 6-volt battery through the medium of a Vibrapak. This and the loudspeaker are external units for remote installation to avoid introduction of magnetic error in compass operation. The 6-tube superheterodyne circuit includes a tuned R.F. stage on all bands. High gain and selectivity are provided by a 175-kc. intermediate amplifier.

Lightweight Mobile Amplifier

● WEIGHING only 20 pounds, the new Thordarson 12 Watt Mobile Amplifier, which operates from a 6-volt storage battery, answers many portable P.A. problems. It measures only 13½" x 7½" x 7¼". The unusual quality and high efficiency of this T-30W12 amplifier (less than 5% distortion) makes it ideal for use on military drilling fields, athletic fields and parade grounds. Designed for use in police cars, fire fighting equipment and sound trucks where a dependable emergency and continuous duty unit is required.

Several output impedances are available by adjusting a simple rotary switch selector, and a standby switch is provided which allows operation the instant the switch is turned on, without waiting for the tubes to heat up. Extra heavy battery cables are supplied with clips for easy connection to the battery. The unit may be used with either a 6-volt or spring wound phono motor and turntable for record reproduction.

Overseas Dial on New Set

● THE famous Overseas Dial, designed by RCA Victor to make tuning for foreign stations as easy as tuning for local stations, has been made available for the first time in a new table model that has been named the "Foreign Correspondent."

The Overseas Dial, which "spreads out" the popular 25- and 31-meter *short-wave* bands to many times their normal space on the dial, is but one of many features on the new "Foreign Correspondent."

The new dial makes quick and accurate foreign tuning possible.

The new receiver tunes in domestic and foreign stations and has a built-in "loop" antenna for domestic and foreign broadcasts.

Foreign band coverage from 8600 to 12,000 kilocycles is provided. The dial is placed on an angle for easy reading, and the markings are easily legible. Other features of the 5-tube receiver are automatic volume control, permanent magnet dynamic speaker, A.C.-D.C. operation, and plug-in for phonograph attachment.

3-Way Aviation Portable Radio

● AN efficient portable radio receiver which receives such important aviation information as CAA weather reports, radio range courses, and airport control tower signals, in addition to standard broadcast programs, has been announced by the Aviation Radio Section of the RCA Manufacturing Company.

The new receiver, housed in a sturdy two-tone airplane fabric covered case, is equipped for three-way operation—on self-contained dry batteries, in a plane, or from an A.C. or a D.C. electric outlet at home, in hotels, etc.

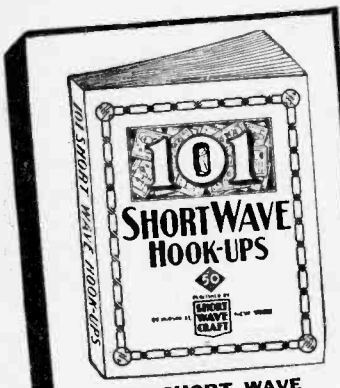
Unusually sensitive and selective for a portable receiver, the unit has a 6-tube, 2-band superheterodyne chassis, equipped with a built-in static-limiter switch to bring in weak signals above stormy noise levels and to reduce possible engine interference. Its many other features include tuned R.F. stage, high antenna sensitivity, and 3-gang condenser to provide freedom from adjacent station interference, rubber mounted chassis to withstand shock and vibration, and built-in loop antenna. Unusually good tone is provided by a large permanent magnet dynamic loudspeaker.

When used in a plane, the AVR-102 is ready for operation when connected to the ship antenna. A convenient jack is provided for headphones. The easily installed dry batteries provide for as many as 200 hours of operation.

A simultaneous radio range filter is available at slightly extra cost. This permits clearer reception of weather broadcasts and other voice transmissions without interference from the radio range signals, upon which the voice transmissions are superimposed. *(Turn to page 60)*

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 wortnwhile 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

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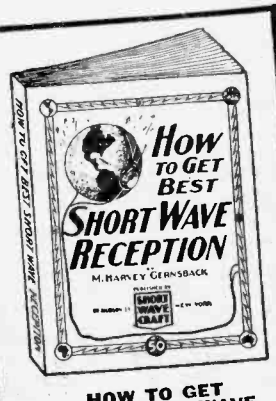

HOW TO GET BEST SHORT WAVE RECEPTION

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

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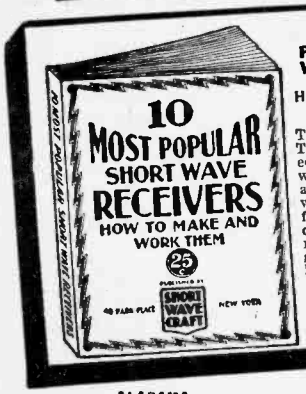

TEN MOST POPULAR SHORT WAVE RECEIVERS

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

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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 get.

150 Illustrations
72 Pages

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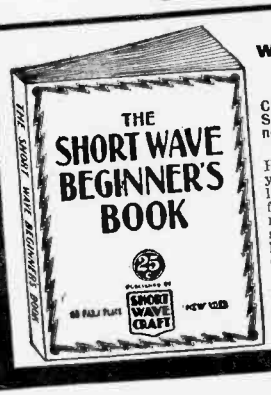

THE SHORT WAVE BEGINNER'S BOOK

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.

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DELAWARE
Wilmington Elec. Spec. Co., Inc., Wilmington

FLORIDA
Radio Accessories Co., Orlando

GEORGIA
Radio Wire Television, Inc., Atlanta

ILLINOIS
Allied Radio Corporation, Chicago
Walter C. Braun, Inc., Chicago
Chicago Radio Apparatus Co., Chicago
A. C. McClurg & Co., Chicago
Midwest Radio Mart, Chicago
Newark Electric Co., Chicago
Sears, Roebuck & Co., Chicago
Max Stein & Co., Chicago
Montgomery Ward & Co., Chicago
Radio Wire Television, Inc., Chicago

INDIANA
Van Sickle Radio, Indianapolis

MASSACHUSETTS
DeWolfe & Fiske Co., Boston
The Personal Book Shop, Boston
Radio Wire Television, Inc., Boston
Library Book House, Springfield
Tremont Elec. Supply Co., Boston

MICHIGAN
Rissi Brothers, Detroit

MINNESOTA
St. Paul Book & Stat. Co., St. Paul

MISSOURI
Burstein-Applebee Co., Kansas City
Radio Labs., Kansas City
Walter Ashe Radio Co., St. Louis
Van Sickle Radio Co., St. Louis

NEBRASKA
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
Blan, the Radio Man, New York City
Adson Radio, New York City
Eagle Radio Co., New York City
Federated Purchaser, Inc., New York
Radio Circular Co., New York City
G. E. Stechert & Co., New York City
The Steiger Co., New York City
Sun Radio Co., New York City
Terminal Radio Corp., New York City
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

OHIO
News Exchange, Akron
United Radio, Inc., Cincinnati
College Book Exchange, Toledo

OREGON
J. K. Gill Co., Portland

PENNSYLVANIA
The 437 Store, Philadelphia
M & H Sporting Goods Co., Philadelphia
Radio Electric Service Co., Philadelphia
Cameradio Co., Pittsburgh

UTAH
Radio Supply, Inc., Salt Lake City.

WASHINGTON
Seattle Radio Supply Co., Seattle
Wedel Co., Inc., Seattle

ARGENTINA
Radio Revista, Buenos Aires

AUSTRALIA
McGill's Authorized Agency, Melbourne

BELGIUM
Emil Arens, Brussels

CANADA
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Electrical Supplies, Ltd., Winnipeg, Man.
Wholesale Radio Supply, Winnipeg, Man.
Canadian Electrical Supply Co., Ltd., Toronto, Ont.
Radio Trade Supply Co., Ltd., Toronto, Ont.
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New Radio Apparatus

Directional Antenna for Planes

● A NEW directional loop antenna for civilian planes which makes radio direction finding possible with a conventional aircraft receiver, has been announced by the Aviation Radio Section of the RCA Manufacturing Company, Inc.

This low-cost antenna makes possible accurate direction finding for the civilian pilot. It can be used to direct the plane toward a radio beacon or a radio broadcasting station or, by simple navigation, can be used to plot a course in any direction with the aid of radio bearings.

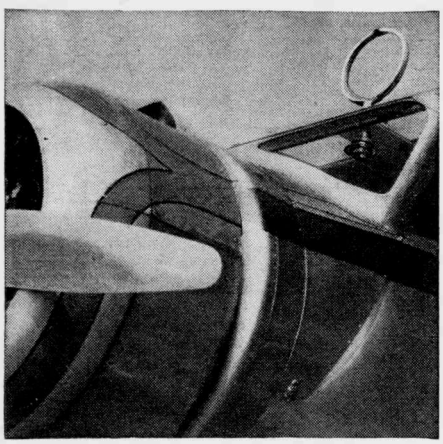
The antenna, measuring 12 inches in outside diameter, is provided in both local and remote control models. It will operate as a direction finder on the beacon (195-420 kc.) band, or on the beacon and broadcast (195-420, and 495-1400 kc.) bands. A high qualilty, air transport size unit, it combines high electrical efficiency with the rugged construction necessary for passing Civil Aeronautic Authority requirements.

The antenna is designed for use with RCA aviation radio receivers Model AVR-7D, E, F, G and H, and two inexpensive conversion kits have been provided to make the installation. It can also be used with any other receiver having an adequate sensitivity, and whose input circuits can be trimmed to match the electrical characteristics of the loop transformer.

The two models are designated as AVA-56 and AVA-56A. The former has the loop turning control at the end of a 10, or 30, inch shaft. The other model provides remote turning control by means of a cable from the instrument board or from some other convenient location.

The electrostatic shielding and balanced windings of the loop materially reduce precipitation static and allow clearer reception of weak signals even under unfavorable conditions.

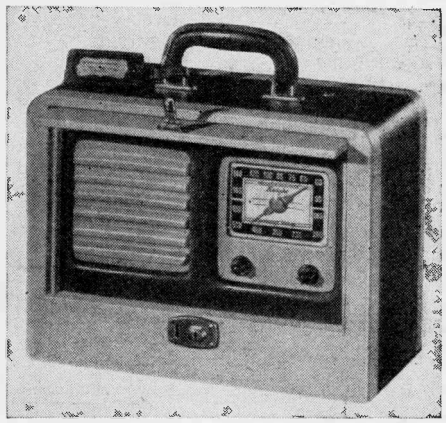
The loop shield is heavily plated and, for extra protection, the entire exposed portion of the loop is coated with tough, abrasion-resisting lacquer.



Double-ended pointers are used on the indicators of both the AVA-56 and the AVA-56A. One end of the pointer shows the bearing to which the loop is rotated, while the other end indicates the calibration correction for the bearing being taken.

New 6-Tube 3-Way Portable

● A NEW 6-tube 3-way portable radio, Model B17115, is presented by the Allied Radio Corp. This new lightweight receiver is easily portable and offers reception from either a battery or any 110-125 volt, 40-60 cycle A.C. or D.C. source. The circuit uses the latest low-drain tubes as follows: 2—1N5GT, 1A7GT, 1H5GT, 3Q5GT, 35Z5GT. Advanced features include: special R.F. stage for extra sensitivity; big full-vision clock-type dial; A.V.C.; built-in "Magna-Beam" loop aerial; heavy duty 3-gang tuning condenser; PM Dynamic Speaker, etc. The battery pack provides 200-250 hours of service. Tuning range is from 540 to 1650 kc. A drop-front disappearing lid can be locked. Has carrying handle and leather name tag. Size: 12¾" x 9¼" x 6½".



New RCA Tubes

● THE RCA Mfg. Co. has made available three new receiving tubes of the popular single-ended type. They are designated as follows: RCA-6SF7, Diode, Super-Control Amplifier Pentode; RCA-6SN7-GT, Twin-Triode Amplifier; RCA-12SF7, Diode, Super-Control Amplifier Pentode.

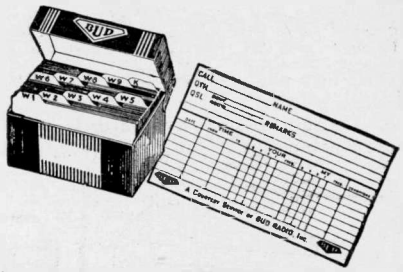
The 6SF7 is a multi-unit, single-ended, 6.3 volt metal tube containing a remote cut-off pentode and a single diode detector. The tube is recommended for use as a combined I.F. amplifier and detector. When so used in phono-combination instruments, the 6SF7 minimizes the difficulty from "play-through" from the radio set. The 6SF7 may also be used as a resistance-coupled A.F. amplifier and will give the same high gain and voltage output as other similar pentodes. (Max. plate volts 300.)

The 12SF7 is identical with the 6SF7 except for its heater rating of 12.6 volts and 0.15 ampere. (Plate volts 300.)

The 6SN7-GT is a single-ended, 6.3 volt, twin-triode amplifier having separate cathode terminals for each triode unit. It is recommended for use in resistance-coupled circuits as a voltage amplifier or phase inverter. The 6SN7-GT has a T-9 bulb. From the circuit designer's standpoint the 6SN7-GT with its separate cathode terminals for each unit offers much greater flexibility in application than do other twin-triodes having only a single cathode terminal. (Plate volts 300.)

New QSO Index

● A NEW QSO Index has just been made available for the first time by Bud Radio, Inc. This Index consists of an attractively lithographed steel



This new QSO Index card file will save hours of hunting through scattered records.

box containing 10 buff bristol index cards and 100 printed station cards (3" x 5") with spaces for all important information. The index cards are marked from W1 to W9 and K, for all United States districts and outlying possessions.

By means of this QSO Index, an operator can keep an accurate file of the stations he contacts. It saves much tedious time that would otherwise be spent in looking up information in the station log.

Radio Direction Clarifier

● A NEW noise-filter, operating on a novel principle, is incorporated in the new radio direction clarifier developed by the E. M. Sargent Co. By means of this clarifier, which is built into a neat self-contained cabinet, with switch and tone control knobs, all noise is eliminated when tuning on the "null" position, leaving a clear-cut signal that can be accurately read to a minimum setting. By means of this clarifier the radio bearing is sharpened by 100%; the device operates on any direction-finder that uses 6-volt battery. The width of the "null" is reduced to about 2 degrees in most cases, making it possible to locate the center line within one degree. Unreliable radio bearings give their own indication when this new device is used, and warning is thus given to the ship's operator or pilot that this particular radio bearing should be checked by some other means, and that it is unreliable at the moment. This instrument is claimed to be the only apparatus that will do this. A switch on the clarifier permits use of the radio direction-finder, either with or without the clarifier in the circuit. The power required for the clarifier is negligible; the device works on beacon signals only, not on voice.

New Radio Catalogs

Radio Warehouse Market

● ONE of the newest radio catalogs is that bearing the label No. 7 and put out by the Radio Warehouse Market, at Akron, Ohio. It contains a liberal assortment of radio apparatus and should be on the catalog shelf of every radio Ham and experimenter.

Antenna Manual

● ALIVE with snappy drawings, containing construction dimensions and feeder connections, this antenna manual just published by Premax Products, Niagara Falls, N. Y., should be on your reading list.

In this excellent manual, descriptions and constructional data with drawings are given for rotary beams of different types, vertical radiators, antennas for frequency modulation reception, marine antennas, vertical beams, police antennas, the extended double Zepp, etc.

New Finish

● A NEW kit supplied by General Cement Mfg. Co. enables the general experimenter and mechanic to easily apply the popular flock finish, without spraying equipment. This finish is suitable for phono turn-tables, cabinets, tube testers, etc. The kit includes the flock material, undercoat, undercoat thinner, brush, and a specially developed original sifter-top can for sifting the flock over the undercoat. Directions are included and the kits are available in the popular colors of brown, taupe, and blue.

National Recording Supply Co.

● THE new 1941 catalog of the National Recording Supply Co. has just come to hand. It illustrates and describes a number of high-class recorders, including a professional console job. A special line of cutting and reproducing needles, as well as records are listed. The catalog contains descriptions of table model recorders for home use.

New Radio Apparatus

Allied New 1941 Spring Catalog

● ALLIED RADIO CORP. announces the release of a new 180-page 1941 Spring Catalog. Many striking photos of the new Knight radios are used extensively throughout the rotogravure and color pages.

Complete new lines of everything in radio are included; all equipment is carefully arranged in clearly defined sections and precisely indexed for speedy reference.

Fifty-seven new 1941 Knight radio models are introduced; featured are new "Personal" Portables, Three-Way Portables, latest Recorder-Phonograph Combinations, Midget Plastic Sets, Table Models, Console Receivers, Auto Radios, Farm Sets, Record Players, and an unusually complete selection of phonograph and recording accessories.

Sound Systems are listed in a large section. These systems make use of the most recent developments in P.A. design and are available in ranges from 7 to 75 watts for every type of application.

For the Serviceman there are over 100 pages devoted to all the latest in test equipment and over 15,000 parts. Fluorescent lighting comes into its own with a strikingly modern presentation in rotogravure. Of special interest also are the bargain merchandise sections, the Photo Cell Equipment, and the section of books and manuals on radio and electronics.

A large Amateur Section, including 8 pages of rotogravure, covers a large selection of Communication Receivers and Transmitters, tubes, keys, transformers, and complete parts and accessories for every amateur purpose.

For the builder and experimenter there is a wide variety of kits, employing from one to six tubes, accessories, projects, diagrams and builders' tools and supplies.

Short-Wave Reception Booklet

● MANY radio listeners, urged on by the desire for more dependable reception of war news direct from the *short-wave* broadcast stations of Europe, are puzzled as to what type of receiving equipment will best serve this purpose. It is for such that Hallicrafters offer a 12-page illustrated booklet entitled *A Short Story on Short-Wave Radio Receivers.*

In the various professional short-wave services, where the utmost in effectiveness and dependability is demanded, receivers of the "communications" type are universally employed. These receivers are available to the public as well, and are in every way suited to the requirements of the most critical short-wave broadcast listener.

This new booklet discusses the advantages of this type of receiver in general and explains the purpose and functions of the various controls, all in non-technical language. It stresses the fact that to operate a communications receiver effectively does not call for technical training or knowledge and is well within the ability of the serious short-wave listener. While the controls are more numerous than in the case of the ordinary home receiver, each has its logical purpose and they all combine to provide the greater operating flexibility called for if best short-wave results are to be obtained.

Any interested listener may obtain a copy of this booklet free by addressing a request to the Hallicrafters, or ask Service Department, RADIO & TELEVISION, 20 Vesey Street, New York City, for Booklet No. 1000A.

Log Book Lists Valuable Data

● A COMPLETE and timely radio log book, which lists the newly assigned frequencies of all domestic stations and contains much non-technical information for short-wave enthusiasts, has been prepared for the radio listening public by the RCA Manufacturing Company.

The 32-page book includes for the first time the *latest* frequency modulation and television assignments, and serves as an excellent guide to all standard U. S. and Canada broadcasting stations.

For the sake of convenience, all U. S. standard broadcast stations have been listed three ways: alphabetically by states and cities, alphabetically by call letters, and by frequency. In addition, there is a virtually complete listing of foreign "short wave" stations, together with call letters, frequencies and exclusive time schedule.

The book's many features make it invaluable for the *short wave* fan. An attractive, two-page time map of the world is included to enable the reader to determine more graphically the time operations of foreign stations. In fact, the listener in any U. S. time belt can tell whether or not any station is on the air at any given time.

CBS to Cover 18 Latin-American Republics

Returning from a seven-week plane trip over Latin-America, William S. Paley, president of CBS, announced that this network had formed a Latin-American radio system to carry programs to 18 of the 20 republics to the south. Haiti and Honduras are the only two countries not yet covered, but negotiations are under way to include them soon. The new network, which will begin operation about September 1st of this year, consists of 39 long wave and 25 short wave stations which will carry regular day-by-day broadcasts of specially prepared CBS programs. Reciprocally, CBS will carry programs that originate in all Latin-American countries as well as programs about Latin-America originating here. While the primary purpose of the new network is to promote better relations with Latin-America, Mr. Paley said the commercial radio possibilities of these countries would be developed for the North American advertiser, thus permitting an exchange of goods as well as an exchange of ideas.

In announcing the formation of the new network, Mr. Paley said, "The close broadcasting collaboration between the Americas that this sweeping plan introduces will give the United States a predominant position in Latin-American broadcasting as compared to any other foreign country in the world, for not only will our short wave signal over the new transmitters be very high-powered but the re-transmission of our programs by long wave facilities throughout Latin-America will assure us a tremendous audience. This is especially true because in almost every case the station connected with this new network is the most popular in the territory it covers.

"My plan was received enthusiastically wherever we went, by radio people and government officials alike. I found a genuine and sincere desire to bring about a better understanding and I was convinced of a real feeling of friendship for the United States throughout my travels. In some countries government rules and regulations stood as obstacles to the introduction of the plan. In these cases alterations were immediately made so that we could proceed.

"Other countries have been very active in short wave broadcasting aimed at Latin-America," Mr. Paley continued. "Much of their output is straight propaganda, selling the ideologies of certain countries and seeking to discredit the way of life of other nations. The air waves from Europe are full of conflicting news reports as each country broadcasts its own official version of events. This condition has brought a new respect in Latin-America for news emanating from the United States. Impartial and honest reporting has won the fight with propaganda and the people of Latin-America now realize that they must turn to the United States to get honest and impartial news. The American press associations serving a majority of important papers down there, and

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Aerovox Corporation	Parts Mfr.	Catalog		Free	14
Allied Engineering Institute	Kit Mfr.	Circulars		Free	16
Allied Radio Corp.	Mail Order	180-Page 1941 Spring Catalog		Free	13, 21
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Radio & Technical Publ. Co.	Radio Textbooks	Circulars on each book		Free	29
RCA Institutes, Inc.	Radio School	Catalog		Free	32
RCA Manufacturing Co., Inc.	Set & Parts Mfr.	Phototube Book		Free	I.B.C.
		RCA Ham Tips		Free	
Remington Rand, Inc.	Typewriter Mfr.	Catalog		Free	4
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the news broadcasts going to those nations, are now generally considered the most reliable sources of information. Unfortunately only a minority of radio listeners throughout Latin-America hear short wave programs. *The propaganda ministries of foreign countries recognized this long ago and from time to time have bought time on the local long wave stations where the big listening audiences are.* It is this type of operation that has been most effective for them. The re-transmission of CBS programs will be a regular, not a spasmodic arrangement. All stations that have affiliated with the Latin-American network of CBS will have available to them for re-transmission any of the programs broadcast by CBS to Latin-America, and they have agreed to carry our programs at least one hour every single day."

BOOK REVIEW

MEN AND VOLTS by John Winthrop Hammond. Cloth covers, size 6½ x 9¼ inches, 436 pages, illustrated. Published by J. B. Lippincott Company, New York, N. Y.

The student of electrical history has a veritable feast in store when he starts reading this excellent book, which covers the early history of the electric lighting and railway industries in America. The great struggles of the early inventors and business men who attempted to introduce electric lighting and trolleys to the public, are interestingly told with many unusual personal sidelights. The early work of Thomas Edison, Elihu Thomson, Charles F. Brush, James J. Wood and others is described in detail. Some of the things that occurred back in the 1880's are hardly believable today.

This book is particularly valuable as the progress of the electrical industry back in the '80's and '90's is here told for the first time in a connected manner, and it was the work of these early American inventors and business giants that culminated in the great General Electric Company of today.

One would never imagine that so much difficulty would be encountered in establishing a successful electric trolley system, just because of the sparking of the brushes on the motors. Finally the carbon brush was thought of and applied—then trolley systems began to grow.

The young student of electricity will find this book valuable, in that it shows how the real electrical inventors kept everlastingly at it until they had licked the many problems which beset them. The patent fight and eventual victory of the Edison incandescent lamp claims in the courts is told, and also many of the amusing technical as well as business problems met with in establishing electric lighting plants across the country, before the turn of the century.

HOW TO MAKE GOOD RECORDINGS, stiff board covers, 128 pages, illustrated, size 5⅜ by 8 inches. Published by Audio Devices, Inc., New York, N. Y.

This book will be found worth reading by everyone attempting to make phono recordings; how a recorder works is explained very clearly, with simple drawings. Other chapters tell how to choose a recorder, how to determine the sound qualities of a recorder, requirements of a good recording disc, what type disc to use and also what kind of needles to employ. Important sections deal with proper adjustment of the turn-table drive, setting the cutting angle, adjusting the depth of cut, correct recording volume, making a radio recording, using the microphone for home or studio recording, where to place the microphone and how to make copies of records.

MATHEMATICS FOR RADIO AND COMMUNICATION by George F. Maedel, A.B., E.E. Stiff cloth covers, 2 volumes, size of each 6¼ x 9½ inches, about 600 pages. Published by Maedel Publishing House, Brooklyn, N. Y.

Here are two books that every man interested in the technical phases of radio will want to study. They have been written especially for students in school, and at home, to prepare them to read technical books and magazine articles on radio. The author is Chief Instructor of the New York School of RCA Institutes, and his books are official texts on mathematics in that well-known school.

Book I (314 pages) covers the subjects: Algebra; Geometry; and Arithmetic.

The chapters are: Addition, Subtraction, Multiplication, and Division in Arithmetic: Definitions and Symbols: Involution and Evolution in Arithmetic: The order of Operations in Arithmetic and Algebra: Fractions in Arithmetic: Definitions and Notations in Algebra: Axioms: Positive and Negative Numbers: Addition, Subtraction, Multiplication, and Division in Algebra: First Degree Algebraic Equations: Exponents and Radicals in Algebra: Standard Products and Quotients: Factoring: Common Factors and Multiples: Fractions in Algebra: First Degree Fractional Equations: Decimals and Powers of Ten: The Metric System: Engineering Problems and the Slide Rule: Quadratic and Radical Equations: Simultaneous Simple Equations: Postulates: Definitions of Geometric Quantities: Rectilinear Figures: Circles: Loci: Similar Figures: Areas: Measurements of the Circle: Constructions: Co-ordinates: Solid Geometry: Formulas Used in Geometry. ANSWERS to the problems are given.

Book II (329 pages) covers the subjects: Advanced Algebra; Trigonometry; and Complex Numbers.

The chapters are: Algebraic Formulas: Numbers and Precision of Measurements: Graphs: Logarithms and Decibels: Trigonometric Functions of Acute Angles: The Right Triangle and Its Applications: Trigonometric Functions of Any Angle: Graphs of Functions and Their Engineering Use: Functions of Combined Angles: Trigonometric Equations and Identities: Oblique Triangles: Ratio Proportion and Variation: Determinants: Simultaneous Quadratic Equations: The Binomial Theorem: Progressions and Series: Complex Numbers. ANSWERS to the problems are given.

What Do YOU Think?

An Echo from Scotland

Editor:

I must congratulate you on the publishing of one of the finest radio magazines I've ever seen—RADIO & TELEVISION. I first discovered it in a ten-cent store while looking through a pile of second-hand magazines. After I had taken them home and started to read the two issues, I knew this was the radio book I had been looking for. The *Question Box* and *Kinks* pages are my favorites, and I never tire looking through my RADIO & TELEVISION issues; I have twenty-four numbers now. I inquired at your London office for the "Hints & Kinks" radio book and a few of your other publications, but they had none in stock. I will have to wait till this war is over and life resumes its normal routine. Here's wishing every success to RADIO & TELEVISION.

JOHN MCLACHLAN,
Moss Street,
Paisley, Scotland.

Why Not Learn Code?

Editor:

Many times I have read readers' opinions to the effect—"Why have code tests for fellows interested only in *phone* communication?", or "Why have code tests for persons interested only in the Ultra-Highs?" I would at this time like to state my opinion on these questions.

I feel that an amateur should be acquainted to a certain degree with all phases of radio that he may encounter in his experiments. Once the test is passed the licensee has his choice of *phone* or *code* operation, and it certainly is to his advantage to know the *code* and carry on some communication in that way.

Also just proceed to tune any *short-wave* set. I grant you there will be many stations on *phone,* but you will also hear countless CODE stations. These stations' messages are just as interesting and in many cases I have found them more so than the station transmitting by voice. Furthermore, I may be going to extremes when I say that, in my opinion I feel it a greater achievement to copy a local "code" station than an overseas *broadcast* station. Because today with the modern transmitting equipment, aerials, etc., it is no feat to hear around the globe with a one-tube set. Yet everyone can't sit down to a one-tube set and copy a local *code* station. To the average listener it is just a bunch of dots and dashes, and as far as he is concerned it would be easy to convince him it was located in China, or some distant part of the globe.

Also with conditions as they are today, and with so comparatively few trained *code* men, you can easily see a "weak link" in our defense chain, if there were to be a code-less test for radio-minded persons.

As for the Ultra-High Frequencies—much is known about them, but much more will be found out, and there is no reason why fellows should limit their communication in this section of the radio spectrum to *phone* operation. While experimenting, give everything a try—and why not *code?*

J. WEISS,
547 E. 105 St.,
Cleveland, Ohio.

He Likes His Plaque!

Editor:

I wish to let you know that I sincerely appreciate the splendid award of the RADIO & TELEVISION *plaque.*

A lot of things have happened to me since Mr. Laughlin and I made those pictures. Have been called into active military duty and am now serving as radioman aboard the Destroyer *U.S.S. Humphreys.* This duty is one of the finest radio experiences I have ever had, the opportunities to learn radio are almost unlimited and am losing no opportunities to grasp everything I can along educational lines.

The extreme value of our amateur and naval communication reserve radio training is now plainly evident. It is very valuable to the navy to get radiomen, even though they have never been aboard a ship. They can do two things well—that is *send* and *receive;* it sounds simple, but that is the backbone of our branch in the naval service.

Have a naval "N" prefix certificate that I had in my shack that I received from Great Lakes Naval Training Station that is signed by Admiral Hayne Ellis and Lt. V. Havard, Jr., who were at Great Lakes at that time. Now they are both gone and another certificate like that would be impossible to get. I knew both of them. To me the RADIO & TELEVISION plaque will be somewhat of a possession like that, as it is signed by Mr. Gernsback, a man whose articles I have read since I was a kid just starting in radio—a dream come true!

Very truly yours,
H. E. MCALLISTER,
Radioman Second Class.

A Voice from England

Editor:

I have been an SWL for just over three years, and during that time I have managed to log 90 countries on 14 mc. The receiver is R.F., detector and two audio, and antennae vary from time to time.

It is very difficult to obtain American literature over here at the present time, and I miss RADIO & TELEVISION very much (it is almost a luxury here, nowadays!).

I would like to correspond and exchange radio magazines with anyone who cares to write me, as we find the "black-outs" very dreary.

The SWL's over here still manage to QRX on the Ham bands between the "blitzes," and the Ham spirit is just as much in evidence as it was before the war.

In conclusion, I will state that I am always ready to QRX for any tests with "W" Hams, and will rope in one or two of the boys over here, if any co-operation is required!

Wishing your fine magazine the very best of luck and 73 (best regards)—

LEONARD F. CROSBY,
81, Plymouth Hse.,
East Hill Estate,
Wandsworth,
London, S.W. 18, England.

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 5)

experiment would impress the student with the notion of gain factor and amplification factor, more vividly than any mathematically expressed relationship.

Or again, instead of a mere blackboard diagram of an inaudible radio frequency oscillator, such a circuit could actually be set up and used to drive a crystal producing supersonics, with which truly astounding demonstrations can be made. These instances and others, such as a capacity relay, or photo-electric phenomena, although not exactly radio in their nature, are certainly directly associated with the basic potentialities to which vacuum tubes may be applied.

Unless a certain amount of showmanship, without academic complications, is offered to attract the high school student, there will be, without doubt, a serious dearth of radio experimenters in the next generation.

Ross Graham,
1001 Fifth Street,
Columbus, Indiana

RADIO IS YOUNG!

● THIS is the voice of one who not so long ago was a beginner in the great field of radio. How dark and strange it seemed to me then, as it no doubt still seems to many. However, I found radio like anything else that one puts one's mind to, it all fits together piece by piece. It really boils down to fairly simple fact and with a little thought, the theory is not hard to follow. We must start at the beginning, at the very simple things; if we don't, we're apt to find the going hard and drop the whole thing. So in reading theory, start with the electron theory and study it; it may not look like radio, but you'll find it is after a bit. In fact, the little things at the start are the foundation of our radio career. Build it sturdy by studying the small fundamentals well. We find radio easy to break into because it is in cheap, simple books that we find the simple beginnings of our study.

By reading we gain radio theory, but it is by actual work with radio apparatus that we actually gain a grip on radio knowledge and put our theory into practice. Our first set is usually a one-tube circuit and it seldom works right away. It seems that one always has a loose connection or a short circuit. If we didn't have this trouble with our sets, then our radio knowledge wouldn't advance very fast. I certainly don't kick about a little repairing. That's what makes radio the red-blooded thrill it is. After conquering troubles we get far more satisfaction out of the job, than if it always worked right away, for it is the *hard things* that beat out the weak-spirited. Trouble is nothing to the real dyed-in-the-wool radio bug; in fact, it's the heart of his work.

So I say to the would-be beginner, if you find you like tinkering with radio, come on in; it won't be hard for you, but to those who lack interest, I say you'd better drop it, because one can never be a success unless he likes his work. It is up to the beginners to carry on. From them have come the circuits of today and from them will come the circuits of tomorrow. *Radio is young*—we're at the beginning today. We may be at the top tomorrow.

David J. Corner,
Box 528,
Vulcan, Alberta, Can.

RADIO'S CHILDREN

● WELL, well . . . . still fooling around with *short-wave* radios . . . . and after all these years! Aren't you a little old for that? Remember, you're not a sixteen-year-old kid any more.

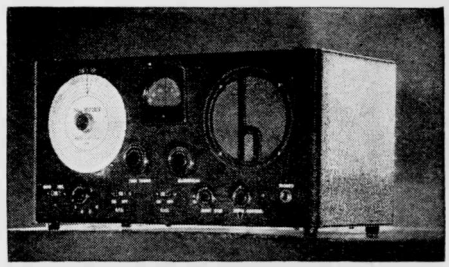
What's the use of kidding yourself? Radio's up a dead-end street. Take, for example, vacuum tubes—the receiver's very heart. Today's filament, grid, plate and screens function identically to those of ten years ago. True, they are smaller perhaps, and amplify a little greater, but SO WHAT? Nothing phenomenal about that! Then there are: Modern AVC, Noise Limiters, Crystal Phasing, etc. You must admit they're only refinements on time-tried radio standards, the TRF and Superhets. "Old-timers" remember those circuits! And lastly . . . . even on my ten-year-old receiver, I still enjoy present-day programs with equal gusto.

No amount of such criticisms can discourage me. I enjoy fooling around with radio, not that it's my profession (although a great profession), but rather as a "hobby," *where I can relax and free my mind from the rut of everyday business affairs!* Where I get just as much enjoyment in smoothing out an erratic regeneration control, as the expert does in solving a great television problem.

What if Noise Limiters and other gadgets are only refinements acquired during the process of time? You would hardly expect a single jump from spark-receiving days to modern receivers. No—it's not a *dead-end*, but rather a one-way street where there's no turning back—always *forward*, in the name of progress!

If all this still indicates childish tendencies (this continual trying to fathom the mysteries of radio) then I—in the future—need never fear the approach of a second childhood!

S. Renaamo,
4318 6th Ave.,
Tacoma, Wash.



Prize receiver; Hallicrafter "Sky Buddy" S-19R, covering the range from 44 mc. to 545 kc., in four bands, with built-in five inch dynamic speaker, awarded to Harry M. Gans, of Hollywood, Calif., for this month's prize-winning Readers' Editorial—see page 5.

CORRECTION NOTICE

In the diagram appearing on page 728 of the April issue no B– connection was shown on the "Little Nipper" conversion hook-up. A B– connection should have been indicated between the 800 ohm and the 3 megohm resistors, in the grid circuit of the 1S4 tube.

866-A/866

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Filament Current	5.0 amperes
Peak Inverse Voltage	
Up to 150 cycles per second	10,000 max. volts
Up to 1,000 cycles per second	5,000 max. volts
Peak Plate Current	1.0 max. ampere
Average Plate Current	0.25 max. ampere
Tube Voltage Drop (approx.)	15 volts

In the few months the RCA 866-A/866 has been on the market, more than 9,000 of these tubes have been *sold!* There is no better evidence that here is another RCA winner—a sensational performer at an equally sensational low price.

This new tube supercedes the 866 and 866-A and may be used in equipment designed for these types. It combines the low starting voltage of the 866 with the ability of the 866-A to withstand a high peak inverse voltage—and, in addition, gives *plus* performance all along the line. It handles higher voltage at lower initial cost—and, equally important, it has amazingly long life achieved by virtue of a new filament. This filament is made of a new material having great emission capabilities. Edgewise-wound "ribbon" construction assures great mechanical strength, at the same time providing more emitting area for the same filament power.

Important among the tube's other features is the special filament shield designed so as to make practical a very low starting voltage. A ceramic cap insulator and a new dome-top bulb minimize danger from bulb cracks caused by corona discharge and resultant electrolysis.

THE RCA PHOTOTUBE BOOK IS HERE!

This comprehensive new booklet on Phototube theory, design and operation should prove both interesting and helpful. Free copy on request to Commercial Engineering Section, RCA Manufacturing Co., Inc., Harrison, N. J. Ask for the RCA Phototube Book.

Ask your RCA Amateur Equipment jobber for copies of the January and Feb.-March issues of RCA Ham Tips containing details on design of rectifier systems and filter systems applicable to the RCA 866-A/866.

RCA

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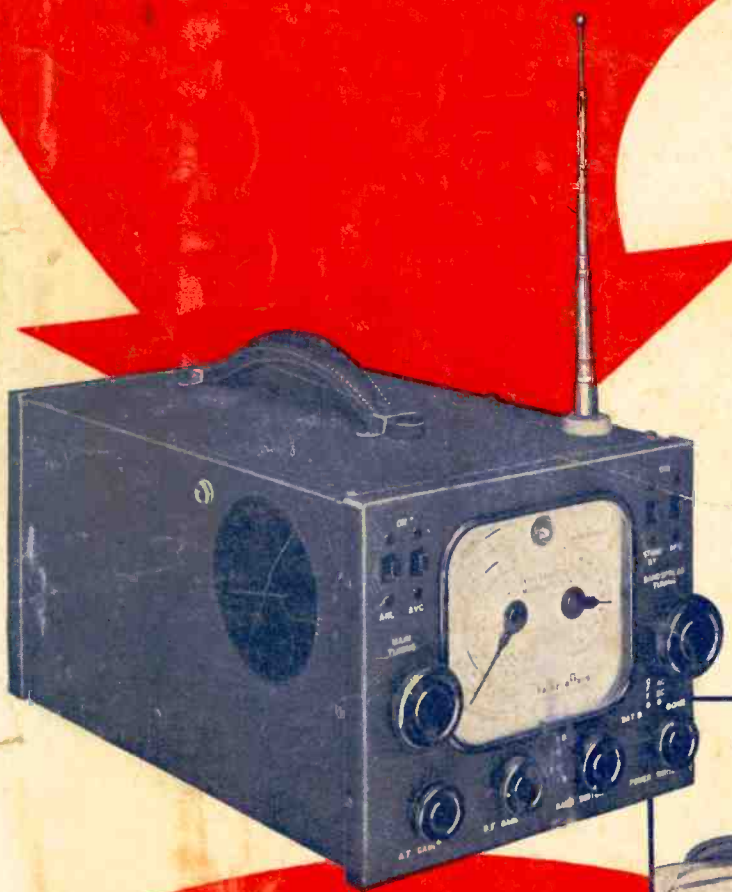
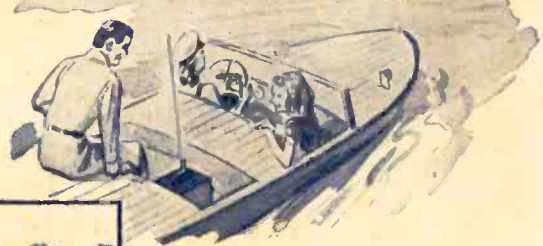


THE Sky-Traveler (Model S-29) is a portable designed to communications receiver tolerances. You can take it with you wherever you go, or use it at home. Operates on 110 volts AC or DC or from its self-contained batteries. Frequency coverage from 542 kc. to 30.5 mc. on 4 bands. Telescope antenna with high gain coupling circuit provides truly remarkable reception throughout the tuning range. Electrical bandspread. Automatic noise limiter. Battery life prolonged through a self-contained charging circuit. RF stage used on all bands. Sensitivity below two microvolts on all bands. Permeability tuned RF and IF circuits. Weight including batteries 18 lbs. The Sky-Traveler (Model S-29) $59.50.



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