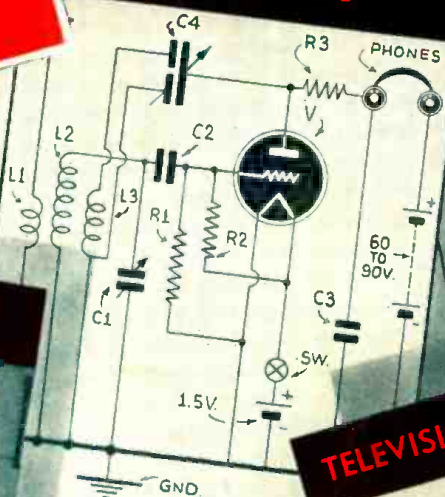


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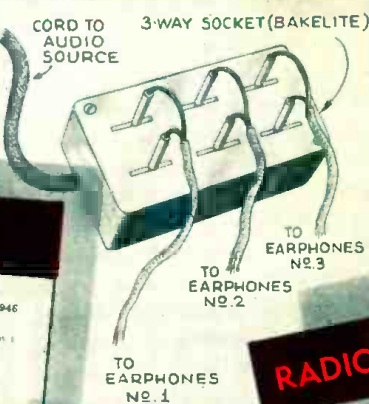
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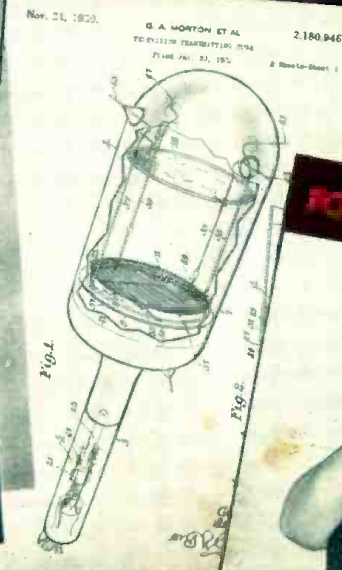
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Continuous coverage from 540 KC to 30 MC with ample bandspread on amateur frequencies. Has noise-limiter, full-vision dial and crystal filter. List Price \$237.50 with speaker.

Features that make a Fine Receiver

Receivers of the NC-100 series are thoroughbred communication receivers, built to the most exacting standards. Quality parts are used throughout, to insure highest performance and long trouble-free service. Typical is the use of air-dielectric trimming condensers throughout RF, IF and oscillator stages. Everywhere you look in this fine receiver you will find abundant evidence that it is built to the finest communication standards, from parts specially designed for communication work.

The NC-100 Receivers are built in a variety of types to suit every purpose. For AC or DC, with or without crystal filter, general coverage or amateur bands only. Look over the model of your choice at your dealers. You will find the quality of its construction as impressive as its performance.

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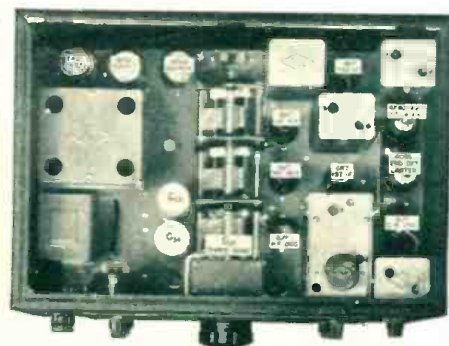
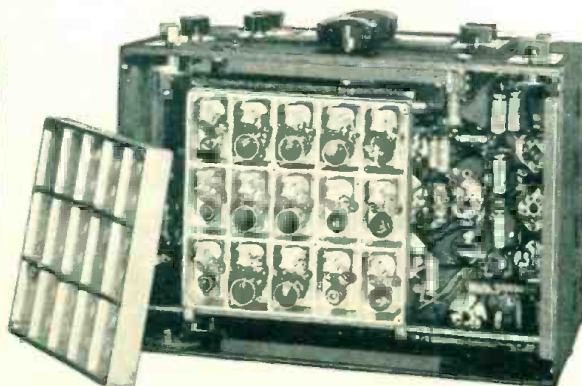
A rugged precision condenser, driven through a preloaded gear drive, provides smooth tuning free from backlash. The full vision dial used on the NC-100A, NC-100XA and NC-101XA is shown at the right. Separate direct-reading scales are used for each range. In addition to swinging over the scale, the pointer moves radially when the coil range is shifted so that it points directly to the frequency. A separate vernier dial is added for precise logging.

MOVABLE COILS

The movable coil tuning unit combines the convenience of a coil switch with the efficiency of plug-in coils. The large cast aluminum shield in the base of the receiver has a separate shielded pocket for each of the RF and oscillator coils. This heavy shield moves bodily on its track when ranges are changed, bringing the desired coils directly below the main tuning condenser and tubes, thus providing the shortest possible leads. Unused coils are moved out of the way, contributing to the receiver's complete freedom from dead spots.

HIGH PERFORMANCE

The 11-tube superheterodyne circuit of these receivers gives high signal-to-noise and great sensitivity and selectivity. To the fine basic circuit have been added all those features which years of experience in building fine communication receivers have shown to be helpful. These include a new noise limiter of truly remarkable effectiveness and (on the "X" models) a crystal filter with wide range control of both phasing and selectivity.





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

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



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

I Trained These Men



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"I repaired many Radio sets when I was on my tenth lesson, I made \$600 in a year and a half, and I have made an average of \$10 to \$20 a week—just spare time."
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Makes \$50 to \$60 a Week

"I am making between \$50 and \$60 a week after all expenses are paid, and I am getting all the Radio work I can take care of, thanks to N. R. I." H. W. SPANGLER, 126 1/2 S. Gay St., Knoxville, Tenn.



Operates Public Address System

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

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

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

Jobs Like These Go to Men Who Know Radio

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

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

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

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

The day you enroll, in addition to my regular Course, I start sending you Extra Money Job

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You Learn About Television, Intercommunicating Systems, Electronic Control Devices

The N.R.I. Course is up-to-the-minute. It gives you the ground-work you need for all profitable Radio fields. You get complete training in modern Television systems. How to install, adjust, service Television sets and antennas is covered. Television texts are kept right in step with new developments. You also learn about practical electronic control equipment, including photoelectric counters and safety devices, electric eye burglar alarms, fire and smoke detectors, and wireless remote control units. The N.R.I. Course is not only basic but highly practical.

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RADIO & TELEVISION

The Popular Radio Magazine

June — 1940
Vol. XI No. 2

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

A NEW STYLE

has been adopted for the makeup of this and succeeding issues of RADIO & TELEVISION. A number of new departments have been added in response to readers' requests. Also note that all articles run complete, without continuations. In order to help you find the departments quickly, subject titles have been incorporated in the running heads at the top of each page.—The Editors

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A Beginner's All-Around Radio Test Set, by Chas. R. Leutz

Part 2—Frequency Modulation Converter, Ricardo Muniz, E.E.

One-Tube Beginner's Transmitter, Herman Yellin, W2AJL

More I-tube DX Circuits for the Beginner—Besides all the New departments—including Electrical Experiments, Patents, Photography, etc.

Cover Composition by Hugo Gernsback and Thos. D. Pentz

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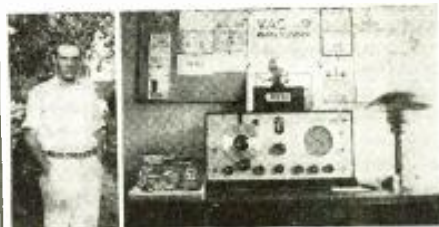
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What Do YOU Think?

READS "R.&T." COVER TO COVER

Editor,

Herewith a photo of my "listening post". My receiver is a Hallicrafter SX-9. I am a member of the *Short Wave League*. Have a V.A.C. and 39 countries verified.



I use "R.&T." exclusively. I am very much interested in the photos of various QSL cards and other SWL listening posts. I always read R.&T. from "cover to cover" several times. Keep up the FB.

Roy RIEDEL
725 N. Belleview Pl.
Indianapolis, Indiana.

If You Hear "Hams"—What to Do

Editor,

I have been listening to the grumblings of the SWL's about not receiving QSL cards from the Hams to whom they send their reports. The Hams also come back with retorts that stop the SWL's for a time, but no matter what the retorts are, the SWL keeps right on grumbling. I have gotten very sick of it all so I decided to write this letter to help those poor fellows that just can't seem to get the Hams to answer reports and also to try to stop this unnecessary wrangling, so here goes.

First of all, don't send your reports to the phone Hams, but instead send them to the CW boys, for they'll be appreciated a lot more by the fellow that runs 25 watts on CW than by the fellow who runs 150 watts on phone. I have myself sent reports to 98 Hams and have received answers from 86 so you see that it isn't too bad to report on the CW Hams. Not only do you find that your reports are answered more frequently, but you will find speed at copying code will increase!

Secondly, you should make your reports brief and to the point. Your reports should contain an RST report, a report on QRM and QRN, and a report on weather and temperature conditions under which the signal is being received. It is also good practise to put in the type of receiving equipment that is being used at the receiving shack. You would do well to put in a barometric report, for I am sure that there are a few Hams interested in such reports.

Lastly, and before I close, I might say that it is advisable to enclose sufficient postage to ensure the return of a QSL card.

73 and I hope your QSL cards pile up! Please don't send an SWL card.

ROMNEY MILLER,
43½ Elm Street,
Newport, R. I.

(More Readers' Letters on page 114)

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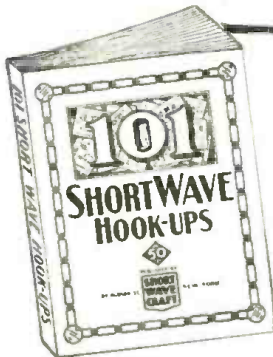
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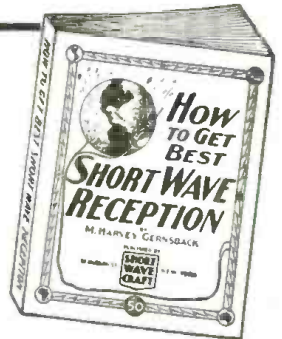


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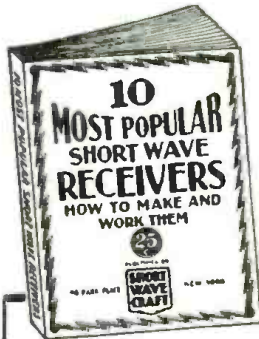
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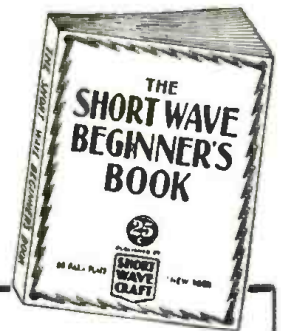
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McGill's Authorized Agency, Melbourne

BELGIUM
Emil Arens, Brussels

CANADA
T. Eaton & Co., Winnipeg, Man.
Electrical Supplies, Ltd., Winnipeg, Man.
Wholesale Radio Supply, Winnipeg, Man.
Canadian Electrical Supply Co., Ltd., Toronto, Ont.
Radio Trade Supply Co., Ltd., Toronto, Ont.
Canadian Electrical Supply Co., Ltd., Montreal, P. Q.

BRAZIL
Agencia Soave, Sao Paulo

CHINA
China News Co., Shanghai
International Bookellers, Ltd., Shanghai

ENGLAND
Goringe's Amer. News Agency, London

FRANCE
Toute La Radio, Paris

GERMANY
Rehr G.M.B.H. SW15, Berlin NW No. 7

HOLLAND
Radio Peeters, Amsterdam, Z.

INDIA
Empire Book Mart, Bombay

MEXICO
American Book Store, Mexico, D. F.
Central De Publicaciones, S. A., Mexico, D. F.
Jaques Salvó, Mexico, D. F.

NEW ZEALAND
Johns, Ltd., Auckland
James Johnston, Ltd., Dunedin
Te Aro Book Depot, Ltd., Wellington

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RADIO & TELEVISION

Editorial

This Radio

By HUGO GERNSBACK, Editor

RADIO—one of the newest yet one of the greatest arts of all time—encompasses such a vast territory that it becomes more difficult from year to year to keep abreast of it. Even the radio expert himself finds it difficult to keep up with all the new uses that radio and radio instrumentalities is put to. Radio has long since outgrown the purely communication angle with which it started out originally in 1900.

Every day sees further applications of the radio art which branch out with great rapidity. Yet, with all of the tremendous activity going on in the various branches of radio, it might be said that we are still at the very early beginning, and that the greatest and most revolutionary applications of radio and its instrumentalities are still to come.

RADIO & TELEVISION in coming issues will make it our mission to inform you of all the newer uses of radio in every phase, because it is felt that during the years to come, those who keep track of these newer applications will not fail to derive many benefits from them. Industries spring up around new radio instrumentalities almost overnight, and it behooves us, therefore, to keep track of what is going on in the vast realm of radio.

Here are a few recent applications which you might find of some interest. As you will note, they are all odd uses of radio and its applications, and may perhaps give you food for thought.

RADIO CLOCK. Recently, the well-known inventor of electric time-pieces, such as the Telechron clock, Henry E. Warren devised a timepiece which is so accurate that it does not vary more than a second in a month. The inventor has built such a clock for a well-known Western astronomical observatory. He calls his latest invention a "singing clock." The "singing" is caused by a metal string which is vibrated electro-magnetically at a rapid rate, giving a low tone which cannot be heard by the ordinary ear. Actually, the entire mechanism works by means of vacuum tubes and other radio components.

RADIO MICROSCOPE. A new electronic microscope has been demonstrated by the Radio Corporation of America, just as we go to press. Former microscopes—indeed, the most powerful—cannot magnify more than about 10,000 diameters without blurring and distortion. Indeed, no ordinary microscope which uses a wavelength of visible light can magnify further than that; the limitation of light itself interposes a barrier which remains insurmountable. Hence, scientists for many years have tried to find better means than light for magnification. This they found in electronic devices, whereby electronic images are enlarged; not by light rays, but by electronic means using radio instrumentalities, and the resulting enlargement is thrown on a fluorescent screen where it can then be photographed. With this new microscope, it will be possible, RCA investigators believe, to get future enlargements as great as 500,000 diameters—a thing undreamt of heretofore.

MINES AND RADIO. The so-called "magnetic" mines, of which we have heard so much lately, owe their great effectiveness to radio means, whereby radio tube amplification is made use of inside the mine. The system is a rather complex one, but the heart of the sensitive arrangement lies, of course, in a type of radio amplifier which gives its effectiveness and efficiency to the

mine. Incidentally, all of the Great Powers are working feverishly on new types of mines, and there are many rumors of especially deadly ones now being experimented with. These new mines are only dangerous to the enemy; never dangerous to those who plant them. It is understood that again radio plays its rôle in this type of mine, and vessels are equipped with a special generator to send out a train of waves which only the makers of the mines know. This then renders the mine ineffective and inoperative. The mines, being self-regulated to a predetermined distance below the surface of the water, cannot be removed by mine sweepers, but the instant an enemy vessel approaches, the mine becomes effective and explodes. It is said to be especially dangerous for enemy submarines not provided with the secret safeguard. Incidentally, the British found a partial answer to some of the German "magnetic" mines. British ships arriving in the United States lately have been equipped with several turns of heavy cable, wound around the ship itself. By this means the "magnetic" mine mechanism has been counteracted. It is thought that a special magnetic field, which is produced on board the ship, is supposed to negate the magnetic field of the ship proper. The idea here, no doubt, is to balance out the powerful magnetic field normally surrounding a steel vessel of large size. Evidently these devices have been more or less successful, because sinking by mines, as far as Allied ships are concerned, has declined very sharply of late.

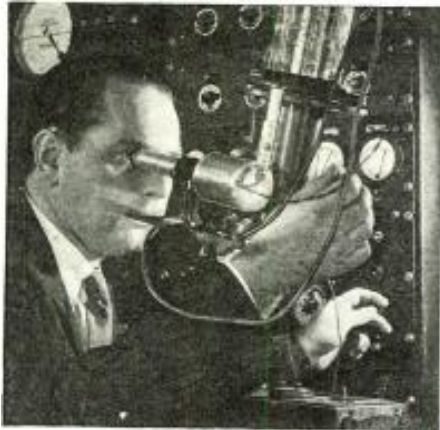
THE RADIO DOG. "Down yonder," in Australia, a police constable has a large police dog who has been brought up by radio—believe it or not! The dog carries with him a light weight portable receiver, equipped with a loudspeaker. His master then speaks into the microphone of a small portable transmitter and the dog hears "His Master's Voice" within a radius of about 1000 yards. By this means the dog actually is made to go through his paces in a most startling manner. He will perform all sorts of difficult tricks at a distance, as long as he is under the command of his master's voice. Here again is a simple application of radio for stunt and entertainment purposes that has not been fully exploited as yet. The possibilities here seem to be endless.

What about horse-racing without jockeys? Well-trained race-horses can be made to go through their paces by the jockey's word. A not-too-complicated harness can be devised easily to eliminate the spoken word of the jockey, so that instead, by radio-mechanical electric-tele-control, the race-horse is made to run the race. Thus, for instance, the reins and whip are electrically controlled in the same manner. The whole apparatus could be built into the shape of a man. In other words, a *jockey dummy*, with all the radio-electro-mechanical apparatus inside of the dummy. As far as the horse is concerned, he wouldn't know the difference—and we have here an entirely new means of horse-racing without a human being on the horse. Each dummy, of course, would have to work on a slightly different wavelength, so that the jockeys, *who would sit in the grandstand*, before their control-boards, could create no radio-interference with each other. I have only mentioned this one example; other similar radio applications suggest themselves, such as the corral and the roundup, and they could easily be arranged by any wide-awake radio man.

On the Cover

ATOM SMASHER!

Using their new 65-foot-high electrostatic generator as a cannon for shooting protons into the cores of three different elements, the investigators have not only changed one metal into another but have produced new measurements of the masses of atoms and high voltage standards by means of neutron emissions.



High voltage measurements are made by means of this electroscope at the control panel Westinghouse's 65 foot high "atom smasher".

NEWS BY RADIO

When the Nazis marched into Denmark, an act shortly followed by a declaration of war on Germany by Norway, the British broadcasting stations were slow to carry the news. When it finally did go on over their short wave transmitters, the commentator remarked that the only information Britain had concerning the new developments was from press reports radioed by American transmitters. A possible reason for this was that telephone communications between Scandinavia and the British Isles went out when the Nazis went in! A short time thereafter a Norwegian radio station confirmed the reports.

NBC ISSUES FIRST SHORT-WAVE RATE-CARD

The first of its kind ever issued, a new rate card covering commercial international broadcasting to Latin America has just been announced by NBC. The new card applies to both WNBI and WRCA and permits sponsors to take as little as 5 minutes on a thirteen week contract. Three languages—Spanish, English and Portuguese—are covered on the card. Last March a leading oil company sponsored the broadcast of the Louis-Godoy "fight" to South America.

The above sent over the ham bands welded W9CHD to W2MSC. The former is the call of Lenore Kingston, radio actress in Chicago, the latter that of Joe Conn, RCA television engineer in New York. Lenore and Joe conversed over the



short waves for about a year. One night Joe asked the momentous question. Lenore replied "dah dah dah ditdahdit" and a few days later he flew out to Chicago, where they were wed. Lenore will go to New York when roles in present NBC serials have been completed.

Television Network Tested — Expansion Planned

ANNOUNCEMENT that the National Broadcasting Company has filed applications with the F.C.C. to construct and operate television stations in Philadelphia, Washington and Chicago focussed interest on the new radio relays by which RCA plans to interconnect television broadcasting stations in various cities. The new system was recently tested with a series of "centimeter wave" radio relays between New York and Riverhead, L. I.

Power for the station, which operates unattended, is supplied from the nearby public service sources; it will automatically switch to use of its own emergency power supply, if line voltage fails and returns—again automatically—when power service is restored. Operation of the relay stations may be started and stopped by radio signals sent over the circuit.

The development of a new, "inductive" type of radio tube has made possible the reliable transmission of very high frequencies between relay points separated by

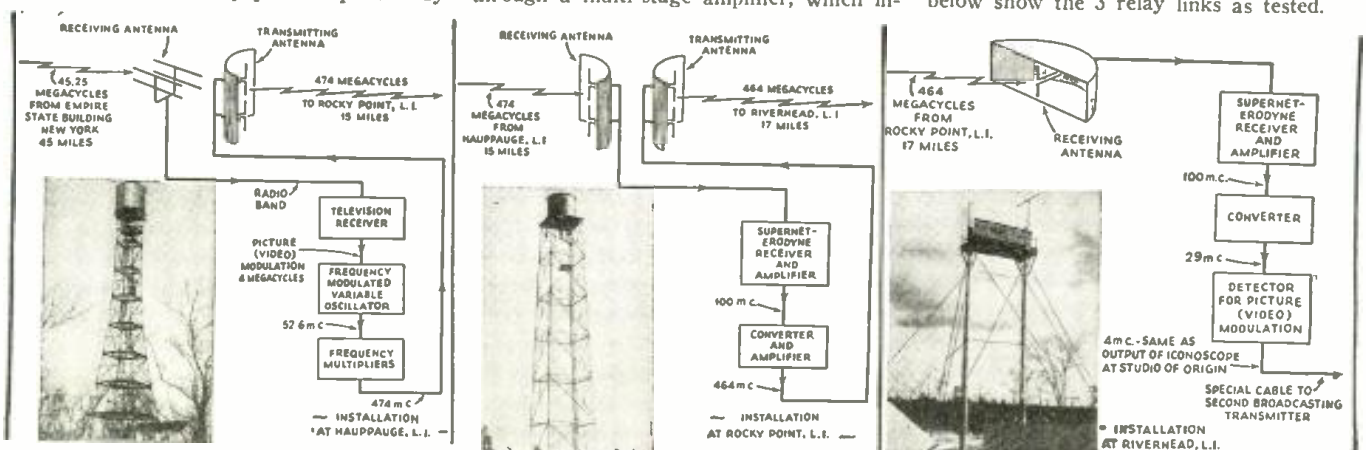
25 to 50 miles with a radiated power of less than 5 watts.

In the system recently tested the first relay point is at Happaugue, L. I. Here the television signals radiated from the NBC television transmitter in the Empire State Building, New York, at a frequency of 45.25 megacycles, are received and "detected," to provide the video component, the band width of which is 4 megacycles. This is used to control a transmitter with multi-stages of frequency tripling, and embodying RCA developments in frequency modulation. At its first stage of conversion into centimeter waves, the video component is employed to frequency modulate an oscillator producing 52.6 megacycles; at the second stage, the frequency becomes 158 megacycles; and in the final stage it is 474 megacycles (.63 or about 2/3 meter).

At the second relay station the signal is received at 474 megacycles and converted to 100 megacycles, after which it is passed through a multi-stage amplifier, which in-

creases its energy to about one watt. This energy is fed to an inductive tube operating as a converter, and the frequency is increased to 464 megacycles. After passing through another inductive type tube used as a straight amplifier in the final stage, the 464 megacycle wave is radiated from the transmitting antenna. The overall repeater gain is about 75 decibels.

At the final station in the relay link, the signal is received at 464 megacycles and converted to 100 megacycles, as in the previous station. After being amplified it is passed on to a second converter, where the frequency is further reduced to 29 megacycles, and in the process of detection, the signal is changed from its characteristic of frequency modulation to one of amplitude modulation. After further amplification at the video frequency, it is then ready to pass along to a second television broadcasting station, where it may be employed to modulate that station's transmitter. Illustrations below show the 3 relay links as tested.



Measures Lightning Strokes

The instrument pictured herewith, known as the *fulchronograph*, measures the magnitude of current and the time of duration of lightning strokes. It is located in a laboratory atop the University of Pittsburgh's "Cathedral of Learning." Developed by Westinghouse engineers the instrument consists essentially of a motor, and a slotted aluminum wheel filled with laminated permanent magnet steel which projects like fins from each side of the wheel. The wheel rotates between two coils which carry the total surge current from the lightning stroke.

Current in the coils produces a magnetic field proportional to the surge current at any instant, and the magnetic steel slot or fin on the recording wheel which happens to be passing in that magnetic field is magnetized in proportion to the amount of current that is carried by the stroke in time divisions as brief as 40 millionths sec.

Two recorder units are used at the Cathedral lightning station. One is a high

speed wheel containing about 400 iron fins and whirling continuously more than 3400 times a minute, completing a cycle in one-sixtieth of a second or 17,000 microseconds (millionths of a second). The spacing of the fins and the rapidity of the wheel enable it to make a record every 40 microseconds or 40 millionths of a second. The result is a schematic picture of the wave shape and surges of a single lightning stroke. The second wheel is slower.

The wheels are calibrated by means of a lightning surge generator in the company's high voltage laboratory by comparing the magnetic reaction of the steel fins to an artificial lightning surge and the wave shape of the surge as reproduced by a cathode ray oscillograph.

With their new instrument the engineers obtained a precise measurement of a lightning stroke from the time it reached its crest of 21,000 amperes until its current fell toward zero after some 20,000 microseconds. After only 100 microseconds the current had already declined to 1,000 amperes, but from this point the current fell relatively slowly until it dropped to 100 amperes at the 7500 microsecond mark on the recorder.

Some 60 of these new surge recorders have been installed in strategic transmission areas throughout the United States.

SHORT WAVE LEAGUE BROADCAST

● ON the 3rd Sunday of each month from 2:15 to 2:30 a.m. Station TGI, 1310 kc., and TG2, 6190 kc., will broadcast programs in the Spatari language dedicated to the *Short Wave League* and to H. Winfield Secor, its Assistant Secretary. Beautiful verification cards will be sent to all who report reception of the broadcast. Those who hear these programs should address Baron Franz Gall von Atlass, Radio Morse, Direction General of Communication, Guatemala City, Guatemala, Central America.

2000 VOLTS FROM HAMMER BLOW

A rap of the gavel on the crystal at the left of the accompanying photograph causes distortion of the crystalline structure. As it is a piezo-electric crystal such stresses impel it to develop a voltage—in this case 2000 volts—from a good smart rap. In any event the voltage generated is



sufficient to cause a flash of the neon bulb. This is a very striking demonstration of crystal qualities—and no pun is intended. —Photo courtesy Bell Telephone Labs.

THE GOOD NEW DAYS

Time was when a sports editor covering a track meet had to be in the stadium or else had to get some kind-hearted colleague to bat out a story for him to cover his absence. Sports reporting is now greatly simplified, as witness the case of Daniel J. Duval, sports editor of the *Schenectady Union-Star*. Lolling back in a comfortable armchair in his home city Duval watched Fenske, Rice and Herbert win various events in the Knights of Columbus Track meet at Madison Square Garden, New York City, 142 miles away! The relay system comprised four television transmitters, the first sent the program from the track to the Empire State Building, whence it was relayed 129 miles north to a double rhombic receiving antenna in the Helderberg Hills. The third relay was 1.2 miles to W2XB which gave the images a fourth transmission.

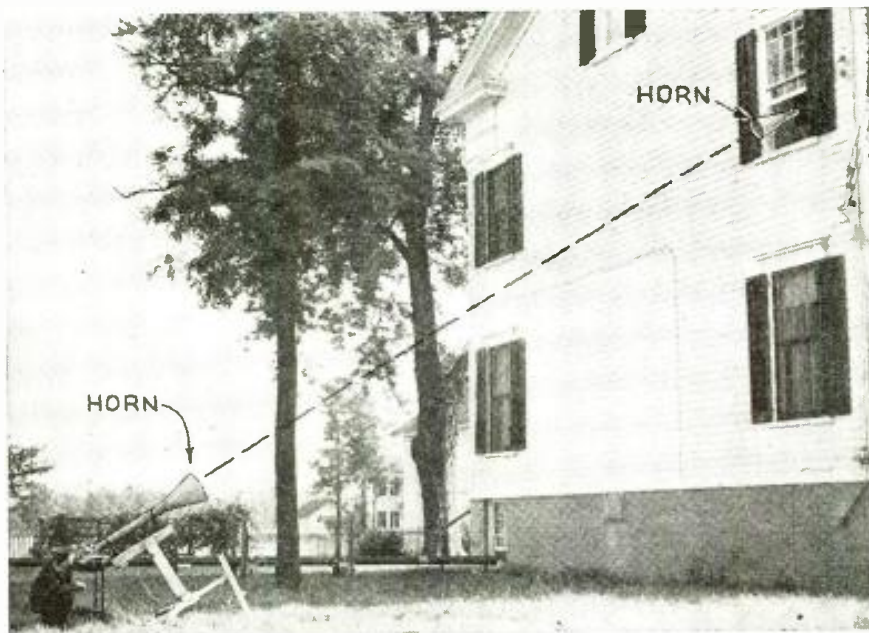


Metal Horns as Antennas Direct Short Waves

Further experiments are being conducted by Bell Laboratories on the directive characteristics of metal horns of various sizes and shapes when used as transmitters of electric waves. By designing the horns with various degrees of taper and in differing lengths the wave can be made to follow a path of almost any desired shape. A gain of 28 decibels was obtained as compared with non-directional transmissions. The horns possess a reasonably flat frequency characteristic. It is believed that further research will reveal still greater improvement on this means of transmission.

FREQUENCY MODULATION ADVANCES

Frequency Modulation is coming in for attention all over the U. S. and one of the latest networks to become interested is the Don Lee Broadcasting System. If a permit for the construction of an F.M. station is granted by the F.C.C. the station will be erected on Mount Lee together with a suitable antenna. Mount Lee is on the outskirts of Los Angeles, Calif.



Scientists See Frequency Modulation on New Scope

Some philosopher once said "believe only that which you see." To prove some of the advantages of frequency modulation,

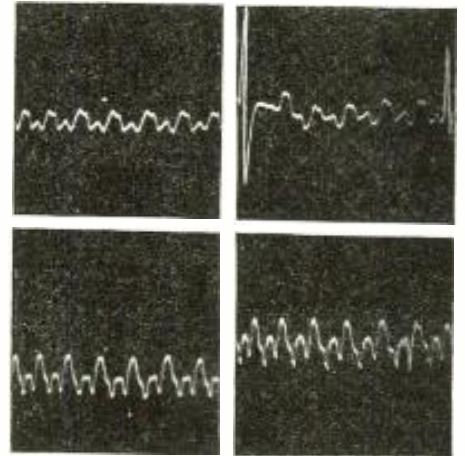


Picture at left shows discharge to test F.M. At

General Electric Company engineers made oscillograms of frequency modulation and amplitude modulation modulated carriers. Peaks in the accompanying illustrations show the difference between the two systems. In the former system sounds are impressed on the carrier wave, changing its amplitude; in the latter the amplitude remains relatively constant but the difference between the peaks is varied. What happens when interference ("static") impinges on the wave is seen by the high peaks produced in the amplitude modulation system. The slight indentation in some of the peaks of the frequency modulation system shows the almost negligible effect of such interference in this system.

Dramatic proof of frequency modulation's freedom from interference was had when a receiver was operated in Steinmetz Hall at the New York World's Fair, where a ten million volt discharge of artificial lightning failed to mar reception to any great extent.

The oscillograms accompanying this article show elapsed time of approximately 1/50 second.



right top are A.M. signals without and with interference; below them, the corresponding F.M.

F.C.C. Standard Interference Measurements

The Federal Communications Commission in ruling on a frequency shift for station KOY of Phoenix, Arizona, has held that methods of calculating interference as embodied in the F.C.C.'s propagation curves take precedent over limited measurements. The reason for this was according to the F.C.C., that its methods are recognized by the radio industry as a whole. A grant to the Arizona station was opposed by KOAC of Corvallis, Oregon.

"A careful review of the exceptions filed by the intervener and of the contentions of any merit made in the briefs and upon the oral argument reveals that the only issue remaining for our consideration is that of interference in nighttime service and that this issue resolves itself solely into questions of fact," says the Commission in today's Opinion and Final Order joined in unanimously by the five Commissioners present.

The Commission goes on to explain:

"The Commission's present Standards of Good Engineering Practice (effective August 1, 1939) deal explicitly with the point raised by the intervener. . . . While the formal adoption of these Standards and their official effective date is relatively recent, the policy expressed in them is of some years standing and has been made clear to the broadcasting industry and particularly to its technical experts.

"The Commission's curves are based upon averages arrived at by careful actual measurement of a great number of signals in all portions of the country and over a long period of time. Their accuracy as reflecting the average situation has been confirmed many times and now is well established. Even more important, although based on averages, their applicability in specific cases has rarely been opposed, in view of the diverse conditions (e. g., seasons, sun spot cycles) taken into account in the figures on which they are based, which conditions are not reflected in a limited set of measurements. Enough has been

said to indicate the basis for declining to accept results inconsistent with the curves unless scrupulous attention is given to employing accurate methods of measurement and to obtaining sufficient data upon which to base a conclusion. Under this criterion the engineering evidence offered by the intervener in regard to the question of interference has been found wanting. . . . The theoretical separation required by the Standards for this class of operation is 735 miles. The actual distance here involved is 977 miles.

"If in the actual operation of KOY objectionable interference should develop as to the present service area of KOAC, the Commission will enter an order requiring appropriate protection," adds the Commission.

ROONEY IN RADIO

Mickey Rooney, who portrays Thomas Edison as a youth in a recent MGM film, is shown in the accompanying picture working with an old time transmitter. The apparatus plays an interesting part in the



film which should be particularly appreciated by all who are interested in radio and experimental electricity.

MUSICAL AMERICANA FOR S. A.

Stations WPIT 11.87 mc. and WBOS 9.57 mc. now send musical Americana to South America, South Africa and Europe by means of the short wave beam. WPIT's 40 kilowatt beam is directed to South America and Europe, while WBOS directs a 10 kilowatt signal to South Africa. The former station is located in Pittsburgh and the latter in Boston. Both are operated by the Westinghouse Elec. and Mfg. Co.

AMATEURS GET FM BAND

THE Federal Communications Commission modified the rules governing amateur radio operators and stations to make available to amateurs the band 58,500 to 60,000 kilocycles for radiotelephone frequency modulation transmission. Previously amateurs were permitted to use radiotelephone frequency modulation in all amateur bands above 112,000 kilocycles. The new rules will make possible wider experimentation in this type of transmission.

JAMMING—A WAR WEAPON

Short wave broadcasts from the belligerent nations continue to reach the U. S. and other parts of the world with few if any interruptions caused by deliberate jamming on the part of hostile nations. An article in *The Wireless World* of Great Britain gives the British explanation for this. Says the editor, Britain and her allies are in an excellent position to jam German broadcasts. Germany likewise could jam the Allied waves. Britain and France have refrained from doing so for two major reasons (a) they feel that German propaganda has little if any effect and (b) they feel that intentionally created interference would infringe upon the radio rights of neutral nations. The editor believes that Germany has withheld jamming because of a fear of reprisals on the part of the Allies. The latter have so many locations for stations that they could not be completely jammed; Germany, having no colonies, would be more at the mercy of this weapon.

Radio Men Brave Gale and Cold for Science's Sake

Transmission of television signals over 250 airline miles by relay from New York City set a new record when Easter services conducted in Radio City were brought to the technicians isolated in the hurricane winds and 18 below zero cold of the weather observatory atop Whiteface Mountain.

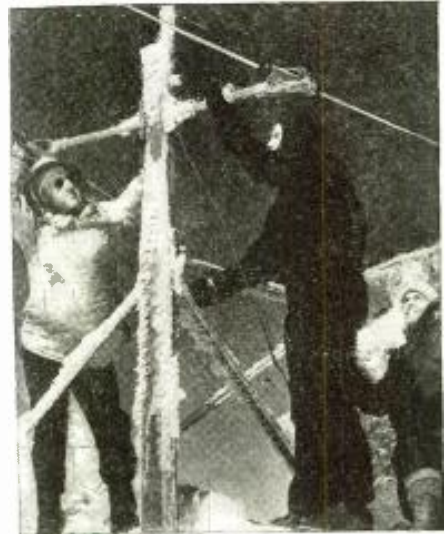
The relay station, operated by General Electric, is about half way between the point of the program's origin and the mountain, third highest peak of the Adirondacks. The program was witnessed by four weather men in addition to the G.E. television engi-

neers. Three of the weather men had been snow-bound since January 16th in the weather station maintained by Rensselaer Polytechnic Institute and New York University.

The five mile highway leading to the observatory was covered with snow 10 to 25 feet deep, and dog-sled drivers from Lake Placid refused to make the trip to the 4872-foot peak. Four men on snowshoes placed the 253 pound load on a toboggan and donning snowshoes hauled the equipment in a six hour moonlight journey, whipped by a 53 mile wind. The television antenna was erected in the face of a 77-mile an hour gale.

After the broadcast had been completed, the wind and cold were so severe that the engineers had to remain another 24 hours before they were able to leave the mountain top.

A dipole antenna was used in receiving the program. Professor Corwin estimated the mountain peak was slightly below the line-of-sight from General Electric's transmitter, which is 1500 feet above sea level in the Helderberg mountains near Schenectady. A double rhombic antenna is used by

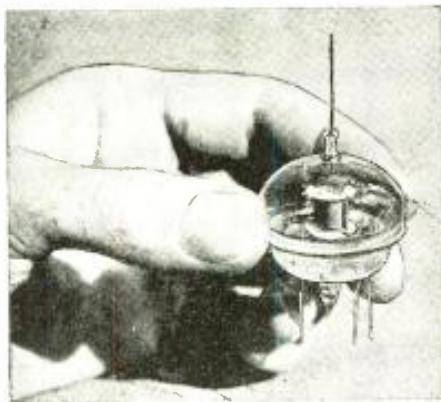


General Electric in picking up the programs well below the line-of-sight from the NBC transmitter atop the Empire State Building in New York and relaying them through the company's new station near Schenectady.



COAXIAL AMPLIFIER

A vacuum tube specifically developed for use in the amplifiers which coaxial cables require at various intervals, involve such small parts and accurate assembly that microscopes must be used in its manufacture. No base is used for the tube is wired directly into the circuit in order to minimize the capacity and leakage between the various lead-in wires.—Photo courtesy Bell Laboratories.



EASTER ON THE COAST

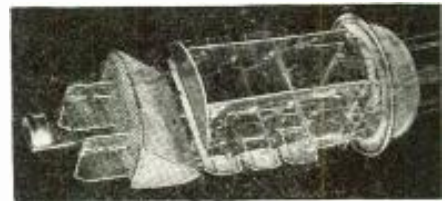
Easter rites celebrated at the Hollywood Bowl were brought to television kinescopes in southern California by Station W6XAO. Two cameras were used to feed images into a four hundred foot co-axial cable connected to a portable transmitter housed in a tent atop a nearby hill. Also at this position was a "hay-rake" antenna. Such celebrities as Tyrone Power and Kenny Baker participated in the program, which was relayed from the hilltop to the main transmitter, from which it was re-radiated to home television receivers.

FOREIGN AMATEUR TRANSMISSION

An Ohio amateur recently asked the F.C.C. whether he could transmit a message from a third person to a foreign amateur station. International radio regulations forbid "owners of amateur stations to transmit international communications emanating from third persons" except by special arrangements between the interested countries. Such special arrangements have been made with Canada, Peru and Chile, with recommendation for further extension in the Western hemisphere. At the same time a Long Island "ham" is advised that the Commission has issued no rule or regulation which specifically prohibits radio communication from an amateur station in the United States to amateur stations in Europe. "However," adds the Commission, "because of the existing conditions in Europe, the members of numerous amateur radio organizations have agreed that it is better policy to discontinue such communication for the duration of the war." Also, there is the practical fact that in the warring countries amateur radio service has been shut down.

NEW ELECTRON MULTIPLIER

The number of secondary electrons leaving a surface struck by a stream of electrons in an electron multiplier is proportional to the number of primary electrons striking it, but the proportionality factor



varies with the voltage driving the primary electrons and the nature of the emitting surface. The new electron multiplier described by J. R. Pierce of the Bell Laboratories utilizes highly complicated calculations in providing a path to be followed by the electrons for maximum efficiency. The photocell electron multiplier illustrated herewith has an output of 30 milliamperes per lumen, and is practically non-microphonic.

Expedition Radio Contacts

The Byrd "Little America" antarctic and the Fahnstock "South Sea" expeditions have been added to R.C.A. Communications, Inc., point-to-point radio telegraph transmitting station at Rocky Point, N. Y., by authority of the F.C.C. This is to enable members of the expeditions to receive programs especially addressed to them and broadcast by radio stations in the U. S.

It was in the form of special temporary authority for the R.C.A. station to communicate with United States Antarctic Service Division, Department of the In-

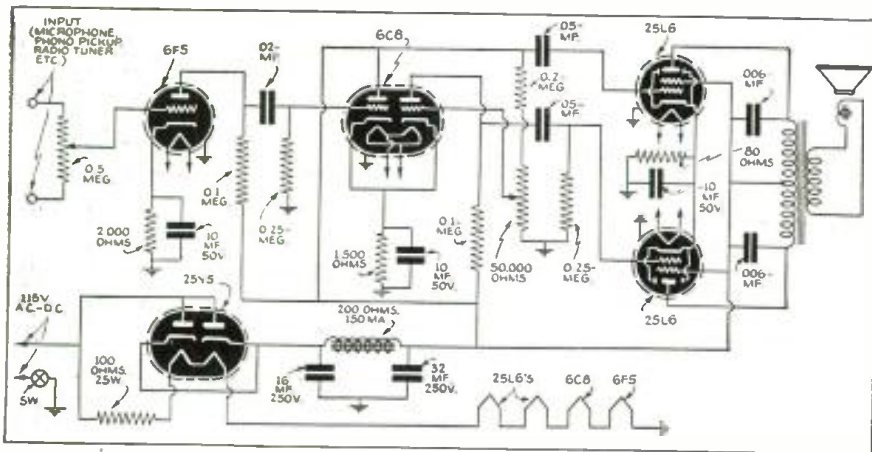
terior, at Little America, and with the Fahnstock South Sea Expedition aboard the yacht "Director II" for contact control purposes only, for a period not to extend beyond the current year, provided that no interference is caused to the regular point-to-point service for which the Rocky Point station is primarily licensed.

Additional R.C.A. point-to-point stations at Bolinas, Calif., and Kahuka, Hawaii, were authorized to furnish contacts to the Fahnstock expedition on a like temporary basis.

SMALL PORTABLE AMPLIFIER

● A SMALL portable amplifier for use by traveling lecturers and other persons is described in *Radio Revista* of the Argentine. The unit is claimed to afford good bass reproduction and to furnish an output of approximately 5 watts from its final push-pull stage.

It will be noted that the unit makes use of the highly desirable phase inversion system, the stability of which depends largely upon the precise value of the resistors employed. The amplifier has enough push to drive a 10" or 12" loudspeaker; a transformer using a 4,000 ohm primary, with center tap, is suggested. The filaments are connected across the 115 volt A.C. or D.C. line in series with a 100 ohm, 25 watt resistance.



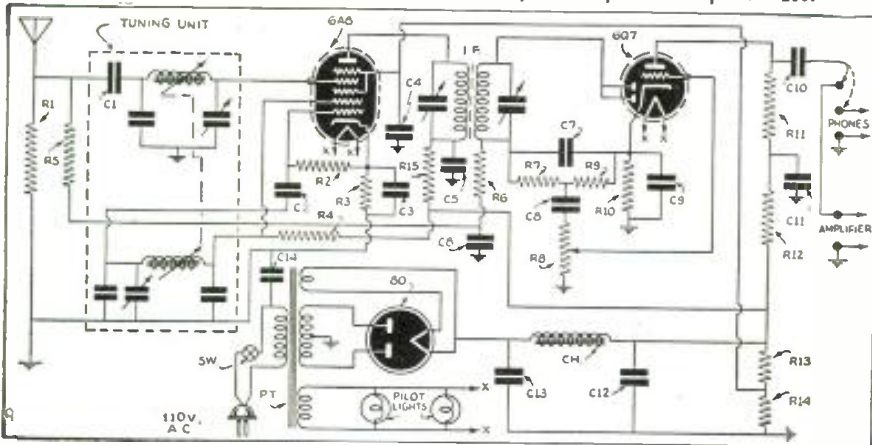
Portable amplifier delivers 5 watt output to 12" drive loudspeaker.

HIGH FIDELITY TUNER

● *Radio Revista*, Buenos Aires, has published a diagram of a high fidelity tuning unit which makes use of permeability tuners. The tuning unit which is indicated by the dotted lines is standard; the values of the other circuit components are shown. A simple switching system permits the output to

be switched either to a pair of head phones or to a high-fidelity audio amplifier. In this circuit the 6A8 is used as the mixer and the 6Q7 as detector. Although the circuit shows a built-in power supply, voltages may be drawn from the amplifier with which the tuning unit and detector are used.

Permeability tuning unit marks high fidelity adapter for phone or speaker use.



BRITISH TELEVISION DEVELOPMENTS

● SEVERAL new developments in television have been reported in Britain's *Television and Short Wave World*. One of the most interesting is a means of preventing the formation of ion blemish, while permitting greater screen brilliance. In this system, the fluorescent material is mounted in a thin compartment at the end of the vacuum tube, and is in loose or powder

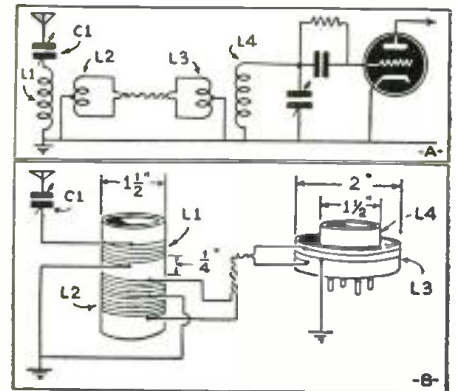
form. This not only permits a greater thickness of fluorescent material and eliminates the need for binder, but makes it possible to remove blemish merely by shaking the tube. The fluorescent layer may be as much as 1 millimeter (.04") thick.

Other patents permit advertising inserts, prevent blurring due to rapid motion, make fadeouts possible, etc.

Latest Circuits
from the
World's
Leading
Publications

INTERFERENCE-FREE ANTENNA COUPLING

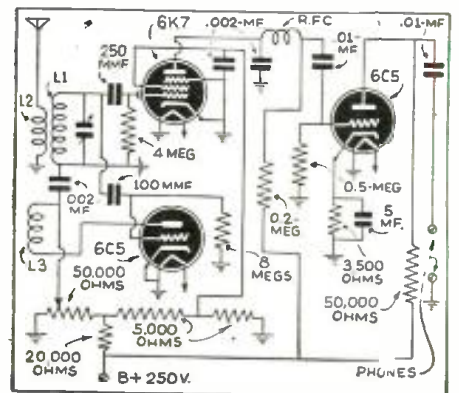
● AN ingenious system of coupling the antenna to a radio receiver when a fairly long lead-in must be used is described in *CQ*, a German publication. Fig. A shows the system while Fig. B shows the detail of the two couplers. The transformer consisting of windings L1 and L2 may be placed near the point of entry of the lead-in, while the other transformer, L3 and L4, is positioned directly at the receiver. In the former, L1 consists of four turns and L2 of six turns with a space of .2 inch between them. L3 is a four turn winding, while L4 consists of the requisite number of turns to make the receiver tune to the desired band; plug-in coils may be used at L4. The antenna tuning condenser, C1, may be a trimmer or a midget variable condenser.



Eliminates lead-in interference.

SEPARATE REGENERATION TUBE

● A SIMPLE and efficient regenerative receiver for use on either the short wave or broadcast bands was recently described in *Radio Tecnica* of Buenos Aires. One unusual feature is that it uses a separate tube—a 6C5—to provide regeneration. The circuit is simple and easily followed. The values of coils L1, L2 and L3 together with the main tuning condenser connected across L1 will depend upon the bands which one wishes to cover. The set may be powered from any standard power supply and if earphone reception is not desired may be connected to any type of audio amplifier, which will permit it to operate a loudspeaker. The advantage claimed for this circuit is that the separate regeneration tube permits the detector to operate at maximum efficiency and affords excellent control of regeneration.



Smoother regeneration control.



A Frequency Modulation Converter

Ricardo Muniz, E.E.

Set construction by Jerrier Haddad

Hot off the griddle comes this "frequency modulation" converter—especially designed for R. & T. by Mr. Muniz. This converter will enable you to receive F-M programs on your present broadcast receiver. The next article will explain the construction of a suitable audio frequency amplifier to operate with it.

● THE converter described in this article will enable you to receive the new F-M (frequency modulation) programs through your own broadcast receiver. By connecting the output of the converter to the phono input connections on your regular broadcast set you can use the audio amplifier system already built into it. In the next article two audio amplifiers will be described for those who wish to have a complete F-M receiver as a unit separate from their present broadcast receiver. One will be a good *low cost* audio amplifier—the other a high fidelity amplifier, still inexpensive as such "animals" go, but somewhat more expensive than the first.

What Is Frequency Modulation? A few words about frequency modulation may help the home constructor to better understand the system and will aid him in adjusting the converter to get the best results. Frequency modulation differs from the present standard amplitude modulation in two major respects. First in the method by which changes in loudness of the original sound are transmitted. Changes in the loudness of the sound to be transmitted cause *changes in the frequency* of the (radio frequency) signal radiated from the antenna. The louder the sound the further the transmitted frequency will deviate from the steady or unmodulated carrier frequency. The loudest sound which the system will transmit will cause the transmitted frequency to change by 75 kc. above and below the steady carrier frequency. The frequency or pitch of the sound will determine how many of these excursions in frequency will take place in each second. For example: To transmit a sound of the maximum loudness and of 500 cycle pitch, the transmitted frequency will fluctuate above and below the steady carrier by 75 kc. 500 times a second.

How Is Frequency Modulation Received? If the original sound produced in the broad-

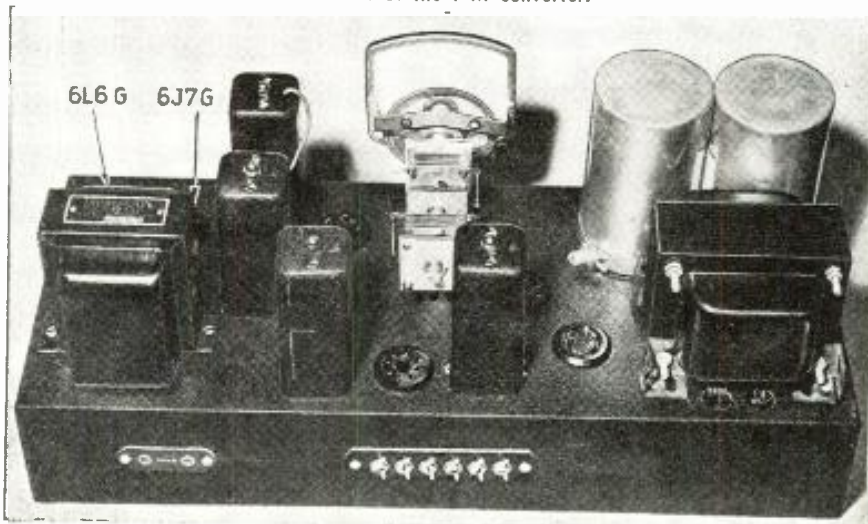
casting studio is to be heard issuing from the loud speaker of the F-M receiver it is necessary, after receiving the radio signals and amplifying them enough, to translate the frequency excursions of the transmitted waves back into *amplitude changes* and the rate at which these excursions take place back into audio frequencies. This is accomplished by the so-called *discriminator* circuit. The discriminator is really the *detector* of the F-M receiver. In essence the discriminator is a somewhat modified A.F.C. circuit. These discriminator circuits take many forms. The most important design requirement is that it must have a linear response to changes in frequency. It must translate excursions in frequency of the transmitted waves into corresponding changes in amplitude of audio frequency voltage to be fed to the audio amplifier. In the discriminator also the rate of these excursions is changed into an audio frequency

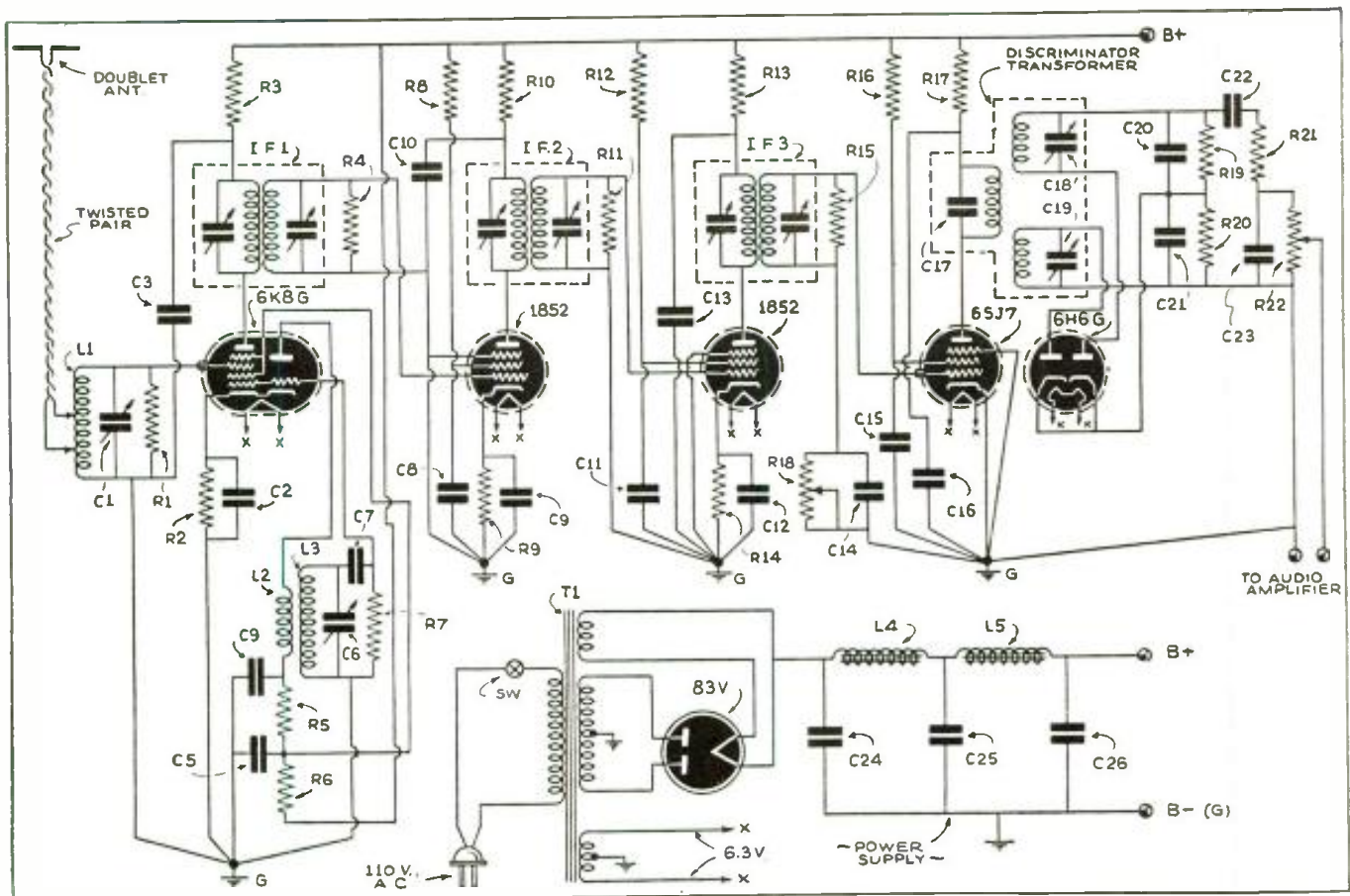
voltage. The most common failing is a compression of the range of volume of sound due to non-linear response of circuits. In general there is no great tendency to reproduce one audio frequency better than another. In a large measure this characteristic contributes to the high fidelity of F-M receivers.

How Is Noise Cut Down? In all F-M receivers you will find a *limiter* tube and circuit. It is the function of the *limiter* to cut out the static and noise. Noise is amplitude modulated. The limiter acts as a "gate" which limits the input to the discriminator to a constant amplitude. As long as the received signals are amplified to a greater amplitude than the gate will pass, noise signals having less amplitude haven't got a chance. It is a characteristic of the *limiter circuit* that it will respond only to the stronger of two signals, provided one is at least two times stronger than the other. This characteristic not only makes it possible to filter out static, but also will make it possible to put F-M transmitters quite close together. As long as one is two times as strong as the other in a given location—only one will be heard, *even though they are on the same assigned carrier frequency!*

The *limiter tube* is usually a tube with a low applied plate voltage, which will give the same voltage output for a wide range

Rear view of the F-M converter.





Wiring diagram of the F-M converter—it works with your present receiver.

of voltages input. The usual signal potential required at the grid of the limiter before limiter action begins is in the order of 5 volts.

Choice of Circuits for the Converter: Due to the amount of signal voltage required at the grid of the limiter it was decided that a superheterodyne type of radio receiver must precede this stage. At the high frequencies employed for F-M broadcasting (40 mc.-44 mc.) radio frequency amplifiers have very little gain. By using a Triode-Hexode converter (Raytheon 6K8G) and two stages of intermediate frequency amplification employing high gain television type pentodes (type 1852) it is possible to obtain ample signal at the limiter within the service area of the F-M transmitter. The intermediate frequency chosen was 1.7 meg. Meissner I.F. transformers were employed, which required only slight modification. A duo-diode pentode, 6B8G, was used as *limiter-discriminator*. The use of the 6K8G multi-purpose tube cuts down the number of tubes in the set to FIVE, not including the power supply rectifier. It will be noted that R_{17} is high, to reduce plate voltage on the pentode 6S17—used as a limiter—to the proper value. Note also the bias arrangement on the limiter, which makes R_{15} the control of level of limiting. The range of this control is of course not very wide. The discriminator circuit used with the duo-diode 6H6G is not usual and is worthy of comment in passing. You will note on examining the circuit diagram that two separate tuned circuits are coupled to the primary coil of the discriminator transformer. One of these is tuned 100 kc. *below*

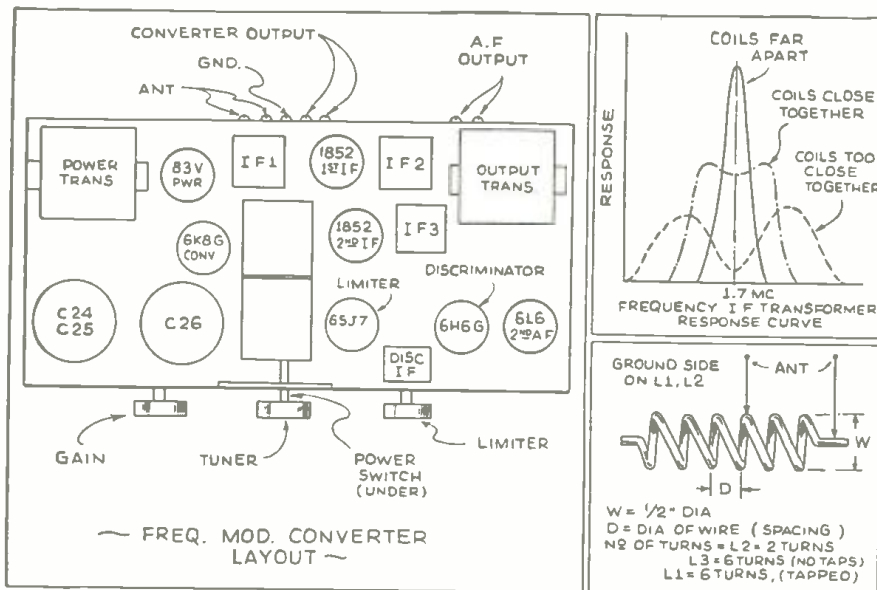
the I.F., the other 100 kc. *below* the I.F. As the transmitted signal experiences frequency excursions the I.F. will also, in proportion. The frequency excursions above steady state I.F. will induce voltage into the upper tuned circuit and produce audio voltage across R_{19} . Those below steady state will induce voltage in the lower anti-resonant circuit and produce audio voltage across R_{20} . The polarities of these voltages will be such that they will *add*, giving two times the audio voltage that a single anti-resonant tuned circuit and a single diode section would produce. C_{22} , R_{21} and C_{23} form an *equalizer* circuit. The transmissions by F-M are all *over-compensated* to give stronger than normal transmission of the higher sound pitches. It is necessary to re-equalize or *compensate* in the receiver to flatten out the audio output to normal at all frequencies. The mode of transmission employed further improves the signal-to-noise ratio characteristics of the F-M system.

The converter circuit used is conventional for triode-hexode tubes and has values suitable for the frequencies employed. L_1 , L_2 and L_3 are home-made and carry radio frequencies. Refer to the sketch for details of number of turns, spacing, diameter, etc. I.F. 1, 2 & 3 are Meissner I.F. as specified in the parts list, which have had their windings pushed closer together on the wooden dowel stick. The I.F. amplifier circuits are conventional except for the use of the high gain 1852 tubes. Circuit constants have been chosen which are suitable for these tubes.

Constructional Tips: Let us consider first the modification of the I.F. transformers.

It is necessary to push the coils closer together because the I.F. system must pass a rather *wide band* as compared with the usual requirement of amplitude modulation. Pushing the coils closer together will broaden the response of the I.F. transformers. They should be pushed together to about $\frac{1}{4}$ inch. See sketch which shows what happens as we push the coils together. You will note that instead of a high sharp peak we get a double-humped response curve of lower value. If we get this just right, the humps are not tall enough compared to the valley between them to seriously affect the response; at the same time the broadness of the curve will be ample to pass the required band of frequencies. If you are lucky enough to have suitable sweep type signal generator and oscilloscope you can get a very "fussy" adjustment of the I.F. band pass. For all practical purposes, however, pushing the coils to within $\frac{1}{4}$ inch will be fine.

The author found discriminator transformers to be quite expensive. It was decided to use an I.F. transformer of the same type as used in the I.F. amplifiers, and alter it for use as the discriminator transformer. This was accomplished by taking one coil off an extra I.F. and slipping the extra coil on the same dowel stick. Thus we have three coils on the I.F. transformer which is converted for use as discriminator transformer. The three coils should each be about $\frac{1}{4}$ " apart. One of the trimmers is also "swiped" from the same I.F. from which we took the extra coil and mounted in the side of the "new" discrim. transf. Thus our discrim. transf. has three close-spaced coils and a total of three trimmers.



Above—Rear view of the F-M converter, also I-F resonance curves and coil data.

It was found that the hard wax with which these I.F.'s are impregnated did not melt off readily and it was therefore chipped off very carefully in order to permit sliding the coils as described above.

If the layout shown in the drawings and the photographs is followed, little trouble will be experienced. Remember that in the converter stage we have ultra-high frequency. Ultra-high must be treated very carefully. The *distributed inductance and capacitance* of leads assumes a very large importance in u.h.f. wiring. *Long leads must be avoided here!* Do not run u.h.f. leads near the chassis. Do not mount u.h.f. parts close together or close to the chassis!

The use of the 1852's in the I.F. introduces some problems. Remember the amplification factor of these tubes is 6750 (transconductance 9000 micromhos). Do everything possible in your wiring to reduce grid-to-plate coupling in the leads. With careful wiring no tendency to oscillate should be encountered.

The most satisfactory way to align the

outfit is by use of signal generator and oscilloscope. It can be done with signal generator and output meter, or "by ear" without any instrument. If the constructor will bear in mind the function of the various circuits, lining up should be a straight-forward operation.

The *input* to the set from the antenna is matched to the feeder impedance by adjusting the taps on the input tuned circuit. Those shown in the diagram of this coil will probably be fine, if you don't want to fool with it. C_4 is adjusted to give the correct oscillator frequency—that is the one which produces 1.7 meg. I.F. by use of its trimmer. The broadened I.F.'s are adjusted by means of their trimmers so that the unmodulated I.F. falls in the center of the response of the transformer. Trimmer C_{17} on the discriminator transformer is also adjusted to I.F. frequency.

Trimmer C_{18} is adjusted to 100 kc. *above* I.F. freq. and trimmer C_{19} is adjusted 100 kc. *below* I.F. freq. With these adjusted in this manner the linearity of the discrim-

inator is adequate. This adjustment is extremely difficult without the use of a signal generator and output indicating device. If this adjustment is attempted by ear on signal, it will probably be made incorrectly.

A simple audio amplifier is mounted on the converter chassis; to be described next month.

F-M Receiver Parts List

- I.R.C. (Resistors)**
 5—10,000 ohm resistors, BT-1 (R1, R4, R6, R11, R15)
 1—400 ohm resistor, BT-1 (R2)
 1—5,000 ohm resistor, BT-1 (R3)
 3—1,000 ohm resistors, BT-1 (R5, R10, R13)
 1—50,000 ohm resistor, BT-1 (R7)
 2—60,000 ohm resistors, BT-1 (R8, R12)
 1—150 ohm resistor, BT-1 (R14)
 1—90,000 ohm resistor, BT-1 (R16)
 1—20,000 ohm resistor, BT-1 (R17)
 1—100,000 potentiometer, CS
 3—100,000 ohm resistors, BT-1 (R19, R20, R21)
 1—500,000 ohm potentiometer, CS

CORNELL-DUBILIER

- (C17, 18, 19 are in I.F. transformers)
 2—35 mmf. mica condensers (C1, C6)
 2—.01 mf. 600 V. condensers, DT-651 (C2, C3)
 12—.05 mf. 600 V. condensers, DT-655 (C4, 5, 8, 9, 10, 11, 12, 13, 14, 15, 16, 22)
 1—.0001 mf. mica condenser (C7)
 2—.00005 mf. mica condensers (C20, C21)
 1—.001 mf. mica condenser (C23)
 2—8-8 mf. (dual) 450 V., EA8801 (C24, 25, 26)

BUD

- 1—S.P.S.T. toggle switch, No. SW1003
 1—"ON-OFF" plate for switch, SW1036
 Insulated mounting strips, TP369
 1—2-jack tip-jack, cat. No. TJ3338
 2—Phone tips, cat. PT-231

PARMETAL

- 1—DF77 chassis and cover, 7" x 17"
 1—Bottom cover plate, BP4515

HAMMARLUND

- 2—MEX-30 trimmers.

RCA (Tubes)

- 2—Type 1852

AMPHENOL

- 8—Octal sockets (S-8)
 1—4-prong socket (S-4)

BIRNBACK

- Size 18 solid push-back wire, No. 382
 Line cord and plug

CROWE

- 1—Rectangular wedge drive dial, No. 154
 2—Dial plates, No. 571
 3—Knobs, No. 286

RAYTHEON (Tubes)

- 1—6K8G
 1—6H6G
 1—6S17
 1—83-U

R & T '40 Communications Receiver

R. P. Adams, W6RTL

Part 1 appeared in the last issue

6. The three-gang, three-circuit, five-way switch (Sw1, Sw2, Sw3) is now disassembled and the wafers respaced so that they are fairly close together. Leads are brought from the second switch section to the coil plate terminals. And, finally, the aligner trimmers removed from the oscillator coils are connected between all but 160 meter terminals on the switch section nearest the panel and chassis ground. The selector terminal for this last section then goes up through chassis to the insulated rotor terminal of C3. The selector terminal of the middle section goes to the stator terminal of this same oscillator tuning condenser, while the selector terminal of the section nearest the back of the chassis goes to the No. 2 or plate terminal of the 7A4 oscillator tube socket.

Bandpass Details

7. If you are to use *bandpass*, I-F transformers in pairs are placed together for

short interconnecting leads. Note that C_x and C_z , the bandpass coupling condensers, tie up short between the normal grid terminal of one transformer in any group and the normal plate terminal of the following transformer and that the coupling is completed by a common ground. If bandpass isn't to be used, decide whether or not it may be eventually added and make room for the additional transformer or not, as you wish.

8. Mount the AF driver transformer between the driver and output tube sockets, below chassis; and between it and the oscillator tank condenser line-up mount the volume control R24 on some sort of convenient and small piece of sheet metal.

First Check-up on Screen and Plate Voltages

9. Complete the wiring up to the *front end* RF coil connections. Check and recheck for proper continuity. Then build up the

power supply, whose construction we needn't discuss, due to its completely conventional layout. Place the tubes in their sockets, temporarily shorting Ant & Mixer 7A7 grids to ground (if RF coils have not yet been built) so that all tubes will be in operation, plug in the power supply, and check for proper voltages. Voltage at the plates of the 7C5s should be in the neighborhood of 300, with 250 at the screens (7C5s), 250 at RF-IF plates, and 100 at I-F screens. If the VR-150-30 voltage regulator is working properly, the measured voltage at the oscillator plate and Mixer screen will be exactly 150 and will show absolutely no variation from this value. RF and I-F cathodes, of course, will measure 3 volts with the RF gain control wide open.

Aligning I-F

10. We may now align the I-F channel. This is done, if you have no access to a

signal generator, by removing the crystal filter from its socket and placing it between the grid and plate of a simple Pierce oscillator built up from available junkbox parts.

The signal is coupled through a capacitor into the line between L12 and L13 and the L13 trimmers adjusted for maximum output. (The signal, while not modulated, will be readily distinguished.) Coupling is now moved back to the second 7A7 I-F plate and L12 adjusted. The process is repeated for L11 and L10, and the signal is finally introduced into the input line to the crystal filter, the filter unit aligned, and then all I-F trimmers carefully re-trimmed for maximum overall output. The beat oscillator may now be turned on and adjusted for a beat with the generated signal.

11. Decide upon the RF band or bands in which you are primarily interested (if you can only acquire two or a limited number of coil forms to start with), then whether you are to feature bandspread or general coverage. With general coverage, remember, you will not use series trimmers in the tuned oscillator circuits; the third switch section will have been eliminated and the oscillator tuning condenser rotor connected directly to chassis ground, putting the whole 50 mmf. of available tuning capacity across the tuned circuit.

Tank the oscillator circuits for the bands in which you are interested to the high frequency limits of these bands. This may be done for any band by connecting a temporary coil, judged to hit fairly close to the band's high frequency limit, across the mixer tuning condenser, by then connecting a short antenna directly to the grid of this coil, by adjusting the selector switch for the proper related oscillator inductance, and by finally tanking the latter inductance (with the related shielded condenser on which the inductance is mounted) until signals of known frequency marking the upper frequency limit of the band are heard. If bandspread is required, the proper related series trimmer is then adjusted until the desired spread is had.

Antenna & Mixer Inductances

12. Now build your Antenna and Mixer inductances, following constructional data given. Bear in mind that this data relates to coils which may be used for either general coverage or amateur bandspread application. Bear also in mind that whatever the application, the Ant. and Mixer tuning condenser stator leads **MUST** tap down on these coils in order to effect a proper track with oscillator tuning. The oscillator circuit minimum C, remember, is relatively high; and an amount of capacity change across that circuit will provide considerably less range of frequency change than the low minimum C RF circuits. Proper tapping, incidentally, should be determined experimentally for each pair of RF plug-in coils—and then only **AFTER** the desired bandspread has been effected in the oscillator circuit and that oscillator circuit tanked to high frequency band limit. The tapping will be correct when the noise level is the same strength across the complete range of dial control.

Coil Considerations

If you cannot get the specified coil forms, make sure that those you purchase have at least five prongs, that the substitutes are of standard 1½" diameter, and that some sort of behind-panel shielding is provided. (Two 3" diameter shields are called for.) These should be closed at one end, and the closed ends stamped or drilled for the installation of steatite or isolantite sockets. Mounting covers, open-centered to permit the plugging-in and removal of coils, will be required. Coils should have 3-30 mmf. trimmers installed within them.

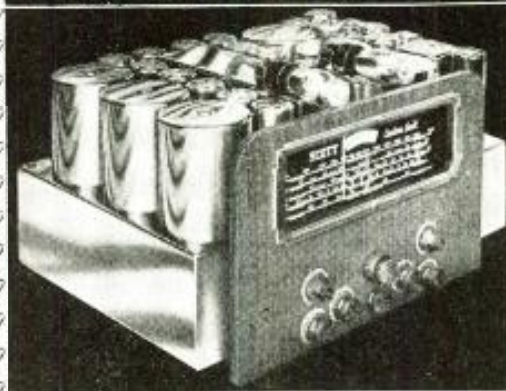
13. With coils built and the circuits roughly aligned, the overall front-end set-up should be repeated and retracked for each band. That is, oscillator shielded tanks should be adjusted for high frequency band limit spotting, oscillator series trimmers adjusted for desired bandsread (if any), Antenna and Mixer coils (plug-in) then tanked (with the built-in trimmers) for a proper high frequency limit match with the oscillator, and, finally, Antenna and Mixer coils stator-tapped for an exact cross-band track.

Filter Adjustment

14. With a good strong CW signal being received, the crystal filter switch should be opened (turning the phasing control to extreme right closes it and shorts out the crystal) and the unit's inductance trimmers adjusted until as the RF tuning is swung

back and forth across this signal, it breaks in with a sharp, readily distinguishable 'ping.' The filter is now properly adjusted and the other I-F transformers in the line-up should be carefully re-peaked to exactly series-crystal frequency (maximum signal level). Close the crystal shorting switch, removing the filter from effective operation, pick up an amateur 'phone signal in the crowded 20 or 80 meter band, and adjust the bandpass coupling capacitors Cx and Cz until splashover interference receives maximum attenuation—with the speech signal remaining still intelligible. Once a suitable Cx-Cz adjustment is effected, re-peak all I-F circuits **EXCEPT** those in the crystal filter unit and then make it a point to leave the Cx-Cz adjustment alone, as any variation in their values and thus the bandpass coupling will affect the I-F transformer peaking to some small extent.

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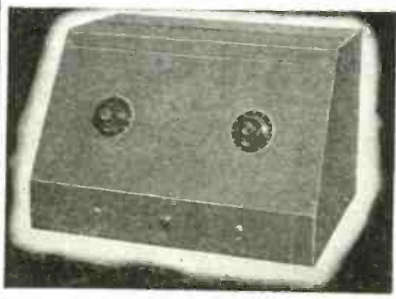
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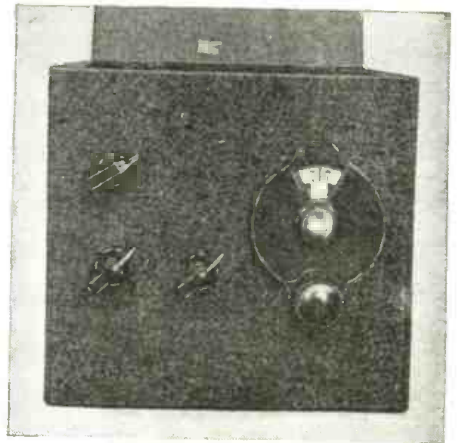
Harry D. Hooton,
W8KPX

This converter permits reception of 2.5 meter waves on your present receiver.

● THE 2.5 meter transceiver, described by the author on page 526 of the January 1940 RADIO & TELEVISION, has proved to be very popular. Many correspondents, however, wrote that they already had a good communications receiver that covered all of the bands down to and including ten meters, or even five meters in some cases, and would much prefer a converter covering both the 56 and 112 megacycle (5 and 2½ meter) bands. Accordingly, we stripped down the transceiver, added a few parts and we now have the converter unit to be described in this article.

Surprising as it may seem, some of the new tubes recently released, particularly the later loktal types, are almost as good for five meter work as the older acorn tubes. For the 112 megacycle region the new loktals are superior to any types that we now have, with the exception of the acorns, and a fairly efficient and inexpensive receiver or converter unit can be constructed easily. The converter to be described herein uses the new type 1232 as a mixer; the oscillator shown in the photographs is a metal 6C5. Better results can be obtained

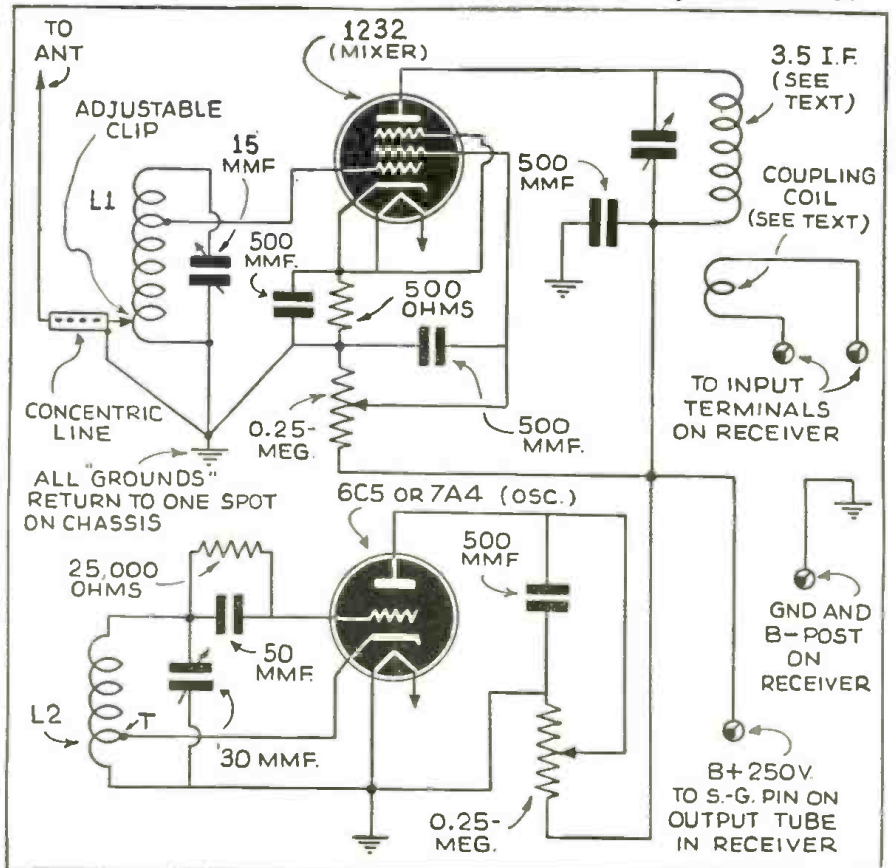
Converter



The 2½ meter converter.

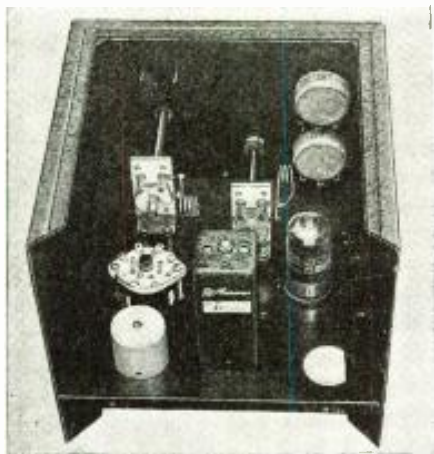
by using a loktal type oscillator tube, such as the 7A4, which is similar to the older 6J5. The oscillator stability using the 6C5, however, is surprisingly good. On five meters, the crystal-controlled stations are tuned in with the same ease that one operates the conventional superhet receiver on the lower frequency bands. There is no modulation hum whatever on this band and the converter may be used for the reception of C.W. code signals; on 112 mega-

Fig. 1. Wiring diagram of converter.



cycles, there is a slight modulation hum on the carrier when an A.C. supply is used on the filaments but it is in no way objectionable and is not noticeable when receiving a modulated signal.

The construction and operation of the unit is quite simple. As Fig. 1 shows, only two tubes are used—a 1232 non-regenerative mixer and a 6C5 or 7A4 oscillator. The mixer circuit is almost conventional in every detail, the grid being tapped down on the coil to obtain a better impedance match. The oscillator circuit is similar to that used in many low-frequency converter circuits and the radio student will have no difficulty in recognizing it as the "grounded" plate Hartley type. The tuned circuits are, as one might expect, quite small in size both physically and electrically, consisting of



Interior view of converter.

coils only $\frac{1}{2}$ " in diameter and 15 and 30 mmf. tuning condensers. The oscillator operates on the low-frequency side of the R.F. signal, curiously enough, to produce the I.F. beat frequency. This gives much better stability on the "ultra highs" and helps to eliminate image interference. The tuning condensers are not ganged. The 30 mmf. oscillator tuning condenser is rotated by the vernier dial; the 15 mmf. mixer tuning condenser is attached to an insulated $\frac{1}{4}$ " shaft and brought out to a knob on the front panel. In this manner it is a comparatively easy matter to keep the two tuned circuits in proper tracking. Both condensers, and for that matter, all of the other parts, are insulated from the chassis. Whenever it is necessary to make a chassis or "ground" connection, an individual wire from that particular part runs to the spot selected on the chassis for the single common ground. Keep all of the wiring, both the "hot" and the "cold" leads, as short and direct as possible; one must remember that on 112 mc. even a very short piece of wire may have considerable inductance and if there is much turning or twisting of the lead, it actually may become an effective radio frequency choke! Avoid the use of soldering lugs or clips as much as possible, soldering directly to the parts themselves.

Two 250,000 ohm potentiometers are used, one in the screen grid circuit of the 1232, the other in the plate circuit of the oscillator, in order to adjust the voltages applied to each for best conversion gain and the greatest signal-to-noise ratio. In several experiments, using a small inexpensive communications-type receiver, such as the

"Sky Buddy" or some similar apparatus it was found that in most cases the power for the converter unit can be taken from the receiver. A 6.3 volt filament transformer (or a 6-volt battery) should be used to supply the heater current; the "ground" connections of the converter and the receiver are tied together, as shown, the B-plus connection being made by slipping a connector over the screen pin of the output tube in the receiver.

The I.F. frequency is about 3.5 mc. The transformer used here is a Meissner iron-core, 2,000 kc. type with a portion of the winding removed. The coupling coil consists of approximately 25 turns of No. 30 d.s.c. enameled wire, close-wound near the "cold" or ground end of the tuned coil. An ordinary twisted pair is used to connect the pickup coil to the input of the receiver. It may be necessary to shield the twisted pair or cut down its length in order to prevent 3.5 mc. signals from feeding into the receiver while the converter is being used.

Almost any type of ultra-high frequency antenna may be used with the converter. The use of beam antennas, however, is desirable, especially if the unit is to be used for the reception of amateur frequency-modulated signals. Much information on various types of 56 and 112 mc. antennas may be obtained by referring to past issues of this magazine or the standard amateur handbooks.

Parts List—2.5 Meter Converter

NATIONAL CO.

- 1—15 mmf. midget tuning condenser, type UM-15
- 1—30 mmf. midget tuning condenser, type UM-35 (two plates removed)
- 1—"One-ten" receiver cabinet, black crackle finish
- 1—Vernier dial, type BM, 0-100-0 scales
- 1—Isolantite socket, midget, 8-prong type

MEISSNER

- 1—Iron-core I.F. transformer, input, 2,000 kc. See text.

NATIONAL UNION

- 1 Type 1232 "loktal" tube
- 1—Type 6C5GT or 7A4 tube. See text.

I.R.C.

- 2—Volume controls, 250,000 ohms

BUD

- 2—Insulating shafts, $\frac{1}{4}$ " bakelite.

CORNELL-DUBILIER

- 4—Mica condensers, midget type, 500 mmf.
- 1 Mica condenser, midget type, 50 mmf.

I.R.C.

- 1 Fixed resistor, 500 ohms, 1 watt
- 1 Fixed resistor, 25,000 ohms, $\frac{1}{2}$ watt

AMPHENOL

- 1—Low-loss mica-filled socket for 1232 tube

MISCELLANEOUS

- 1—Set coils as follows:

2½ meter coil:

112 mc. oscillator, 1 turn No. 18 bare tinned hookup wire $\frac{1}{16}$ " diameter, tapped at about $\frac{1}{3}$ turn from the cold end.
112 mc. mixer, $1\frac{1}{2}$ turns No. 18 bare tinned hookup wire $\frac{1}{16}$ " diameter, tapped $\frac{3}{4}$ turn from each end.

5 meter coils:

56 mc. oscillator, $3\frac{1}{4}$ turns No. 18 bare tinned hookup wire, $\frac{1}{16}$ " diameter, tapped 1 turn from cold end.
56 mc. mixer, $4\frac{3}{4}$ turns No. 18 bare tinned hookup wire, $\frac{1}{16}$ " diameter, tapped $1\frac{1}{2}$ turns from each end.

Above coil values are approximate only. In actual practice the amount of turns will vary slightly and it may be necessary to squeeze or pull out the coils slightly in order to make them cover their specified ranges.



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10 Meter Mobile Rig

Part 3—Conclusion

Howard G. McEntee, W2FHP

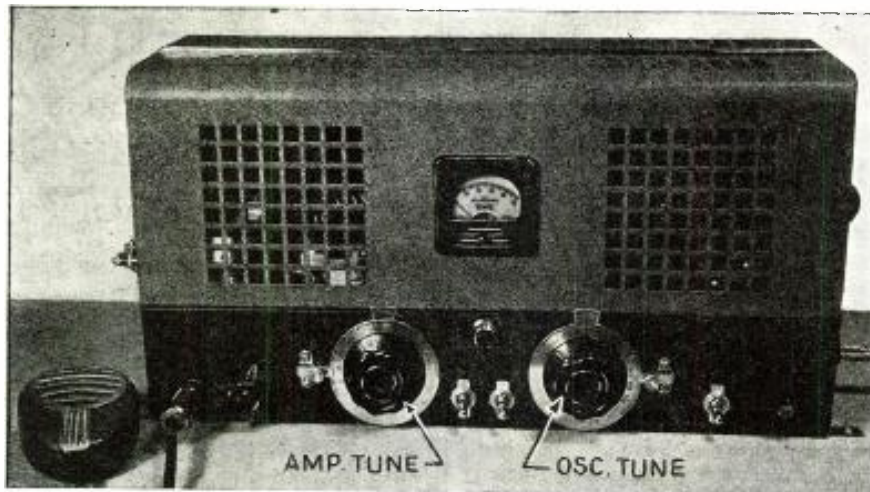


Fig. 1. Completed transmitter ready for installation. Note the dial locks; these are very important.

● **CONSTRUCTION** of the transmitter follows the usual lines and is quite orthodox in most ways. The parts are laid out on the chassis and marked (use red pencil for this as it is easier to see); then the various holes are cut.

Mount all sockets first, then fasten the tuning condensers in place. Since they must be insulated, butt-in insulators are used for the purpose, four to each condenser. A hole at least $\frac{3}{4}$ " in diameter should be made for the shafts to obviate shorting. Mount the dials and the dial locks in place. The latter are National ODL and are an absolute necessity since jarring of the car causes unlocked condensers to vary in a short time.

The Carter motor-generator is mounted last, and must be raised above the chassis about $\frac{1}{2}$ " on bushings to clear various insulators and screw heads.

The shield shown in Fig. 4 is of copper bent to shape and held by soldering lugs.

Probably the most important point in obtaining trouble-free operation is the heavy ground lead which runs the length of the chassis. All ground connections should be made to this bus, rather than to chassis or other points. The bus connects directly to the grounded battery lead at the battery input prongs.

Watch Voltage Drop in 6 Volt Circuits

The greatest care must be taken throughout to reduce voltage drop in all the 6 volt circuits to an absolute minimum. Thus, the red heavy lead from the power unit connects directly to the ground battery prong (positive is grounded in this particular installation) while the black heavy lead runs direct to the antenna relay, No. 2, which also serves to turn on the power supply.

A 30A (30 ampere) fuse is used in the holder, and while it produces a drop in voltage of about $\frac{1}{4}$ volt the protection afforded is considered worthwhile. From the fuse holder to the power relay (RY No. 2)

two No. 12 pushback leads were run in parallel.

While a voltage drop in the generator leads will cause a reduction in the available high voltage (but will do no real damage), a similar drop in the heater leads will cause the power amplifier tube to lose emission, which indeed is serious. Therefore, every effort must be made to supply as near full rated heater voltage to the tube as possible. Keep the battery cables as short as possible and make them no smaller than No. 10.

The final amplifier coil was made plug-in, so that the outfit could be used on 5 meters with the least trouble. The fixed link is snipped off and a three-turn link of pushback substituted. Wrap the turns with tape and shove the coil in between the last two turns of the final tank at the ground end. The coupling coil should have one end grounded at the coil socket; a lug under one of the socket mounting screws will do the job. A heavy lead should then be run from

Parts 1 and 2 of this series appeared in the April and May issues. The first article explained how to build a simple one-tube converter, the output of which feeds into a regular auto broadcast receiver.

the same screw under the chassis to the ground bus.

The oscillator coil, L1, is composed of $6\frac{1}{2}$ turns of No. 12 wire, $\frac{5}{8}$ " inside diameter and $1\frac{1}{4}$ " long. The coupling condenser to the HY60 grid may be hooked directly to the hot end of L1.

Subsequent testing has shown that increased output may be had by replacing the grid-leaks of both the 6J5 and HY60 with 10,000 ohm units. If these are of the 10 watt wire wound type, no R.F. chokes will be required at these points. Also, a 5000 ohm resistor was inserted in series with the oscillator plate supply to reduce the voltage somewhat.

The RF section should be put in operation first, with the audio tubes removed. This means that the generator output must be dropped somewhat. The simplest way to do this is to temporarily connect about 10 feet of No. 20 pushback in series with the generator hot A lead.

After allowing the tubes to warm up, turn on the high voltage with the meter in the oscillator circuit. Rotation of C3 should cause a sharp dip in plate current, showing that the crystal is oscillating properly.

The grid current of the amplifier tube should now be checked, and should run between 2 and 4 ma.

Rotate C4 to resonance, whereupon the plate current of the amplifier should drop sharply. Now hook a 10 watt lamp to the

Fig. 4. A copper shield separates the audio equipment from the final amplifier. The heavy ground lead is a great help in "bug" elimination.

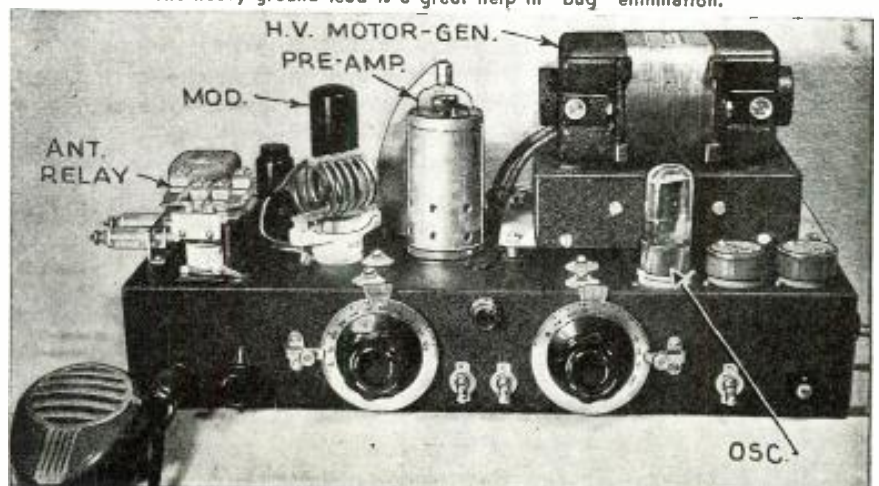




Fig. 2: The complete installation includes transmitter, battery, charger and antenna. Placement of these components will vary with different makes of cars, but battery leads must be kept short.

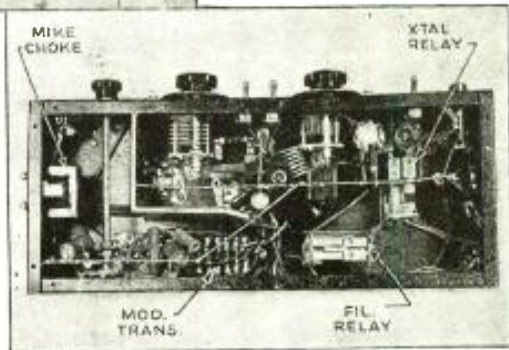


Fig. 3: Parts are mounted without crowding, which contributes to long trouble-free operation. The shield on the final amplifier may be omitted if desired.

output terminals and adjust the coupling coil, L3, so that the bulb lights.

Final Operating Check

We are now ready for the final operating value checks. Insert the audio tubes and remove the temporary generator series resistor. The following values should be obtained: 6J5 plate voltage, 250V.; plate current, 20-25 ma.; HY60 grid current, 2-3 ma.; screen current, 6-8 ma.; screen voltage,

Come on, Amateurs; tell us what you want! The editors are looking for good construction articles on amateur transmitters, receivers, and antennas — so send 'em along, with photos and diagrams. Don't forget amateur television! Let's hear from you, soon!—Editor

225V; plate voltage 350V; plate current 50 ma. These values are had when the coupling is adjusted to the proper value, and the lamp load bulb should light at full brilliancy.

At these values the current drain from the battery is about 21 Amps., but of course this drain is effective for a very short time only. When idling, the transmitter draws only about 2 amperes, so one battery charge will do for a great deal of operating.

Coupling from set to antenna was covered in the previous article, as was placement of the set. As pointed out before, it is imperative to have short heavy battery leads. If the plate current of the final amplifier rises to the proper value, then slowly drops down to a lower point, it is sure evidence

that there is excessive drop in the low voltage lines.

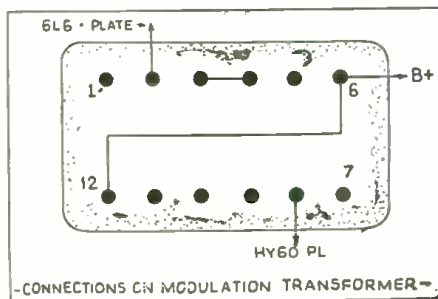
The meter on the dash reads combined plate, screen, and grid current, so that it will always read about 10 ma. higher than actual plate current as shown on the transmitter plate meter.

The control circuits at the operating position may be altered slightly by running the common connection between the crystal pilot light and the high voltage pilot to terminal 6 rather than to terminal 1 on the transmitter cable socket. This will make the lights operate when these circuits are in use rather than vice versa.

The crystal frequency in the original set shifts about 10 kc. when the relay is energized, and power output does not noticeably change. It is probable that a shift of even 20 kc. could be used, but after all, the idea of this arrangement is to shift only enough to get out from under QRM, so the crystals need be no more than 10 kc. apart in actual practice.

The whole installation has been found to work very smoothly in practice and the emitted signal is of good quality and stability.

As the construction is relatively simple and the efficiency good, this rig is well worth any Ham's time.



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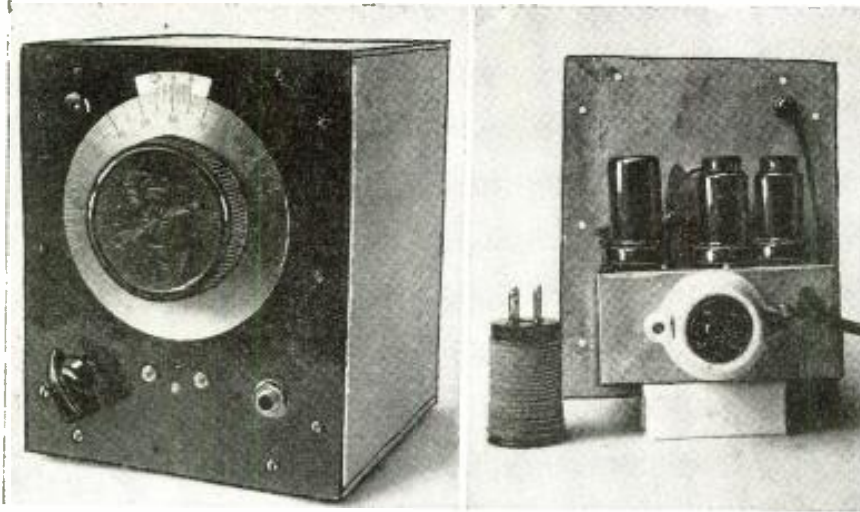
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A.C.-D.C. Frequency Meter

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Front and rear views of the frequency meter.

● A FREQUENCY-METER for average use in the amateur's station should embody the following features: it should provide an accurate means of checking transmitted frequency in accordance with section 152.44 of the F.C.C. regulations; it should be simple of construction as well as self-powered; it should be economical to build, yet have such quality of components that the performance is not impaired; and a most

desirable feature is the ability to check the frequency meter at almost any time of the day or night against known frequency transmissions.

The unit to be described fulfills the above requirements, the latter condition being accomplished by designing it to cover a portion of the *broadcast band* instead of one of the ham bands. Thus it can be put into service and checked against "marker" sta-

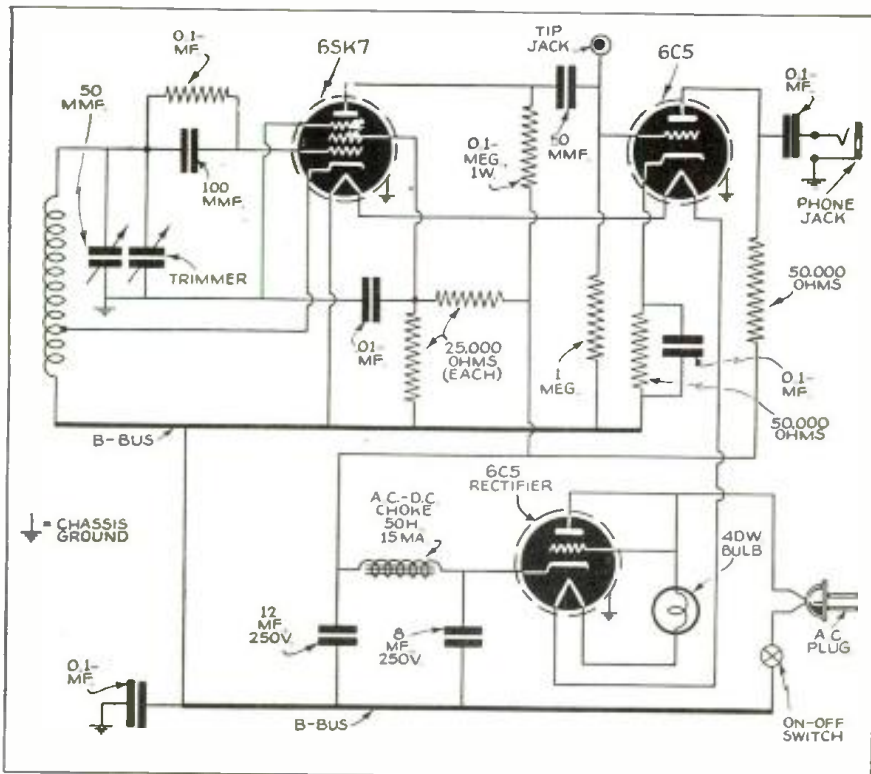
tions at almost any time without waiting for regular marker stations to be on the air, and, as broadcast stations maintain their frequencies to better than 10 cycles accuracy, it will readily be seen that a frequency-meter of the type described, having a finely graduated vernier dial, can be made to provide very accurate reference points for calibration purposes.

Oscillator

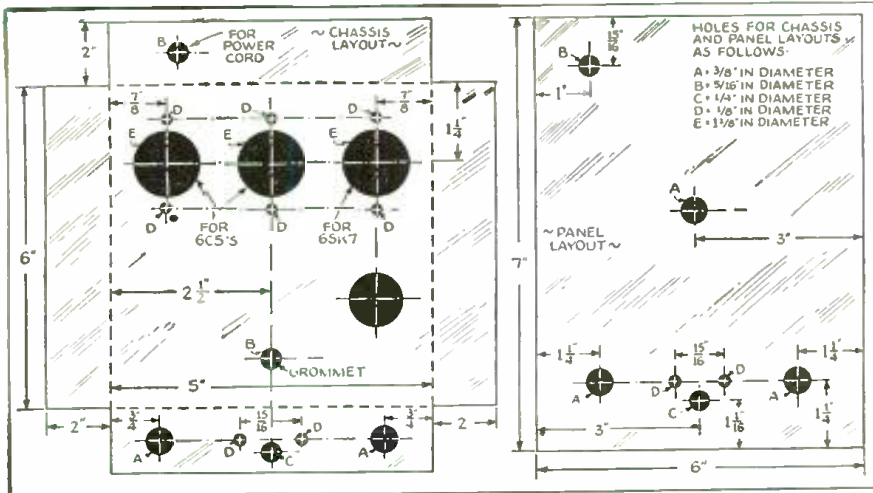
The oscillator circuit is the electron-coupled type, which is one of the most stable (and therefore one of the most suitable) circuits. Several types of screen-grid tubes may be used in the oscillator, although a type 6SK7 is used in the model described. Grounding the suppressor instead of connecting it to cathode improved the operation of the circuit. Plenty of band-spread is available to enable accurate checking against broadcast stations and to provide spread for the harmonics. Coverage is from 850 kc to 1,000 kc. and harmonics, therefore, cover all amateur bands at present in use.

This frequency meter will prove useful to every Ham, and will also prove valuable to students and others desiring to make frequency measurements.

Hook-up of the parts necessary for building the frequency meter.



This provides plenty of spread for ordinary amateur use but, for more precise measurements on 40 meters and the higher frequency bands where a greater spread is necessary, the tuning condenser can be made to tune over that portion of the broadcast band from 870 kc. to 940 kc., the 40 meter or 8th harmonic thus occupying a larger portion of the dial. This is done by removing turns from the coil and increasing the capacity of a trimmer condenser. By these means almost any amount of band-spread can be achieved. The trimmer condenser just mentioned is in parallel with the main tuning condenser and is incorporated for the purpose of re-setting the frequency-meter to zero-beat with a "marker" station if it is found that the setting has varied, as may be occasioned by a change in temperature, humidity, or warm-up drift. The trimmer is mounted on the front panel by means of the mounting screws provided with it and adjustment is then made with a screw-driver or similar tool inserted in the trimmer set-screw which protrudes through the panel. It would be more convenient to use a small variable condenser instead of the semi-variable type herein used, so that a bar knob may be used for varying the capacity of the trimmer. The reason one was not used in the model described is because the junk box yielded a semi-variable type of the proper capacity.



Dimensions for the chassis and panel are shown above.

The two connections from this condenser are brought up through a small hole in the chassis and soldered directly to the rotor and stator terminals of the main tuning condenser.

On the front panel is seen the tip jack for an external connection to the oscillator. A short piece of wire inserted in the jack provides plenty of radiation for zero-beating a signal against a "marker" station although this will not ordinarily be used as the oscillator generates strong signals. It will be seen from the circuit diagram that this external connection is made to the grid side of the plate coupling condenser.

Power Supply

The B supply is the conventional half-wave rectifier, operating from 110 volts, A.C. or D.C. This type of power supply has good regulation and is to be preferred where a stable source of B supply is of prime importance. A 6C5 with its grid and plate connected together acts as the rectifier tube, although almost any type of tube with the same filament voltage and current requirements can be used if the precaution is taken first to connect together all the grids and the plate. The filter consists of a single choke of high inductance and two electrolytic condensers.

Construction

The construction of the instrument should be evident from the photographs. The cabinet is home-built from scrap aluminum, and measures 6 x 7 inches with a depth of 8 inches. The chassis, also home-built, measures 5 x 6 x 2 inches and is of the same material also, although both do not necessarily have to be so. The controls seen in the front view (besides the antenna tip jack) are the ON-OFF switch at the bottom left, the trimmer condenser in the center just below the tuning condenser dial, with the phone jack to the bottom right. The interior view shows the coil, the 6SK7 tube, the 6C5 amplifier-detector next, and the 6C5 rectifier to the right.

The 40-watt Mazda light bulb which is used in place of a ballast tube or line cord resistor for dropping the filament voltage mounts through a hole in the rear wall of the cabinet with the bulb proper on the outside so that heat will be readily dissipated.

In constructing the instrument use fairly heavy hook-up wire and mount everything solidly. Scrutiny of the schematic diagram will reveal the fact that the negative return leads and one side of the A.C. line are not connected to the chassis, but are tied together and grounded through a .1 by-pass condenser. The phone jack, variable condenser and suppressor of the 6SK7 are grounded to the chassis.

If A.C. hum is encountered after putting the instrument into operation, it can be lessened by connecting a .1 mf. by-pass across the A.C. line cord inside the chassis.

Coil Data

The oscillator coil consists of 115 turns of No. 28 D.C.C. wire, close-wound on a standard 4-prong 1 1/4" dia. coil form, the last 40 turns being "bank" wound. The cathode tap is taken at the 30th turn from the bottom (or ground side) of the winding.

Parts List

R.C.A.

- 1—Type 6SK7
- 2—Type 6C5

I.R.C. (Resistors)

- 1—100,000 ohm insulated resistor, BT 1/2
- 1—100,000 ohm insulated resistor, BT 1
- 1—1 megohm insulated resistor, BT 1/2
- 2—50,000 ohm insulated resistors, BT 1
- 2—25,000 ohm insulated resistors, BT 1

CORNELL-DUBILIER (Condensers)

- 1—100 mmf. bakelite condenser
- 1—50 mmf. bakelite condenser
- 1—.01 mf. 400 volt tubular
- 3—.1 mf. 400 volt tubular
- 1—8 mf. 250 volt electrolytic
- 1—12 mf. 250 volt electrolytic

THE NATIONAL CO.

- 1—Type No. ST 50 tuning condenser

HAMMARLUND

- 1—Type CTS-85 trimmer condenser

UTAH-CARTER

- 1—Open-circuit phone jack

HART & HAGEMAN

- 1—S.P.S.T. rotary switch

STANCOR

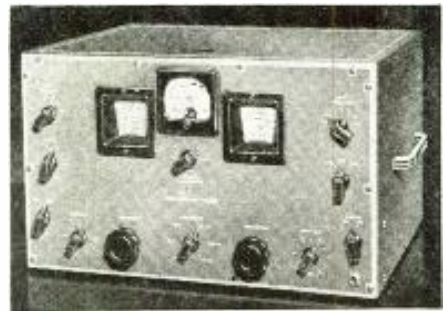
- 1—50 henry 15 ma. choke, type C-1515

CINCH MFG. CO.

- 4—wafer sockets, 3 octal type for tubes, and 1 four-prong type for coil mounting

MISCELLANEOUS

- 1—Mazda 40-watt bulb
- 1—National, Crowe, or similar vernier dial
- 1—Insulated tip jack
- 2—Rubber grommets
- Chassis and cabinet



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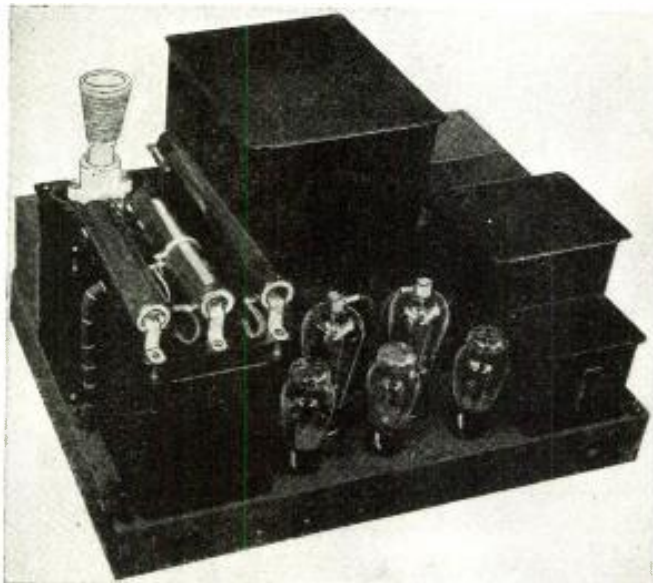
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Power Supply Design

*Charles T. Kolz, Jr., W2BKZ



500 watt power supply for transmitter.

What capacity condenser should be used with a certain power transformer? What should its voltage rating be? These and dozens of other questions are pondered daily by radio amateurs—the answers are to be found in this timely article by Mr. Kolz.

● THE power supply might be called the "heart" of any electronic device and rightly so, because it is required to supply a constant source of potential to its associated tube elements without which the various functions of detection, amplifications, oscillation, and rectification could not be fulfilled. The proper design of such necessary energy giving devices has been simplified considerably by a number of equations which should be "duck soup." Knowledge of simple arithmetic is all that will be necessary for rapid calculation. Applying this arithmetic together with a little good judgment will result in the design of efficient and economical power equipment.

The half-wave rectifier only passes current on half the A.C. cycle, consequently making it more difficult to filter into D.C. and also to secure good voltage regulation for varying loads. A full-wave rectifier consists of two such half-wave rectifiers, each passing current on opposite halves of the cycle. Each half of the A.C. wave is combined in the output as shown in Fig. 1. The resulting current is of a uni-directional pulsating nature and can be filtered or smoothed out to any desired degree depending on the particular application. The percentage of ripple voltage present constitutes the "Purity," so to speak, of the D.C. present at the output of the filter. The lower the ripple voltage percentage, the closer we approach the "pure D.C." produced by, let us say, a battery, a point very desirable in the average power supply. Of course, again, it is stated that the application regulates the permissible and allowable magnitude of the ripple voltage in a given supply. In the event the output voltage is to be used for C.W. telegraphy, a ripple percentage of 5 per cent or less will give an apparent "pure D.C." if the transmitter has high frequency stability. When used in conjunction with radio-telephone transmitters and self-controlled oscillators, the percentage of ripple should be 0.25 per cent or less with even lower than 0.1 per cent being found necessary for receivers and speech amplifiers. So it can be seen that the

results of the design of power equipment vary widely according to individual application. As an example, suppose a supply was needed for a pair of the new RCA 812's operated in a pushpull, class "C," plate modulated stage. The manufacturers' tube characteristics show that for use in amateur service, 1250 volts D.C. at 250 M.A. is required for normal operation. Due to the constant current present in a Class "C" stage, this power supply only requires fair regulation and ripple of less than 0.25 per cent.

To properly select the power transformer, the total load current must be determined. For fair regulation, the bleeder resistance should be designed to draw about 10 per cent of the current in the external load of 250 M.A. or 25 M.A. In other words, the transformer should be capable of supplying a minimum of 275 M.A., which is the total load current. Now, its RMS or secondary voltage must be determined by the process of working backward from the 1250 volts required. First, the D.C. resistance of the two filter chokes required is 240 ohms causing a voltage drop of 66 volts found by applying Ohms law, thus: $E = IR$ or $E = .275 \times 240$ or $E = 66$ V.

Mercury vapor type rectifiers have a fairly constant voltage drop of fifteen volts regardless of the load current. This loss of 15 volts as well as the 66 volts drop across the filter chokes added to the required 1250 volts produces the "average" value required of 1331 V. Because most power transformers today are indicated with RMS voltages, this value can be arrived at in the following manner:

$$E_{RMS} = E_{AVERAGE} \times 1.11$$

$$\text{or } E_{RMS} = 1331 \times 1.11$$

$$\text{or } E_{RMS} = 1477 \text{ V. AC each side}$$

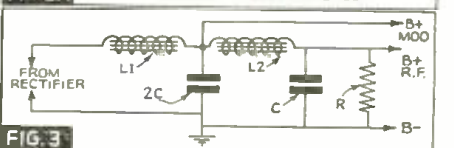
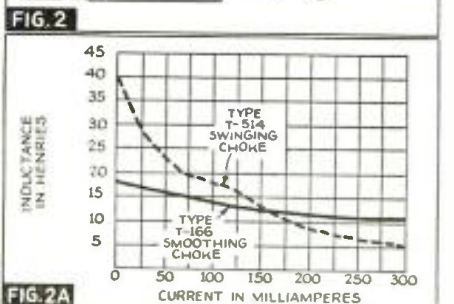
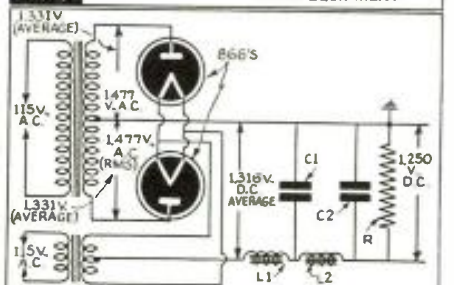
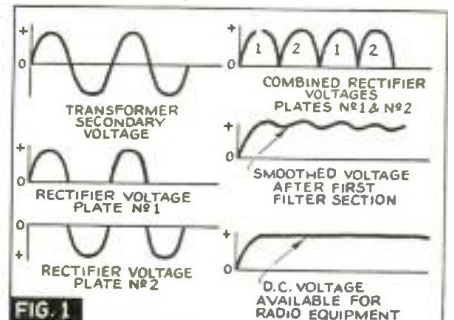
From these figures, we gather that the power transformer must supply 1477 volts each side of the center tap at 275 M.A.

Our next problem is the calculation of the values of C and R. The bleeder current, we have decided, was to be 10 per cent of the external load of 25 M.A. Again applying Ohms law, we arrive at:—

$$R = \frac{E}{I} \text{ or } R = \frac{1250}{.025}$$

$$\text{or } R = 50,000 \text{ ohms}$$

Diagrams below: How current is rectified and smoothed out in filter circuit; variation of inductance in a "swinging" choke; basic power supply filter circuit.



*Kenyon Transformer Co., Inc.

The power dissipated in the bleeder resistor can be calculated by substituting in the equation:

$$W = \frac{E^2}{R} \quad \text{or}$$

$$W = \frac{1250 \times 1250}{50,000} \quad \text{or} \quad W = 31.2 \text{ watts}$$

It is customary to select a resistor whose rating is more than twice the actual power dissipated. In other words, a 100 watt bleeder of 50,000 ohms would be ideal. Calculation of the value C must be accomplished by substituting in the following equation:—

$$C_1 C_2 = \frac{.5 E_{DC}}{E_R \times .335 \times L_1 L_2}$$

Where

E_{DC} = D.C. voltage

E_R = Ripple voltage

L_1 = Inductance of 1st choke in henries

L_2 = Inductance of 2nd choke in henries

Substituting, we get

$$C_1 C_2 = \frac{.5 \times 1250}{3 \times .335 \times 11 \times 11} = \frac{625}{121} \quad \text{or}$$

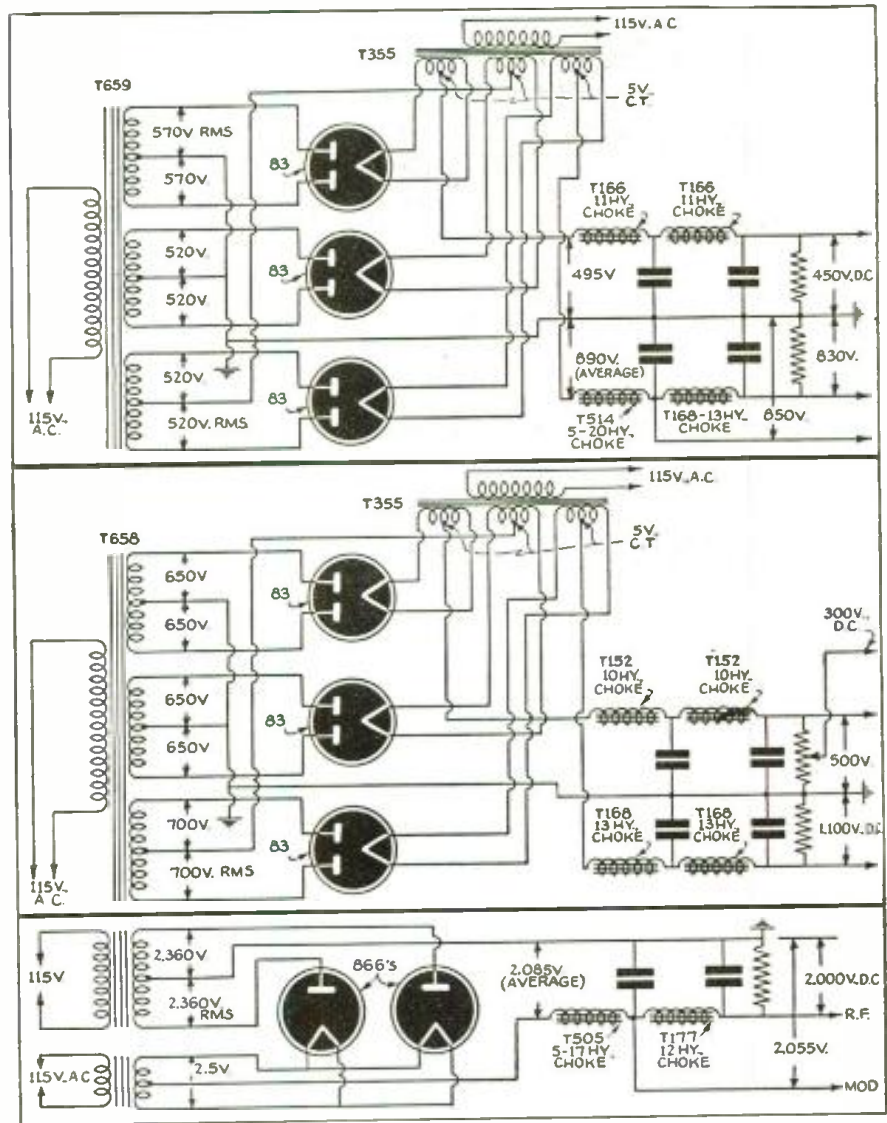
$$C_1 C_2 = 5.1$$

The value of C_1 and C_2 could be 2 mf. each or C_1 could be 1 mf. with C_2 , a 5 mf. condenser. In other words, the two filter condensers multiplied must equal the result obtained by the equation. Of course, slight changes in this result must be required to fit in with the commercial values of capacitors available to the constructor. The voltage rating is determined by adding 20% to the D.C. output voltage. The voltage rating therefore would be 1250×1.2 or 1500 volts. Such a condenser rating is available in all the popular brands of capacitors. The ripple voltage required for the above calculation is the product of the plate voltage and the percentage of ripple found necessary for a particular application.

$$E_R = E_{DC} \times \frac{\% \text{ ripple}}{100} \quad \text{or}$$

$$E_R = 1250 \times \frac{.25}{100} = 3.125$$

For simplicity of calculation, all the numbers to the right of the decimal point were dropped. The selection of the rectifier tubes depends on the peak inverse voltage present in the rectifying circuit and the total average current. The peak inverse voltage will be the RMS voltage of $1477 \times 2 \times 1.4$ or 4068V which is well within the rating of a pair of 66 type tubes. The total load current of 275 M.A. is also within the rating of 866 type tubes. The above formula can only be applied to choke input filters. Computation of percentage of ripple in condenser input filters cannot be made by simple formulas. Their use is definitely not recommended except in low voltage power supplies for receivers and other low drain radio devices. Due to very poor voltage regulation and the necessity for reduction of the load current to 25 per cent of the rated peak current of one rectifier tube, employment of this means of filtering is decidedly not too advantageous. In fact, the only thing that can be gained by its use, is a comparatively high output voltage. At lighter loads, it can approach the peak transformer voltage



Diagrams for the 500 watt and also 100 watt transmitter power supply units.

($E_{RMS} \times 1.4$) decreasing to the RMS value or lower with heavier loads. In choke input filters, the maximum rectifier peak plate current is prevented from exceeding the peak rating by the input choke, which has a certain minimum value of inductance called the *critical inductance*. This value should be calculated from

$$L_{CRIT} = \frac{R_{LOAD}}{1000} \quad \text{or}$$

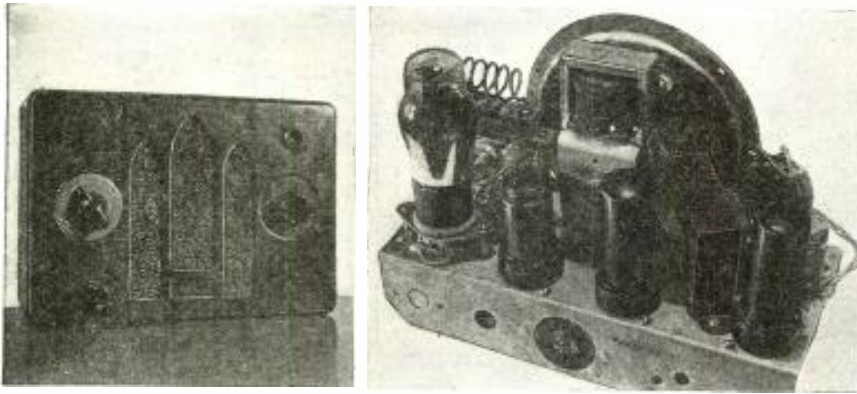
$$L_{CRIT} = \frac{4510}{1000} = L_{CRIT} = 4.5 \text{ henries}$$

This means that the input choke of our power supply should be of a value no less than 4.5 henries or the filter may have a tendency to go towards condenser input operation with its adherent disadvantages. By employing a choke of greater inductance, we materially reduce the ratio of peak-to-average plate current. Thus, the strain on the rectifier tubes is eased and the regulation of the output voltage is improved, simultaneously.

Power supplies which energize a varying load such as a Class "B" modulator usually require a "swinging choke" at the input to the filter. If a *smoothing* choke were employed in such a filter, its physical size and price would make its use prohibitive. This

is due to its inability to provide critical inductance at low values of plate current and still maintain a high inductance value at maximum load. It, therefore, is necessary to utilize a choke with little or no air gap called "A Swinging Choke." This type of choke will maintain a critical or a greater value automatically over a specified range, its inductance falling as the load is increased. This fits in perfectly with the fact that the critical value of inductance decreases proportionately with the increase in load from minimum bleeder current to the maximum rated load of the supply. Sometimes in transmitter application a supply is called upon to energize both R.F. and modulator sections. In such cases a "swinging choke" to carry the total load current is selected. The modulator voltage is then taken after the input choke as shown in Fig. 3. The second choke, then is only required to pass the currents of the R.F. section and the bleeder alone. This system makes for the reduction of physical size in components and, consequently, their cost.

It also requires an increase in the capacity of the first filter condenser by a multiplier of 2 and the bleeder is selected to draw 20% of the total load current. In the design of power supplies for lower voltages, the same calculations are made.

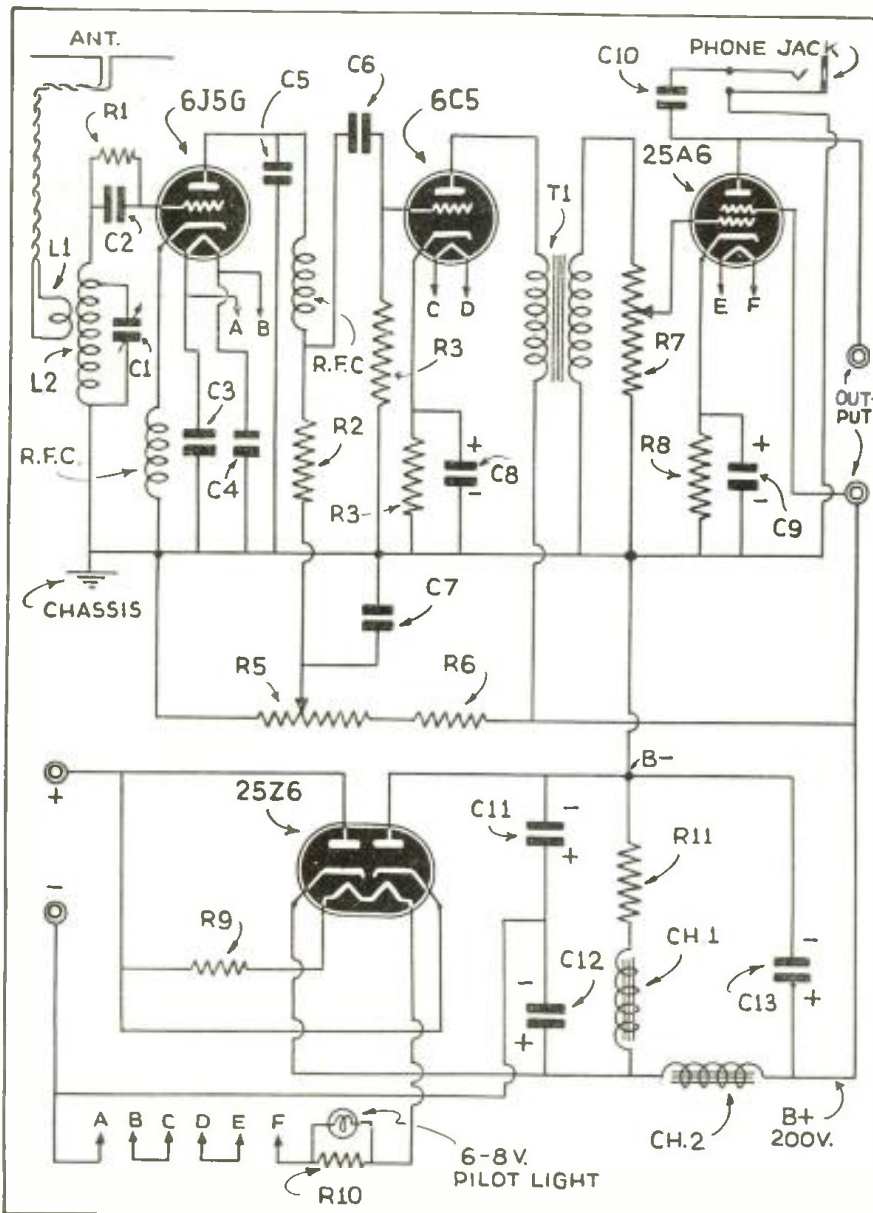


Note the very compact design on this 2 1/2 and 5 meter receiver.

Simplicity is the keynote of this amateur receiver for 2 1/2 and 5 meter reception, which is easy to build and adjust as there are no I.F. stages to peak. It is a transformerless 110 volt A.C.-D.C. job that works very smoothly and packs a real wallop.

Compact A.C.-D.C. 2 1/2 & 5 Meter Receiver

Burt L. Zimet, W2JUX



● MANY amateur operators in the course of a QSO have expressed a wish for a very simple five-meter receiver. One that would work anywhere, on any type of voltage, yet maintain the desirable features of sensitivity coupled with plenty of "whack." This led us to wonder why one hears or reads so little, if anything, of A.C.-D.C. type five-meter receivers. Well, you know how hams are — once the question was formed there was an immediate urge to begin building to see "why" and "why not."

In planning the receiver, the important factors of performance and economy were carefully considered before the final design was adopted. Simplicity dictated the use of but four tubes and economy urged the stripping of an old broadcast type A.C.-D.C. midget receiver for parts, chassis and cabinet. Fortunately this midget was housed in a metal cabinet thus saving the expense of purchasing one. However, these small metal cabinets are quite reasonable and one certainly would have been purchased if the above had not been on hand.

The tube complement finally selected was a 6J5G super-regenerative detector, a 6C5 first audio which was transformer coupled to a 25A6 power amplifier and a 25Z6 rectifier working as a voltage doubler. The sturdy little 25Z6 tube is easily capable of delivering 200 volts under full load when using two 16 mf. filter condensers. It is, however, absolutely essential that correct polarity of the condensers be observed for proper D.C. voltage.

As in all A.C.-D.C. receivers the filaments are hooked-up in series using a 180 ohm line cord resistor to drop the input voltage to the proper value.

By inserting a 40 ohm (25 watt) resistor in series with the filaments paralleling this resistor with a 6-8 volt pilot light (blue bead, 250 ma. type) the usual "on-off" jewel indicator can be incorporated.

In stripping our B.C.L. midget, all parts such as the speaker, volume control, choke, etc., were permitted to remain in their

original positions. Since the sockets were the octal type these, too, were left alone, except one, for which we substituted an Amphemol isolantite socket. This socket, for the 6J5G, was selected for its low loss on the high frequencies.

The coil assembly was constructed of two small $\frac{1}{2}$ " x $2\frac{1}{2}$ " pieces of mycalex and three midget type banana plugs and jacks. The diagram and photo are self-explanatory and no difficulty should be encountered with this little unit. The coil which consists of five turns, $\frac{1}{2}$ " diameter, No. 18 solid enamel wire, is tapped one turn from the grid end. This method of tapping the coil band-spreads the five meter band over most of the dial. Although this method may be replaced with the usual hook-up, it is handy to have in cases of heavy QRM.

In referring to the diagram it will be noticed that the speaker field is not hooked up in the customary fashion. The reason for this is that our original B.C.L. midget receiver had a speaker field of 3,000 ohms D.C. resistance and since this would drop the voltage too much, it was decided to use the field as part of a bleeder circuit and a separate 300 ohm choke as the filter. Of course if the reader has a speaker with a 300 or 400 ohm field this would be used in place of the choke and no bleeder would then be necessary.

Originally it was planned to isolate the chassis from the receiver proper (keeping "B" negative off the chassis) in order to prevent the shorting of the A.C. voltage upon accidental grounding of the receiver. But this method introduced two serious problems; the first of which manifested itself as a 60 cycle hum that could not be removed by the usual filter methods. The second problem was that of erratic oscillation of the detector tube, due to the additional capacities created by the isolated chassis. Both problems were immediately solved by connecting the return of the cathode R.F. choke to the chassis. There was no further de-bugging to do.

In order to eliminate the usual difficulties of coupling the antenna to the receiver and the resultant *dead spots*, it was decided to use inductive coupling. This coupling coil is $\frac{1}{4}$ " in diameter, six or

seven turns. No. 22 hook-up wire and is placed into the grid coil. Care should be taken to place this coupling coil in the *grounded* end of the grid coil, as inserting this coil at the grid side will cause the detector to stop regenerating due to too tight coupling. Proper adjustment is attained when the detector regenerates throughout the entire range of the tuning condenser with the antenna connected.

Several different values of regeneration controls were experimented with, but trial showed that 20,000 ohms was proper and smooth regeneration was secured. This control should be advanced until the detector just begins to super-regenerate (manifested as a gentle hiss) for maximum sensitivity.

Little more can be mentioned about the circuit except perhaps to urge that the usual rule of *short leads* be adhered to.

I.R.C. (Resistors)

250,000 ohms, $\frac{1}{2}$ w., R-1
100,000 ohms, $\frac{1}{2}$ w., R-2
500,000 ohms, $\frac{1}{2}$ w., R-3
1,000 ohms, $\frac{1}{2}$ w., R-4
20,000 ohms, Pot. regeneration control, R-5
20,000 ohms, $\frac{1}{2}$ w., R-6
500,000 ohms Pot. volume control, R-7
400 ohms, 1 w., R-8
180 ohm line cord resistor, R-9
40 ohm, 25 w., R-10
5,000 ohms, 25 w., R-11

HAMMARLUND 15 mmf., C-1

CORNELL-DUBILIER (Condensers)

100 mmf. mica, C-2, C-3, C-4
.0003 mf. mica, C-5
.01 mf., 400 v. paper, C-6
.1 mf., 400 v. paper, C-7
10 mf., 25 v. paper, C-8
20 mf., 25 v. paper, C-9
.1 mf., 400 v. paper, C-10
16 mf., 150 v., C-11, C-12
8 mf., 450 v., C-13

COIL DATA

6 or 7 turns $\frac{1}{4}$ " dia., No. 22 hook-up wire, L-1
5 Meters, 56 mc.—5 turns $\frac{1}{2}$ " dia., No. 18 solid enamel wire, tapped 1 turn from grid side, L-2
 $2\frac{1}{2}$ Meters, 112 mc.—3 turns $\frac{1}{2}$ " dia., No. 18 solid enamel wire, tapped 1 turn from grid side, L-3

UTAH

3,000 ohm speaker field, CH-1
400 ohm choke (A.C.-D.C. midget type) CH-2—
(junk box)

OHMITE

High frequency R.F. chokes, RFC

MISCELLANEOUS

3:1 audio transformer, T-1

MAGNETIC SPEAKER AS A MICROPHONE

● MANY amateurs have found that a good quality magnetic speaker makes an excellent microphone. The standard crystal or velocity microphone input of the modulation amplifier may be used. In case you have been using a carbon mike, a single

stage pre-amplifier will have to be used to step up the output of the speaker-microphone. The photograph illustrates the remote control table of a transmitter. Notice the pre-amplifier in the back, and the Wright-DeCoster speaker-mike.—*Courtesy of Allied Radio Corp.*



Loud-speaker used as a microphone.

The editors want—Construction Articles on receivers, converters, transmitters, adapters, facsimile recorders, television receivers, frequency modulation adapters and receivers, etc.

Send them to *Editor, RADIO & TELEVISION, 20 Vesey St., New York City.*



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How Amateurs Relay Station

W2USA at World's Fair

in New York

Arthur H. Lynch, W2DKJ



The handsome QSL card sent to all stations contacting W2USA, the Amateur station at the World's Fair, New York.

● When Mr. John S. Young, Director of RADIO & TELEVISION for the World's Fair, at New York, invited us to undertake the installation and operation of the amateur radio station at the Fair, we knew, from past experience, that it would be necessary to have a suitable organization and that, in spite of the fact that the Fair would pay for the actual installation of our aerials and equipment, it was going to be necessary to have quite a bit of money to defray incidental expenses. There could be nothing hit or miss about the undertaking.

Mr. Young assisted us in the selection of the space we have been occupying and lent all the encouragement he could, in the matter of providing incidental facilities, such as furniture, lighting equipment and typewriters, etc. It was his desire to have us get our station on the air before the end of 1938.

In order to get off on the right foot, we called in the Legal Department of the American Radio Relay League to assist us in the preparation and the execution of our corporation papers. The W2USA Radio Club, as a result, is a duly chartered membership corporation, operating under the laws of the State of New York. The present membership is limited to those who take an active part in the running of the home station, in the Communication and Transportation Building. Our charter, however, provides for other types of membership, and it is the present plan to permit those amateurs who co-operate with the home station to become actual members of our associate group.

Getting on the Air

While we recognized the desirability of getting on the air at as early a date as

possible, we realized, also, that our station would be watched by amateurs throughout the world, and we wished to carry on in a perfectly orderly fashion. In order to avoid the delays which we felt sure would develop, the plan of installing our own five meter equipment, operating it as a portable station and securing the co-operation of many other amateur stations to act as relaying points for us, was put into operation. It was fortunate that this plan was adopted. As a matter of fact, there were so many legal hurdles which had to be taken, in connection with the formation of our corporate body, that we were not actually in a position to apply for our license until long after the first of the year. Our official call letters were issued the day before the Fair opened and then only after we had telegraphed the F.C.C. and had received a telegraphic reply, authorizing the use of the W2USA call.

Because all of our preliminary work was done, on the ultra-high frequencies, some amateurs, unaware of the obstacles we had to overcome, gathered the false impression that our activities were to be devoted to that form of operation, exclusively. Others thought that we were not going to give C.W. telegraphy any part in our picture and that all of our activity was to be on "phone." Of course, neither of these premises was correct. Our original plan for operation included all of the facilities which were detailed in RADIO & TELEVISION, for May, 1940, as well as certain other services which, even up to now, have not been placed in operation. We feel confident that these

the remotest idea of the difficulties and the hardships which had to be borne. The Hall of Communications—now the Communication and Transportation Building—was nothing but an empty shell when we moved in. It was colder inside than out. We were provided with a small shack, made of wall-board, but without either heat or ventilation. A borrowed oil stove gave us the heat, but there was never any ventilation. All the work which had to be done, in connection with the erection of aerials, could not be undertaken by us but had to be done, under our direction, by regular employees of the Fair.

Approval of every little detail of our plans had to be given by the man who was in charge of the Fair's public address equipment. He was convinced that it was going to be impossible for us to operate our station in the space adjoining his, without causing interference.

All of which proved that the initial plan to have other stations help us was not only desirable, but, as it turned out, absolutely essential. It is with a view to assisting other amateurs, who may be faced with something of a similar problem, that we devote so much attention to this portion of our story.

We believe that the successful use of relaying stations by W2USA is positive proof of the desirability of using the ultra-high frequencies for local and "feeder" contacts and using the other bands for distant contacts, exclusively. Because it is comparatively common practice for high-power, twenty meter phone rigs to carry on local "rag-chews," when very much less power would do the job better, without interfering with other stations hundreds or even thousands of miles away, is no valid reason for doing likewise.



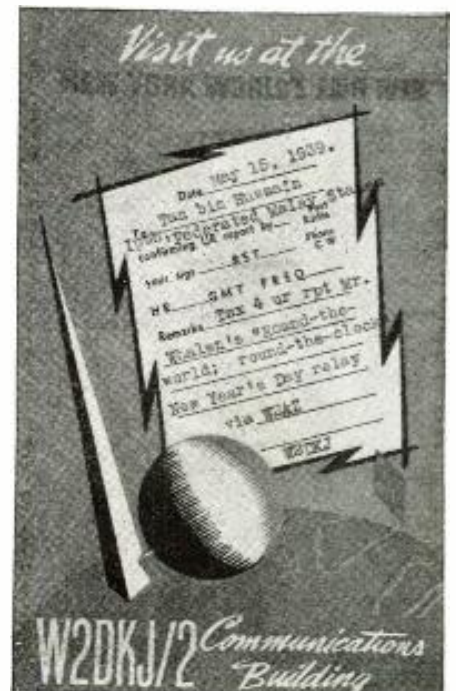
"Courtesy card" given to visiting radio amateurs who have their U. S. Amateur operating license cards with them. This card entitles them to "operate" at station W2USA.

new services will be put in operation during the present season. It is our desire to have the co-operation of all amateurs, not only "local" operators, but those in all parts of the world.

Relaying Stations

It is a matter of amateur tradition that difficult operating conditions simply increase the determination to do a good job. Thanks to those amateurs, who recognized our difficulties and jumped right into the job with us, we were able to give what has been recognized as the sort of performance of which amateur radio may well be proud. The history of the services which have been performed at W2USA has been summarized in preceding articles of this series. No one who was not actually on the job, during the first few months of operation, could have

The original QSL card sent out by station W2USA—it bore the call letters of Arthur H. Lynch, W2DKJ.



Amateur Radio

So, with our 400 watt, 5 meter transmitter, hooked to one of the double, extended Zep antennas, designed by Frank Lester, W2AMJ, and operating under the call letters, W2DKJ/2, and with many local stations relaying our transmissions, we undertook to let the world know that the amateur radio station, located in the Hall of Communications, at the World's Fair in New York, was *on the air!*

The accompanying drawings show just how it was possible to utilize the many thousands of dollars worth of equipment and the excellent locations of other amateur stations, for the handling of relays to and from the Fair station.

It is very important to give full consideration to the possibilities of operation, if similar arrangements are thought to be desirable for the handling of messages to and from areas which may be without service of any other kind, as a result of some form of disaster. When floods, hurricanes, earthquakes and other forms of calamities have occurred in the past, it is noteworthy that the only form of communication which could be counted upon was that which was provided by amateur radio communication facilities.

In such events, the success of utilizing portable, ultra-high frequency equipment, for getting information to and from the stricken areas to those outlying areas, where power lines and other forms of communication facilities were available, suggests further consideration and preparation for improving such services for future emergencies.

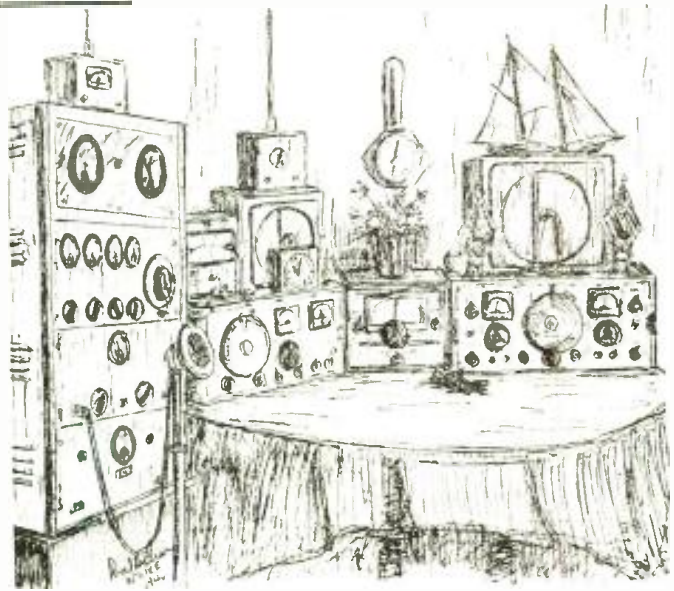
Radio stations, located in high buildings, operated from storage battery power or even from generators, driven by gasoline engines, can be counted upon to do their work, when all other services have been put out of commission.

The relaying stations, which have been doing such excellent work, in the routine operation of the amateur station at the World's Fair, at New York, are not confined to operation on the ultra-high frequencies. Through them, instead of being confined to one station and to one frequency, we have been able to avail ourselves of the services of some ten or twelve of the most up-to-date amateur stations in this part of the world. Then, too, we have been able to carry on actual communication on all bands, even though our own station was operated on the five meter band, exclusively. There is another point about this form of operation which is a distinct advantage, though the point of origin may be owned by an operator with a class "B" license, it is possible for messages or even phone conversations originating from his station, being relayed on the bands which would not be open to him otherwise, if due regard for the regulations is given by the relaying station or stations.

Automatic Relay

In addition to the handling of regular traffic, from such a station, there is always the possibility of having items of general interest to amateurs on all bands sent out at the same time, by *automatic relay*. In other words, the relaying stations pick up the ultra-high transmissions and feed them into the speech equipment of their own transmitters, so that copying and re-reading of the messages are not required. The regular weekly QSTs which are sent out from W2USA at 9.45 p.m. each Friday night, were handled in the foregoing manner,

Since 1907, Lt. Perce B. Collison, W2IXE, has been an ardent ham. His drawing of his rig shows his 5-10 m. phone, CW, ICW xmtr, and his receiver, a specially built Hall-crafter "5 & 10." His antennas, a 5 m. Zep and a 10 m. Johnson "Q" are 400 feet in the air—probably the highest in New York. He is a charter member of numerous radio clubs.



prior to the time that it was possible for us to get our own transmitters going on all bands.

On several occasions this form of relaying was greatly augmented by additional relays, at remote points. For example, our first "Round-the-world; round-the-clock" radio relay was sent out from our station on five meters; picked up and sent out

radio station, in his temple, in Thibet. The priest sent a return message over the same route. American stations, other than local, could not hear either our own station or W2JCY; they could, however, hear GM6RG, who was covering most of North and South America with a very loud signal.

Similar double and triple relays were effected by several other stations which put out our signals, during that time. An excellent job was done for us by Frank Carter, W2AZ (first operator to work 100 different foreign countries on "phone" and have them verified for admission to the A.R.R.L. "Century Club"). Not having facilities to receive us on five meters, he drove over to our station, made a copy of the relay message and sent it out several times, with the result that we received reports of it having been heard in many foreign countries.

QSL Cards (Veris)

The accompanying copies of the various cards which have been issued by the W2USA Radio Club are attracting an unusual amount of enthusiasm. So far, there have been three types. The first was sent to those who sent in reports of having heard our first "Round-the-world; round-the-clock" New Year's Greeting. The recipients of those cards really have something in the nature of a "keepsake" which will soon become very valuable. The number which was sent out was definitely limited; they were not mailed until they could be cleared through the post office which was opened on the Fair Grounds and they were sent with the special issue N. Y. World's Fair stamps.

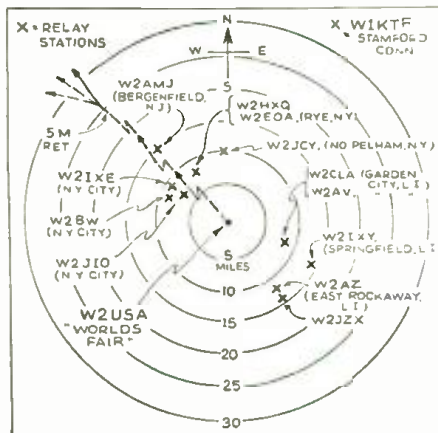
Not exactly QSL cards are the *certificates* which are supplied by our "Traffic Control Committee," to all those visiting operators who bring their licenses with them, when they visit our station and who actually make contact with one or more stations for us. They are just about the size of the license and they enable those who hold them to join in the operation of our station at any time they see fit, without the formality of re-registering.

QSL cards for the 1939 contacts and for those who visited the Fair station last year are now in the process of mailing. We have some ten thousand of them to get out. There has been a considerable delay, but we are told that they are well worth waiting for.

An entirely new card will be issued for the 1940 season, and we hope to be able to get them out as the contacts are made. We have many other interesting innovations for the 1940 season.

¹ Mr. Lynch's 400 watt, 5 meter transmitter was described by him in a series of articles, entitled "The 5-40-400 Transmitter" in *SUONER WAVE CRAFT* for August to October, 1938.—Ed.

² Mr. Lynch has had the courage of his convictions on these points. Single-handed, he ran up the highest individual ultra-high frequency score ever made, during an A.R.R.L. Field Day Contest.—Ed.



Map of "World's Fair" district (New York) showing how amateur relay stations are spotted around station W2USA.

again, on ten meters, by L. M. Cockaday, W2JCY; picked up and sent out again on ten and twenty meters, simultaneously by Brian Groom, GM6RG, of Dalashiells, Scotland; picked up and again sent out on ten meters by David R. Crawford, W3FPI, who was operating "portable" aboard an American steamer, then located 100 miles east of Aden, in the Persian Gulf, and his signals were picked up by a Lama priest, at his

W2USA—Relay Stations

POWER WATTS	CALL	NAME	TRANSMISSION	LOCATION
400	W2AMJ	Frank Lester	5 meters	Bergenfield, N. J.
200	W2IXE	Perce Collison	Ret. on 10 mtrs.	New York City
100	W2BW	Dr. A. L. Walsh	Ret. on 5 mtrs.	New York City
600 & 1000	W2HXQ	Kay Kibling	Ret. on 75, 160 mtrs.	Rye, N. Y.
1000 & 1000	W2EOA	Chas. Kibling	Ret. on 10, 20 mtrs.	Rye, N. Y.
600	W2JCY	Com. L. M. Cockaday	Ret. on 10 mtrs.	North Pelham, N. Y.
850	W2AZ	Frank L. Carter	20 meters	E. Rockaway, N. Y.
400	W2JZX	Viola Grossman	75 and 160 mtrs.	E. Rockaway, N. Y.
1000	W2IXY	Dorothy Hall	20 meters	Springfield, L. I.
1000	W2CLA	Dr. L. J. Dunn	20 meters	Garden City, L. I.
1000	W2AV	John L. Hines	20 meters	Garden City, L. I.
1000	W1KTF	David Kendall	10 and 160 mtrs.	Stamford, Conn.
250	W2JIO	Robt. Gunderson	20 and 75 mtrs.	New York City

Ret. = Retransmission

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NC100A	120.00	24.00	8.48
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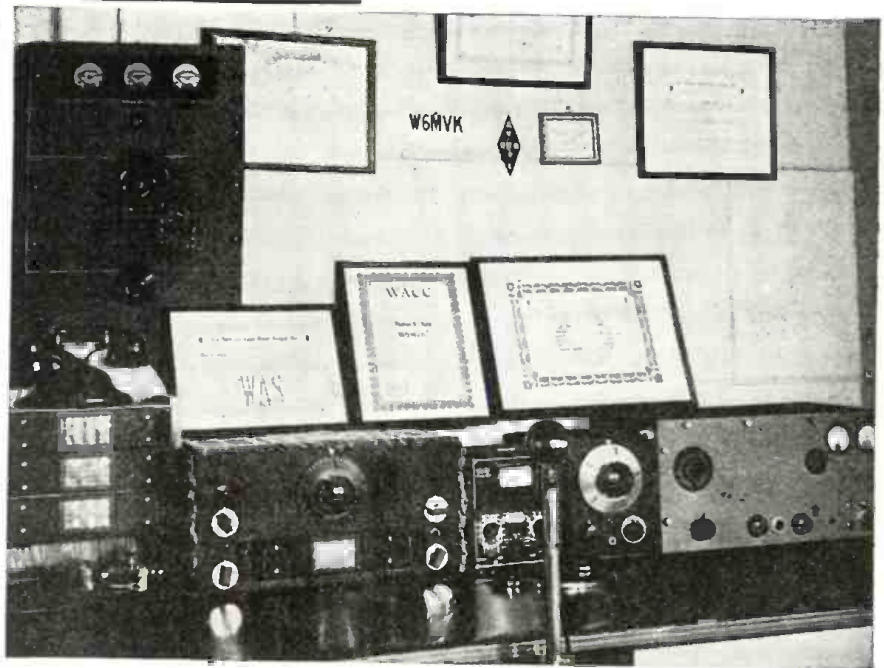
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This month's winner of the Honor Plaque for the best Ham Station photo.

"Honor" Plaque Awarded

For Best HAM Station

To Thomas S. Chow, W6MVK

• AMATEUR Radio Station W6MVK is licensed to Thomas Sue Chow at 701-8th Street, Modesto, California. He is an American-born Chinese, and has never been anywhere except California. Tom is 24 years old and unmarried. He lives with his uncle;

a brother, W6OFD, George; and a sister, W6QMW, Betty.

W6MVK's interest in amateur radio began in 1935. That spring he practiced the code on a borrowed tape machine, reading up on radio from radio magazines. By

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

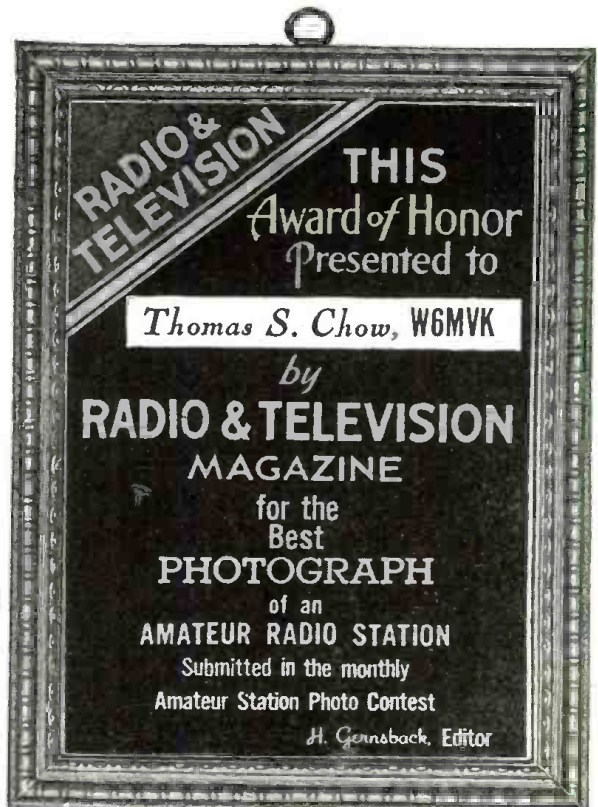
Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name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

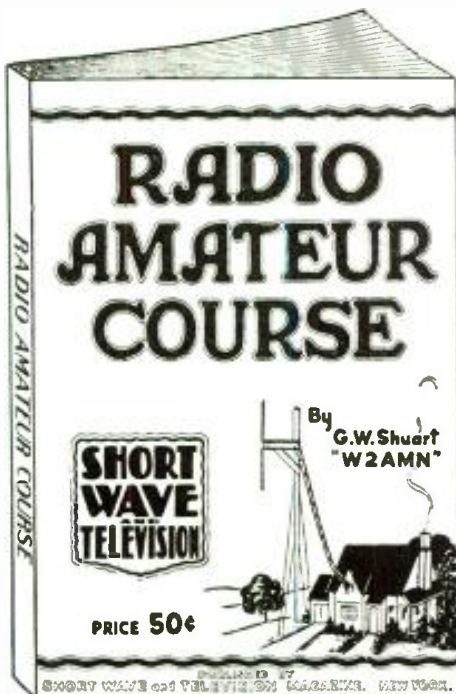
State briefly the number of continents worked, the total number of stations logged or contacted, and other features of general interest. Mention the type of aerial system and what type of break-in relay system, if any.

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.





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summer enough of the code and theory was absorbed to allow the license to be issued. His first station consisted of a home-made 6-tube superhet. The transmitter consisted of a 5 ft. wooden relay type rack holding up panfuls of salvaged and home-made parts.

Five months after being on the air he won the WAS (Worked All States) club certificate, being among the first 100 (No. 98) and establishing a "shortest time after licensed" record for this achievement.

In 1937, winning first in the entire U.S.A. was a habit, and W6MVK made a clean sweep of 3 of the 4 major contests sponsored for "hams." Next year W6MVK won WACC No. 2 (Worked all 58 California Counties). Only three of these certificates have ever been issued.

All the previously won awards did not concern any DX work. In 1938 W6MVK turned to this different field and came through by winning the VK ZL DX contest in the junior division for the North American field.

Description of Amateur Station W6MVK

The radio room has a 12-ft. ceiling, and is lined with rectangular blocks of Celotex. The curtains are of heavy monk's cloth and a work shelf and bench occupy a full side of the room. An 8-foot table holds the HRO, Jr., receiver, its coil rack, a modulation monitor, a home-made frequency meter and ECO, a 250-watt portable transmitter, and a 7-tube home-made superhet, receiver. The main transmitter stands beside the table and is remotely controlled from the operating table. A Shure 702 crystal non-directional mike is used on a floor stand and a pair of Trimm fones are used for CW so as not to disturb the rest of the household. One wall has 20 certificates won for various contests. No QSL cards decorate the walls.

W6MVK has answered every QSL card from amateur stations, and SWLs promptly. He has had over 5,000 QSO's on the bands, with the use of CW and fone, on all amateur bands under 30,000 kc. W6MVK says, "Nowadays, when so many foreign amateurs are off the air because of the wars, the work of the SWLs in reporting signals is being more and more appreciated by 'hams' all over the world."

Description of Transmitters

The main transmitter, inset in picture, is a 6-foot relay rack mounted on rollers. The transmitter starts with a 6A6 crystal oscillator, or doubler, 616G buffer doubler, an RK20A buffer as the exciter. This rig uses bandswitching of any three bands from 160 to 10 meters. This, in turn, is connected to the antenna or link-coupled to a pair of Eimac 75T's in a pushpull bandswitching final. Up to 800 watts input is run into the final at 2,000 volts on the plates. The remaining panel holds a pair of RCA 811s as Class B audio tubes and the 300 watt modulation transformer. The speech input consists of a separate cabinet and with a Shure 702 crystal mike. The pre-amp tube is a 6J7. This is cascaded into a 6C5 and another 6C5 transformer coupled to a pair of 2A3s in self-biased Class AB1 pushpull drivers. The output from this speech amplifier is fed through a 500-ohm line to the Class B modulator tubes.

The R.F. end of the 500-watt portable starts with a 6V6G crystal oscillator, an RK20 buffer doubler, and an RCA 806 in the modulated final stage. A pair of TZ40s are used with a regulation audio speech amp.

The 250-watt portable seen on the operating table uses only two coils, changed through the front panel. A 6C5 Pierce crystal oscillator drives a 6V6G buffer or doubler and that in turn is capacity coupled to a RCA 211. It is grid modulated for phone with a 6J7, 6C5, 6F6 arrangement, and 60 watts of carrier is obtained.

A 6-volt battery operated transmitter and receiver is powered with a Vibrapack for portable and emergency work. The antenna arrangement consists of a 144 ft. per leg diamond beam pointed toward Europe. The antenna is located in the next block and fed with a 600 ft. of 600-ohm feeder line. This is quite necessary as the noise level at the station is nearly always above R5.

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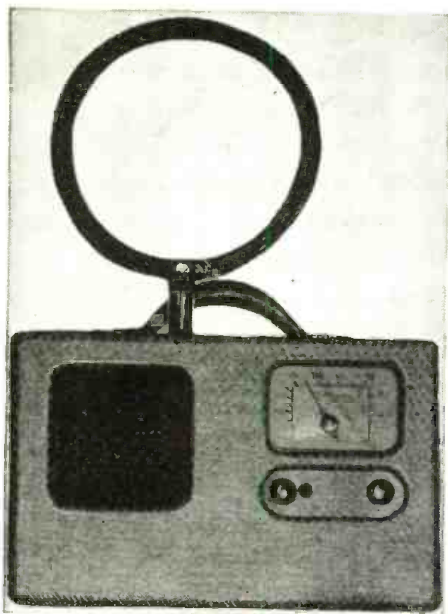
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Adding an EXTERNAL LOOP Increases Portable's DX Range

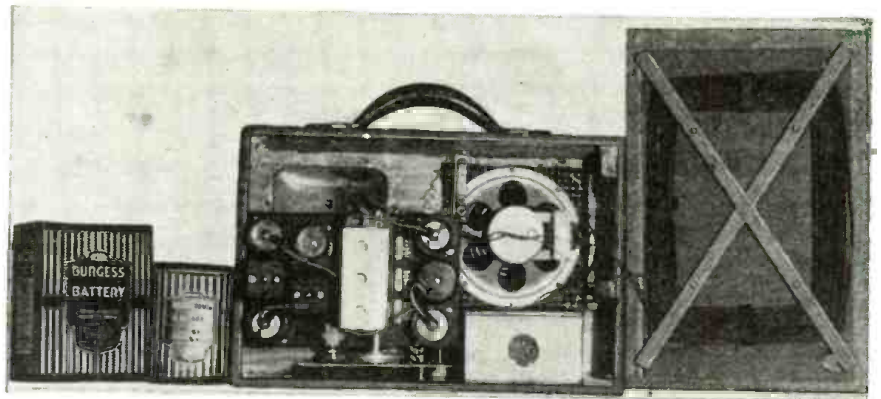
Charles R. Leutz

The author describes how to add an external loop antenna to a standard portable receiver, and in this way increase its DX reception range.



Above—the redesigned portable receiver, fitted with external loop antenna for DX reception.

Right—Rear view of the DX portable, complete with batteries and loop antenna.



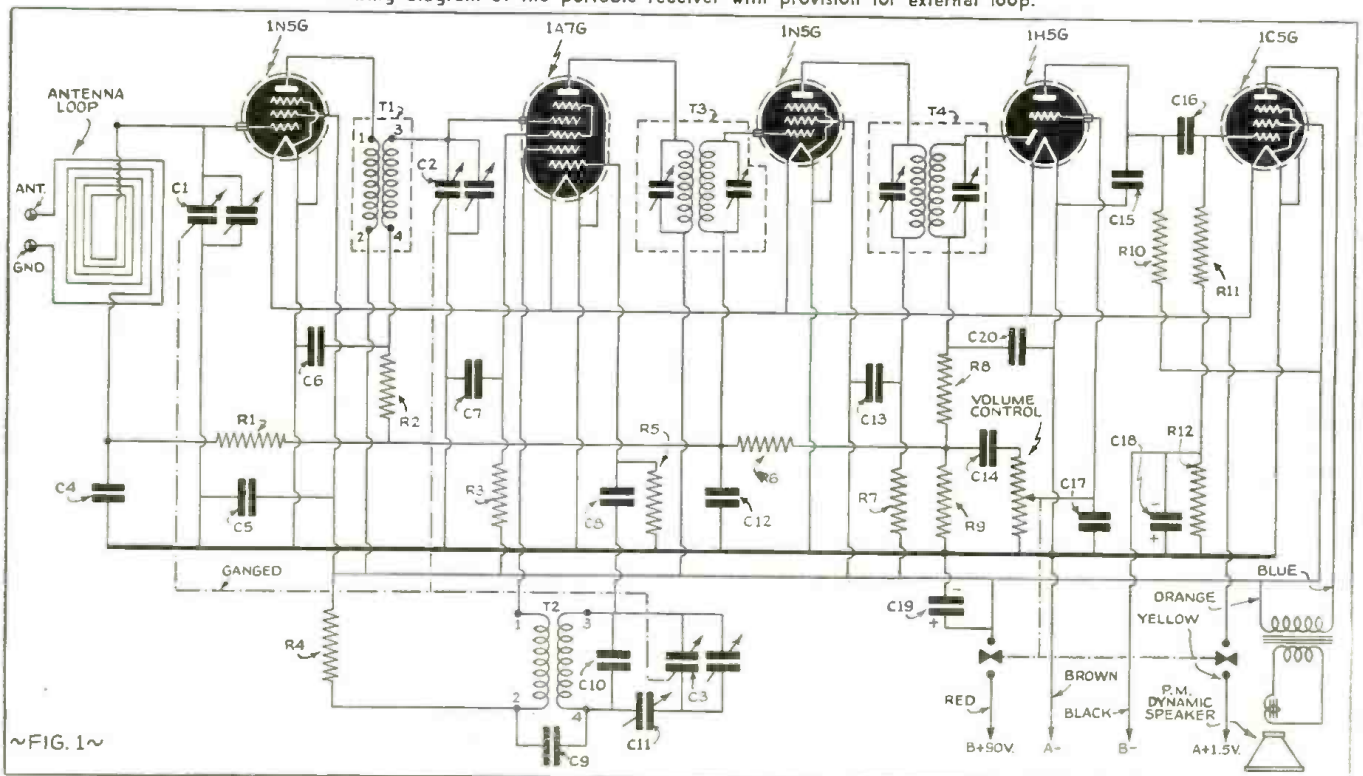
● THE average battery-operated portable radio is intended primarily for short range reception. During the summer vacation months, many people move deep into the country or to the sea-shore which may be quite some distance from principal broadcast stations. Accordingly, in this connection, a good portable capable of reasonably long distance reception will be in demand. The portable about to be described has picked up as many as 45 different broadcast stations in one evening, some of which were over 1,000 miles distant. The tests were

made exclusively with a loop and satisfactory volume was obtainable from all the stations.

The circuit is a superheterodyne using 5 tubes. However, it actually gives 6-tube performance because the 1H5G is used as a diode-detector-AVC and first audio

stage. The balance of the tube array consists of a 1N5G, direct radio frequency amplifier, a 1A7G converter, a 1N5G intermediate R.F. amplifier and a 1C5G pentode audio output tube. All the tubes have a low loss ceramic base. Excellent quality of reproduction is obtained by using a re-

Wiring diagram of the portable receiver with provision for external loop.



sistance coupled audio amplifier with a high grade output transformer and 5" permanent-magnet dynamic loud speaker. Figure 1 shows the complete schematic wiring diagram.

Figure 2 gives the general chassis layout and Fig. 3 gives the essential cabinet dimension. These can be varied to suit individual taste.

The first construction step covers mounting the sockets in the chassis, followed by mounting the triple gang condenser, intermediate R.F. input transformer, intermediate R.F. output transformer and the R.F. transformer. Care must be taken to insert the tie lugs indicated in the pictorial diagram. Next, the volume control, oscillator coil and padder condenser are fastened into place.

The assembly is now ready for wiring, first connecting the wires which lay close to the chassis, inserting the condensers and resistors last. As each connection is made, it should be marked off on the pictorial diagram with a colored pencil.

The loop consists of $27\frac{3}{4}$ turns, wound flat, starting on inside dimensions of $4\frac{1}{2}$ " x 8". The construction of this built-in loop is clearly shown below. If provision for an outside antenna is desired, one additional turn, a separate piece of wire, is wound around the outside turn of the finished loop and connected to antenna and ground terminals.

After finishing the chassis wiring, the flexible leads and grid clips are added for four of the tubes as indicated. Connections can then be made to the loop, loud speaker and batteries. The tuning dial can then be mounted and the set is ready for test. Before inserting the tubes, the volume control should be turned on, which closes the filament and "B" circuits; then the filament and "B" voltages can be checked at the

sockets for normal values, no load. Check can also be made at each "B" return. Provided the voltages are in order, the tubes can be inserted and the set aligned. The intermediate R.F. transformers are factory peaked. Check the gang condenser dial setting, the dial to be at maximum clockwise position with the condensers fully meshed.

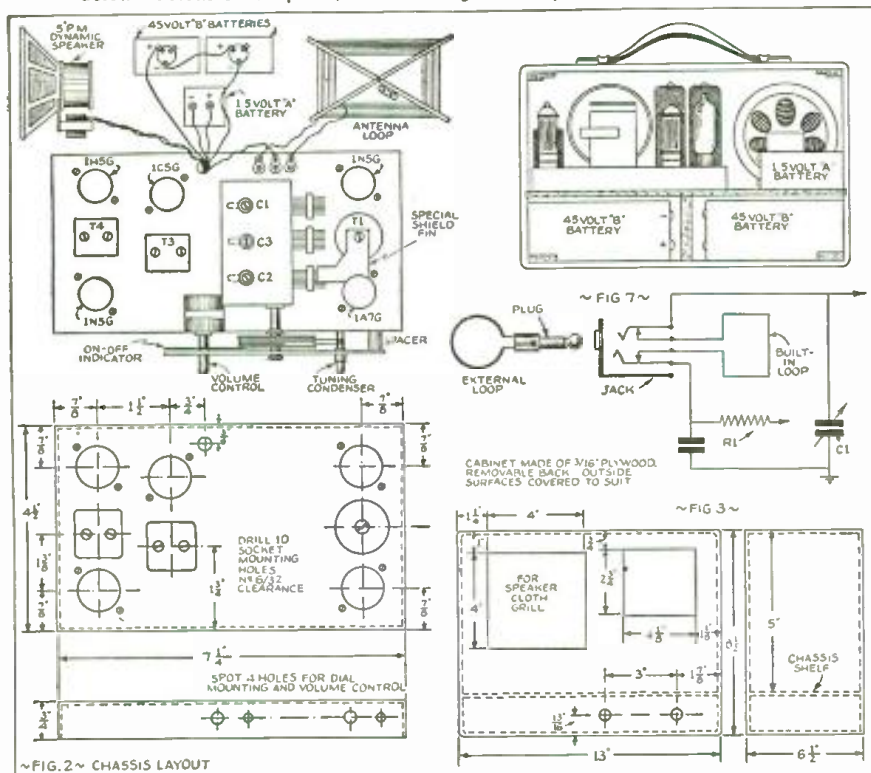
Set the dial pointer to a local station of known frequency, preferably 1400 kc. or 1500 kc. if necessary, and adjust the center gang condenser trimmer (C-3), first, which is the oscillator circuit. After adjusting C-3 for maximum response, then adjust C-1 and C-2 to resonance, or maximum signal response.

Then set the dial pointer to a local station of known frequency, in the vicinity of 600 kc. and adjust the padder condenser, C-11. With each adjustment of the padder C-11, rock the gang condenser back and forth for maximum response. During these adjustments the signal strength will gradually increase to a peak and then decrease. The correct setting is at the peak. During these adjustments the signal strength must be kept at a minimum, so the AVC does not come into operation and so the effect of the adjustments is readily discernible. After setting the padder, the dial setting is returned to the 1400 kc. position and the trimmers, C-2, C-1 and C-3, given a final adjustment. The intermediate R.F. transformer peaks can now be checked and slightly readjusted if necessary.

The set is now ready for service and can be mounted in the cabinet, the position of the chassis and batteries being shown in Fig. 1.

Where extremely long range is required, an extra external loop, adjustable in direction, is suggested. Figure 6 is a front view of the complete receiver with the

Below—details of the panel, chassis and general layout of the loop receiver.



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WARNING: The TELEJECTOR is not to be used as a detective device for listening in on private phone conversations in any place where this is contrary to Government or police regulations.

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special extra loop installed. This extra loop consists of 20 turns of No. 22 rubber covered wire wound bundled on an average diameter of 8". The turns are cemented together with Amphenol 912 liquid coil dope. Upon hardening, the coil dope holds the turns together, forming a self-supporting loop. The extra loop turns are terminated to a phone lug. The latter is also taped and cemented to the loop turns. A double circuit jack, as shown in Fig. 7, is arranged so that when the external loop plug is inserted, the internal or built-in loop is automatically disconnected.

Parts List

MEISSNER

- 1—Punched steel chassis, black wrinkle finish, No. 11-8251
- 1—5" PM dynamic speaker with output transformer, No. 19532
- 1—Dial plate assembly, No. 19531 and glass No. 19535
- 1—3-gang 365 mmf. condenser (C-1, 2, 3) No. 9919 and shield No. 25-7831

- 1—Shielded R.F. transformer T-1, No. 9914
- 1—Unmounted oscillator coil T-2, No. 9916
- 1—456 kc. input I.R.F. transformer T-3, No. 16-5741
- 1—456 kc. output I.R.F. transformer T-4, No. 16-5743
- 1—Volume control and switch, VC, 1 megohm, No. 19533
- 1—Cabinet with leather handle, No. 11-8244

CORNELL-DUBILIER

- 1—1 mf. 200 volt paper condenser, C5
- 2—.05 mf. 200 volt paper condensers, C4 and C6
- 6—.01 mf. 400 volt paper condensers, C7, 9, 12, 13, 14 and 16
- 3—.0001 mf. mica condensers, C8, 15 and 20
- 1—.00001 mf. mica condensers, C10
- 1—Padder condenser, C11, No. 22-7008
- 1—.00005 mf. mica condenser, C17
- 1—10 mf. 25 volt electrolytic condenser, C18
- 1—16 mf. 150 volt electrolytic condenser, C19

I.R.C.

- 3—100,000 ohm 1/4 watt resistors, R1, 2, 3
- 2—50,000 ohm, 1/4 watt resistors, R4, 8
- 1—200,000 ohm, 1/4 watt resistor, R5
- 1—2 megohm, 1/4 watt resistor, R6
- 1—2,000 ohm, 1/4 watt resistor, R7
- 2—500,000 ohm, 1/4 watt resistors, R9, R10
- 1—1 megohm, 1/4 watt resistor, R11
- 1—800 ohm, 1/4 watt resistor, R12

MISCELLANEOUS

- 5—Octal sockets
- 1—Single, 1 double and 2 triple tie lugs
- 4—5/16" and 13/8" rubber grommets
- 2—Connectors for B battery and 1 connector for A battery
- 4—Small grid clips
- 2—Walnut bakelite control knobs, for 1/4" shafts
- 1—Wood frame for loop
- 1—Antenna-ground terminal
- 65—Feet No. 22 rubber insulated loop wire
- 18—No. 6/32 x 1/4" machine screws
- 34—No. 6-32 hex. nuts
- 31—No. 6 lock washers
- 40—Feet No. 22 rubber covered wire

BURGESS

- 2—No. 830, 45 volt and 1 No. 47 1 1/2 volt batteries

HYTRON (Tubes)

- 2—1N5GTX
 - 1—1A7GTX
 - 1—H5GTX
 - 1—1C5GTX
- Extra external rotating loop material.

MALLORY

- 1—Phone plug, No. 75
- 1—Double circuit phone jack No. 704B

AMPHENOL

- 1—2 oz. bottle 912 coil dope

A Compact 28 Mc. Rotary Beam Aerial

Harry D. Hooton, W8KPX

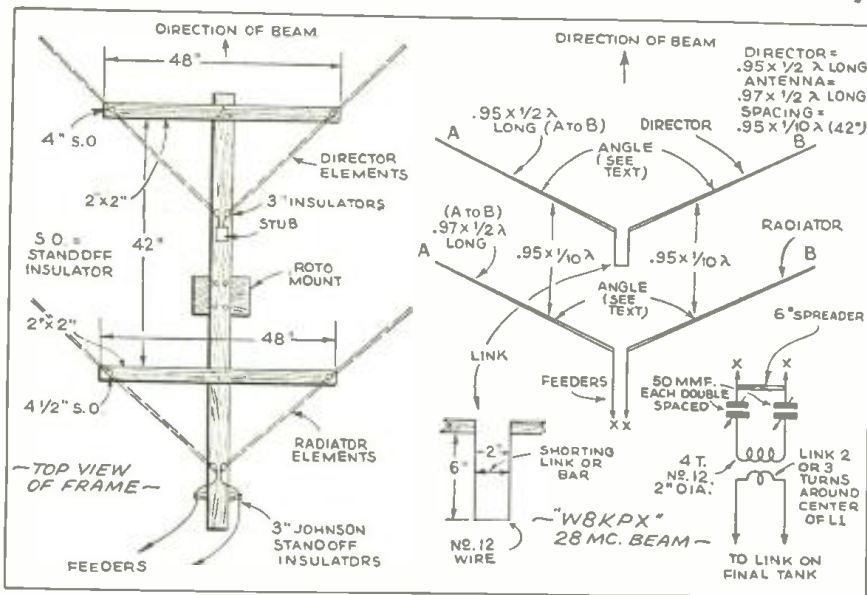


Fig. 1, right, and Fig. 2, left, show construction details.

● WITH the introduction of the new lightweight, adjustable elements for directive antennas, the erection of almost any type of 14 or 28 mc. horizontal "beam" has now become a more or less simple and inexpensive operation.

As the drawing, Fig. 1, shows, the antenna really is a two-element affair using a half wave radiator with a half wave parasitic director placed directly in front of it. The spacing between the two elements is close—approximately one-tenth wavelength or about 42 inches. The radiator and reflector elements are not placed in a straight line as in the conventional arrangement, but are pulled back at the centers to assume a double "V" position as indicated. Extensive experimental and test transmissions have been made using this antenna and the results indicate that the directive properties of the array are not very much affected until the "V" is closed beyond a certain angle—possibly 60 or 70 degrees. This means that the antenna can be made quite compact and still retain its efficiency.

The construction and adjustment of the array is not at all difficult. The author uses the standard commercial elements which

make the installation and adjustment comparatively simple.

The wood frame is constructed in the form of a double "T" and is illustrated in Fig. 2. Only three pieces of wood are required—a single 2x4 six feet long, and two 2x2's about four feet long. The centers of the two cross-pieces must be exactly 42 inches apart, as shown in Fig. 2. The antenna and director elements are placed in the positions indicated by the dotted lines and are mounted on Johnson type 66 and 67 stand-off insulators or their equivalents. The ends of the quarter-wave elements should be spaced about 2 inches apart at the centers of both the antenna and director; the spacing of the director tuning stub should be exactly 2 inches.

Almost any kind of feeder system may be employed with this antenna; the author used an ordinary spaced, resonant transmission line approximately one-half wave long with the original installation. The use of twisted pair for transferring energy from the transmitter to the antenna is not recommended because of the heavy losses which take place on frequencies as high as 28 mc.

The adjustment or tuning of the antenna

is extremely simple. The radiator is adjusted to the proper length as given in the formula:

$$L = \frac{468}{\text{Freq. (Mc.)}} \times 97$$

the director length =

$$\frac{468}{\text{Freq. (Mc.)}} \times 95$$

(L = Length of half-wave antenna in feet.) The director length will be influenced somewhat by the spacing between it and the antenna and usually must be adjusted experimentally. In general, it will be found that the director will be 1% to 2% less in length than the antenna.

The director matching or tuning stub is not absolutely necessary for the proper operation of the system and may be omitted, the director elements being joined together at the center by means of a short piece of No. 12 copper wire. However, the short stub affords an easy means of making adjustments. The link consists of a pair of clips connected together with a short piece of copper wire; the length of the link, from the end of one clip to the other, should be exactly 2 inches. Once the proper adjustment is found, solder a piece of No. 12 copper wire across the two lines of the stub and cut off the length of wire between the link and the end of the stub.

The antenna may be used for receiving; in fact, it is advisable to make some arrangement for switching the feeders back and forth from the transmitter and receiver, in order to take full advantage of the directive properties of the antenna. The use of the "beam" for both transmitting and receiving should make even a very low power station quite effective for 28 mc. work.

Parts List

PREMAX

- 1—RP-4218 Element Kit
- 1—"Rotomount" (rotary mount for frame)

JOHNSON

- 4—Type 66 standoff insulators
- 4—Type 67 standoff insulators

MISCELLANEOUS

- 1—2x4" piece of white pine wood, 6 ft. long
- 2—2x2" pieces of white pine wood, 4 ft. long

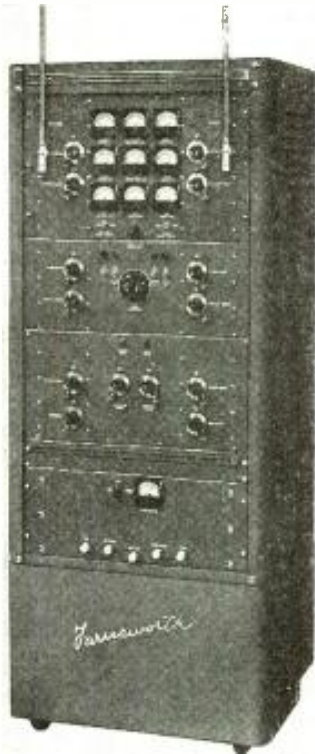
Farnsworth Developments

● THE Farnsworth television "camera," known as the image dissector, is making rapid advancement. Shown on the cover is a view of the interior of the camera; herewith is the assembled camera as it appears in use by the transmitting technician. Features claimed for this apparatus include a sensitivity of 30-45 microamperes per lumen,

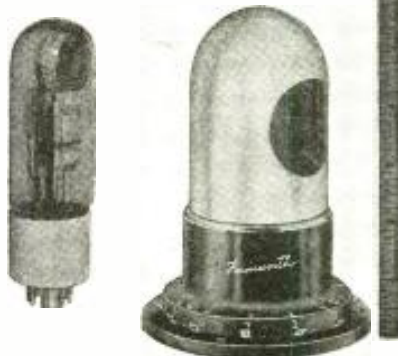
telescope projector for the transmission of motion pictures, a telescope channel, a master timer and pulse generator, and mobile equipment. It is the mobile equipment which is



Portable Television "Camera"



Television Transmitter panels in rack.



Photocell electron multipliers; 6 stage is at left.

adequate aperture for 441 line scanning, freedom from shading effects, absence of retrace surge, and lack of keystone distortion. The company also has developed a

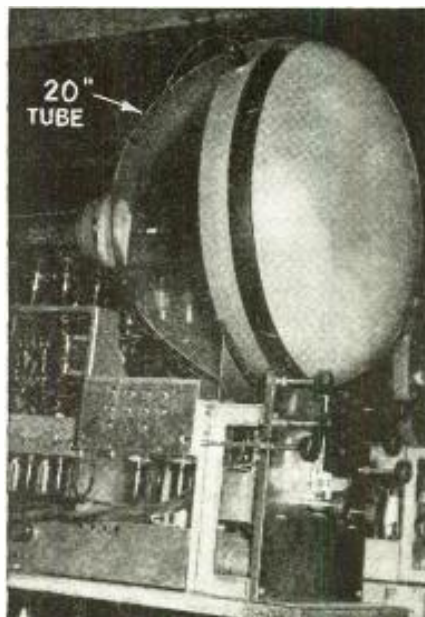
illustrated on this page and on the cover. In addition the company has produced 6 stage and 11 stage photocell electron multiplier tubes, which are shown herewith.

LIBERAL TELEVISION SALES OFFER

● IN order that potential purchasers of television receivers may not be frightened away by rulings of the F.C.C. based upon possible obsolescence of equipment, the Allen B. Du Mont Laboratories is guaranteeing its customers that any changes necessitated in its receivers by a change of television standards prior to January 1st, 1942, will be made *absolutely free of charge*. Subsequent to that date any changes necessitated by revision of standards will be made at cost.

The company also estimates that the life expectancy of their 14" television receiving tubes is approximately 3 years. It is claimed that these tubes will remain free of ion blemish, which is manifested as a small dark spot at the center of the viewing screen. One of the Du Mont television cameras and the insides of the receiver using a 20 inch viewing tube are shown herewith.

Dumont is now working on a transmitter for the New York area.



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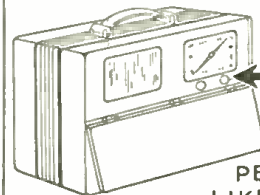
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PUT THIS NEW 14-TUBE CHASSIS IN YOUR PRESENT CABINET

only \$19.95 COMPLETE

Color Television by Scophony Uses Three Special Tubes

● LARGE screen projected television pictures have been made possible by the Siatron, a new development of the Scophony system, described in *Electronics and Television & Short-Wave World*, London. The process is different from the more usual method in that the subtractive method of color separation is employed. The accompanying illustration shows the path of the

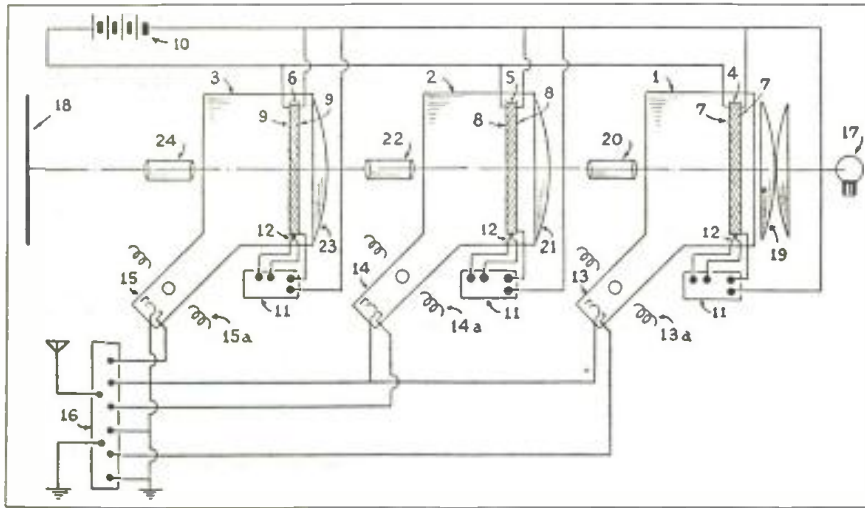
respectively. Each screen is situated in an electric field provided by pairs of transparent electrodes 7, 8 and 9, across which is maintained a potential difference by means of a source of potential 10. The screens can also be maintained at a suitable temperature by means of a thermostatic control of suitable form, which in the example shown consists of a source of current 11 for each

of the primary colors of the object being transmitted.

The sense of the modulations applied to the beam is such that the density of the deposit produced is inversely proportional to the intensity of the corresponding primary color. The three beams are caused to traverse the three screens 4, 5 and 6 in synchronism by means of scanning coils 13a, 14a and 15a.

The material and/or temperature of the screens are chosen so that the colored deposits produced therein have the required complementary colors. White light from a suitable source 17 is projected successively through the screens 4, 5 and 6 in such a way that the screen images are superimposed in register on a reproduction surface 18. This can be done by fully illuminating the first screen with a condenser system 19 which also forms an image of the light source 17 on a first projection lens 20 situated between the first two screens 4 and 5. This projection lens forms an image of the first screen 4 on the second screen 5 in register, and the light is focused by means of a field lens 21 on to a second projection lens 22 which forms an image of the second screen 5 on the third screen 6 in register. A field lens 23 focuses the light passing through the screen 6 into a final projection lens 24 which forms an image of the third screen 6 on the reproductive surface 18, forming thereon the final color picture.

It will be noted that with the inverting optical system shown, the image on the screen 4 must be inverted, that on screen 5 upright and that on screen 6 inverted, so that the projection lens 24 forms an upright image on the screen 18. This can be arranged by applying the deflecting currents to the coils 13a, 14a and 15a in a suitable sense or direction.



Three color filters operate from incoming signals in new system.

light beam from the source of illumination to the screen. Three complementary color screens on each of which a momentary color deposit is produced.

A complete description of the system follows as taken from the British publication.

Three cathode-ray tubes 1, 2 and 3 are provided, each comprising a transparent image screen indicated at 4, 5 and 6, re-

tube which passes a current through one of the electrodes 7, 8 and 9 of each screen, the amount of the current and hence the temperature for each screen being controlled by a thermo-couple 12 in each screen. Means indicated at 13, 14, 15 are associated with the tubes for producing a scanning cathode-ray beam and the amplifying arrangement 16 is fed by signals representative of each

Mechanical System Simplifies Making Television Movies

● THE E. M. I. Laboratories of England have developed a new means of making motion pictures of television images. The accompanying drawing shows how a continuously moving film receives images of television programs projected by a mirror drum system.

In the drawing, 1 is television signal receiving device shown as a cathode-ray tube having a screen 1a, tube 1 being arranged to be actuated by the signals radiated by the transmitter so as to reproduce the transmitted pictures on the screen 1a. The tube can, for example, be a standard monitoring tube for the transmitter and either a positive or negative record may be made depending upon the polarity of the image on the cathode-ray tube.

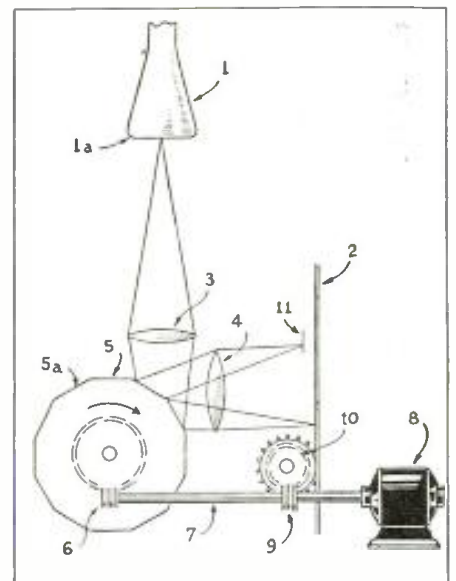
The screen of the tube is imaged on the film 2 through an arrangement comprising lenses 3 and 4 between which is the mirror drum 5 having reflecting elements 5a, the mirror drum being driven through a worm gear 6 from a shaft 7 by an electric motor 8; the shaft also carries a further worm gear 9 through which a drive is transmitted to the film driving sprocket 10.

The speed at which the film is driven relative to that of the drum 5 and the number of elements 5a, is so chosen that there is no relative motion between the image of the cathode-ray tube screen 1a and the film. The optical system may be designed so that successive images are contiguous, leaving no waste space between frames.

The actual speed of the film is such that a satisfactory exposure is obtained and the area of the film illuminated at any instant may be limited by means of a mask 11, which preferably corresponds to the picture area on the screen of the cathode-ray tube, so that each picture is photographed only once.

This system can also be used for scanning film. This can be done by illuminating the cathode-ray tube to an even screen brilliance and facing a photo-cell behind the film.

The author of the article believes, says *Electronics and Telev. & S-W World*, London, that some day motion picture studios may replace their cameras by cathode-ray pickup tubes and photograph their films from a monitor tube in much this way.



Mirror drum and C-R tube used in British film transmitter.

An Open Letter to the F.C.C. re: Television

Mr. James L. Fly, Chairman
Federal Communications Commission
Washington, D. C.

Mr. dear Mr. Fly:

The writer has been watching the progress of television in the United States since sometime in 1926—the days when a 60-line picture was considered the last word in high definition. As he is still active in the field, he was extremely interested in

(a) The Commission's brief approval of partial commercialization of television broadcasting; (b) the Commission's rapid change of heart on such authorization; and (c) your explanation, as delivered over the NBC and Mutual networks.

As one whose living is indirectly dependent on television, I feel rather strongly on the subject. While I can see that only the highest ideals motivated the F.C.C. in its original standpoint and rapid reversal thereof, I believe that the Commission was (at least in part) either misled by incorrect information or failed to take certain facts into consideration.

I realize that the F.C.C. is authorized to regulate communications so as best to serve "the public interest, convenience and necessity." I further realize that your original ruling on television and the reversal thereof were made with these points in mind. But I wonder whether the Commission is aware that perhaps the public might be the best judge as to whether or not the public wishes to buy television receivers? The possible obsolescence of television receivers within a comparatively short time has been widely publicized even prior to the Commission's reversal of its original ruling. The receivers are by no means in a price class which would induce the impoverished to purchase them. A piece of apparatus which costs as much as a small automobile will, I am confident, be bought only by those who can afford major expenditures. It has been my experience that this class of person, having enough intelligence to gather money, is able to judge reasonably well as to how best to spend it.

The problem of obsolescence, incidentally, is not necessarily a major one. I recently interviewed the Chief Engineer of a leading western television transmitter, who told me that the station had broadcast at 331 lines for a period, after which it shifted to the present so-called standard of 441 lines. Each owner of a television receiver found his apparatus "obsoleted"—yet was able to make minor alterations which did away with the temporary obsolescence and made it capable of receiving the 441-line images. The cost of such circuit changes was hardly prohibitive, being from \$2 to \$5, depending on the set.

It is my opinion that the Commission's reversal of its original ruling in the matter of television has worked tremendous harm upon that part of the public who own the some 2,500 television receivers now in operation in the metropolitan area. A survey conducted by the writer has shown that the average television viewer considers the art highly satisfactory *technically speaking* but believes the programs to be of inconsiderable entertainment value. Such lookers-in yearn for the day when "big names" and elaborate presentations will reach the television screen. This highly desirable end can be attained only through the commercial sponsorship of television programs, for the stations can not be expected to bear the entire burden of both talent and technical costs indefinitely.

It has been my privilege to witness television programs nightly since the inception of regular broadcasting over W2XBS. I have watched studio technique improve tremendously. Further advances can, I believe, be expected. As the television director of a major network told your Commission, detail and shading of 441-line images

can be much improved even *before* it is necessary to go to a higher number of lines per frame. Having, as previously mentioned, watched the change in television technique I can concur heartily with his statement.

It is, of course, known that companies not utilizing the same circuits used for transmission and reception as are employed by RCA, G.E. and similar manufacturers, are eager that standards be not "frozen." They are correct. The writer can see no reason why *both* systems should not be permitted on the air, the set purchaser to be given a perfectly free choice as to what type of apparatus he prefers to buy. Both systems have spent appreciable sums in acquainting the public with the relative merits of their products.

The contrasts you pointed out between the field of television and the automotive industry were both interesting and true. However, when one buys a car having four-wheel brakes, he has no guarantee that next year's legislators will not demand that automobiles to be safe for the road must have dual four-wheel brakes, thus obsoleting the car, taking it off the road, and thus ruining his investment. When phonograph recording was changed from the old "hill and dale" type to the present method of "side to side" modulation, the early Edison machines were obsoleted. Still no government body made any attempts to protect the phonograph industry. Airplanes, too, changed from the "pusher" to the "tractor" type and the old models are no longer seen, yet I do not recollect anybody attempting to regulate the manufacture or sale of airplanes. In the amateur motion picture field, the American standardization of 8 and 16 millimeters for film widths has made it virtually impossible for the amateur motion picture photographer to obtain the 9 1/2 millimeter film which earlier motion picture cameras used. Nonetheless, the amateur movie industry has progressed rapidly, and there seems to be little harm done those persons who early invested in the now obsolete 9 1/2 mm. equipment. Something might be said about the possibility of frequency modulation radio transmission obsoleting the present amplitude modulation receivers, yet it is unthinkable that any body would legislate all present radio receivers out of existence. Radio advanced to its present high state of perfection because it was allowed to grow in the way which the public considers best suited "to the public interest, convenience and necessity." Do you not think television would grow equally well under the same conditions?

In announcing a price reduction of its television receivers, one of the leading manufacturers offered to rebate the difference in price between its original models and the new figure to all purchasers of the older sets. With such a liberal policy established, it seems likely that the industry can be trusted to make liberal trade-in allowances if present models become obsolete or to modernize them at low cost should they fail to receive signals sent out by an improved system. They were not compelled by federal regulations to make any rebates; they know the value of good will and certainly will strive to hold it if receivers now being sold are soon obsoleted.

In the foregoing, I have spoken not as a casual busybody but as one who has been active in radio since 1922 and in television since 1926. I hope that you will accept this letter (which we plan to publish in RADIO & TELEVISION MAGAZINE) in the helpful spirit in which it is offered.

Sincerely yours,

Radio & Television,

ROBERT EICHBERG,
Television Editor

Television Detail Shown in Chart

● THE amount of detail possible from a given number of scanning lines was recently surveyed by engineers of the Allen B. Du Mont Labs. who do not believe that higher definition may be economically obtained by an increase of band width at the present time. According to the Du Mont engineers, the following table shows the approximate number of picture elements obtainable with standard scanning frequencies.

Scanning Lines	Approximate Picture Elements
240	60,000
441	200,000
625	400,000
882	780,000

These engineers feel that by reducing the repetition rate of television transmission to half its present value (which is 60 half pictures or 30 complete frames per second) double the number of picture elements may be transmitted over a channel of present width. The engineers believe that a higher persistence screen will make such transmission possible and have developed one for which they claim many desirable features. They are also experimenting with larger tubes and have developed one twenty inches in diameter. A scanning detail of 625 lines is necessary, they state, to take full advantage of the increased screen area.

Now licensed to broadcast, Du Mont is constructing a station to test these theories.

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MODEL 100 100-A with fixed condensers, covers 1600 to 2000 kilocycles. List Price \$12.50

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Diagrams of Interest

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All diagrams and descriptions accepted and published will be paid for at regular space rates. Diagrams may be for receivers, adapters, amplifiers, etc. Send them to Hook-Up Editor, RADIO & TELEVISION, 20 Vesey St., New York City.

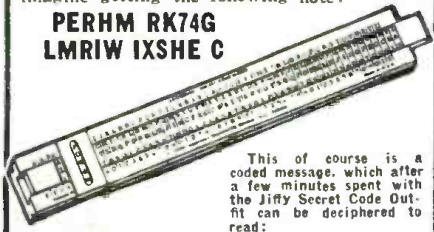
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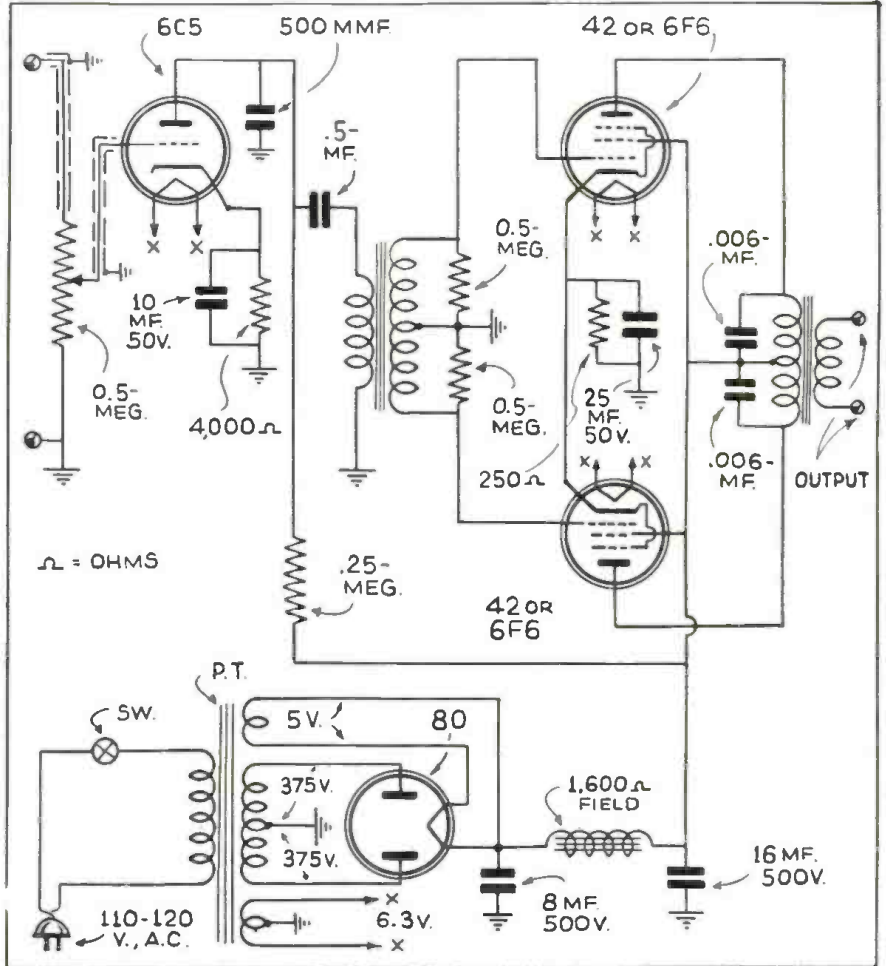
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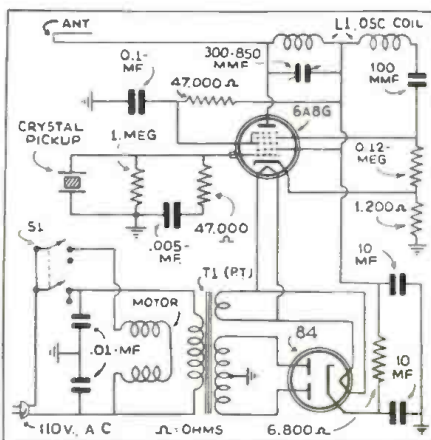
1915 SO. STATE ST., Dept. RT-640 Chicago, Ill.



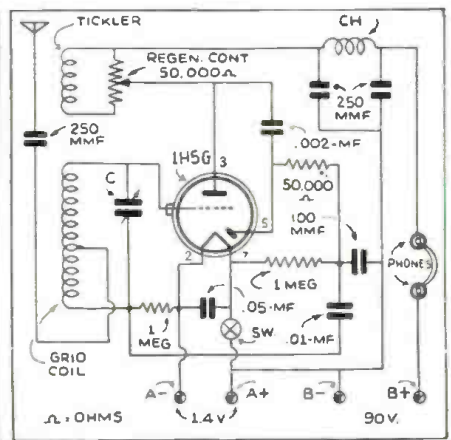
TEN WATT AUDIO AMPLIFIER: This audio amplifier will prove useful for many different requirements; it may be used for a phonograph pickup, or as a small public address amplifier. It may also be used in connection with a radio tuning unit for regular radio reception. The output transformer and impedance should match the impedance of the loud-speaker employed.

Experimenters will find this circuit useful and it may be built up from odd parts even though their values may not be exactly the same as those given.

—Courtesy Radio Technica, Buenos Aires, S. A.

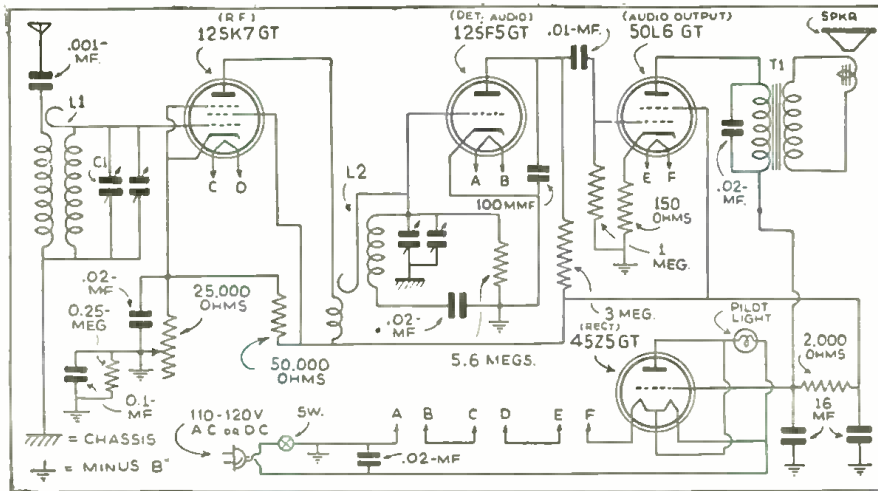


WIRELESS RECORD PLAYER: Radio experimenters are showing a great deal of interest in wireless record players and the accompanying diagram of a recent G.E. Co. circuit will prove valuable. The parts required are few in number. T1 is the power transformer, L1 may be a broadcast "oscillator" coil.

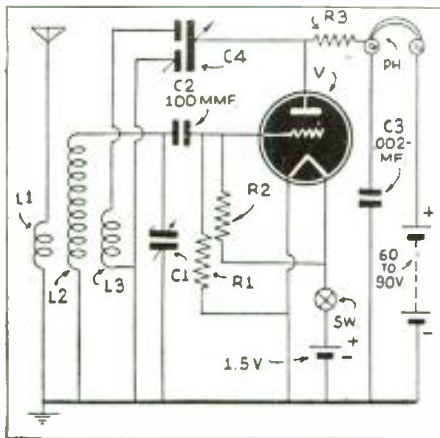


MONO-TUBE RECEIVER: This one tube receiving circuit, utilizing the 1H5G tube, will appeal to all radio experimenters, especially the beginner. The grid and tickler coil data have been given many times before, or may be found in any book of radio coil data. The choke CH may be a 2.5 milli-henry standard R.F. choke.—Courtesy Radio Technica.

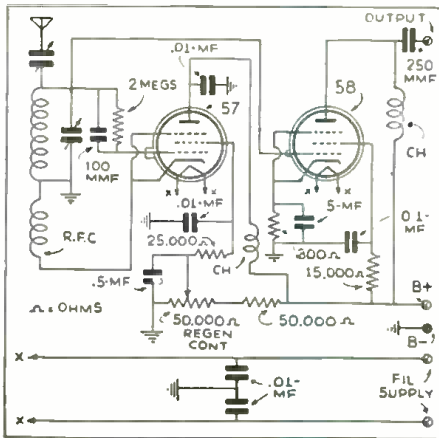
to the Radio Experimenter



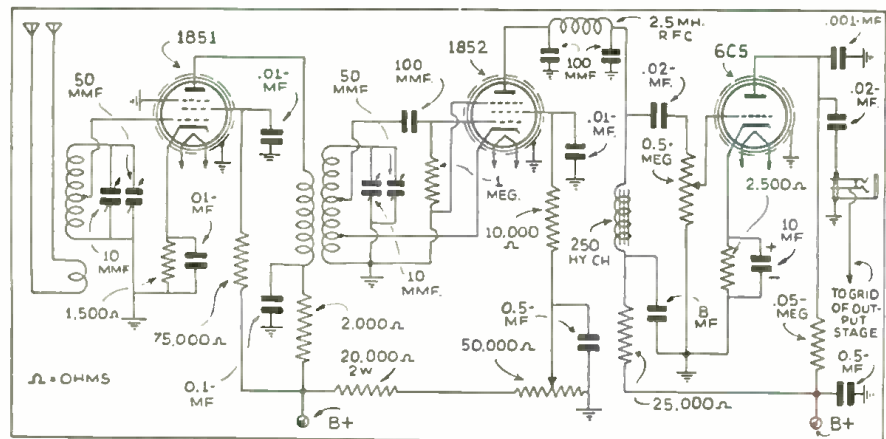
110 VOLT A.C.-D.C. 4 TUBE B.C. RECEIVER: An interesting tuned radio frequency receiving circuit, utilizing the latest type tubes. The coils should have the proper number of turns to cover the broadcast band with the usual capacity tuning condensers. A permanent-magnet dynamic speaker may be used.—Courtesy of G.E. Co.



ONE TUBE REGENERATOR—A regenerative circuit employing split stator condenser to afford smoother operation. Resistances R1 and R2 are balanced to provide the correct bias. Coils L1, L2 and L3 and condensers C1 and C4 are chosen to cover desired band. R3 about 10,000 ohms. Tube employed may be any one available to the experimenter.



REGENERATIVE PRE-SELECTOR: This pre-selector—utilizing the regenerative principle—will boost those weak signals before you feed them into your regular radio receiver. The tuned grid coil must have the proper number of turns to tune over the desired band; see any coil data book or previous articles in this magazine.—Courtesy Radio Technica.



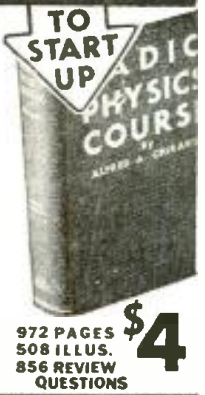
THE ULTRA DX THREE: A 3 tube ultra high frequency receiver especially designed for experimenters. The values of the various resistors and condensers are given in the diagram, and the coil data can be found in other articles covering the desired U.H.F. bands. The lineup comprises a tuned R.F. stage, a regenerative detector and a 6C5 first audio stage. This circuit is particularly suitable for reception in the region of 5 meters and below.—Australasian Radio World.



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Here's a dandy receiver for anyone desiring a 1-tube head-phone set, that may be plugged into any 110 volt A.C. or D.C. lamp socket. It uses a new type 110 volt tube, thus eliminating all series ballast resistances.

The convalescent in a ward or a semi-private hospital room can enjoy radio reception from near and far without annoying other occupants of his room and without taking up valuable space on his bedside table, since the Pigmy occupies much less space than a telephone desk set.

The Pigmy is built on a metal chassis $1\frac{3}{4}$ inches by $3\frac{3}{4}$ inches by $\frac{3}{4}$ inches high. Two sockets are mounted on this chassis: one for the plug-in coil and the other, an

● THE Pigmy has many interesting features. It uses the new 117L7GT tube, which combines a beam power pentode amplifier with an efficient rectifier. This tube operates directly from any 110-220 volt house lighting circuit, A.C. or D.C. and does not require any ballast tube or other form of series filament resistor. As a result, receiver design is simplified and there is a saving in space, since the tube itself is only $1\frac{3}{4}$ inches in diameter and $37\frac{1}{16}$ inches overall length. The seated height is $2\frac{7}{8}$ inches.

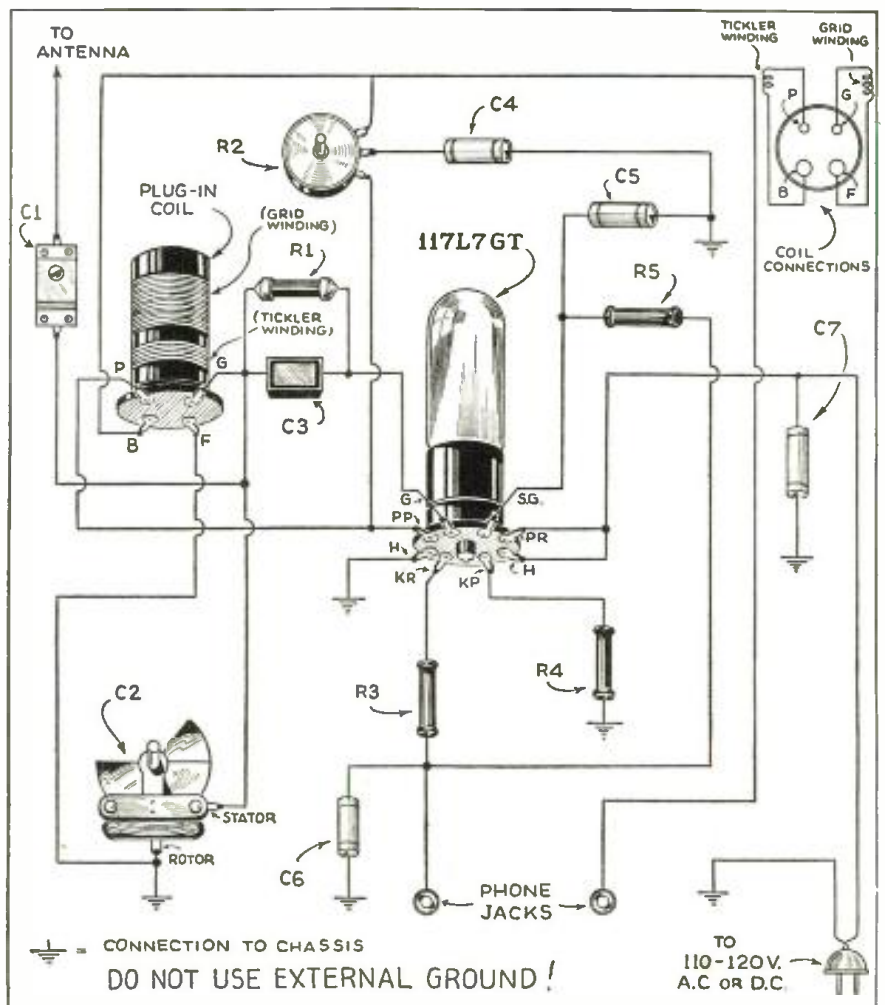
The chief purpose in designing this little set was to employ the 117L7GT as a combined rectifier and regenerative detector, employing sufficient audio amplification for effective earphone operation.

A special effort was made to reduce components to a minimum by discarding all parts not absolutely necessary for efficient operation. Although the Pigmy looks like a toy, it is an "honest-to-goodness" set which actually performs with a high degree of efficiency. With an ordinary aerial, it brings in strong local stations with enough volume to operate a small magnetic speaker. Using earphones, it also brings in *foreign* stations with ease on the short wave bands. When tested under adverse conditions, in a steel building, it was able to bring in local broadcasting without an aerial, other than a few feet of wire thrown on the floor.

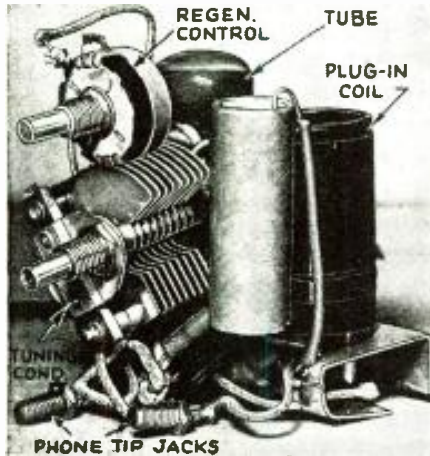
A set such as the Pigmy has hundreds of uses. When traveling, it can be stowed into a spare corner of the suitcase or handbag and can be used in a hotel room or guest room without disturbing others. It is also a handy set to bring along on a vacation trip for use in a tourist camp or a seaside bungalow. The business man can keep this little set in a desk drawer at the office and listen in to the latest news reports not only from his local broadcast stations, but also direct from London, Berlin, Rome, etc., just as though he had a private wire, without intermediary re-broadcasting.

A handy radio set indeed is this one-tube receiver, which is small—uses no batteries—and may be plugged in to any lamp socket.

Anyone can build this simple 1-tube receiver by following the accompanying picture diagram.



octal, for the 117L7GT tube. A few of the small resistors may be soldered beneath the chassis, but the rest of the resistors, together with the fixed condensers, are wired above the chassis. The potentiometer, variable condenser and phone jacks are mounted on the front panel of the wood cabinet. This cabinet is 4 inches wide, by 4 $\frac{5}{8}$ inches high, by 3 inches deep. The variable condenser is mounted in the center, with the regeneration control potentiometer on top



A chassis view of the 110 volt A.C.-D.C. portable.

and the phone jacks at the bottom. The wiring should be completed before mounting the two controls and the two jacks on the front panel of the cabinet. The chassis is then mounted in the cabinet with the chassis rear wall flush with the rear of the cabinet. This leaves space at the front of the chassis for the various condensers and resistors. Finally, a small size antenna trimmer is fastened, by means of a wood screw, to the upper rear of the cabinet.

The actual wiring of the Pigmy is amazingly simple. Looking at the bottom of the tube socket with the keyway pointing down and starting at the lower left, assign numbers to the terminals from 1 to 8, counting in a clockwise direction. One terminal of the line cord is then soldered to tube socket terminal No. 7. This is the heater terminal. This is also connected to No. 6, which is the rectifier plate connection. A .1 mf. by-pass condenser, C7, is soldered to the No. 6 terminal with its other end grounded to the chassis. The purpose of this condenser is to eliminate 60 cycle tunable hum. The other line cord connection and the other heater terminal No. 2 are each soldered to the chassis. Terminal No. 1 is the cathode of the rectifier section of the tube. This is the rectified high voltage (D.C.) point. It is connected to a 10,000 ohm filter resistor, R3, which in turn connects to one of the earphone jacks and also through a 1 megohm resistor, R5, to the pentode screen-grid terminal No. 5. A .1 mf. by-pass condenser, C5, is also connected to No. 5 with its other terminal grounded to the chassis.

A 40 mf. etched foil electrolytic condenser of midget type C6, is connected to the output of the 10,000 ohm resistor, with the negative terminal of the condenser grounded to the chassis. This is all the filtering this set needs for humless operation.

The pentode plate tube socket terminal

No. 3 connects to the plate coil socket terminal "P" (i.e., in the Hammarlund coil, this is the one connecting to the lower end of the small [tickler] winding). The No. 3 terminal is also connected to one of the end terminals of the potentiometer R2. The coil socket terminal "B," in contact with the upper end of the tickler winding, connects to the other outside terminal of the potentiometer and also to the second phone jack. The center terminal of the potentiometer is connected to condenser C4, and the other side of this condenser is grounded to the chassis.

The grid terminal of the tube socket No. 4 connects to the grid-leak R1, and grid condenser C3, and the other terminals of these two components are connected to the grid terminal of the variable condenser C2 and the grid terminal of the coil socket. In the case of the Hammarlund coil, this is the one connecting to the top of the long winding. The coil socket prong connecting to the bottom of the long winding is grounded to the chassis; the variable condenser ground terminal is also grounded to the chassis. The grid terminal of the variable condenser is also connected to the inside terminal of the antenna trimmer C1, while a short length of wire is soldered to the outside terminal of the antenna trimmer, to serve as an antenna connection.

These few connections are the only ones required to complete the job. Anyone, no matter how inexperienced, should be able to wire this set from start to finish in less than half an hour.

The Pigmy, complete with tube and coil, ready to operate, weighs only 17 ounces. As regards current consumption, this set draws less than 1/10 of an ampere and requires less than 11 watts as compared to the 40 watts of the ordinary table-type midget receivers.

List of Parts Required for the Pigmy 1-Tube All-Electric All-Wave Set

HAMMARLUND

(Condensers, Coils and Sockets)

- 1—19 plate 140 mmf. variable tuning condenser, Star type or MC-140-M (C2)
- 1—Antenna trimmer, 3 to 35 mmf., type EC-35 (C1)
- 1—Set short wave plug-in coils, 17 to 270 meters, type SWK-4
- 1—Broadest plug-in coil, 250 to 500 meters, BCK 4
- 1—4 prong Isolantite coil socket, type S-4
- 1—8 prong Isolantite coil socket, type Octal

CORNELL-DUBILIER (Condensers)

- 1—Mica condenser, .0001 mf., type 1W (C3)
- 1—Mica condenser, .005 mf., type 1W (C4)
- 2—1 mf. tubular paper condensers, type DT4-P1 (C5, C7)
- 1—40 mf., 150 volt etched foil electrolytic condenser, type Beaver No. BR4015 (C6)

I.R.C. (Resistors)

- 1—1 meg., $\frac{1}{4}$ watt fixed resistor, (R1, R5)
- 1—10,000 ohm, $\frac{1}{2}$ watt fixed resistor (R3)
- 1—150 ohm, $\frac{1}{2}$ watt fixed resistor (R4)
- 1—75,000 ohm potentiometer (R2)

CANNONBALL

- 1—Pair headphones

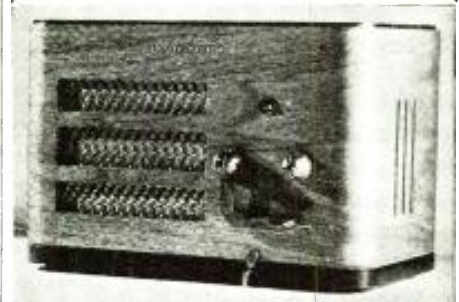
ARCTURUS (Tube)

- 1—117L7GT tube

MISCELLANEOUS

- 2—Phone jacks
- 1—Line cord and plug
- 1—Roll hook-up wire
- 2—Knobs
- 2—Dials
- 1—Metal cabinet
- 1—Wood cabinet

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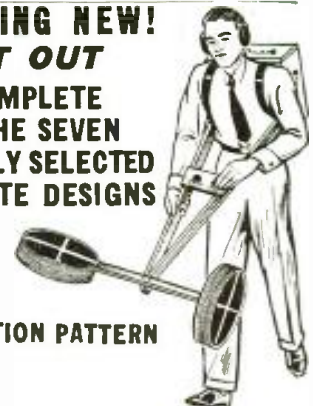
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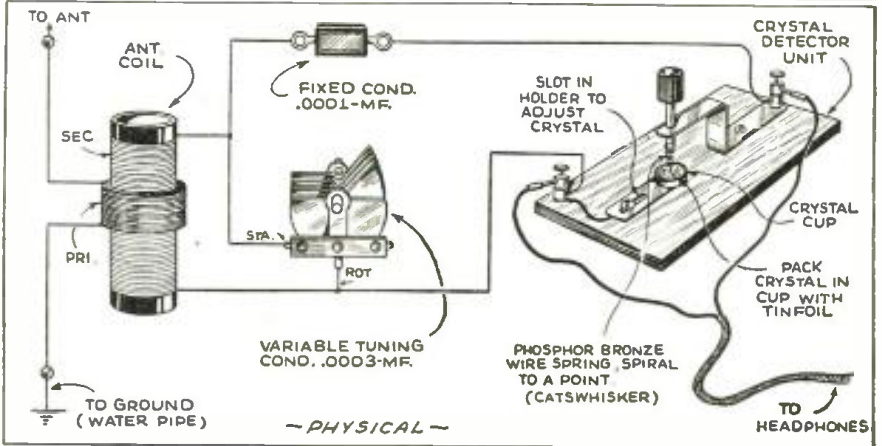
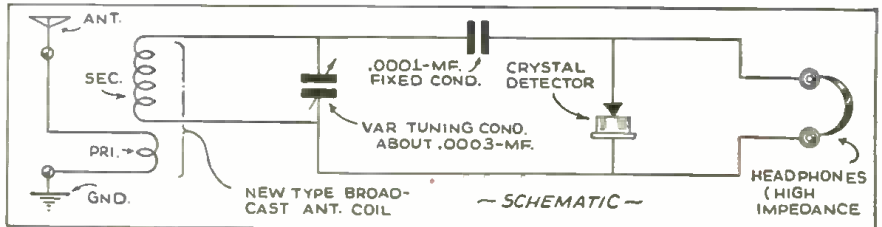
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A Simple Crystal Receiver

● FOR reception of broadcast stations especially where the receiver to be used is within 20 miles or so of the station, a crystal receiver often proves useful. Fixed crystals or one with an adjustable contact point are available, and the accompanying diagram shows one method of connecting the tuning coil, condensers, crystal detector

would like to know what frequencies or wavelengths were successfully received with the crystal.

If you wish to wind the antenna coupler yourself the secondary winding may comprise 126 turns of No. 28 insulated wire, close-wound on a 1 1/2" diameter cardboard or other tube. The antenna coil may be 15



Hook-up of Crystal Detector Receiver.

and pair of high resistance phones. The phones should have at least 2,000 ohms resistance. The tuning coil may be picked up in the radio parts stores very cheaply, and should be designed to cover the broadcast band. When you purchase the coil, be sure to ascertain what capacity tuning condenser is to be used with it, in order to cover the band from 200 to 550 meters. Crystal detectors have not proven very satisfactory for short wave reception, but the editors will be very glad to hear from those who do have success in this direction, and also

turns of the same size wire, wound at one end, or else wound over a piece of paper at the center of the secondary; this transformer is for use with a .00015 mf. capacity tuning condenser. The experimenter may try a metallic needle contact, pressing against a piece of fused silicon or iron pyrites. Molybdenum has also been used with a metal point; a double crystal combination comprises a piece of zincite pressing against a chunk of chalcopyrites (copperpyrites).

Other crystals may be experimented with.

The 1-Tube "DX" Eavesdropper

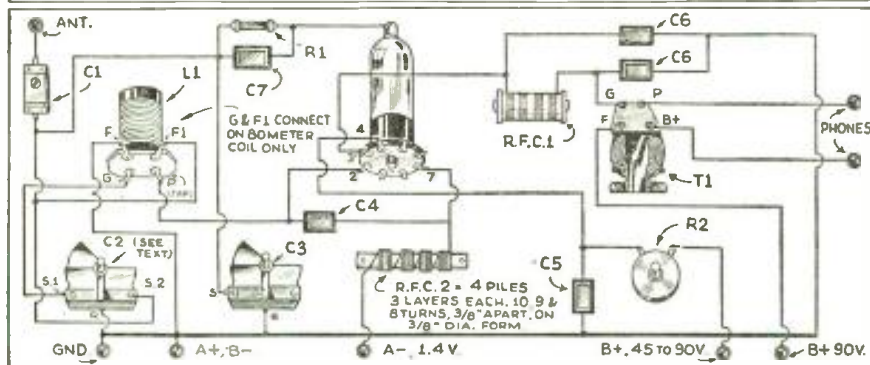
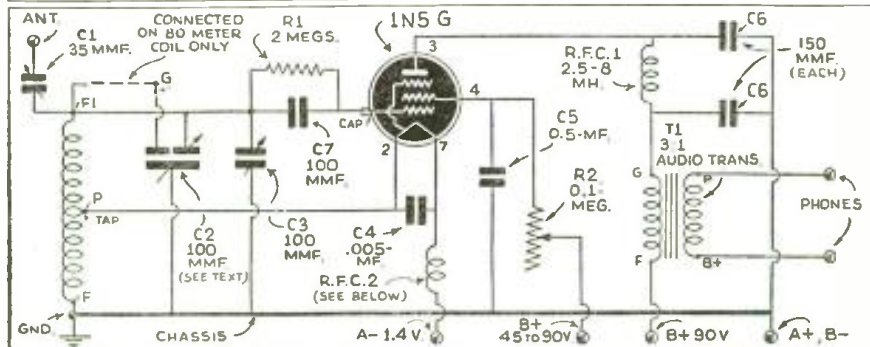
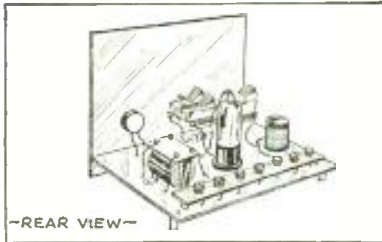
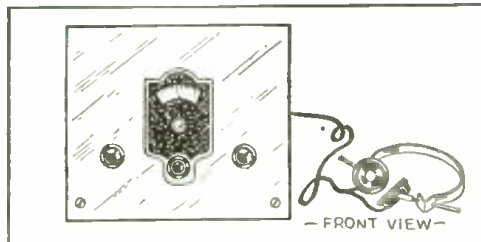
● ONE tube sets are always welcome to the dyed-in-the-wool radio fan for several reasons; the apparatus required is inexpensive and there is much less chance of an error occurring in the connection of the parts. The accompanying one tube circuit, which will pick up foreign stations, uses one of the new 1N5G battery tubes operating on a single dry cell. Two small 45 volt B battery units connected in series to give 90 volts complete the power-supply requirements.

The coils may be wound on 4-prong tube bases, or small coil forms available in most radio shops and having a diameter of about 1 1/4". The coils have one winding only as the diagram shows, and regeneration is afforded through a tap on the coil. Herewith is the coil winding data for the various short wave bands.

Band	Grid to Fil.	Fil. to Ground
80m.	20 t.	1 1/2 t.
40m.	12 t.	1 1/2 t.
20m.	3 t.	1 1/4 t.

All parts may be mounted on an aluminum or other metal sub-base with a metal panel, if desired, to support the dial and other control knobs. The ingenious set-builder may also like to place all the parts, including the batteries, in a small carrying case provided with a handle. The various short wave bands and the broadcast band may be covered by means of plug-in coils.

A dual condenser arrangement is used for tuning and provides band-spread; a National 100 mmf. variable is cut down into two sections comprising 5 plates and 2 plates. On 20 and 40 meters, the 2-plate section is connected in parallel with the 100 mmf. band-setting condenser and spreads the band over most of the dial, thus



Beginners will find this 1-tube receiver a real DX'er.

allowing easier tuning. On 80 meters the 2-plate section is not sufficient to cover the entire band, so the extra 5-plate section is connected in parallel with it. This is done by connecting the 5-plate section to the blank prong of the coil socket; in the 80-meter coil a wire is run from the grid prong to the blank prong and thus, when the coil is plugged in, the extra section of the condenser is connected in parallel with the 2-plate condenser.

The filament choke is wound on a piece of 3/8" dia. wood 4" long. There are 4 sections of No. 28 cotton or silk covered wire on it; each section is wound in 3 layers. The bottom layer has 10 turns, the second layer 9 turns, the top layer 8 turns. The sections are placed 3/8" apart. An old audio transformer of about 3-to-1 ratio is used to couple the high resistance headphones to the plate circuit of the tube, and the R.F. choke connected in series with the plate may be of 2.5 to 8 mh. inductance.

If any trouble is experienced in getting the set to regenerate, as manifested by the usual steaming or rushing sound heard in the phones, it may be necessary in some cases to adjust the position of the tap along the antenna tuning coil. Another way to adjust the set so as to regenerate properly is to readjust the series antenna condenser.

Parts List

- 1—100 mmf. National 270 degrees condenser, cut down, see text
- 1—35 mmf. antenna trimmer (Hammarlund)
- 1—100 mmf. condenser, variable (Hammarlund)
- 1—.005 mf. mica condenser (Solar)

- 1—.00015 mf. mica condenser (Solar)
- 1—.001 mf. mica condenser (Solar)
- 1—.05 mf. by-pass condenser (Solar)
- 1—1 meg. half watt resistor (I.R.C.)
- 1—100,000 ohm variable resistor (I.R.C.)
- 1—2.5 to 5 mh. choke (Hammarlund)
- 1—Filament choke (special), see text
- 1—1-to-1 audio transformer
- 2—4 prong Isolantite sockets (Hammarlund)
- 1—Dial, National type B; 270 degree
- 1—Set of coils, see coil table. (For broadcast band, the coil may be wound with about 124 turns No. 28 S.S.C. or enam. wire, tapping it 30 turns from the filament end, Use a 140 mmf. or larger tuning condenser with this coil.)
- 1—1N5G type tube (R.C.A. Radiotron)

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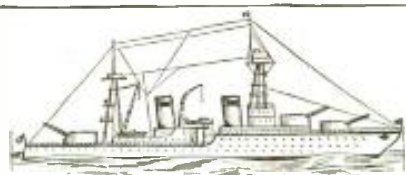
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Edited by Herman Yellin, W2AJL

3-Tube Mike Amplifier

? I would appreciate seeing a diagram of a 3-tube amplifier using a 57, 2A5 and an 80 to be used with a single-button carbon microphone. Please show a tone control to accentuate the bass notes.—H. J. Schuler, Montclair, N. J.

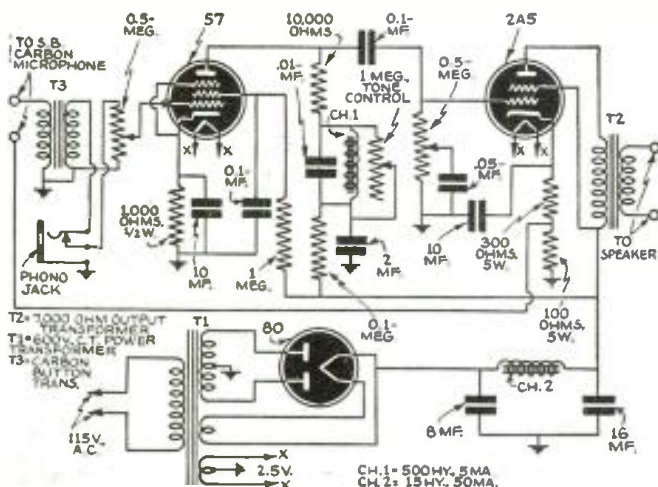


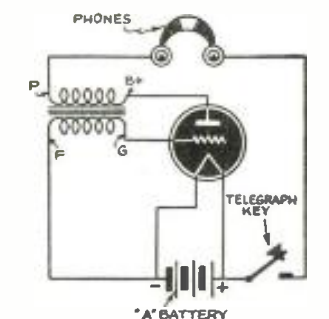
Diagram for 3 tube amplifier suitable for use with mike or phonograph pick-up. No. 1215.

A. A diagram showing such a circuit is shown here. Either a carbon-button mike or a phonograph can be used with this amplifier. The one meg. variable resistor, TC, in the plate circuit of the 57 controls the amount of bass accentuation. When its resistance is at a maximum, the bass notes are at a maximum; when the resistance is at a minimum, the bass response will be at a minimum. A standard high frequency elimination tone control is also shown in the grid circuit of the 2A5. Voltage for the mike is ingeniously furnished through the tapped bias resistor of the 2A5.

Code Oscillator

? Will you please print a diagram of a battery-operated code oscillator using an '01A tube?—P. Lanfear, The Glen, N. Y.

A. Here is a diagram of the simplest code practice oscillator. Any 3-element battery tube can be used, as long as the correct battery voltage is applied to the filament—5 volts for an '01A; '30 takes 2 volts. Any of the 1.4 volt tubes can be used with a small flashlight battery for filament supply.



Simplest code practice oscillator. No. 1216.

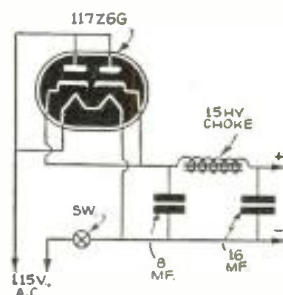
Adding Speaker to Small Set

? Can I add a 2-inch speaker to the "Tiny Tim" receiver described in the December issue? Please furnish coil information for the 160 meter band.—Bobby Barnhill, Bristol, Va.

A. Yes, the stronger stations can be heard on the speaker; merely connect the speaker transformer to the phone jack. Coil data for the 160 meter band is: L-1, 65 turns No. 22 S.S.C.; L-2, 20 turns No. 30 S.S.C. Coils are spaced 3/16" from each other and wound on a 1 1/2" diameter form.

100-Volt Power Supply

? Will you please describe a power supply to furnish 100 volts D.C. and not containing a power transformer or filament resistor.



Simple rectifier. No. 1217.

A. Shown here is a power supply using a 117Z6G tube as rectifier. This tube has a 117 volt filament and so requires no voltage-dropping resistor.

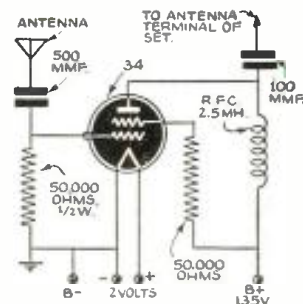
Rectifier and Other Tubes on Same Transformer

? I intend operating the filament of my 80 rectifier and the filaments of the 6.3 volt tubes from the same transformer winding. Is this permissible?

A. Decidedly not. The 80 filament is rated at 5 volts and will not last long with a higher voltage applied to it. More important, however, is the fact that the 80 filament has a high potential to ground and so would quickly cause a breakdown between the filament and cathode of the 6.3 volt tube. If you wish to run the rectifier filaments from the same winding as the other tubes, use a rectifier having a separate cathode, such as the 6X5G or 6Z5G.

Untuned R.F. Stage

? Could you print a diagram of an untuned R.F. stage using a 34 type tube? I wish to add this amplifier to my regenerative receiver.



An untuned R.F. stage. No. 1218.

A. A diagram of an untuned R.F. stage is shown here. Although the antenna resistor can be replaced with an R.F. choke, the resistor will provide better rejection of any powerful nearby stations. Incidentally, the R.F. stage will eliminate radiation from your regenerative detector.

Tuning in 113 KC. Time Signals

? I intend building the "Half Pint" portable receiver described by Mr. Cisin in the October '39 issue for use in picking up time signals on 113 kc. Can you give me any additional information since I wish to have only the volume control and switch on the front panel?—J. E. Triff, Pittsburgh, Pa.

A. With only a few changes the "Half Pint" should serve admirably for your purpose. Substitute a 500 mmf. condenser for the original tuning condenser, cutting off all but one-quarter inch of its shaft and slotting it so that it can be tuned by a screw-driver. You might mount the condenser with brackets onto the baseboard so that the shaft does not project outside the panel, leaving a small hole in the panel for inserting the screw-driver. The grid coil can be a 5 millihenry coil such as an R.F. choke coil, while the tickler can be one or two sections from a pie-wound choke.

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.

Deviation of Loop

? I recently built a directional receiving loop antenna, but I've noticed that all stations come in with the loop pointed to either the north or south, never east or west, even when the station is east or west of my location. What do you suggest?—P. F. Fox, Meadville, Penna.

A. You evidently have some metal structures in the immediate vicinity shadowing your loop on your west and east sides. These metal masses have the effect of shifting the apparent direction of the signal. Any mass of metal in the loop vicinity will cause this shift. In fact, large masses of metal lying between the radio station and the receiving loop or topographical variations will also cause a bending of the signal. It is for this reason that marine direction finders are not used when the signal does not travel entirely over water.

Interference Reduction

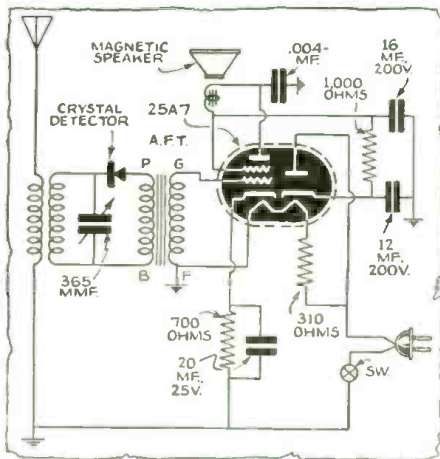
? Are there any devices on the market which will reduce or eliminate the interference caused by electrical equipment having moving contacts?—Evaristo Chen, Panama, R.P.

A. Several manufacturers have small noise eliminators which consist of a pair of condensers and sometimes a pair of chokes, the entire unit being placed between the A.C. line and the piece of equipment. Different types of filters are available for the different types of noise-producing electrical equipment.

Crystal Detector with V.T. Amplifier

? Could you furnish me with a diagram of a broadcast receiver using a crystal detector and capable of operating a magnetic speaker?—Joseph R. Recos, Dubuque, Ia.

A. We are showing such a receiver, which makes quite a compact job. The coil used is an ordinary broadcast antenna coil. A 25A7 is employed as amplifier and rectifier. A dynamic speaker may be used, in which case an output transformer having a primary impedance of 4500 ohms must be employed.



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<p>No. 1 HOW TO BUILD FOUR DOERLE SHORT WAVE SETS Thousands of radio fans have built the famous DOERLE Short Wave Radio Receivers. So insistent has been the demand for these receivers, as well as construction details, that this book has been specially published. Contains EVERYTHING that has ever been printed on these famous receivers.</p>	<p>No. 2 HOW TO MAKE THE MOST POPULAR ALL-WAVE 1- and 2-TUBE RECEIVERS This book contains a number of excellent sets, some of which have appeared in past issues of RADIO-CRAFT. These sets have been carefully engineered. They are not experiments. Not only are these sets described in this book, but it contains all of the illustrations, bookups, etc.</p>
<p>No. 3 ALTERNATING CURRENT FOR BEGINNERS This book gives the beginner a foothold in electricity and Radio. Electric circuits are explained. Ohm's Law, one of the fundamental laws of radio, is explained; the generation of alternating current; sine waves; the unit—volts, amperes, and watts are explained. Condensers, transformers, A.C. instruments, motors and generators.</p>	<p>No. 4 ALL ABOUT AERIALS This book explains the theory underlying the various types of aerials; the inverted "L", the Doublet, the Doublet, etc. It explains noise-free reception, how low-impedance transmission lines work; why transposed leads are used. It gives in detail the construction of aerials suitable for long-wave broadcast receivers, for short-wave receivers and for all-wave receivers.</p>
<p>No. 5 BEGINNERS' RADIO DICTIONARY Are you puzzled by radio language? Can you define Frequency? Kitesveit? Tetrad? Screen grid? Baffle? Anode? Triode? Pole? Ionization? Joule's Law? Harmonic? Gravity Cell? If you cannot define these very common radio words and dozens of other, more technical, terms used in all radio magazines and instruction books, you need this book in your library.</p>	<p>No. 6 HOW TO HAVE FUN WITH RADIO Stunts for parties, practical jokes, scientific experiments and other amusements which can be done with your radio set are explained in this fascinating volume. It tells how to make a newspaper talk—how to produce silent music for dances—how to make "visible" music—how to make a "silent radio" unit, usable by the deafened—how to make toys which dance to radio music, etc., etc.</p>
<p>No. 7 HOW TO READ RADIO DIAGRAMS All of the symbols commonly used in radio diagrams are presented in this book, together with pictures of the apparatus they represent and explanations giving an easy method to memorize them. This book by Robert Eichberg, the well-known radio writer and member of the editorial staff of RADIO-CRAFT Magazine, also contains two dozen picture-wiring diagrams of similar radio sets that you can build.</p>	<p>No. 8 RADIO FOR BEGINNERS Hugo Gernsbaek, the internationally famous radio pioneer, author and editor, whose famous magazines, RADIO AND TELEVISION and RADIO-CRAFT are read by millions, scores another triumph with this new book. Any beginner who reads it will get a thorough ground work in radio theory, clearly explained in simple language, and through the use of many illustrations. Analogies are used to make the mysteries of radio clear.</p>
<p>No. 9 SIMPLE ELECTRICAL EXPERIMENTS Over 100 interesting and practical electrical experiments are described in this book, covering every branch of electricity—from simple experiments with magnets to high frequency "stunts." All of the experiments described can be carried out with simple apparatus, most of which can be found about the home.</p>	<p>No. 10 TELEVISION Every one is asking the question "How does television work?" This book explains all of the different systems of television from the simplest to the most complex. It describes in A-B-C style just how the image is scanned, how the scene is picked up by the television camera and broadcast to your home, etc. Various types of television systems are described.</p>

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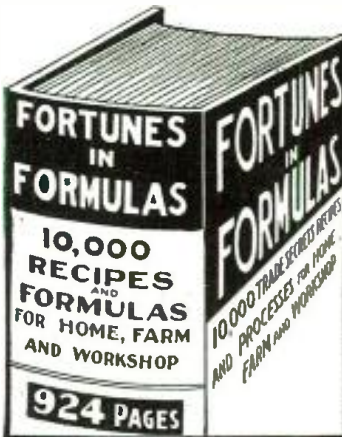
- CHAPTER I. Arithmetic—Addition—Subtraction—Multiplication—Division.
- CHAPTER II. Factoring and Cancellation—Fractions—Decimals Percentage—Ratio and Proportion.
- CHAPTER III. The Metric System.
- CHAPTER IV. How to Measure Surfaces and Capacity (Geometry).
- CHAPTER V. Powers and Involution—Roots and Evolution.
- CHAPTER VI. Mathematics for the Manual and Technical Craftsman—Thermometer—Conversion—Graphs or Curves Plotting—Logarithms—Use of the Slide Rule.
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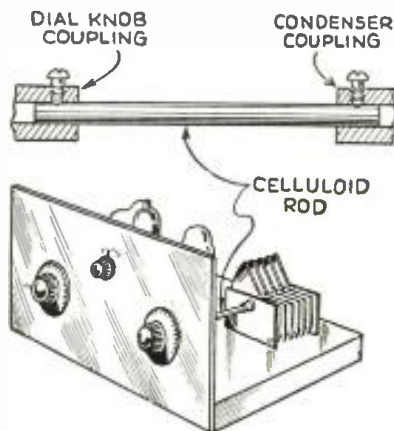
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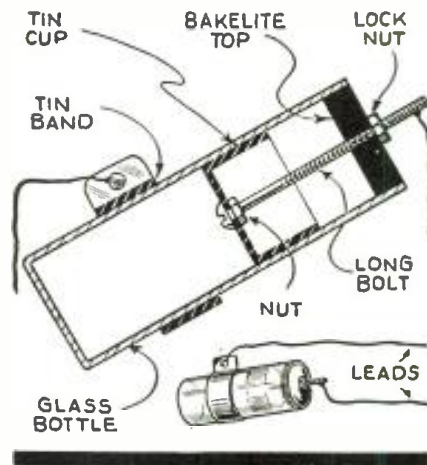
In ultra-high frequency radio work or even when playing around with short-wave sets, one of the greatest troubles is that due to body capacity. An easy way to rec-



tify this is to place the tuning condenser well back from the panel. An insulated shaft to connect the knob or dial to the rotating part can be made from 1/4" diameter celluloid knitting needles or even from glass tubing of that size.—Billy Joe Moore.

Neutralizing Condenser

A neutralizing condenser for low and medium power transmitters is easily made from an empty wide-mouthed cylindrical bottle or from a piece of heavy glass tubing. A bakelite disk is threaded to fit an adjusting screw and cut to fit into the upper end of the bottle. It may be cemented in place.



The brass or tin cup used as the movable plate of the condenser is made by cutting a disk of the metal and soldering it to a short cylinder of the same diameter. The other condenser plate is a tin or brass band on the outside of the bottle. The glass must be thick enough to stand the applied voltage with a liberal safety factor. A lock-nut is provided to maintain the condenser in adjustment.—Bill Curran.

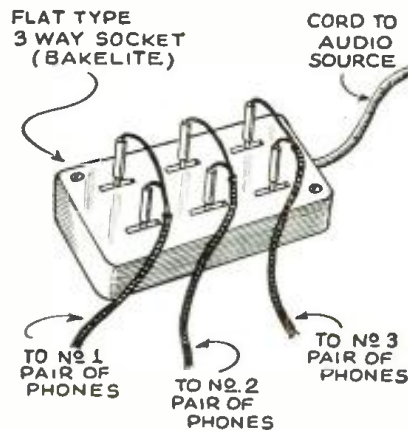
Sour Soldering

It is often necessary to solder some connection when there is no soldering flux at hand. Whenever this occurs it is simple and satisfactory to use a few drops of lemon juice in place of the soldering flux. The juice must be spread over the joint being soldered.—Eugene Manning, W5FZQ.

"Cover" Kink

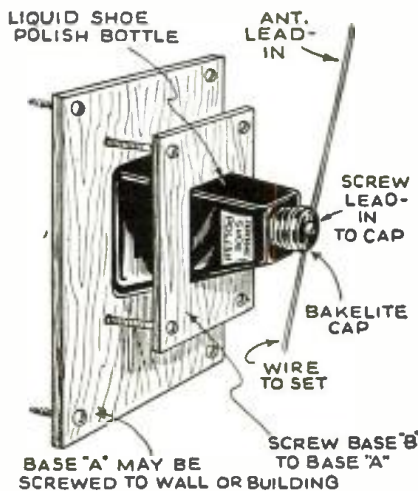
Multiple Phone Jack

Recently I found myself without any jacks to make up a unit for multiple head phone operation. I made up an emergency multiple jack by using a flat-type 3-way 110-volt outlet block. I simply inserted the phone cord tips in the slots where the prongs of the 110-volt attachment blocks ordinarily go.—I'eryllyn Hein.



Stand-Off Insulator

A shoe-polish or other bottle of convenient shape may be used to make an efficient stand-off insulator. A wooden mounting is made to hold the bottle securely. The bottle cap is drilled to take a machine screw, to which the wire may be fastened. The bottle should be thoroughly dry inside before the cap is placed on it, and a few drops of shellac inside the cap will help keep moisture out.—George Baumgartner.

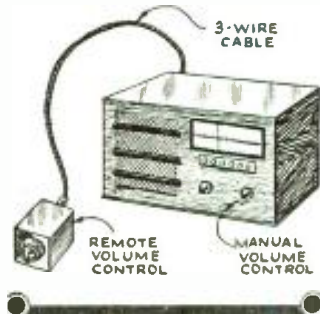


RADIO KINKS

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Remote Volume Control

When a radio broadcast changes from speech to music or vice-versa, there is usually a



considerable difference in volume. For this reason, some form of remote volume control is extremely welcome—indeed far more necessary, in my opinion, than remote tuning.

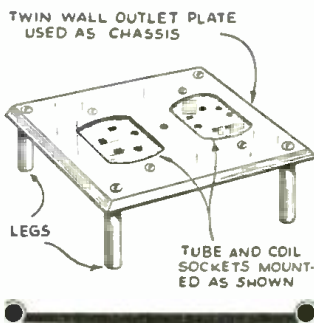
One method of achieving such control lies in connecting a new volume control in series with the one provided in the set. This new control should be somewhat lower in resistance than the one originally provided by the manufacturer. Even better is to install two new controls, each equal to half the resistance of the original.

Another method is to connect a variable resistor across the

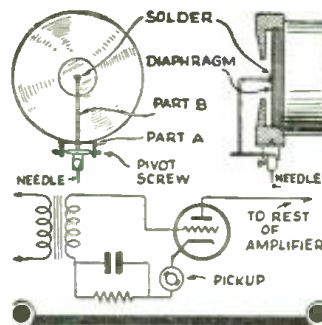
antenna and ground posts of the receiver; and still another is to connect a variable resistor in series with the voice coil of the loud speaker. Whichever method is used, the remote unit can be connected to the receiver by means of 2- or 3-wire cable, and installed in a small box.—*V. Ostinelli.*

Miniature Chassis

If a small chassis is needed in a hurry, one can be made cheaply and easily from an ordinary electric outlet box plate. Stand-offs can be screwed on each corner so that parts can be mounted underneath it. Tube sockets can be mounted in the receptacle holes on the plate. Plates with one hole for one receptacle and a switch can be used for a chassis having one



tube socket and a switch. I have found that these chassis work very well when experimenting with different types of circuits.—*Alexander Riccio.*



Home-Made Pickup

A simple and inexpensive phonograph pickup can be made from the parts of an old non-electric pickup head and an earphone.

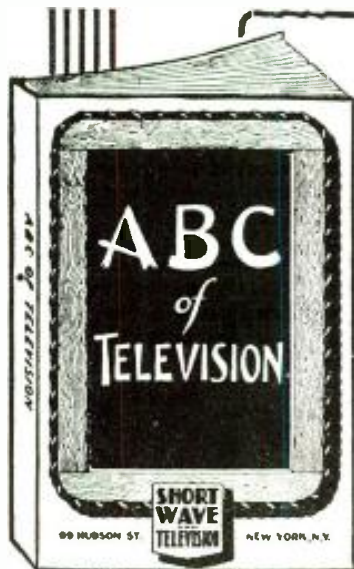
The needle holder for the electric pickup is removed from the old pickup head and attached to the earphone in the following manner: A 1/8" hole is drilled in part "A" of the needle holder and is countersunk to accommodate a 6-32 flathead screw. A hole is then drilled in the bakelite cap of the earphone and is threaded with a 6-32 tap.

The part "A" is then attached to the earphone cover by the short flathead screw. The end of part "B" is soldered to the diaphragm of the phone. The lacquer on the surface of the diaphragm must be scraped off first and care must be taken so as to not bend the disc.

Part "B" is then placed between its pivot points and the points tightened to give the desired tightness. Vibrations of the diaphragm, caused by the record, produce an alternating current in the windings of the earphone; this alternating current is fed to an amplifier which is in turn connected to a loudspeaker; a simple coupling system is shown in the drawing. The quality of the pickup unit is fairly good.—*Carl Helber.*

Code Oscillator

While there have been many code practice oscillators described in radio magazines during the past ten years, one of the simplest ways is to utilize your own short wave receiver. Simply tune in WWV, the Bureau of Standards station. They transmit a 440 cycle tone almost continuously. By inserting a key in a power lead or the voice coil lead one can practice code at will.—*Harley L. Christ.*



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CHAPTER 3—Need for a large number of picture elements; need for broad channel width in transmission of high-fidelity television signals.
CHAPTER 4—The use of the cathode ray tube in television receivers; necessary associated equipment used in cathode-ray systems.
CHAPTER 5—How a television station looks and how the various parts are operated.

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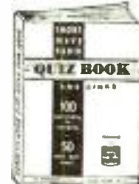
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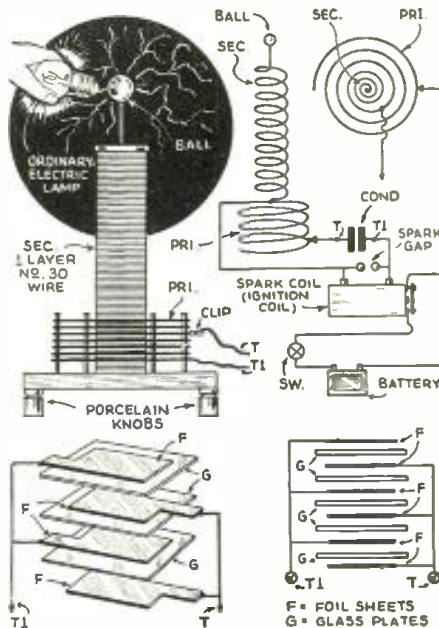
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Small High Frequency Coil Produces Strange Effects

● IF you have a small spark or ignition coil lying about you can have a lot of fun with high frequency currents by building the simple Oudin coil illustrated. The primary winding of the high frequency coil may comprise a dozen turns of bare or insulated wire wound on a tube about 4" in diameter. If bare wire is used it may be No. 12 or No. 14 and the turns spaced about 1/4". The secondary winding consists of one layer of about No. 30 insulated (bare wire can be used) copper wire wound on a cardboard or other insulating tube (or even a wooden rod) 2" diameter, spacing the turns the thickness of the wire apart. This can easily be done on a lathe by winding two pieces of wire on simultaneously side by side, and then removing one of the wires afterward, or thread may be substituted for the second spacing wire. In connecting the lower end of the secondary to the primary or outer coil, be sure that the direction of the current through the two coils is continuous or in the same direction.

The high voltage condenser connected in series with the primary winding of the Oudin coil may be made up of glass plates, such as old photo negatives from which the emulsion has been removed by soaking in hot water. The spark gap is connected across the secondary of the spark coil. One of the diagrams shows how alternate tin-

foil sheets are connected to common terminals, so that every other metal sheet is charged with an opposite current sign. The



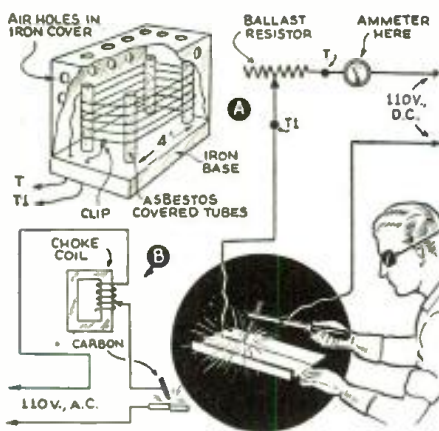
Circuit of high frequency coil, with detail of condenser construction, winding, and one interesting experiment.

foil or other thin metal sheets should be cut 1/2" smaller all around than the glass plates, with a connecting tab or lug extending from one end of the sheet. In assembling the condenser the metal sheets are stacked so that the projecting tabs stick out first on one side and then on the other, so that when soldered or bolted together afterward, you will have every other foil sheet connected to each respective terminal.

To obtain the maximum high frequency spark discharge from the ball terminal connected to the upper end of the Oudin secondary, the number of turns in the Oudin primary coil should be varied by means of a clip as shown; tune this primary circuit to resonance by varying the number of glass and tin-foil plates in use for each case. Also the length of the spark gap on the spark coil is varied until maximum results are obtained. For a 1/2" spark (or ignition coil) the spark gap will have to be greatly shortened, until a blue white spark of about one-fourth the usual length results.

Ordinary lamp bulbs may be lighted by holding the brass base near the high frequency ball terminal and other vacuum tubes may be likewise illuminated. Sparks may be taken harmlessly into the body by holding a piece of metal in the hand and approaching it toward the high frequency terminal of the Oudin coil.

Simple Arc Welder for Home or Shop Metal Work



How simple arc welder is built and used.

● A SIMPLE electric arc welder can be made cheaply from the few parts shown in the accompanying sketch. First of all, do not forget to thoroughly protect your eyes with a pair of dark glasses or goggles. To control the amount of current passed through the arc (which should be held down to a value of 5 to 10 amperes) a ballast resistance is connected in series with the arc. A resistance coil (or grid) works very well on direct current but for A.C. circuits an impedance or choke coil (primary winding of a small transformer will serve the purpose very well) works much better and allows a more stable arc to be drawn.

The ballast resistance may be made by winding about 20 ft. of either German silver or other resistance wire around 4 porcelain tubes (or asbestos covered iron rods) laid

out on a square 4" x 4" as shown. One side of the circuit is connected to an adjustable clip, so that the current can be regulated, and if you can obtain an ammeter it would be well to connect it in series with the circuit and the current adjusted to a suitable value.

For A.C. operation an old transformer core may be picked up for a few cents and a winding of several layers of No. 14 D.C.C. copper wire placed on one or both of the longer legs of the core. It is well to bring out taps from each layer after the second, and diagram B shows how the adjustable choke coil is connected in series with the arc.

The welder has a multitude of uses. It can be used to make long seams, join dissimilar metals, perform spot-welding operations, repair leaks, etc.

Home-Made Electric Drink Mixer Mounts on Wall

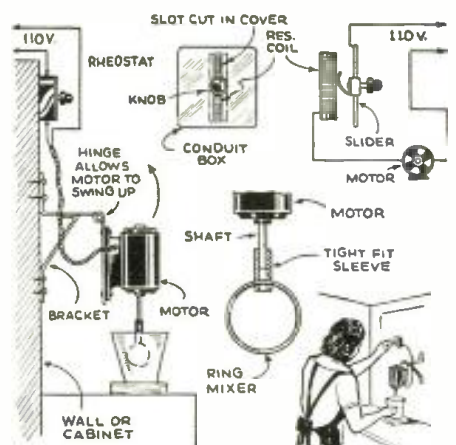
● SMALL electric motors are available on the market today at a very low price; one of the most useful applications of such a motor is for the purpose of mixing drinks, or the stirring of solutions in the chemical laboratory. Our illustration shows how such a motor may be screwed to one leg of a large iron strap hinge, so that the motor with its attached mixer may be swung upward out of the way when not in use. The rheostat for regulating the motor speed is optional, but is very desirable in the photo or chemical laboratory. It may be made from a porcelain tube or an asbestos covered iron tube, wound with a layer of about #16 German silver or other resistance wire. The turns of wire are placed a slight distance apart and a spring slider is mounted so as to slide along a brass bar as shown.

In this way the current supply to the motor may be regulated by changing the amount of resistance in the circuit. The mixing attachment may be picked up in the "5 and 10" or it may be simply a wire ring soldered or riveted to a brass sleeve which will fit snugly on to the end of the motor shaft.

Variable speed mixer mounts on wall or cabinet, and can be used for stirring drinks or batter, whipping cream and other kitchen tasks.

Win a Prize

Readers are invited to send suggestions for simple electrical experiments to: *Electrical Experiment Editor, Radio & Television, 20 Vesey St., New York, N. Y.* A 1-year's subscription to this magazine will be awarded for every experiment published.



**Make These
PHOTO-CELL EXPERIMENTS
In Your Own Lab**

PHOTO cells are found on the average experimenter's work table today and the accompanying sketches show several interesting experiments which can be performed with such a cell. Illustration A shows an electric siren—here a disc containing a series of holes arranged around a circle is rotated in a beam of light falling on the cell. A 2 or 3 stage amplifier is connected in the circuit between the cell and the loud-speaker. The source of light is an ordinary electric bulb, fitted with a reflector and a projectional lens. For the purest notes this lamp should be supplied with battery current or else well-filtered D.C. The faster the speed of the disc the higher the pitch of the note heard in the loud-speaker.

Experiment B consists of waving the hand up and down across the beam of light

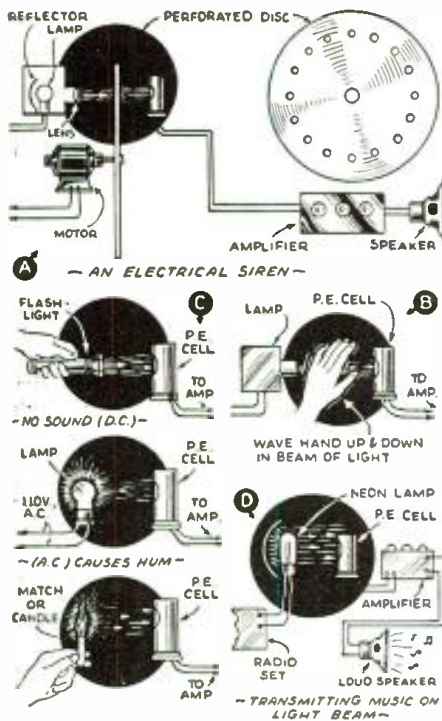


Photo-electric cell enables you to make (a) light-beam siren; (b) burglar alarm; (c) experiments with light sources; (d) talking light beam; and numerous other experiments.

falling on the photo-cell, which will give a loud noise in the speaker each time the hand is moved up or down.

Fig. C: A nice demonstration is to play an ordinary battery flashlight on the photo-cell; no noise will be heard in the loud-speaker. Now we take an ordinary bulb supplied with the usual A.C. lighting current; the well-known 60 cycle hum will be heard in the speaker.

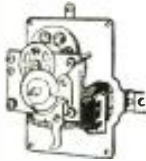
Another experiment may be demonstrated by holding a lighted match or candle in front of the photo-cell—fluctuating sounds will be heard as the match or candle flame changes in intensity. The transmission of voice over a light beam may be demonstrated over short distances by connecting the output of a radio set to a neon lamp placed in the focus of the reflector.

SUPER BARGAINS

Practically all of the attractive items listed here are brand new, others are reconditioned like new; but ALL are in PERFECT WORKING ORDER. In many cases, the parts alone total more than the price we are asking. 100% satisfaction guaranteed or your money refunded. ORDER FROM THIS PAGE. Use the convenient coupon below. Include sufficient extra remittance for parcel post charges, else order shipped express, collect. Any excess will be refunded. C.O.D. shipments require 20% deposit. If full remittance accompanies order, deduct 2% discount. Send money order, certified check, new U. S. stamps. No C.O.D. to foreign countries.

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24-HOUR ELECTRIC CLOCK MOVEMENT



Made originally by the famous Waterbury Clock Company as part of an automatic defrosting timer for electric refrigerator. Has a powerful synchronous self-starting motor and complete clock movement. The handy experimenter can attach a calibrated dial and simple pointer in order to make an accurate electric clock. If taken apart, its gears may be used for many experimental purposes and, in themselves, are worth more than the cost of the entire unit. The line. One lubrication lasts practically a lifetime. Ship. wt. 3 lbs.

clock may be used only on the 110-20 volt 60 cycle A.C. line. One lubrication lasts practically a lifetime. Ship. wt. 3 lbs.
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YOUR PRICE **95c**

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3 1/2 R.P.M. SYNCHRONOUS MOTOR

110 Volt, 60 Cycle A.C. Only

There are 101 uses for a synchronous motor making only 3 1/2 revolutions per minute. Ideal for crowd-catching store-window displays, agitating magnet-developing tanks, as an electric winch on model motor boats, as derrick motor in erector sets, etc. Built-in high-ratio step-down gears provide amazing amount of power. Made by Haydon Mfg. Co. of Waterbury, 2" in diameter x 2 1/4" x 1" thick overall. Ship. Wt. 2 lbs.



ITEM NO. 76
YOUR PRICE **\$1.95**

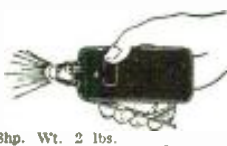
A.C. "SQUIRREL CAGE" SYNCHRON. MOTOR

Self-starting shaded pole motor designed for radio chassis for Push Button Tuning. High speed, powerful. One lubrication lasts lifetime. Excellent for model railroad trains, small boats, humidifier water pumps, etc. 1/2" long shaft, 3/16" diameter. Complete with brass mounting posts, 2 1/4" x 2" x 3/4" overall. For 110 volts, 60 cycles, A.C. only. Ship. Wt. 4 lbs.

ITEM NO. 77
YOUR PRICE **\$1.35**

MECHANICAL FLASHLIGHT

This battery-less flashlight generates its own power merely by pressing handle. Gives strong light whenever needed. Costs nothing to maintain. Amazing new miniature dynamo operates flashlight. Pocket size, 4 1/4" x 2" x 1". Ship. Wt. 2 lbs.



ITEM NO. 88
YOUR PRICE **\$2.25**

MOTOR FOR ROTATING RADIO BEAM ANTENNA

One Revolution per Minute



Built by Honeywell as a temperature regulator for coal fired furnaces but ideal for many other uses, especially for rotating beam antennas on the roof for directional beaming and reception of radio signals. Built-in commutator switching permits turning antenna from north-south to east-west direction from remote point. Constructed for hard usage. Has double-end shafts geared down to about one revolution per minute. Ideal for window displays and other slow-moving mechanical motions. 110 volts, 60 cycles. A.C. only. 6 1/2" x 6 1/2" x 4 1/2". Ship. Wt. 10 lbs.

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Powerful 300-Watt Ultra-Violet Bulb



The best and most practical source of ultra-violet light for general experimental and entertainment use. Makes all fluorescent substances brilliantly luminous. No transformers of any kind needed. Fits any standard lamp socket. Made with special filter glass permitting only ultra-violet rays to come through. Brings out beautiful opalescent hues in various types of materials. Swell for amateur parties, plays, etc., to obtain unique lighting effects. Bulb only. Size of bulb. Shp. Wt. 1 lb.

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YOUR PRICE **\$2.00**

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LIFTS MORE THAN 20 TIMES ITS OWN WEIGHT

LITTLE GIANT MAGNET. Lifts 5 lbs. easily. Weighs 1/2 oz. Made of ALNICO new high-magnetic steel. Complete with keeper. World's most powerful magnet ever made. The experimenter and hobbyist will find hundreds of excellent uses for this high quality permanent magnet. Measures 1 1/4" x 1 1/2". Ship. Wt. 1/2 lbs.



ITEM NO. 86
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EXTRA BARGAINS

IMMERSION TYPE WATER HEATER. 110 VOLTS A.C. or D.C. Excellent for aquariums, etc. Ship. Wt. 1/2 lb.
ITEM NO. 83
YOUR PRICE **35c**

6-VOLT A.C. MOTOR. Fine for door chimes, model electric trains, erector sets, etc. Ship. Wt. 3 lbs.
ITEM NO. 79
YOUR PRICE **\$1.95**

G.E. INDUCTION DISC MOTOR FOR RECORDING PLAYBACK AND DISPLAY PURPOSES



Substantially constructed by General Electric, this ball-bearing motor is a high-quality phonograph unit. Its power and smooth-running make excellent home recording work. Its speed, governor-controlled, is variable both below and above 78 r.p.m. For 110 volts, 60 cycles, A.C. Solid less turntable and shaft, 7 1/4" diameter x 5 1/2" high. Ship. Wt. 14 lbs. Packed in Original Box.

ITEM NO. 81
YOUR PRICE **\$3.95**

SEWING MACHINE MOTOR

For electrifying foot-treadle sewing machines and replacing burned-out motors on electrified machines. Powerful and high-speed; numerous other uses. Ideal as handy grinder-polisher motor. Small, compact, flat on two sides, requiring a minimum of space. Speed controllable by foot-pedal rheostat (available optionally for \$3.75). Its 1/2" diam. shaft is available with or without pulley (pulley 15c extra). Completely enclosed and dirt proof. Measures 3 1/2" x 5" x 2" overall. Ship. Wt. 7 lbs.



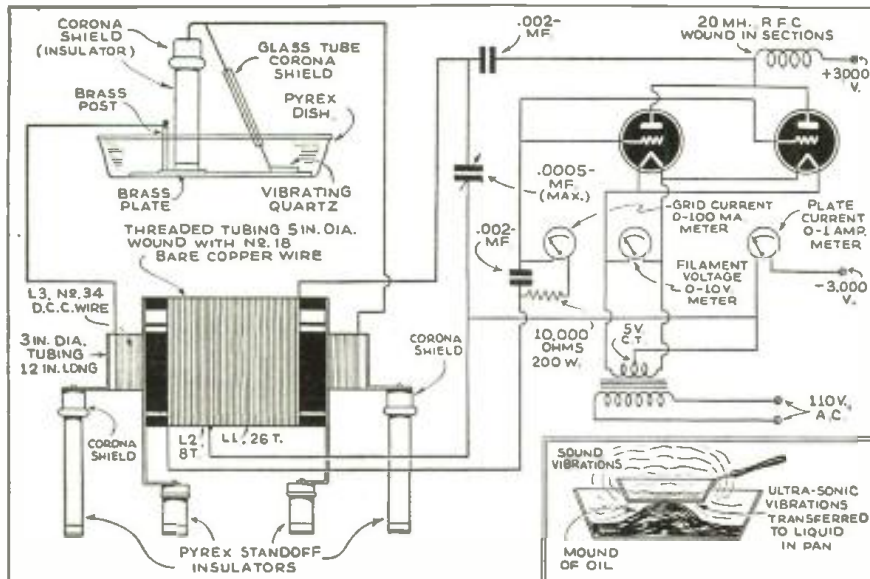
110 Volts—A. C. or D.C.
ITEM NO. 79
YOUR PRICE (motor only) **\$3.75**

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Experiment in Ultra-Sonic Sound



Radio Oscillators prove valuable for producing ultra-sonic sound waves.

● IT is stated that more than 40 per cent of the energy applied to the plates of the oscillator tubes in the circuit shown is transformed into *ultra-sonic* (super-audible sound) *vibration* in an oil bath surrounding the crystal, and as little as 75 watts input power will maintain a continuous mound of oil four centimeters high over a 1-inch square quartz crystal.

Approximately one-third of the energy radiated into the oil bath can be transmitted to any liquid in a thin bottom glass vessel. A glass tube having a diameter of 1 inch

and closed at one end with a flat glass membrane was placed in the oil bath directly over the quartz plate, according to *Radio & Hobbies*, Australia.

It was found that 50 cubic centimeters of water could be heated at the rate of 2 degrees Fahrenheit per minute with a plate voltage of 1,200 volts and a plate current of 50 milliamperes.

In the schematic wiring diagram shown, a pair of 806 oscillator tubes in parallel is connected in a circuit similar to the shunt-fed Hartley oscillator.

The primary oscillator coil is inductively coupled to a secondary coil which feeds power to the piezoelectric crystal immersed in an oil bath. The secondary of this transformer supplies the high frequency voltage directly to the crystal, and is wound with double cotton covered wire on a 3-inch tube.

Since a separate secondary coil is used for each different quartz crystal, no attempt is made for continuously adjusting the frequency of the output circuit.

Instead, the secondary coil is adjusted by winding a coil to have a natural frequency somewhat lower than the natural frequency of the crystal. Turns are removed from this coil until optimum activity of the crystal is obtained. The secondary gives a voltage step-up ratio of between 10 and 15, depending upon the frequency.

The quartz crystal rests on a heavy brass plate in an open dish of transformer oil. This brass base acts as one of the condenser plates or electrodes for applying voltage to the crystal. The circuit oscillates only at the frequency to which the secondary is resonant, and if the secondary coil is removed, the tube oscillates at a higher frequency.

The author states that the mode of operation is superior to an arrangement having a primary and secondary tuned to the same frequency, because it pushes the undesired resonant peaks (which occur when two tuned circuits are closely coupled) so far away that it cannot produce enough grid excitation to give oscillation.

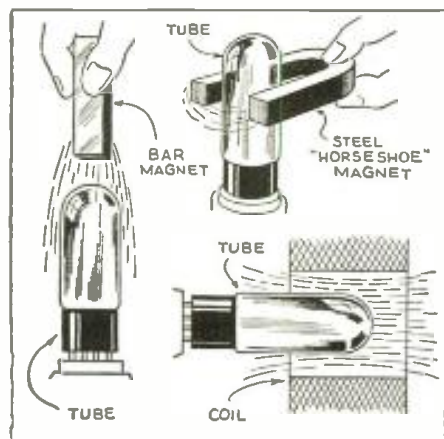
This allows the oscillator to put full power into the crystal circuit and into the quartz crystal in a stable condition.

More Ideas for the Radio Experimenters

EXPERIMENTS WITH MAGNETS ON VACUUM TUBES

● SEVERAL years ago there were a number of experiments made to show the effect of the magnetic field on a vacuum tube while in operation. Here is a fertile field for the dyed-in-the-wool experimenter. While a special tube has been devised for ultra-high frequency use in connection with a powerful magnetic field, still this tube is not generally available to the experimenter; therefore there is an opportunity for ex-

perimenters to try out the effect of permanent magnets, for example, on vacuum tubes while in operation. The magnet may be tried in different positions and also at different distances from the tube. Be careful not to bring the magnet too close to the tube, if it is of the filament type, as the magnetic field will react on the field about the filament or even the grid member and may cause it to form a short circuit with one of the other electrodes within the tube. In some cases the presence of a magnet near an amplifier tube will cause a greatly increased strength of signal, and we predict that many as yet unknown effects are still to be discovered in this little explored field of radio experimentation. If you have some interesting results, don't forget to write the editor about them, and include a sketch or photo of the apparatus, with diagram. —H.S.



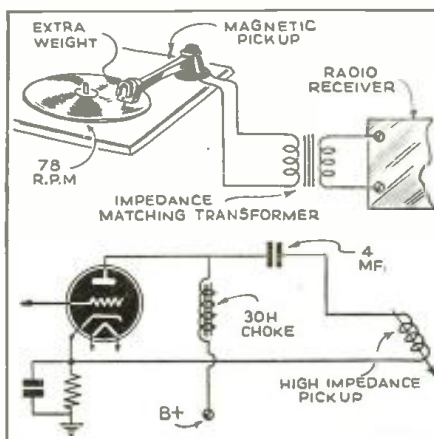
The effect of magnets on radio tubes is interesting.

RECORDING RADIO PROGRAMS

● IT is frequently desirable to record radio programs and while a recording machine fitted with a special recording head undoubtedly gives the best results, still the experimenter can have plenty of fun by using an ordinary magnetic pickup, plus some pre-grooved records. The output from the radio receiving set is connected to the magnetic pickup; an impedance matching transformer should preferably be used for

maximum results, i.e., the secondary of the transformer should match the impedance of the magnetic pickup.

For recording purposes you will have to experiment and add a little extra weight in the form of a strip of lead (possibly 6 to 10 oz.) to the magnetic pickup. Another idea would be to arrange a threaded rod and nut fitted on the pickup arm, in order to traverse it across a plain ungrooved record blank. Don't use a crystal pickup for recording, as it will probably be shattered. Pre-grooved records are available in diameters of 6, 10 and 12".



How to record programs.

DIGEST OF RADIO PATENTS

TELEVISION TRANSMITTING TUBE

● A NEW television transmitting tube invented by George A. Morton and Arthur W. Vance has many desirable features. One



Secondary emission tube.

of these is greatly increased sensitivity as compared with Mosaic screen tubes of the direct exposure type previously made. Intensification of the electrical image is accomplished by means of secondary emission and this image is intensified before the scanning operation takes place. The optical image causes a current image to be generated and to impinge on a Mosaic electrode consisting of secondary emitters. Successive neutralization of the charges produces a train of electrical impulses which may be fed into an amplifier and television transmitter. The patent (number 2,180,946) has been assigned to RCA.

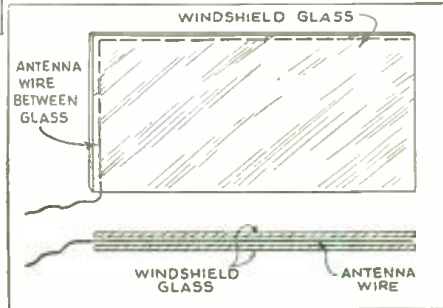
REMOTE CONTROL RECEIVER

● THE Hazeltine Corporation has been assigned patents granted Leslie F. Curtis for a system of remote control radio. In Mr. Curtis' system the remote control ap-

paratus includes a carrier signal to effect control operations at the receiver, a predetermined sequence means which will operate in numerous positions, and an arrangement to respond to this sequential control and a time-delay relay, which leaves the carrier wave generator in operation only as long as necessary to perform its function.

WINDSHIELD ANTENNA

● A PATENT has been granted Roscoe E. Wolaver covering a method of installing auto radio antennas inside the windshield. Mr. Wolaver's idea is that the aerial will thus be protected from dirt, rust and other effects of the weather. In his invention the antenna will be sandwiched between the two layers of glass which are now used in shatter-proof windshields, and will be so positioned that it will be out of the line of sight, along the windshield's edge. (Patent No. 2,197,601.)



Antenna in windshield.

RADIO AIRCRAFT SIGNALLING

● A PATENT granted Francis W. Dunmore, and assigned by him to the United States Government, relates to a method and apparatus for continuous transmission and reception of radio signals in aircraft to enable the pilot of one plane to tell when another is approaching. Mr. Dunmore has devised several systems in one of which each plane carries 3.5 meter equipment with a 20 mile radius. The modulation of the transmitted wave is automatically varied according to the transmitting plane's altitude and in the receiving plane a warning lamp shows the altitude of the plane which is approaching.

Through the use of this system any plane is able to tell when another plane is approaching and at what altitude so that, if the planes meet, each is enabled to fly over or under the other, thereby avoiding mid-air collisions. In addition to the altitude indications, the pilots have means of detecting the course being followed by approaching planes.

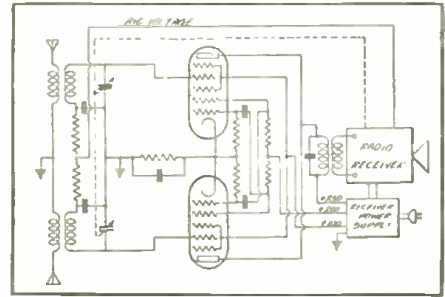
RADIO OIL DETECTOR

● THE familiar Geiger counter has been adapted for uses in oil well locators by Gerald L. Hassler. Mr. Hassler's theory is that petroleum is a strong absorbent of radioactive gaseous emanations. He believes that the oil is made temporarily radioactive by emanations from radioactive materials underlying the oil deposits. He believes that

by lowering a Geiger counter into the bore of an oil well it will be possible to detect oil deposits because of such radioaction from gases absorbed by the oil. (No. 2,197,453.)

DIVERSITY ANTENNA SYSTEM

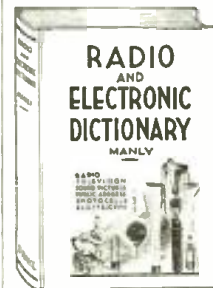
● A NEW diversity antenna system which makes use of a pair of tubes to couple into the radio receiver has been assigned to RCA



Diversity antenna coupling.

by Winfield R. Koch. A pair of antennas is spaced in the desired relationship and connected to primary coils, the secondaries of which are coupled to the control grids of a pair of multi-element tubes. The outputs of these tubes are joined by means of coupled plates and feed into the primary of a coupler, the secondary of which connects to the input of a radio receiver. An automatic circuit limits the sensitivity of both tubes in proportion to the signal intensity and causes the tubes to become alternately conductive to take advantage of differentials of signal strength on the two antennas.

RADIO AND ELECTRONIC DICTIONARY Containing 3,800 Definitions



THIS RADIO AND ELECTRONIC DICTIONARY, written by Winfield P. Manly, explains the meaning of 3,800 words used in radio, electronics and other closely allied fields. It includes new terms used in radio transmission, sound pictures, television, public address, aviation radio, navigation and industrial control, photo-electricity, photocell application, telephotography, etc. This dictionary permits learning every new expression whether you hear it or read it. Alphabetically arranged for quick reference. 550 illustrations augment definitions in the text.

The book is recommended for students, instructors, engineers, service men, experimenters, salesmen and everyone in any way associated with radio. ONLY BOOK OF ITS KIND—HANDY—EASY TO USE—AND TIMELY. THE RADIO AND ELECTRONIC DICTIONARY is new, authentic and printed in a single volume of 300 pages, size 6 x 9 inches. The book weighs two pounds, and bound in durable cloth. SHIPPED ANYWHERE \$2.50 IN U. S. A. POSTPAID . . . Price

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A few of the Features in June, 1940, RADIO-CRAFT

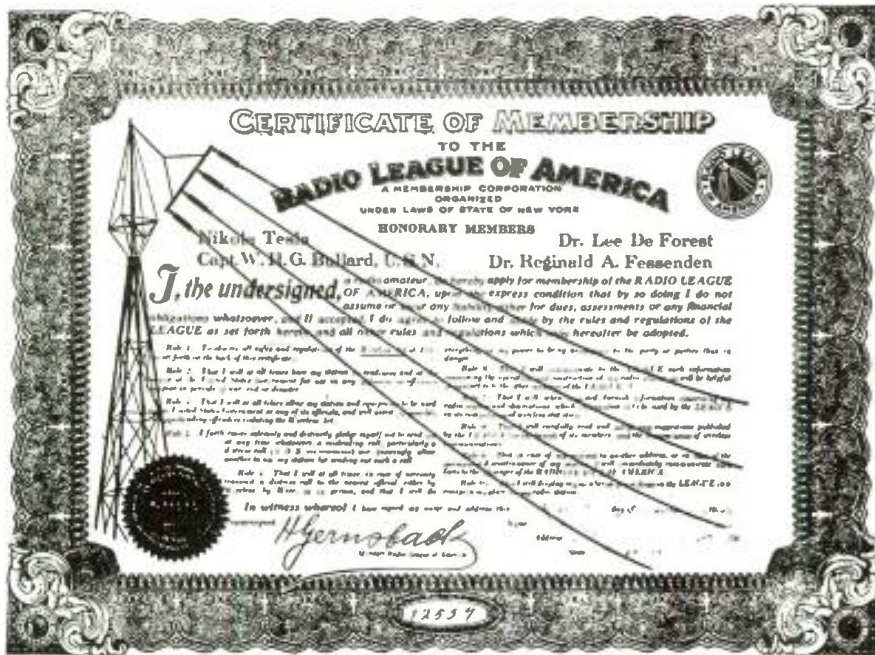
- Marine-izing Radio Receivers
- Servicing R.F. Coils
- Speaker Matching Technique
- Practical Sound Recording
- A Truly Universal 30-Watt Amplifier for 6-V. 110/220A.C.-D.C. Operation
- Electronic "Reverberation Control"
- 1940's Portable Sets
- How to Make a 2-Tube Superhet, Using Pentagrid Converters
- An Easily-Built Vacuum-Tube Voltmeter

(Continued from page 67)
"The Reader Writes"

A word from "old-timer" Harold B. Clein
 The other day I was pawing over some used Radio publications in a second-hand book shop. Clear at the bottom of the dusty heap, I discovered a much prized copy of an old Gernsback Radio Magazine, vintage 1919!

Idly flicking over the pages to see if there was anything I wanted, I came across an

What
 Do
 You
 Think?



Remember way back 20 years ago when the Radio League was Radio's leading organization?

announcement urging readers to join the RADIO LEAGUE OF AMERICA, which was being sponsored by Mr. Gernsback.

This League article brought back a whole series of memories, and without waiting any longer I headed for home. On arriving, the first thing I did was start pulling a miscellaneous assortment of magazines, old radio parts, and what not from our store room, and then I found what I was looking for! My Certificate of Membership in the RADIO LEAGUE OF AMERICA. This is illustrated herewith. I also found my R.L. of A. membership button, which is now in my coat lapel.

My certificate is dated June 24th, 1920, which shows that my interest in Radio is at least 20 years old. It also shows that the GERNSBACK PUBLICATIONS actually pioneered one of the first, if not the first, Radio Society in the world devoted to the problems of both the Amateur and the Listener. There were, of course, one or two Societies for the Amateur alone, in those days, but these were in the midst of adolescent growing pains, and were far too specialized to suit the average beginner's taste. I am sure the RADIO LEAGUE OF AMERICA was the first International Radio Society.

My certificate and that old 1919 Gernsback magazine have brought me a strange flood of recollections. I started out by building a crystal detector, loose-coupler, receiving set, and gradually worked up through the one tube ("Audiotron") receiver, all from designs in the Gernsback

magazines of that time. Later, I bought a one-tube semi-regenerative affair (I say "semi" because sometimes it worked and sometimes it didn't) but was so disgusted with it that I went back to the designs in Mr. Gernsback's magazine.

I even tackled a *superheterodyne* when a design appeared that looked fairly simple, and it worked, too! I can honestly say that of all the receivers and gadgets I have made following the instructions in the Gernsback Publications, not a single one has proved to be a failure.

Now I have grown lazy. I have a big custom-built communications type receiver, and just to show it hasn't gathered cobwebs, I have over 110 different countries *verified* (not counting CW) since I bought the receiver some three years ago. But I still think it was lots more fun in the old days. The days when everyone went on the air with a half kilowatt spark transmitter, without license, and the neighbors sent out searching parties to try to locate that "so-and-so" who made their lights blink all night long!

My Certificate of Membership in the RADIO LEAGUE OF AMERICA is now hanging in a frame over my receiver. Every time I look at it I get an urge to *start making things!* I know before long I'll have out my soldering iron and a boxful of radio parts,—and you can bet your bottom dollar that the design I follow will be in a current Gernsback radio publication.

HAROLD B. CLEIN,
 1427 Maltman Ave., Los Angeles, Calif.

Hints to S-W Listeners

Editor,

Would like to make it known that I will be glad to QSL 100% all correct reports received here. Frequencies most used are 7150 and 7230 kc., with a power input of 45 watts.

As most SWL's have in mind obtaining at some time or another a Ham "ticket," I would suggest that they spend more time listening to CW stations. In addition to receiving more cards, code speed is noticeably increased, whereas, listening on 'phone bands helps little toward obtaining the "ticket" and a lower percentage of reports are QSL'ed.

Along with the usual part of the report, most Hams would like a thorough check on their note, and to be notified of the presence of any clicks, chirps, or any peculiar characteristics, if there should be any. Information *other than just a report* is usually appreciated by the amateur.

EDW. R. SHERMAN, JR., W1LNN,
 91 Grove St.,
 North Attleboro, Mass.

READERS PLEASE NOTE

RADIO & TELEVISION has moved its New York General, Editorial and Advertising offices to NEW QUARTERS. Please address all correspondence to

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

A Frank Opinion

Editor,

I have read the recent numbers of RADIO & TELEVISION incorporating *Foto-Craft*. I'm not a *photo fan*, but an ardent *radio fan*. I know there is not much hope of breaking up the magazines, but as long as you do not cut the length of the radio articles, I have no objection.

The *Question Box* and the other articles are fine: let's see more of them.

JOE CYRIL MAY,
 McCurtain, Oklahoma.

Top-Notch Listening Post

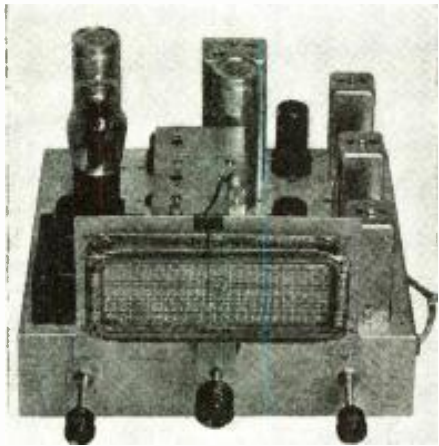


I am sending a photo of my equipment which is a National receiver of the 80-X series. I would like to exchange photos and SWL cards.

Morris Horwood
 3104 Edgewood Ave.
 Richmond, Va.

Freq. Mod. Adaptor

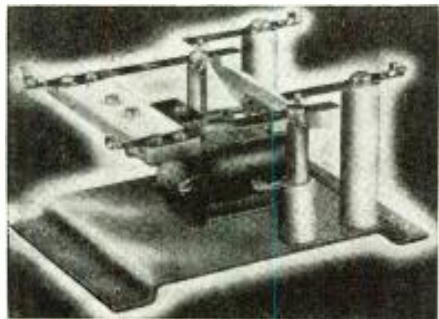
• THE new frequency modulation adaptor #43A being marketed by Browning Laboratories, Inc., can be attached to the audio channel of any set to make possible the reception of static-free frequency-modulation broadcasts. The unit consists of R.F., I.F., detection and power-supply systems, less only tubes and dials. A six inch dial is recommended for use with the apparatus. The tube complement includes one 18S2,



two 6X4's, one 6K8, one 6SJ7, one 6H6 and one 80. The leaflet which describes this adaptor contains a complete diagram and also shows a circuit for a degenerative, phase-inversion, push-pull audio amplifier, which may be attached to it to make it a complete high-fidelity receiver. The amplifier utilizes one 6SC7 and a pair of 6V6G's in push-pull.

New Antenna Relay

• NEW antenna switching relay has been added to the rapidly growing line of amateur parts and accessories produced by the Meissner Mfg. Co. Primarily designed for automatic transfer of the antenna of the transmitter to the receiver in break-in operation, it is also adapted to any type of high frequency switching. The device incorporates a double-pole, double-throw arrangement, with unusually large contacts designed to handle



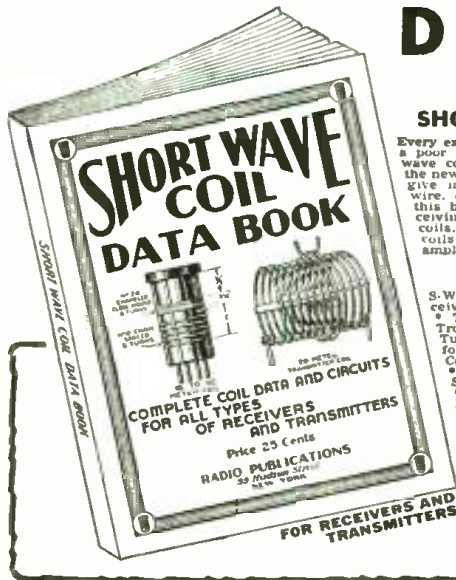
heavy loads. As the contacts are wide open on the break, a 1 KW. transmitter may be switched without danger of arcing. The contact arms provide "straight-through" feed, with transmitter connections at one end and antenna at the other, equally spaced throughout. Insulation is Alkimag 196 ceramic, permitting operation as high as 60 mc. with negligible loss. The standard unit is provided with a coil for 110 volt a.c. operation.

New Plug-in Transformers

• A NEW series of transformers made in both standard and submerison proof types has just been announced by the Kenyon Transformer Co. Conveniently designed to plug into a 11 prong metal socket they are both neat and easy to install. There are 21 new units including line to line, crystal mike to line, low impedance source to grid, inter-stage transformers, output transformers and chokes. With no D.C. in the winding, the frequency response is plus or minus 2 db., 30 to 20,000 cycles. The units are 2 1/2" high and 1 1/2" in diameter.

Repairs Carbon Controls

• A COMPOUND to cure the ills which afflict noisy carbon controls has been announced by the General Cement Manufacturing Co.'s radio division. This compound, known as Carbon-X is applied to the defective spot in order to quiet noisy controls. It comes in 2 oz. bottles.



DON'T FAIL TO GET THIS

SHORT WAVE COIL DATA BOOK

Every experimenter knows that the difference between a good and a poor radio set is usually found in the construction of short-wave coils. Coil winding information is vitally important and in the new coil book all "dope" appears. There're illustrations which give instructions on how to wind coils, dimensions, sizes of wire, curves and how to plot them. Every experimenter needs this book—it also contains complete data on all types of receiving coils, together with many suitable circuits using these coils. Also complete data on various types of transmitting coils with many transmitting circuits such as excitors and amplifiers using the various coils described.

Contents Briefly Outlined

S-W Tuning Inductance Charts • Coil Data for T. R. F. Receivers • One Tube Oscillodyne • Two Tube Bandspreeder • The Mono-Coil • 2-Tube Old Reliable • 2-Tube Globe Trotter • 2 Winding Coils—10-500 Meters • Doerle 3-Tube "Signal Gripper" Electrified • 3-Tube Bandspreeder for the Ham • General Coverage Coils on Ribbed Forms • Coil Data for Superhet or S-W Converter • Ultra S-W Coils • Switch Coils for S-W Superhets • Experimental Coils • S-W Antenna Tuner • Most Popular S-W Tuning Circuits Described • Self-Supporting Transmitting Circuits Employing Coils • All Band Antenna Tuner for Transmitting • Plug-in Coils for Excitors • Frequency-Wavelength Conversion Chart.

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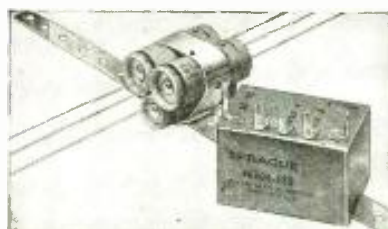
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Name
Address
City State

Electrical Stepping Switch

• A UNIQUE magnetic stepping switch for performing complicated switching operations has been introduced by the Coto-Coil Co., Inc. One application of this switch, is to a band switch turret for changing a radio transmitter operating frequency by remote control. The drive unit is energized by momentary impulses on a push-button and moves the switch section through their current sequence. Various combinations of poles and contacts make it possible to adapt this switch to nearly any kind of radio or industrial switching problem.

Metal Mounting Straps

• ST METAL Mounting straps, strong enough to hold any combination of Sprague atom type condensers in a firm compact assembly make it easy to combine various capacities and voltages in a single unit. The manufacturer claims that several different condensers strapped together with this strap will be smaller and cheaper than the



original unit and replacement. The straps will fit round or rectangular types and lock secure in place by means of a metal eyelet without the use of a screw-driver. Copies of the new Sprague Products Co. catalog describing this development can be had on request.

The Biggest Value in Radio Books

RADIO AMATEUR COURSE

See Page 93



"JIFFY"

Magazine Binders

Sturdily built and covered with black fabricoid. Has two stamped metal ends with 12 spring wire separators. Magazines can be inserted and removed in a jiffy. No fuss—no lost time—no labor.

No. 1. 12"x9 1/2", with 2-inch back for Radio-Craft, R.&T., Radio News, etc. \$1.50
No. 2. 10 1/2"x7 1/2", with 3-inch back for QST, Radio, Popular Mechanics, etc. \$1.25
No. 3. 8 1/2"x6 1/2", with 3-inch back for Reader's Digest, etc. \$1.00
P.P. Prepaid in U.S. and Canada

GREATEST SLIDE RULE VALUE!



10 inch enameled slide rule, made of kiln dried genuine mahogany wood, has auxiliary removable magnifier with pins in fit (cursor) runner. This rule has inch, millimeter, sine, log and tangent scales. Packed in individual carrying case. This rule is equal in performance to a \$10.00 rule. Our special price, P.P. prepaid anywhere... \$1.00

8" Slide Rule 25c
36 Page Illustrated Book of Instructions 10c
36 Page Book Stanley's Slide Rule Practice, 500 Fascinating Examples and Answers 10c
All Three Items Prepaid for 40c

GOLD SHIELD PRODUCTS

Dept. RT-6-40 330 Greenwich St. New York

COMMERCIAL NOTICES 10¢ A WORD

Under this heading only advertisements of a commercial nature are accepted. Remittance of 10¢ per word should accompany all orders. Copy should reach us not later than the 10th of the month for the second following month's issue.

AGENTS WANTED

300% PROFIT SELLING GOLD Leaf Letters for Store Windows; Free samples. Metallic Co., 446 North Clark Chicago.

CORRESPONDENCE COURSES

USED CORRESPONDENCE Courses and Educational Books Bought, Sold, Rented, Exchanged, Catalog Free. Vernon Exchange, Itzehagar, Alabama.

DIATHERMY MACHINES

DIATHERMY. SHORT-WAVE Therapy, and ultra short-wave therapy machines custom-built by radio engineer at considerable saving over commercial machines; 8 meters, 16 meters or any other frequency specified can be furnished. Machines substantially built with high patient safety factor, 350-300 watts output. Neat professional appearance. Automatic safety time switches. All necessary pads and electrodes. For sale only to physicians.

hospitals, and sanatoriums. Prices from \$195.00 to \$300.00. Not for sale to the general public. Write for further information giving your own specifications and requirements. Allan Stuart, 1015 Wilson Ave., Teaneck, N. J.

INSTRUCTION

\$15.00 STEAM ENGINEERING Course—8 vols. \$4.50; Radio and Electrical text-book bargains—get Hat, Life of Napoleon, 3 de luxe volumes \$3.00. \$10.00 New Encyclopedia of Science, 1300 pp. \$4.50; Hopkins "Experimental Science," 2 vols. \$3.50. Harry Ackerson, Box 322, Ram-ey, N. J.

MISCELLANEOUS

INVENTORS, SONGWRITERS, Authors: Protect your Ideas. Total cost \$2.00. Request free Booklet, Evidence Bureau, 11501 Broadway, N.Y.C.

PATENT ATTORNEYS

INVENTORS — PROTECT YOUR rights before disclosing your invention

to anyone. Form "Evidence of Conception"; "Schedule of Government and Attorneys' Fees" and Instructions sent free. Lancaster, Ellings & Rommel, 436 Bowen Building, Washington, D. C.

PHOTOGRAPHY

GORGEOUS HAND COLORED Enlargements which are "fascinatingly and attractively different." Popular priced—Guaranteed. 4x6—35c; 5x7—45c; 8x10—80c. For sample Colored Print, send negative and dime to—Color Craft Studio, Danbury, Iowa.

SWL—CARDS—QSL

SWLS—QSLs, COLORFUL, Economical. Meade, 819 Wyandotte, Kansas City, Mo.

RADIO DIAGRAMS

ANY RADIO DIAGRAM 25c. SPECTY manufacturer, model. Radio magazine free. Supreme Publications, 3727 West 13th, Chicago.

Silver Plating Kit
 • A NEW silver electroplating kit has been announced by Rapid Electroplating Process, Inc. It is adapted from an industrial outfit and is intended for home and shop use. The kit comes complete with silver compound, under-coat brush, metal polish, plating brushes, lead wires, connectors, polishing paper, brass strips, battery holder, batteries and full directions. Suggested uses—for the



improvement of conductivity of electrical connections on radio sets, electrical instruments, etc., and for plating and repairing jewelry, novelties, models, etc. The plating compound is a highly concentrated jelly which makes it easier to use than the more familiar liquid electrolytes. The manufacturer claims that the quality produced is equal to the best commercial plate of equal thickness.

Switch Coil Kit

• A SWITCH coil kit to replace plug-in coils has just been announced by the New England Radiocrafters. The basic kit contains a 5 point index head with 3 1/2" pillars and divided spaces, permitting the addition of 4 more switch wafers. It also includes a two-pole 5 position switch wafer with HF bakelite insulation and silvered double contacts, 5 coil forms, 3/4" in diameter and 2"



long made of paper fiber, dehydrated and impregnated with PO liquid polystyrene, and a 2 oz. bottle of this liquid for holding coil windings in place and impregnating other RF insulation. Extra switch wafers and coil forms are furnished at a moderate cost, as is a 5 point switch plate with a 1 1/2" dial and 1 1/4" plate bakelite pointer knob.

"G" Tubes Discontinued

• THE Hytron Corporation has announced that "GT" tubes will be substituted for "G" tubes in its line. In the future the tubes will be branded for example "6K7GT"—"6K7G." Both types of tubes have the same characteristics and the new move simplifies the replacement problem from the dealers' standpoint.

National Union Batteries

• A COMPLETE line of replacement radio batteries for sale through the radio service profession has been announced by National Union Radio Corp. The batteries are in cases which resemble the familiar green and black cartons which contain the company's tubes, condensers and panel lamps.

Aviation Communications Course

• RCA INSTITUTES, INC., has announced a new Aviation Communications Course which teaches the operation of radio and teletype services used in commercial aviation, government agencies, press organizations, police networks, point-to-point and marine systems. The first term covers the fundamentals of electricity and radio, communications networks and code instruction. This latter is carried through all four terms. In the second term radio laws, traffic procedure, and general communication commercial equipment are studied while in the third term special transmitters and auxiliaries come in for a large share of attention. In the fourth term the students learn about special receivers, remote control circuits, meteorology and special regulations. The students are given actual experience in the type of work they are learning.

FOR SALE (NON COMMERCIAL) 3¢ A WORD

Under this heading we accept advertisements only when goods are offered for sale without profit. Remittance of 3¢ per word should accompany all orders. Copy should reach us not later than the 10th of the month for the second following month's issue.

HAVE SOME CRIBBAGE BOARDS for sale easily worth 50c. Will now sell for 25c apiece in order to get rid of this stock, plus 7c postage. All have edges molded. Stanley's Craft Services, Box 518, Munising, Mich.

COMPLETE ELECTRIC AUDIO Oscillator \$3.95. WILBY, 16 Sanger, Medford, Mass.

RCA 156A TUBE TESTER, \$25! Like new, Wilbur (book, Highland Avenue, Wadsworth, Ohio.

DON'T BUY A RECEIVER UNTIL you get my free list of reconditioned, guaranteed Receivers! Practically all models at money saving prices. Trade-ins, Time Payments. Send for List, W2AFA, 12 West Broadway, New York.

NATIONAL A.C. SW3, 5880 POWER Pack, tubes, five set, coils, complete QSLs. Will trade for British, Indian stamps of same value. Ensign Courier, Monmouth, Oregon.

FOR SALE: ALL SHIPPED ON TEN day free trial. Reconditioned guaranteed receivers with same guarantee as new receivers. Sky Buddies \$15.00. SW3s \$30.00. FB3s \$9.00. Sky Champions \$29.00. NC-44s \$34.00. S11 Super-Skyriders \$39.00. Breting 12s \$44.00. Breting 14s \$49.00. SX-24s \$49.00. PR-15s \$69.00. RME-69s \$89.00. Super-Pro \$129.00 with crystal filter and high fidelity speaker, many other models cheap. Write for free list. W2ARA, Butler, Missouri.

BARTER AND EXCHANGE 1¢ A WORD

NO ADVERTISEMENT TO EXCEED 35 WORDS, INCLUDING NAME AND ADDRESS

Space in this department is intended solely for the benefit of our readers, who wish to BUY or EXCHANGE anything in the Radio and Photographic fields for Radio, Photographic and other merchandise; therefore we charge only 1¢ a word. Each word in name and address is counted. Remittance should accompany order. Only one advertisement can be accepted from any reader in any one issue. Copy should reach us not later than the 10th of the month for the second following month's issue.

HAVE A BATTERY OPERATED loudspeaker code oscillator; several 1- and 2-tube battery radio sets. Will trade for musical instruments or radio parts. Ralph E. Hicks, Laverne, Okla.

HAVE WESTON SENIOR PHOTO- meter. Trade for small SW receiver. Xmitter crystal, transformer or what have you? Walter Joyce, 537 Keleher, Albuquerque, N. Mex.

WANT ARGUS OR SIMILAR CAM- era; have two pair phones, one single phone, also over \$80.00 worth of Popular Science and similar magazines, with list of all radio articles therein. John H. Fisher, New Paltz, N. Y.

HAVE COLONIAL 32 D.C. RE- ceiver, radio parts, chemistry set, battery charger. Want 616 osc. complete with crystal for 160 M; pre-selector or converter made by Stromberg-Carlson, in 1937. Victor Kosma, 337 E. 13th St., N. Y.

WANTED: HOWARD 430, 450A, 460, SX17, 5m converter, crystal velocity mikes, recording equipment, classical records. Have: RCA 9-54 mixer-changer, receiver, amplifier, speaker, 1X clock. Approved Tech. AC-DC V.O.M. Want Itoyal "Siknet" typewriter. Bob Forman, Monmouth, Ill.

WOULD LIKE TO TRADE RADIO transmitting and receiving equipment with anyone. Please write for list. Carl A. Kowalski, 1239 Kinsmore Ave., Fort Wayne, Ind.

TRADE A HOWARD 430 IN A-1 shape for a Philco 1163X (Chas. W. Leigh, 162 Passaic St., Trenton, N. J.)

WANTED: RIDER'S MANUALS 2 to 10. Have a 25 watt P.A. system complete; intercommunicating system, 10 stations; bound volumes Modern Electrics, Electrician and Mechanic. Electrical World; amplifiers, speakers, meters. Roy W. Budd, 3725 Montclair, Kansas City, Mo.

SWAP MIKE, PHONO-MOTOR, pick-up radio, typewriter, camera, projector, electric shaver, red seal records. Will trade photo goods. Instruments, Lists, M. Epstein, 2933 Kukulie, Indianapolis, Ind.

HAVE NEW PRECISION MULTI- meter 830, tube tester, telephone handset, Thordarson neon transformer, code oscillator, carbon microphones, 400 volt power pack, motors, want Sky Champion or similar receiver. D. Shanks, 549 Alabama Ave., Bklyn, N. Y.

WANT: SKY CHAMPION OR HOW- ard 438 in good condition. Have Taylor Aneroid barometer, cost \$12, perfect condition. 3 vol. set of Mine Exam. Questions and answers, cost \$12. Write Wm. Coburn, Box 177, Milan, W. Va.

WANTED: ANY TYPE RADIO RE- ceiver, standard or short wave. Will purchase or give Lionel O' gauge outfit (1939) or 2.50 postage stamps in expensive album. All letters answered. Alex Hegel, 1709 Stephen St., Bklyn, N. Y.

5-TUBE T.R.F. KIT DRILLED chassis and panel tubes and speaker. 700-150 MA. transformer, never used. Want combination tube and set checker. TZ 40's (1B transformer per TZ107). Triplett 3 1/4 meter. E. J. Hoover, West Liberty, Ia.

I WILL TRADE AN AMERICAN model CD double button carbon microphone for 160 meter crystals or 10 meter crystals or transmitting tubes. Send list to: W9IME, 816 University St., Springfield, Mo.

HAVE GOOD RK20. TRADE FOR pair 807's, T20, etc., or 3/4" F:1.65 projection lens for Univex projector. Beaded screen, wood type for printing QSLs, used portrait camera, photo engraving equipment or what? WBJHP, Pottsville, Pa.

HAVE 1.4 VOLT, 2 VOLT, SW radios, crystal sets, diagrams, metal locator, tubes. Want U. S. stamps, old iron penny banks, old pictures. John Haynes, Doe Run, Missouri.

TRADE ANTENNA ELIMINATOR and brand new 3" speaker for what have you? Such as an amateur call model, Viter Monk, 51 Vineyard St., Providence, R. I.

We cannot accept responsibility for any statements made by the readers. All dealings MUST be above board. Remember you are using the U. S. mail in all these transactions and therefore you are bound by the U. S. Postal Laws and Regulations and without exaggeration. Treat your fellow men the way you wish to be treated. We welcome suggestions that will help to make this department interesting and helpful to our readers.

P. E. SOUND ON FILM HEADS, recorder parts, lab. equipment, home-made gadgets. You unused stuff and correspondence covering amateur recording experience swapped for mine. W. Sanford, 560 Walnut, Fall River, Mass.

WANTED A 3 or 4 BAND SLIDE rule or Hallerater type dial for communications receiver. Please state your needs. Ralph Minervino, 3 Cooper St., Dover, N. J.

WANTED: LEITZ'S SILVER GHOST complete with \$5 to \$500 meter coils, also wireless record player. Send detailed condition to Schoonover, Oakland, N. J.

HAVE 2-TUBE ALL-WAVE KIT, small, sensitive transmitter, auto heater, 1 Winchester 22 rifle, book on "Radio Construction and Repairing," LeJay manual for rewinding generators. Swap lists. All letters answered. C. Ottosen, Crook, Colo.

TRADE BRUNO VELOCITY MIKE, 211 tube, A.C. line filter. Want 1/2" electric drill, auto radio, etc. Newell J. Kelly, 208 Congress, E. McKeesport, Pa.

WANTED 2 1/2 METER TRANS- ceiver ready for operation, or portable radio complete with batteries, have 16mm (400 ft.) movie projector with film, 1/2 H.P. gasoline engine, electric sweeper motor, send list. Bob Miller, Box 374, McConnellsville, Ohio.

WANTED: ONE GOOD SW RE- ceiver for cash or will trade, camera or motors. What have you? Earl Frenz, 309 Ontario St., S.E., Minn., Minn.

HAVE COILS, CONDENSER AND diagram, builds 7-tube, 3-band super, also earphones and miscellaneous parts. Will trade for microphone. Pickup head or what have you? Kelsey, 415 E. 15 St., Tulsa, Okla.

HAVE STAMPS, TRAINS AND equipment, chemicals and equipment, radio parts, books, magazines, battery charger, power supply, etc. Want radio equipment, Victrola motor and crystal pickup. Frank Seward, 224 Prospect Place, Rutherford, N. J.

TRADE CAR RADIO 6 T. PACIFIC A-1 for good 4 or 5-tube AC-DC S.V. receiver, 40' telescoping ant. for AC-DC or battery code osc. QRA Bonnie Johns, 2106 Boise, Sioux City, Ia.

(Continued on opposite page)

New Radio Apparatus

New Crystal Holder Socket

● A NEW socket for crystal holders announced by the American Phenolic Corporation is made of low-loss Amphenol "912," which is pure polystyrene. According to the manufacturers' claims, losses are so low as to be negligible and the material is non-hygroscopic, will not collect frost and is tough and strong. Phosphor bronze contacts are silver plated to reduce resistance and the holder may be mounted either on top or under the chassis with a single screw.



J. H. Bunnell & Company Obtain H.F. Buzzer Rights

● THE J. H. Bunnell & Co., of New York have acquired the dies and jigs for making the well-known Century high-frequency buzzer previously manufactured by the Federal A. C. Switch Co. of Buffalo, New York. This buzzer is popular with radio hams and experimenters as it gives a very high pitched note, which may be changed by simple adjustment.

Crasley Chatterbox

● THE Crasley Chatterbox is a 2 way loud speaking communication system for use between offices or departments in businesses, between rooms in a home, between judges and announcers at sporting events, etc. Each unit—there are two to a set—is a complete transmitter and receiver. The units plug directly into the AC lines and in most cases no additional installation work is necessary. However, in locations where much noise is carried over the lines a direct transmission line may be used to afford noise-free communication. Each unit contains 3 tubes and a ballast. The loud-speaker is also used as a microphone.

Mico Transmitter Capacitors

● CORNELL-DUBILIER offers transmitter manufacturers and Hams a complete variety of mica capacitors for low-power transmitter applications in the Types 4 and 9 Moulded Mica units. Not only are these capacitors especially designed to meet the rigid electrical requirements of this service, but various mounts and accessories have also been made available to provide the utmost convenience in application.

The Type 4 units are rectangular in shape with projecting ears at the lower corner, drilled to provide insulated mounting, and with conventional heavy gauge soldering lugs. The Type 9 are hexagonal with tapped metal bushings moulded into the bakelite to provide screw connection terminals. Both types are available for D.C. working voltages of 600, 1200 and 2500 and in a wide variety of capacities ranging from .00005 to .03 mf. for the Type 4 and to .06 for the Type 9. Insulation resistance is 20,000 megohms per unit.

Small-Size Electrolytics

● IN the belief that electrolytic capacitors designed only for radio service work can be made more useful than older standard types, new Red-Caps have been given the radio trade by Solar Manufacturing Corp. The 12 ratings are so made that they cover the majority of filter block repair requirements. Lengths are uniform, but diameters are much less than heretofore offered. This new idea means that several units strapped together occupy no more space than the original filter. Servicemen can in this way make their own filters. Only a small inventory need be carried to take care of average repair jobs. The condensers are sealed in metal tubes and rated to withstand extreme surges.

READERS PLEASE NOTE

RADIO & TELEVISION has moved its New York General, Editorial and Advertising offices to NEW QUARTERS. Please address all correspondence to

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

BARTER and EXCHANGE ADS (continued)

I NEED 1/2 INCH ELECTRIC DRILL, rider manuals and camera. Have all kinds of radio parts and tubes. Carl Harp, Crescent, Okla.

HAVE SUPER N SHADOW MAGIC Illusion good as new, will trade for Sky Buddy receiver or model plane and motor. Warren Fulker, 1419 Clay St., Lynnhurg, Va.

WANT A SHORT WAVE RECEIVER, 2 or 4 tubes. Will trade either Brown or Hulsey camera for both or radio parts of own choosing. James White, 24 Garden St., Meriden, Conn.

WANTED: RADIO PARTS CONDENSER, resistors, R.F. chokes, tubes, etc. I have N.W. taxidermy course. Junior Candler code receiver and 20 gauge shotgun to trade. Write for details, Henry F. Becker, 901 Howard St., Indianapolis, Ind.

WANTED: BUSINESS ADVERTISING pencils and book matches from everywhere. Will send my pencil in exchange. Have all kinds radio parts, tubes, etc. N.R.I. course, want old condenser, or transmitter. Woodrow Ballard, Plains, Kansas.

HAVE MEISSNER 3-BAND RADIO, tubes and speaker, assembled and ready to play. Want good 8 mm camera and projector. Intelligent letters will be answered. Stanley T. Galaski, 232 7th St., Bklyn, N. Y.

WILL SWAP A PAIR OF LITTLE Tritler earphones in A-1 condition for long key or what have you? Harold Lantow, WBSB, Newark, N. J.

TRADE RECORD CHANGERS, AMPLIFIERS, speakers, radios, parts, anything for radio goods, receivers, projectors, films, Test Instruments, meters. Warren W. Wigner, 1220 Fairview St., Ft. Wayne, Ind.

WANTED: COMPLETE LATEST N.R.I. Radio Communications and Television course with all lessons and questions. Will buy same. Would like part of experimental equipment but not necessary. J. L. Wasson, Box 428 R.F.D. 1, Woods Cross, Utah.

WILL TRADE SHORT WAVE RECEIVER with plug-in coils and complete lastman developing outfit for a Junior Candler course or similar course. Anthony Salomini, 106 Clermont Ave., Bklyn, N. Y.

WANTED: 3-24's, 2-15's, NEW preferred, have 4-32's, never used, in perfect condition. G. M. Behringer, Oakland, N. J.

SWAP: TUBE TESTER, DEPENDABLE, model 303A, good condition for \$3.50. Set or small 150 phone smelter. Edward Derry, 1 Camp Fernow, 8-56, Eastford, Conn.

HAVE NEW RADIO PHYSICS AND modern servicing, atoms, xmitting (tubes, sprks, meters, tubes, filters, 24-10 M. set. Want camera, typewriter, Hallcrafters, Howard. Have bicycle. Helen Wax, 156 Taylor St., Bklyn, N. Y.

WILL TRADE LIONEL O GAUGE triplane train and radio parts for HOAF Hudson. Also want very old RFL super clipper or SW3 or small metal lathe. Baber, Packanaek Lake, N. J.

WANTED: ALL TYPES OF 16 MM silent motion picture equipment including films. Have 1929 model radio phono pickup, typewriter, etc. C. W. Philpot, 315 W. Main St., Laurens, S. C.

HAVE PHONOGRAPH MOTOR, magnetic speaker, resistors, condensers and tubes. Want phonograph oscillator, D. J. Gilmore, 146 Hawthorne, Belmont, N. C.

WANTED: A SMALL USED TRANSMITTING set, cheap. Pay cash or swap anything in standard radio equipment. W. C. Fennell, P.O. Box No. 7, Ector, Texas.

WILL TRADE UTAH, JR. TRANSmitter, Std. MacKey and Eilon 5-tube receiver for best offer of short wave tube receiver or what have you? Roy Reynolds, 319 Lincoln St., Benton Harbor, Michigan.

WILL PAY CASH OR TRADE FOR midjet radio, developing and printing equipment, micro-scooter, or portable radio. Jess Butler, Kalama, Wash.

SWAP: RADIO PARTS, PHOTO equipment or will pay cash for a 1 cylinder 1 or 2 H.P. gasoline engine. James Grabuska, 93 Westbury Park, Watertown, Conn.

CATHODE-RAY TUBE WANTED: 3 inches or smaller. May have burnt screen but must be otherwise OK. Must be reasonable. Give details, condition and price. Philip Allen, 6 Bigelow St., Cambridge, Mass.

SWAP: 50 TUBE 8 MFD., 475 W.V. electrolytic, cardboard, 40 tubulars, same capacity and rating, all brand new; volumes 2, 3, 4 and 5 Official Radio Service Manuals, what have you? Albert Buckner, Charleston, Mo.

WANT GOOD COMMUNICATION receivers. Have new 1166A Triplet analyzer with walnut case (40 lbs for \$17.50 net) in perfect condition; also number 9 Rider's manual and 36 assorted collinear receiving tubes, Eugene Strimling, 1213 Queen No., Minn., Minn.

HAVE ONE- AND TWO-TUBE radio, crystal sets, radio parts, want U. S. coins or what? John Haynes, Doe Run, Mo.

WANT GOOD USED S.W. RECEIVERS, F. B. 7 or Sky Buddy or any good receivers. Complete description and lowest price for cash. Chas. Putnam, 38 Stanley St., Galt, Ont., Can.

WANT RFL, VOLT-Ohm MULLIAM meter or 7 for 100 power supplies, 400 volts at 150 mhz; 600 volts at 200 mhz. Excellent voltage regulation, 2.5 volt filament. Cards immediately answered. W2MJZ, 5702 14 Ave., Bklyn, N. Y.

HAVE PRECISION 520 ELECTROMETER test (comb-Precision signal generator) Decca camera F.3.5 lens, R.C.A. 807 Beam power tube (Gato) parts, accessories, Remington typewriter, Julius Lewis, 1241 Putnam Ave., Bklyn, N. Y.

WANTED: VARIABLE POWER camera, prism binoculars, 8 mm. camera projector, photomicro recorder, paper, typewriter, radio course. Have radio parts, magazines and cash. Describe fully when writing. S. Balashek, 232 Sunset Ave., Newark, N. J.

I HAVE B ELEMATOR TRICKLE charger, formers, starter motor, A.C. motor-speakers, 22 rifle and scope, typewriter, radio course. Want: Sky Buddy, similar receiver, swap lists, Lettens answered. Penneck Bowen, 309 Davis Road, Llanerch, Pa.

WANTED: 70 B MAJESTIC RADIO chassis. Have test equipment manuals, other parts and small radios for trade. Wm. Phillips, Box 212, Gypsum, W. Va.

TRADE STAMP COLLECTION IN album, 1382 different, catalog value over \$20.00 plus 1287 duplicates and new 1910 standard postage stamp catalog value \$8.00, stamp magazines, etc. for late model Sky Buddy. John Schmiege, Grand Rapids, Minn.

HAVE AN ARGUS 35 MM KILBaker, minus lens, with case! In good shape to swap for an exposure meter of about equal value. Henry P. Miller, 117 Springfield Ave., Rochester, N.Y.

WILL TRADE HOYT HOT WIRE meter 1 1/2 amp. telencx, 3 tapes with out use, for 0-1 millimeter or what have you. Chas. H. Godfrey, 5 So. Clinton St., Poughkeepsie, N.Y.

HAVE SLIGHTLY USED EIMAC 3-5 tube 40 meter and transmitting and receiving equipment to swap for good photographic exposure meter. Herman Yellin, W2AJL, 371 New Lots Ave., Bklyn, N. Y.

WANTED: HOWARD MODEL 460 or Hallcrafters SX-23 or? Have Triplet tube and set tester, 52 lessons of R. T. A. and set analyzer. Utah scope and magnifying radio. Joseph Lesniak, 3603 29th St., Detroit, Mich.

WANTED: SAXOPHONE, 5 TUBE table phonograph, good amateur receiver, or what have you? Have Scott International junior album and 8,000 stamps. E. Beaudoin, 10 St. Ursule, Quebec, P. Q., Canada.

WANTED: TSAILE HAM RADIO parts—rush paid for good bargains! What do you want in place of cash? 100% QSL and correspondent, Dirk S. Mannheim, 427 W. 51st St., Des Moines, Ia.

HAVE HOWARD 10 TUBE MEISSNER 15 tube receivers, 21 Jewel Elgin, Waco Film 8 mm. camera, projector, Royal Underwood portable typewriter, super pro Hammarlund receiver, good Collins, Harvey transmitter. Jerome Kosmoski, 6 Southern Ave., Augusta, Me.

WANTED: BOOK ON AERIALS, 20,000 coils plus crystal phones, 16 mm. film coils, auto tone plate. Offer books, film, projector, crystal radio, hobby goods. Radolph Zak, 2709 E. 9th St., Cleveland, O.

SWAP—COMPLETE N. R. I. RADIO and television course; also all wave set servicing instrument for short wave receiver camera. What have you? Bert Alley, 119 Tremont St., Chattanooga, Tenn.

WANTED: SKY BUDDY, MAXVALS, radio parts, and late N. R. I. or L. E. S. course. Have fiction and education books, stamps, guitar, camera and cash. S. F. Carter, Star Route, Lulu, Ga.

HAVE: \$30 VALUE CHEMICAL apparatus, chemicals; two Van Nostrand meters; one amp. D. C., other volts D. C., three scales each; photo water coloring outfit will swap all for portable typewriter. Selden, 528 Atlantic Ave., E. Rockaway, L. I.

HAVE NEW 247, 245, 19 TUBES, need 6F8, 6A7 (metal types). Have John J. multivolt ray transformer. Pioneer Airflow generator suitable for building wind-charger. Send your list. Joseph Terrillini, Route 3, Box 414, Petaluma, Calif.

WANTED: SKY BUDDY, GHIRARDI's radio physics course, radio correspondence courses or other radio books for 49 Flying Aces and 36 assorted outdoor and aviation magazines and 16 fiction adventure books. Write Wilho Sotula, Brookston, Minn.

WANT GUPAR, HAVE MOVIE-mount 16mm movie camera with Elga chromatic lens. Can also take 40 candled shots. Morris Emanuel, 1376 Washington Ave., Bronx, N. Y.

WANTED: WESTON ANALYZER OF old type. Will swap any article or pay cash. S. E. Browning, 12 S. 12th St., Darby, Pa.

WILL TRADE AN ASTATIC JT 30 crystal mike for an Argus or other good L.35 or f. 4.5 camera. Please give description of your camera. John P. Watt, R.10, 1 Girard, Ohio.

WANT OUTBOARD MOTOR ANY condition, motorcycles and radio parts. Have most anything to trade. All letters answered. E. J. France, Jr. 229 Orchard St., Mt. Airy, N.C.

HAVE 2,000 DIFFERENT U.S. AND foreign stamps mounted in album. Also have 5,000 mixed. Want vinyl watch, bicycle or? Have 516 transmitter for a plate camera. Chester Zuchora, 2748 Meade, Detroit, Mich.

WANTED: 24 JARABON OR CORNELL Dubilier condensers or capacitors 0.001 mfd. battleship type. In good condition or new. Made in 1917, 12,500 volts. State price. Otto Strasser, 332 E. 89th St., N.Y.C.

HAVE A.C. SW3 WITH 1 SETS coils, Sky Chief receiver, Jr. Instructograph with 5 tapes and osc.; want HRO Senior, HQT20X, No 101X; Chet Ratski, 272 E. Poplar St., Plymouth, Pa.

HAVE 4900 S. HUKOK, 4 MONTHS old, like new, worth \$75.00, 1210 A Triplet tube tester, worth \$10.00; N.R.I. servicing course, fence charger, Van Philco 677 oscillator; or what have you? H. N. Hauke, 726 Carrollton St., Metairie, La.

WANTED: SET OF RIDER'S MANUALS, not necessarily new, but complete. Lowest price makes the sale. E. Seebing, 920 Prospect Place, Elyria, N.Y.

HAVE 7 TUBE PHILCO RADIO 36 1/2" by 21" by 11". Like new. Want a Scoutmobile. Will answer all letters. What have you? R. P. Griffith, 4 W. 157th St., Riverdale, Ill.

HAVE TO TRADE: 12 WATT RCA amplifier; 0-1 meters; p.m. speaker; A.C. phone motor with magnetic pickup; tubes; repeating ring, etc. Want communications receiver and typewriter. All correspondence answered. Raymond Glasnapp, Armstrong, Iowa.

HAVE RADIO PARTS, BOOKS ON home manufacturing, money making ideas, spare-time business. Want telephone directory from small town. Will swap even. Correspondence invited. Johnny Bell, 1216 So. Presa, San Antonio, Texas.

WANTED: TYPEWRITER, LATHIE, candle camera, photo equipment, printing press, N. R. I. course or what have you? Y. H. H. radio parts 3/4 in. Briggs and Stratton motor. Popular mechanic magazine. Harold E. Schmalfeldt, Prairie Home, Mo.

SWAP PRACTICALLY NEW TRIPLET signal generator model 1631 with electronic frequency sweep, also 110 volt D.C. motor, 100 watt power. What have you? W2MTT, W. L. States, 9205 Whitney Ave., Elmhurst, L.I.

WANTED: BACK ISSUES OF Radio. Will pay cash or swap. I have large number of books and magazines. I will answer all letters. Vernon Gibbs, Jeffersonville, Ky.

HAVE 8 MM MOVIE CAMERA 27 foot and projector, sliiter, rifles, power woodworking tools, outboard motor, etc. Want transmitter-short wave receiver. No junk. Grant Reed, RR No. 3, White Cloud, Mich.

WANT RADIO PARTS, DIAGRAMS, coil winding data for various meters. Interested greatly in S.W.L. cards. P. R. Fatahka, 257 Nalgan Road, Dalar, Bombay, India.

BATTERY CHARGER, THICKLE charger, magnetic speaker, variable condensers, Veeder counter for Handee grinder or electric drill in good condition or what have you? Joseph Marsh, 111 Van Liew Ave., Milltown, N. J.

HAVE 75 TO 500 POWER MICROSCOPE, two cameras, V. S. foreign unused, used stamps, miniature pool table, Western hard-covered books. Want 2 1/2 meter transceiver or what have you radio? Ken Wilson, 13 E. Jackson St., Wilkes-Barre, Pa.

WANTED: USED COMMUNICATIONS receiver, will swap 1939 Coronado 6 tube push button car radio in excellent condition and other radio items. Will include complete photo-electric cell for higher priced receiver. Bengel Nielsen, Ringsted, Iowa.

WANTED: SCOTT'S NATIONAL Hammarlund receiver, state price, describe fully. Swap—Hallcrafters, DeForest radio course, Triplet tube tester, Crasley and RCA auto radios, meters, phono coils, tubes, etc. Oliver Klein, 2235 N. 39th St., Milwaukee, Wis.

(Continued on following page)

BARTER and EXCHANGE ADS (continued)

HAVE ALL KINDS OF USED R.A.D. parts for short wave sets. Will exchange for a pair of head phones of 2000 ohms each. J. C. Halesy, 1908 Faraon St., St. Joseph, Mo.

HAVE VIOLIN IN GOOD CONDITION. cost \$80.00 when bought, with case, two bows. Will swap for some power tools if can possibly be arranged. Will explain in letters. Stanley's Craft Service, Box 316, Munising, Mich.

WANTED: PRE-SELECTOR OR good a.w. receiver. Have 7 tube I.C. receiver, midket B.C. receiver, not working, 2 sets earphones, 155 V. B. eliminator, also numerous tubes and parts. Peter Feely, Prospect Ave., Mamaroneck, N. Y.

HAVE SW-3 COMPLETE AND RECONDITIONED. Lots of s.w. parts and small set for beginners. Will swap for bicycle, rifle or what you? T. E. Steiner, Marshallville, Ohio.

WANTED: FACTORY BUILT COMMUNICATIONS receiver, test equipment, parts. Have new \$25 set engineering books, .22 rifle, \$4 slide rule, \$20 unused U. S. stamps, Ditzgen drawing instruments. R. H. Huddleston, 605 So. Washington, Bryan, Texas.

500 MAGAZINES, RADIO & TELEVISION, QST, Popular Mechanics, Popular Science, Field and Stream, Hunting and Fishing, many others. Swap for anything of value in radio; receiver, xmitter, M. W. Flagg, Foster St., Littleton, Mass.

GOOD DUAL SPEED A.C.D.C. Greenfield, Phono motor, 12 in. turntable, RCA flat magnet pickup. Will trade for good radio or four cylinder motor cycle engine. H. M. Sale, CCC Co. 730, Alpine, Wyo.

WANT CANDLER CODE COURSE, have 400 volt DC power pack, 1886 kc. crystal and holder, and other misc. parts. Want correspondence with SWL, YLs, and hams, will answer 100%. Charlie Van Meerbeke, East End Ave., Bedford, N. J.

SWL EXCHANGE
Remittance of 1c a word for each word in the name and address should accompany order.

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RCA Institutes Catalog
• A CATALOG (#3908) has been issued by RCA Institutes, Inc. The catalog outlines classroom and laboratory facilities in both the New York and Chicago schools, student employment, living accommodations and expenses, requirements for admission and the courses in radio and electrical communication, television, radio servicing and commercial radio operating. Also outlined are the preparatory course and briefly an interesting home-study course.

Book on Electrolytic Capacitors
• ENGINEERS, service men, students and experimenters will find the complete story of electrolytic capacitors in the 300-page book, "Electrolytic Capacitors," by Paul McKnight Ducey, published by Cornell-Dubilier Electric Corp.

Approximately the first half of the book is devoted to a comprehensive treatment of the theory, design and actual manufacturing considerations involved. The second half gives practical information on specific characteristics, applications, testing, life, advantages and limitations of various types, etc. One entire chapter is devoted to A.C. electrolytics and their application, with special attention to industrial applications.

The "Appendix of Useful Information" offers a complete presentation of useful measurement methods and similar data.

"Manual" Now Free
• THE Manual of Radio Servicing, a 32 page booklet issued by Supreme Publications and formerly sold for 10c is now offered free to the readers of this magazine. This book should be of interest to hams, experimenters, servicemen and fans for it contains many important hints on radio operation and servicing. In making your request for a copy refer to booklet No. 116A.

BOOK REVIEW
TELEVISION, by V. K. Zworykin and G. A. Morton. Contains 646 pages, 6 1/4 x 9 1/4 inches, 509 figures. Published by John Wiley & Son, Inc., New York, N. Y.

The name of Vladimir K. Zworykin on any book means that it is highly authoritative and absolutely accurate. While that of Dr. G. A. Morton is somewhat less familiar, it is also well known that he like Dr. Zworykin, is associated with the Electronic Research Laboratory of the RCA Manufacturing Co., and therefore is an authority on the subject on which he writes.

The book, which is copiously illustrated with photographs, diagrams and graphs, gives the reader a thorough grounding in television theory and practice. Its first section deals with such fundamental physical principles as electron emission, electron optics, vacuum practice and fluorescent materials.

The second section covers the transmission and reproduction of television images and discusses video pickup devices and picture reproducing systems other than the standard cathode ray tube. Among the systems included is that used by Scopophony in England.

The third section of this work deals with the Iconoscope, the Kinescope, the electron gun, video amplifiers, scanning and synchronizing circuits and transmitter and receiver considered as a whole.

THE VICTORY OF TELEVISION, by Philip Kerby, contains 120 pages, size 5 1/2" x 8 1/4" and is published by Harper & Brothers, New York and London.

The author has been publicizing television for NBC. This volume commences with a discussion of the early beginnings of radio and discusses briefly some of the television pioneers. By far its greatest portion is devoted to modern television. It describes, in layman's language, what goes on in a modern television studio and tells of problems encountered in lighting the subjects adequately for the comparatively insensitive iconoscopes.

Mr. Kerby considers the new medium as possible competition for the motion picture, theatre, and radio. He discusses what types of programs are suitable for telecasts and the problems which sponsors will encounter. Finally, he tells how television will be financed and predicts its future. The latter portion of the book is devoted to F.C.C. regulations on television, a dictionary of television terms, and an index. An 8-page insert of photographs supplements the illustrative frontispiece.

SIMPLIFIED FILTER DESIGN by J. Ernest Smith. Published by RCA Technical Press, New York, 64 pages. Size 8 1/2 x 11".

The essential material of this book is organized and whipped into shape by RCA engineers and while it does not contain a comprehensive treatment of filter theory, and assumes that the reader has a fair knowledge of the subject, it does present a rapid method of accurate filter design. In it the usual filter theory is supplemented with a system of graphs, which tremendously reduces the necessity for wearisome mathematical calculations. Its numerous tables and formulae, together with the circuits and graphs, make it virtually a "must" for the design engineer.

I Cover the Pacific Coast!

(All times are P.S.T.)

Lyle M. Nelson

● WITH the outbreak of hostilities between Germany and the Scandinavian countries, short wave radio took on an added importance here in the Pacific slope of North America. Many short wave fans spent almost 24 hours a day by their radios, listening to the latest war news direct from London, Berlin, Copenhagen, Oslo and Paris.

The British Broadcasting stations were on the air almost continuously with news flashes. As always, GSD on 11.75 mc. and GSC on 9.58 mc. were the best here.

Reception from Berlin still is mostly confined to the North American program, from 1:50 to 7:50 p.m. over DJD on 11.77 mc. and from DJB on 15.20 mc. on the program for Asia and the Far East.

Paris is well received here on the 11.71-megacycle frequency daily from 5 to 9:30 p.m. In addition to this a special early morning program for the United States is heard on 15.13 mc. from 7:30 to 8 a.m.

Kendall Walker of Yamhill reports a new station announcing as "Radio Andorra" (in French) on 11.85 mc. This station, he says, is broadcasting experimentally and can be tuned irregularly throughout the mornings and afternoons.

Several listeners have reported hearing the Finnish stations in Lahti back on the air with English news broadcasts over OIE on 15.18 mc. from 10:20 to 10:30 a.m., near 12:45 p.m. and on OIF on 9.50 mc. during the late evenings, usually near 10 p.m.

Kurt DeWitt of Portland, Oregon, writes that MTCY on 11.74 mc. is booming through to the Pacific Coast with the volume of a local station each night from 9 to 11 p.m. The broadcasts begin with an English news summary which is followed by talks in English, and native Chinese music. At 11 p.m., just before closing down, another English news summary is given.

Paraguay's ZP14 again is making its presence known on 11.72 mc. now that CJRX has shut down. This powerful Paraguay broadcaster is on the air every night until 5 p.m.

Another South American still listed in the logs of Pacific Coast DX'ers is HCJB of Quito, Ecuador. HCJB has a program entitled "The Friendship Hour" daily at 6 p.m. on 12.46 mc. Installation of the new transmitter has greatly improved reception here.

After a long absence from the air, VPD2 of Suva, Fiji, has returned to 9.54 mc. and now is broadcasting from 10 p.m. to 1 a.m. Mr. Walker reports good reception near the first of the program.

OLR4A of Prague occasionally clears the QRN on 11.84 mc. and reaches the Pacific Coast. Best reception is at sign off at 6 p.m.

Some morning when you're in the mood for a good variety program, slip around to 9.53 mc., the hideout of ZBW3 of Hongkong, and you'll be treated to the latest in popular dance tunes, played by the Hongkong Ballroom orchestra, with typical Chinese music as a second course. ZBW3 is on the air from 2 to 7 a.m. and is one of the best stations heard here on the coast.

English news, with a Rome slant, can be tuned at 6 each night on either 2R04 on 11.81 or 2R09 on 9.67 mc. Both stations are fair here, with 2R04 usually the better.

Manila's KZIB on 9.49 mc. and KZRM on 9.57 mc. continue to be among the best of the Far Eastern short wave stations. KZRM is on the air from 2 to 7:30 a.m. while KZIB is listed as 2:30 to 7 a.m.

2R06 on 15.30, 2R04 on 11.80, 2R03 on 9.63 and 2R011 on 7.22 mc. all carry the American program from Rome from 5:15 to 7:10 p.m.

A recent letter from CR7BG, received by John Cavanagh of Oregon City, reveals that a special English program now is being broadcast for North America daily on 15.285 mc. from 4 to 5 a.m.

Two new Moscow stations now are broadcasting on 11.65 and 9.69 mc. according to

FREE CATALOGS and INFORMATION

By carefully reading the advertising columns, you will find many offers to furnish literature containing valuable technical information that will help you in your work. Use this list freely.

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		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Millen, J., Mfg. Co., Inc.	Parts Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
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		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
National Company, Inc.	Set & Parts Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
National Radio Institute	Radio School	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
National Schools	Radio School	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Nelson Co.	Used Courses	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
New York Y.M.C.A. Schools	Trade School	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Par-Metal Products Corp.	Parts Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Radio & Technical Publ. Co.	Radio Textbooks	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Radio City Products Co.	Test Instruments	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Radolek Co., The	Mail Order	1940 Radio Profit Guide		Free	127
		Catalog		Free	67
		RCA Ham Tips		Free	I.B.C.
		Literature		Free	79
		52-page Book		Free	67
		Booklet	S-6	Free	89
		Information		Free	93
		Catalog		Free	67
		Catalog		Free	89
		Circulars on each Book		Free	101
RCA Institutes, Inc.	Radio School	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
RCA Manufacturing Co., Inc.	Set & Parts Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Scott, E. H., Radio Labora- tories, Inc.	Set Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
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Sprayberry Acad. of Radio	Radio School	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Teleplex Co.	Code Machine	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
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		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Triplett Electrical Inst. Co.	Parts Mfr.	1940 Catalog		Free	97
		Illustrated Bulletins		Free	99
		1940 Catalog		Free	89
		Catalog		Free	I.F.C.
		64-page Book		Free	65
		Literature		Free	67
		72-Page Catalog		Free	104
		Booklet		Free	67
		Catalog		Free	97
		Circulars on each Book		Free	101
Tri-State College	Radio School	1940 Catalog		Free	

World Short Wave Stations

(Revises only published this month; for complete list see last issue.)

Mc.	Call	Station	Time
26.135	W5XAU	OKLAHOMA CITY, OKLA., 11.49 m., 6 am.-10 pm.	
26.050	W9XTC	MINNEAPOLIS, MINN., 11.52 m. Relays WCTN 10 am.-8 pm.	
26.050	W9XH	SOUTH BEND, IND., 11.52 m. Addr. South Bend Tribune. Relays WSBT-WFAM 2.30-6.30 pm., exc. Sat., Sun. and Thurs.	
25.900	W9XPD	ST. LOUIS, MO., 11.58 m. Addr. Pulitzer Pub. Co. Relays KSD. 10 am.-1, 4-8 pm.	
25.300	W9XOK	ST. LOUIS, MO., 11.86 m. Addr. St. Louis Times-Star, Relays KXOK. Irreg.	
21.540	WPIT	PITTSBURGH, PA., 13.93 m., Addr. Grant Bldg. Relays KDKA 9-10 am.	
21.530	GSJ	DAVENTRY, ENG., 13.93 m., 5.40-8.45 am. to East.	
21.500	WGEA	SCHENECTADY, N. Y., 13.95 m., General Electric Co., Irreg. Replacing WGEA, 15.33 mc.	
18.480	HBH	GENEVA, SWITZERLAND, 16.23 m., Addr. Radio Nations. Fri. 8.45-10.15 am. to Asia.	
17.820	2RO8	ROME, ITALY, 16.84 m., Addr. (See 2RO4, 11.81 mc.) 4.30-7.15, 7.30-7.50 am., 9.30-10.55 am., 6-7.55 pm. to So. Am.	
17.810	GSV	DAVENTRY, ENGLAND, 16.84 m., 7-8.45, 9-11.30 am. to No. Amer. News, 8.15, 11 am.	
17.800	OIH	LAHTI, FINLAND, 16.85 m. Irreg.	
17.790	GSG	DAVENTRY, ENG., 16.86 m., Addr. B.B.C., London. 5.40-8.45; 9-11.30 am.	
17.780	WNBI	BOUND BROOK, N. J., 16.87 m., Addr. Nat'l Broad. Co., 8 am.-4 pm. to Europe, 4-9.15 pm. to So. Amer.	
17.765	TPB3	PARIS, FRANCE, 16.89 m. Addr. 98 Bis. Blvd. Haussmann, "Paris Mondial." 5-10 am. to Asia.	
15.410	RV96	MOSCOW, U.S.S.R. 19.47 m., Irreg.	
15.330	KGEI	SAN FRANCISCO, CALIF., 19.57 m. Addr. General Electric Co., 6.30-11.15 pm. to So. America.	
15.320	OZH	SKAMLEBAK, DENMARK, 19.58 m., Oper. uncertain.	
15.310	GSP	DAVENTRY, ENG., 19.6 m., Addr. (See 17.79 mc.) 2-5 am., to Near East, 1.30-3.30 to N. A.	
15.300	2RO6	ROME ITALY, 19.61 m., 1-2 5-9.25 am., 11 am.-2.35, 3-5.30 pm. For N. A. 8.15-10.10 pm. News at 10.	
15.290	VUD3	DELHI, INDIA, 19.62 m. Addr. All India Radio. 1.30-2.30, 7.30 am.-12.30, 9.30-11.30 pm.	
15.290	LRU	BUENOS AIRES, ARG., 19.62 m., Addr. El Mundo. Relays LRI, 7-9 am.	
15.285	CR78G	LOURENCO MARQUES, MOZAMBIQUE, 19.63 m., 7-8 am. to N. A.	
15.280	DJQ	BERLIN, GERMANY, 19.63 m., Addr. Broadcasting House. 12.05-11.10 am. News 9 am.	
15.260	GS1	DAVENTRY, ENG., 19.66 m., Addr. (See 17.79 mc.) 12.57-5 am., 12 am.-3.30 pm. to Africa.	
15.255	CR78D	LOURENCO MARQUES, MOZAMBIQUE, 19.67 m., See CR78H, 11.79 mc. for Sked.	
15.250	WRUL	BOSTON, MASS., 19.67 m., Addr. University Club. 11 am.-8 pm. Sun. Irr. to Europe.	
15.245	TPA2	PARIS, FRANCE, 19.68 m., Addr. 98 Bis. Blvd. Haussmann, "Paris Mondial." 5-9.45 am. to Asia.	
15.240	YUF	BELGRADE, YUGOSLAVIA, 19.68 m., 5.55-6.55 am. to S. A.	
15.230	DXT	BERLIN, GERMANY, 19.70 m. 8-9 am. to N. A. in Par. with DJ8.	
15.210	WPIT	PITTSBURGH, PA., 19.72 m., Addr. (See 21.540 mc.) 10 am.-3 pm. to Europe.	
15.200	DJB	BERLIN, GERMANY, 19.74 m., Addr. B'cast'g. House; 12.05-6:30-9 am.; 11.10-11.40 am. 4.50-10.45 pm. for N. A. News 6.45, 8.15 am.; 6, 8.15, 10.30 pm.	
15.195	TAQ	ANKARA, TURKEY, 19.74 m., 5.30-7.30 am. News in English at 7.15 am.	

SHORT WAVE STATION LIST

Owing to lack of space, the complete World Short Wave Station List will not be published hereafter. Readers who are interested in having complete copies of the RADIO & TELEVISION "Short Wave Station List" may obtain same free of all cost. Simply send a self-addressed envelope (legal size, about 4" x 9") bearing 3c postage to Short Wave Station List, RADIO & TELEVISION, 20 Vesey St., New York, N. Y. A complete Station List will be sent you without charge.

Mc.	Call	Station	Time
15.190	XGOX	SZECHWAN, CHINA, 19.75 m., 8.30-9.30, 10-11.05 pm. to N.A., 11.30 pm.-1 am. to Japan.	
15.190	OIE	LAHTI, FINLAND, 19.75 m. Addr. (See OFD, 9.5 mc.) 9 am.-5 pm.	
15.170	TGWA	GUATEMALA CITY, GUAT., 19.78 m., Addr. Minist're de Fomento. Daily 12.45-1.45 pm.; Sun. 1.45-5.15 pm.	
15.170	LKY	OSLO, NORWAY, 19.78 m. Daily 12.30-4 pm., Sun. to 4.30 pm. Operation uncertain.	
15.160	DXS	BERLIN, GERMANY, 19.79 m., Near 6.45 am. Irreg. in Par. with DJ8.	
15.155	SBT	MOTALA, SWEDEN, 19.80 m. 1-4.30 pm., 8-9 pm. to N. A.	
15.150	YDC	BANDOENG, JAVA, 19.8 m., Addr. N. I. R. O. M. 6-9 pm. ex. Sat., 10.30 pm.-2 am., Sat. 7 pm.-2 am., daily 4.30-10.30 am.	
15.140	GSP	DAVENTRY, ENG., 19.82 m., Addr. (See 17.79 mc.) 3.30-5, 9-11.30 am., 3.50-6 pm.	
15.130	TP8	PARIS, FRANCE, 19.83 m. Broadcasts to U. S. 10.30-11, 11.30 am.-12.30 pm.	
15.130	WRUW-WRUL	BOSTON, MASS., 19.83 m., Addr. World-Wide B'cast'g. Foundation. University Club. 8.45-10.30 pm. Ex. Sun.	
15.120	HVJ	VATICAN CITY, 19.84 m. Sun., Thurs. 8.30-9 pm. to N. A.	
15.040	RKI	MOSCOW, U.S.S.R., 19.95 m. Works Tashkent near 7 am.; at present not sked.	
15.010	JZK	TOKYO, JAPAN, 19.99 m. Heard here 8-9 pm., testing.	
14.180	KFJEG	CANTON ISLAND, 21.16 m., on sked. 2.30-4.30 am.	
12.486	HIIN	TRUJILLO CITY, DOM. REP., 24.03 m., 11.40 am.-1.40, 7.10-9.10 pm.	
12.000	RNE	MOSCOW, U.S.S.R., 25 m. 6.30-7.30 am., 7-8.30 pm. (Eng.). 8.30-10 pm. Surs. 6.30-10.30 am. 7-10 pm.	
11.895	RIG	MOSCOW, U.S.S.R., 25.22 m., 5.30-6, (French), 6-6.30 am. (Eng.)	
11.895	XGOY	SZECHWAN, CHINA, 25.22 m. 5.30-7.35, 7.40-9, 9.40-11, 11.10-11.50 am. 2-4.20 4.30-6.20 pm. News 6.15 am. 5 pm.	
11.885	TPA3	PARIS, FRANCE, 25.24 m. (See 15.245 mc.) 1-4, 10.15 am.-5.15 pm. to Asia and Africa.	
11.880	TPB7	PARIS, FRANCE, 25.25 m., 4.45-7.45 pm. to S.A., 8 pm.-12.45 am. to N.A. News 8.03, 11.30 pm. 12.15 am.	
11.873	YUM	MADRAS, INDIA, 25.27 m. 6.30 am.-12.30 pm.	
11.870	WPIT	PITTSBURGH, PA., 25.27 m. Addr. (See 21.540 mc.) 3-10 pm.	
11.870	VLQ2	SYDNEY, AUSTRALIA, 25.27 m., 2.30-3.30 am.	
11.860	GSE	DAVENTRY, ENG., 25.30 m., Addr. (See 11.75 mc.) 2.15-5 am. to Asia; 6.24-9.15 pm. to S. A.	
11.955	PRF5	RIO DE JANEIRO, BRAZIL, 25.31 m., 5.55-7 am.	
11.850	HAD3	BUDAPEST, HUNGARY, 25.32 m. Addr. Radiolabor, Gyali Ut 22. 5-6.20 pm. to S. A.	
11.845	TPC8	PARIS, FRANCE, 25.33 m., 10.30-11, 11.30 am.-12.30, 1.15-4.15 pm. to N. A.	
11.840	OLR4A	PRAGUE, BOHEMIA, 25.34 m., Addr. Czech Shortwave Sta., Praha XII, Fochova 16. Daily 7-9 pm. to No. Am.	

Mc.	Call	Station	Time
11.830	VLW3	PERTH, W. AUSTRALIA, 25.36 m. 1-5 am. 12.30-1.30 pm. to Africa.	
11.825	CXA14	COLONIA, URUGUAY, 25.37 m. Rel. LR6 3.30-9.05 pm.	
11.820	XEBR	HERMOSILLA, SON., MEX., 25.38 m., Addr. Box 68. Relays XEBH. 10 am.-4 pm., 8-10.30 pm. Irr.	
11.810	2RO4	ROME, ITALY, 25.4 m., Addr. E.I.A.R., Via Montello 5. Daily 1-2, 3.30-3.45, 4.30-4.55, 7.20-9.25, 9.30-10.55, 11 am.-2.25, 2.30-5.30, 6-7.55, 8.15-10.10 pm. to N. A. News 10 p.m.	
11.800	JZJ	TOKYO, JAPAN, 25.42 m., Addr. Broadcasting Co. of Japan, Overseas Division 12-1.30 am. to N. A. News 12.03 am. Also 7-9.30 am., 2-4, 4.30-5.30 pm.	
11.800	COGF	MATANZAS, CUBA, 25.42 m., Addr. Gen. Betancourt 51. Relays CMGF. Irreg.	
11.790	WRUL	BOSTON, MASS., 25.45 m., Addr. (See 15.130 mc.) 11 am.-8 pm.	
11.780	-	SAIGON, INDO-CHINA, 25.47 m. 6-10.15, 10.30-11 am. to N. A., 6.35-7.15 pm., 12.05-12.45 am.	
11.780	HP5G	PANAMA CITY, PAN., 25.47 m., Addr. Box 1121. 12-1.30, 6-10 pm.; Sun. 9 am.-noon.	
11.775	MTCY	HSINKING, MANCHUKUO, 25.48 m. Addr. Central Broadcasting Station 601 Daido-Taigai, Hsinking. 1.30-2.20 to N. A. Also 8.40-9.30, 9.50-10.50 am., 4-4.50 pm.	
11.760	2RO15	ROME, ITALY, 25.51 m., 11.40 am.-3, 6.30-7 pm.	
11.740	HVJ	VATICAN CITY, 25.55 m., Tu. 6.30-7, 10-10.30 am., Thurs. 9-9.30 pm.	
11.740	CB1174	SANTIAGO, CHILE, 25.55 m. 6-11 pm. Sun. 6-11 pm.	
11.740	CR6RC	LUANDA, ANGOLA, 25.55 m., 6.45-8 am., 2-4 pm.	
11.735	LKQ	OSLO, NORWAY, 25.56 m., 10 am.-12.30 pm. Sun. 9.30 am.-12.30 pm. Operation uncertain.	
11.735	YUE	BELGRADE, YUGOSLAVIA, 25.56 m. 9-10 pm. to N. A.	
11.730	WRUW-WRUL	BOSTON, MASS., 25.58 m., Addr. World-Wide B'cast'g. Foundation, University Club. 8.45-10.30 pm. Ex. Sun.	
11.718	CR78H	LAURENCO MARQUES, PORTUGUESE E. AFRICA, 25.6 m. Daily 12-1, 4.30-6.30 am., 12-4 pm., Sun. 5-7 am., 10 am.-2 pm.	
11.718	TPA4	PARIS, FRANCE, 25.60 m. (See 15.245 mc.) 1-5.15 pm. to Africa. 6-7.45, 8 pm.-12.30 am. to N. A.	
11.700	HP5A	PANAMA CITY, PAN., 25.64 m. Addr. Radio Teatro, Apartado 954. 7-10.40 am. 5-10.45 pm. Sun. 6-10.45 pm.	
11.400	CJRX	WINNIPEG, CANADA, 26.32 m., Addr. James Richardson & Sons, Ltd. Off at present.	
11.040	CSW3	LISBON, PORTUGAL, 27.17 m., Addr. Nat. Broad. Sta. 11 am.-2 pm., Sun. to 3.45 pm., to Angola.	
10.955	CR6BD	BENGUELA, ANGOLA, 27.39 m., 2.30-3.30 pm.	
10.400	YSP	SAN SALVADOR, EL SALVADOR, 28.55 m., 1-3, 6.30-11 pm.	
10.290	DZC	BERLIN, GERMANY, 29.15 m., 4.50-10.45 pm. to Brazil.	
10.260	PMN	BANDOENG, JAVA, 29.24 m. Relays YD8 6-9 pm., 10.30 pm.-2 am., 4.30-11.30 am. Ex. Sun.	
10.070	-	DEUTSCHE FREIHEITSSENDER, 29.82 m., loc. in Germany, under cover. 3-3.30 pm.	
10.042	DZB	PODEBRADY, BOHEMIA, 29.88 m., 2.40-3.25 pm.	
9.925	JDY	DAIREN, MANCHUKUO, 30.23 m. Relays JOAK daily 7-8 am. Works Tokyo occasionally in early am. Oper. uncertain.	
9.855	EAQ	MADRID, SPAIN, 30.45 m., Addr. P. O. Box 951. 5-7.30, 7.30-9.30 pm. to N. A. Sat. 1-3 pm. to Canary Isl. News 8.40 pm.	
9.835	COCM	HAYANA, CUBA, 30.51 m. Addr. Transradio Columbia, P.O. Box 33. 8 am.-12 mid. Sun. 8 am.-11 pm. CMCM.	
9.825	SVJ	ATHENS, GREECE, 30.54 m. Heard near 8.30 am.	

Station List

Mc. Call		Mc. Call		Mc. Call	
9.815 IRF	ROME, ITALY, 30.57 m., Works Egypt afternoons. Relays ZRO, 5.20-5.40 am. Daily 1.50-2.30 pm. to N. A.	9.550 YUB2	BOMBAY, INDIA, 31.41 m., Addr. All India Radio, 9.30-10.30 pm., 1.30-3.30 am. (Sat. 1-3.30 am.); Sat. 9.30 pm.-4 am., Sun. 5-6 am.	6.860 YNOP	MANAGUA, NICARAGUA, 43.63 m. 8-9.30 pm.; Sun. 2-3 pm.
9.740 CSW7	LISBON, PORTUGAL, 30.80 m. Addr. Nat. Broad. Sta. 2.15-3 pm. to Europe Ex. Surs.; 3.15-6 (Sun. 4-6 pm.), to Brazil, 6.05-8 pm. to N. A.	9.555 XETA	MONTERREY, MEXICO, 31.38 m. Addr. Box 203, 8.45 am.-Mid.	6.780 HIH	SAN PEDRO DE MACORIS, DOM. REP., 44.25 m. 7-8 pm. Sun. 5.20-6.40 pm.
9.705 ZHP	SINGAPORE, MALAYA, 30.92 m. 4.40-9.40 am., Wed. and Sat. 12.40-1.40 am., Sun. 5.40-9.40 am.	9.560 OAX4T	LIMA, PERU, 31.38 m., 7-8, 11.30 am.-1.30 pm.	6.760 YNRS	MANAGUA, NICARAGUA, 44.38 m. 6.40-10.40 pm.
9.685 TGWA	GUATEMALA CITY, GUAT., 30.98 m., 10-11.30 pm. Ex. Surs. Sun. 7 pm.-mid.	9.538 VPD2	SUVA, FIJI ISLANDS, 31.46 m., Addr. Amalgamated Wireless of Australasia, Ltd. 1-4.10 am.	6.465 TGWB	GUATEMALA CITY, GUAT., 46.40 m. La Voz de Guatemala. Daily 7.45-9 am. 12.45-3.45 pm., 7.30 pm.-12.15 am. Sun. 10.30 am.-5.15 pm., 7 pm.-12 m.
9.685 RV96	MOSCOW, U.S.S.R. 30.98 m. 2.3-3.0, 5.30-6 pm. News 5.30 pm.	9.523 ZRG	ROBERTS HEIGHTS, S. AFRICA, 31.5 m., 3.15-9.50 am., Sun. 3.30 am.-3 pm.	6.355 IAC	COLTANO, ITALY, 47.20 m., 3-3.25 pm.
9.680 XEQQ	MEXICO, D.F., MEXICO, 30.99 m. 9.55 am.-12.45 am.	9.520 OZF	SKAMLEBAK, DENMARK, 31.51 m., Addr. Statsradioforien, Heibergsgade 7, Copenhagen, 8-11 pm. to N. A. Operation uncertain.	6.335 OAXIA	ICA, PERU, 47.36 m., Addr. La Voz de Chiclayo, Casilla No. 9. 7.30-11 pm.
9.680 TPC23	PARIS, FRANCE, 30.99 m. "Paris Mondial" 1-3 am., 1.20-4.15 pm.	9.520 RV96	MOSCOW, U.S.S.R., 31.51 m., 1-6 pm. (English 3-3.30, 4.30-5 pm.) 1-9.	6.315 OAX4G	LIMA, PERU, 47.62 m., Addr. Apartado 1242, Daily 6-12 mid.
9.680 VLQ5	SYDNEY, AUSTRALIA, 30.99 m. Addr. Dept. of Inform. 2-4, 6.30-7.7.8 to N.A. 8.15-8.45, 10.30-11.30 am. to N.A.	9.510 GSB	DAVENTRY, ENGLAND, 31.55 m., 12.57-3.15 am., 3.50-6; 6.24-9.15, 9.37 pm.-12.30 am. to S. A.	6.310 HIIZ	CIUDAD TRUJILLO, D. R., 47.50 m., Daily except Sun. 11.40 am.-12.40 pm., 5.10-7.40 pm.
9.675 —	SAIGON, INDO-CHINA, 31.01 m., Addr. 17, Place A. Foray, "Radio Boy Laundry," 7.30-10.30 am. Irreg.	9.505 YUD	BELGRADE, YUGOSLAVIA, 31.57 m., 7.55-8.55 pm. to S. A.	6.290 HIIG	TRUJILLO CITY, D. R., 47.69 m., 7.10-8.40 am., 11.40 am.-2.10 pm., 3.40-9.40 pm.
9.665 ZRO9	ROME, ITALY, 31.04 m., 11.40 am.-3.30, 5.30-6, 6.30-7.40 pm.	9.500 OFD	LAHTI, FINLAND, 31.58 m., Addr. Finnish Brct. Co., Helsinki, 12.05-3 am.	6.245 HIIN	CIUDAD TRUJILLO, D. R., 48.04 m., Addr. "La Voz del Partido Dominicano," 11.40 am.-1.40, 7.10-9.10 am.
9.660 YNCM	BLUEFIELDS, NICARAGUA, 31.06 m., 7-10 pm.	9.465 TAP	ANKARA, TURKEY, 31.70 m. Daily 9.30 am.-4.30 pm. News 2.15 pm.	6.200 TG2	GUATEMALA CITY, GUAT., 48.39 m., Addr. Dir. Genl. of Electr. Commun. Relays TGI Mon.-Fri. 7.30-10 am., 6-11.30 pm., Sat. 6 pm.-3 am. Surs. 3-8 pm.
9.660 LRX	BUENOS AIRES, ARG., 31.06 m., Addr. El Mundo, Relays LR1, 6.30-7.45 am., 10.15 am.-11 pm.	9.360 COBC	HAVANA, CUBA, 32.05 m., Addr. P.O. Box 132, 7 am.-12 mid. Sun. 7 am.-10.30 pm.	6.190 HVJ	VATICAN CITY, 48.47 m., Wkd s. 2-3 or 3.30 pm.
9.660 HVJ	VATICAN CITY, 31.06 m. Sun. 5-5.30 am., Wed. 2.30-3 pm. Mon. & Thurs. 6.30-7 am., 8-8.15, 8.30-8.45 pm. to N. A.	9.345 HBL	GENEVA, SWITZERLAND, 32.11 m., Addr. Radio Nations, Mon. Wed., 6.45-8.15 pm.	6.170 DXQ	BERLIN, GERMANY, 48.62 m., 2.40-3.25 pm. News 2.50 pm.
9.650 IABA	ADDIS ABEBA, ETHIOPIA, 31.09 m., 3.30-5.30 am. (Sun. 2.30-5.30 am.) 8 am. 2.30 pm.	9.295 HI2G	CIUDAD TRUJILLO, D. R., 32.28 m., 7.10-8.40 am., 11.40 am.-2.10 pm., 7.10-9.40 pm.	6.150 HI3C	LA ROMANA, D.R., 48.78 m., "La Voz de la Feria"—4.55-6 or 8 pm.
9.650 DJW	BERLIN, GERMANY, 3.09 m. 4.50 pm.-10.50 pm. for S. A.	9.205 PYA2	RIO DE JANEIRO, BRAZIL, 32.59 m., 5.55-8 pm.	6.140 WPIT	PITTSBURGH, Pa., 48.86 m. Addr. Westinghouse Electric & Mig. Co. Relays KDKA 10 pm.-12 mid.
9.650 CR7BE	LOURENCO MARQUES, MOZAMBIQUE, 31.09 m. Addr. P. O. Box 594, 2.4 pm. to Portugal.	9.010 TYA2	PARIS, FRANCE, 33.19 m., 1.30 am., 1.30, 2.30 and 4 pm.	6.197 CR7AA	LAURENCO MARQUES, MOZAMBIQUE, PORT. E. AFRICA, 48.87 m., Daily 12-1.4.30-6.30 am., 12-4 pm.; Sun. 5-7 am., 10 am.-2 pm.
9.645 LLH	OSLO, NORWAY, 31.10 m. Daily 1.10-4.15 7.50 am., Sun. 1.20-8 am. Operation uncertain.	9.860 COKG	SANTIAGO, CUBA, 33.48 m. Addr. Box 137, 6.40 am.-Mid ite; Irreg.	6.120 WCBX	NEW YORK CITY, 49.02 m., Addr. See 6.170 m., 12 m.-2 am. exc. Fri. & Sat.
9.645 XGOY	SZECHEWAN, CHINA, 31.10 m., 9.40 am. to N. A.	8.850 COCQ	HAYANA, CUBA, 33.90 m., 6:50 am.-1 am.	6.100 WNBI	BOUND BROOK, N. J., 49.18 m., Addr. Nat'l Broad. Co. 9.45 pm.-mid.
9.640 CXAB	COLONIA, URUGUAY, 31.12 m., Addr. Belgrano 1841, Buenos Aires, Argentina. Relays LR3, Buenos Aires 5 am.-11 pm. Sat. to Md.	8.700 COCO	HAVANA, CUBA, 34.48 m. 7.30 am.-mid.	6.094 ZHJ	PENANG, FED. MALAY STATES, 49.23 m., 6.40-8.40 am., except Sun., also Sat. 11 pm.-1 am.
9.630 ZRO3	ROME, ITALY, 31.15 m., Addr. E.I.A.R. via Montello 5, 12.50-2.59, 3.30-4.45, 6-7.55, 8.15-10.10 pm. to N. A. News 10 pm.	8.665 COJK	CAMAGUEY, CUBA, 34.62 m., Addr. Finlay No. 3 Altos, 11.30 am.-12.30 pm., 3.30-7, 8-8.30 pm.	6.090 ZNS2	NASSAU, BAHAMAS, 49.26 m., Addr. Dir. of Tel. East St., Nassau. 8-9 am., 1.30-2, 6.30-11 pm.
9.625 HATS	BUDAPEST, HUNGARY, 31.17 m., Addr. Radiolabor, Gyali Ut 22.	7.968 HSP6	BANGKOK, THAI, 37.65 m. 8-11 am. Ex. Mon.	6.080 OAX4Z	LIMA, PERU, 49.34 m. Radio Nacional 7 pm.-1.30 am.
9.610 VLQ	SYDNEY, AUSTRALIA, 31.22 m., 2-4, 6.15-6.45, 8.5-8.45 am.	7.870 HCIRB	QUITO, ECUADOR, 38.12 m. La Voz de Quito. 8.30-11.30 pm.	6.060 WLWO	CINCINNATI, OHIO, 49.5 m., Addr. Crosley Radio Corp. Relays WLW. Sun. 8 am.-6.30 pm., 11 pm.-2 am., Tues., Wed., Fri. 5.45 am.-6.30, 11 pm.-2 am. Mon., Thurs. & Sat. 5.45 am.-2 am.
9.600 RAN	MOSCOW, U.S.S.R., 31.25 m. 3.3-3.40, 4.30-5, 6-8.30 pm. to N. A. 8.30-9 pm. in French. News at 8 pm.	7.865 SUX	CAIRO, EGYPT, 38.15 m., 12.30-3.30 pm. (Arabic)	6.055 HJFA	PEREIRA, COLOMBIA, 49.55 m., 9 am.-Noon, 6.30-11 pm.
9.595 EIRE	MOYDRUM, ATHLONE, EIRE, 31.27 m. Addr. P.T.T., Castle, Dublin, 7.30-8.30, 9-10 am., 12.30-4.30, 5-6 pm.	7.850 ZAA	TIRANA, ALBANIA, 38.22 m., 6.30-8 am., Sun. to 8.30 am.	6.030 RV96	MOSCOW, U.S.S.R., 49.75 m. 2-6, 7-8.30 pm. to N. A., 8.30-9 pm. News 7 pm.
9.595 HBL	GENEVA, SWITZERLAND, 31.27 m., Addr. Radio Nations, Mon. & Wed. 6.45-8.5 pm.	7.614 CR6AA	LOBITO, ANGOLA, 39.39 m., 12.30-1.15 pm., and Mon., Wed., Fri. 2-4 pm.	5.975 HI1J	SAN PEDRO DE MACORIS, D. R., 50.21 m. Addr. Box 204, 11.40 am.-1.40 pm., 6.10-8.30 pm.
9.590 VUD2	DELHI, INDIA, 31.28 m., Addr. All India Radio, 1.30-3.30, 6.30 am.-2.30, 9.30-11.30 pm.	7.520 RKI	MOSCOW, U.S.S.R., 39.89 m. 4.30-5.30, 7-8.30 pm. to N. A.	5.875 HRN	TEGUCIGALPA, HONDURAS, 51.06 m. 6-11 pm. Sun. 6-9.30 pm.
9.570 TYB	PARIS, FRANCE, 31.35 m., 12.30-4 pm.	7.445 FG8AH	POINT-A-PITRE GUADELOUPE, F.W.I., 40.30 m., 6-7.10 pm., Sun. 9.30-11 am. P. O. Box 125.	5.020 YV4RQ	PUERTO CABELLO, VENEZ., 59.76 m., 5-9.30 pm.
9.570 HJAB	BARRANQUILLA, COL., 31.35 m. Eves.	7.360 R—	MOSCOW, U.S.S.R., 40.76 m., 4-5 pm. in Eng.	4.945 HJCW	BOGOTA, COLOMBIA, 60.67 m., 7-8 am., 7.30-11 pm. Sats. to 11.40 pm.
9.570 KZRM	MANILA, P. I., 31.35 m., Addr. Erlanger & Galinger, Box 283 Wkds. 4.30-6 pm. Mon. to Fri. 5-9 am. Sat. 5-10 am., Sun. 4-10 am.	7.290 DJI	BERLIN, GERMANY, 41.15 m. 5-5.30 pm.	4.875 HJFH	ARMENIA, COLOM., 61.54 m., 8-11 am., 6-10.30 pm.
		7.270 DXM	BERLIN, GERMANY, 41.27 m., 4.15-4.30, 6.15-6.30 pm. in Eng.	3.490 CR7AB	LOURENCO MARQUES, MOZAMBIQUE, 86 m., See CR7AA, 6-137 m.
		7.260 OZU	SKAMLEBAK, DENMARK, 41.32 m. 2.5 pm. Operation uncertain.		
		7.240 DXJ	BERLIN, GERMANY, 41.44 m., 8-8.30 pm. in Eng.		
		7.230 GSW	DAVENTRY, ENGLAND, 41.49 m., 1.40-11.30 am., 11.52 am.-6 pm., 6-24-8 pm., to Europe.		
		7.220 ZRO11	ROME, ITALY, 41.55 m., 8.15-10.10 pm. News 10 pm.		
		7.174 CR6RS	LOBITO, ANGOLA, 41.81 m., 6.30-7.30 am. Also Tue., Fri., Sun. 2-4 pm.		

TELEVISION FOR WAR

THE *Army and Navy Journal* has pointed out that a recent television broadcast (described on page 5 of the May R. & T.) in which a television pickup in an airplane radiated images of the terrain beneath, might be adapted to U. S. defense. This publication said that the demonstration proves the potentialities of the new art for war time use. Particularly as "the services realized that in a time of national emer-

gency, they would take over the NBC, a subsidiary of the RCA, which is an American owned corporation, the executives of which are retired and reserve officers of the *Army and Navy.*" The publication's article concludes by referring to the art as one which "promises to be not only entertaining and educative for the general public, but of illimitable service in connection with the defense of the country."

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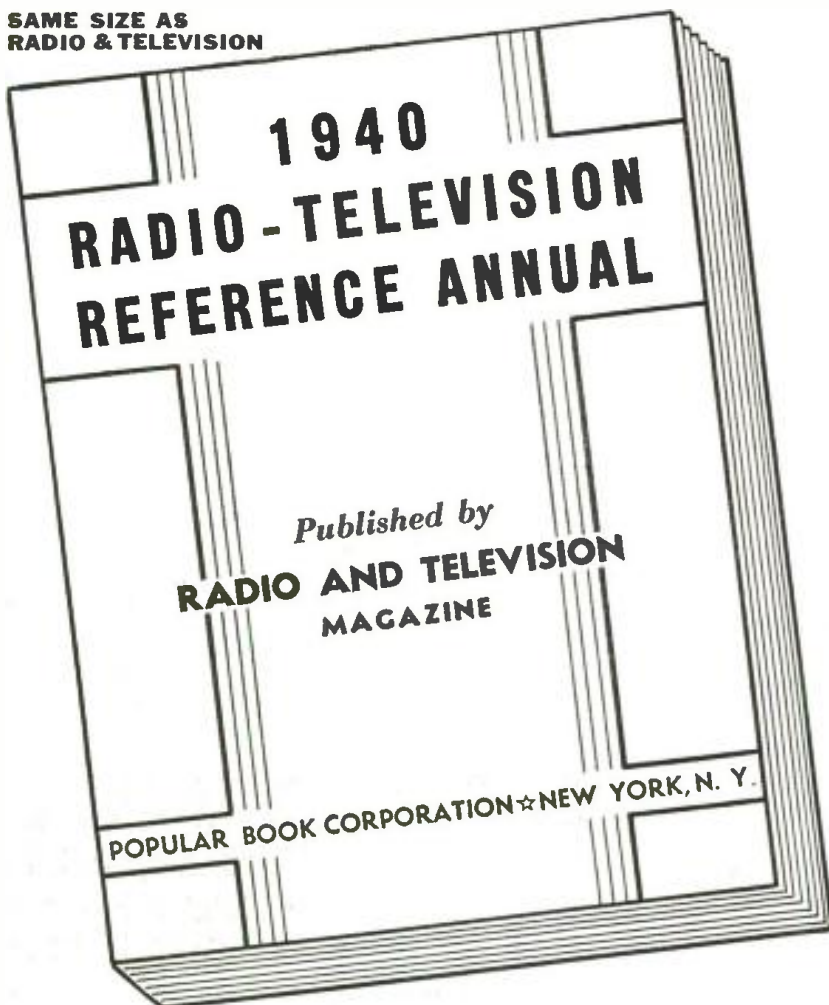
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**RADIO & TELEVISION
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FOTO-CRAFT

SECTION

Edited by Robert Eichberg

Photography with a PURPOSE

Kate Smith

(The Songbird of the South)

● SOMETIMES I wonder which I get more pleasure from—my dog, Freckles, or all the photographs of Freckles strewn around my apartment.

For the two of them—Freckles and taking pictures—are my two hobbies. Luckily they are hobbies which go beautifully together. Now if I liked to collect stamps and old china, I'd have to do them quite separately. As it is, I have Freckles and I take pictures, so naturally I take pictures of Freckles.

There's no problem of which came first—the chicken or the egg. I first became interested in photography when I was out in Hollywood in 1931 making my film, "Hello, Everybody." A year or so ago when I bought Freckles—a four months old cocker spaniel pup—I particularly picked him for his photogenic qualities, beautiful limpid brown eyes, soft red-gold coat and long floppy ears.

It's been fun to make pictures of Freckles as he grew from a youngster, a little wobbly on his legs, into a dignified grown dog. And as I can trace his development through my pictures, I can trace my own development as a photographer. Pictures I make now I'm much more proud of, because I've learned about proper treatment of light and

shade, about composition, about human interest.

I would advise any amateur photographer not to treat his hobby haphazardly by just going out with his camera and shooting anything that comes along. It's much more fun, I think, to follow a method I've developed and take pictures with a purpose. Concentrate on one subject, at least temporarily, and snap enough pictures of that one subject to fill a scrapbook. It's a wonderful way of watching your own growing competence, and it gives picture making a shape and a homogeneity that's very satisfying.

I can explain better by telling a little about how my own photo hobby developed.

I'd played around with photography a little after watching Hollywood's ace cameramen at work, but I didn't become a real camera hound until by accident I was the only one on the scene to photograph a real news event.

This is how it happened. With Ted Collins, my manager, and Mrs. Collins, I was resting after a road tour at Hot Springs, Arkansas. We were staying in a little guest house just across the way from the Mountain Valley Hotel.

Early our first morning there, we were



"Our Kate" uses a Contax III with f1.5 lens—and all the gadgets.

awakened by the cry of "Fire!"

I was too excited to gather up my clothes. All I could think of was my new camera. I grabbed it and rushed out, to see the hotel in flames. Well, naturally, having my camera there, I took some pictures. They were the only photographs of the tragedy, and all the local newspapers printed them. That's the nearest I've come to being a real news photographer, and those newspaper clippings are still among my proudest possessions.

That was my start in photographing fires. I have two scrapbooks full of fire pictures, some of them made with color film. I had a friend in the fire department who used to tip me off when there were big fires nearby, so I got some unusual shots.

Since my fire picture days, I've specialized in any number of things. I became specially interested in color film, and used to haunt the flower shows, wonderful places for color. Then too I have a country place up in Lake Placid, and the autumn colors there are almost unbelievably beautiful.

There are all sorts of specialties that one can stick to in amateur photography, and I've tried most of them. For material for my daily noontime CBS broadcast, I got in the habit of browsing around the lower East Side section of New York. The stories of some of these poor people should be

(Continued on page 128)

Kate shoots her manager, Ted Collins, with movie starlet Linda Darnell.



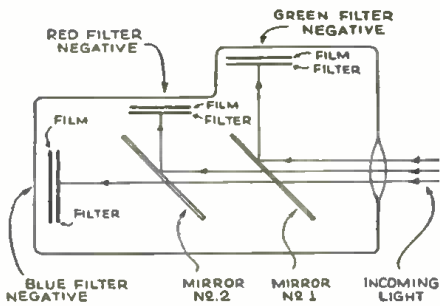
Kate and Ted inspect her shot of Banff, displayed at the Zeiss exhibit.





A set of separation negatives. No. 1 was made through the red filter, No. 2 Green filter, and No. 3 blue filter. These are the photographer's primaries. The gray scale is the only thing these negatives have in common and it remains unaffected by the filters.

Below: The one-shot camera is the most practical method of making all 3 separation negatives instantaneously. The light as it enters is reflected, the remainder passing to the rear of the camera.



● OF course you want to make color prints! The point is where to start. That's the problem that confronts the advanced

amateur graduating from the black and white stage. That's the purpose of this article: to tell you just where to start.

When I say *color prints* I do not mean "transparencies" to be viewed by holding up to a light source. I refer strictly to *prints on paper*, so let's talk only about that.

Color prints on paper; they're beautiful things if you can produce them, and you can if you're the painstaking type of worker. The production of a print in colors on paper may be divided into 2 parts: making the negatives and making the print. In this article we shall discuss only the making of the negatives, which is a job in itself. For the making of the print, read a *modern* book on color photography. Don't read any book which is older than 1936 or your education in color will be archaic. New methods are follow-

Cameras with a ground glass are best for separation negatives because the entire scene can be viewed as it will appear. Rule a frame on your ground glass and focus so that the registration marks, color squares and gray scale fall outside the actual picture area.



Separation Negatives

Tracy Diers, Instructor of Photography at the Central Queens Y.M.C.A., Jamaica, N.Y., tells how to make color separation negatives, from which color prints (not transparencies) can be produced.

ing each other with amazing rapidity, so keep abreast of these developments.

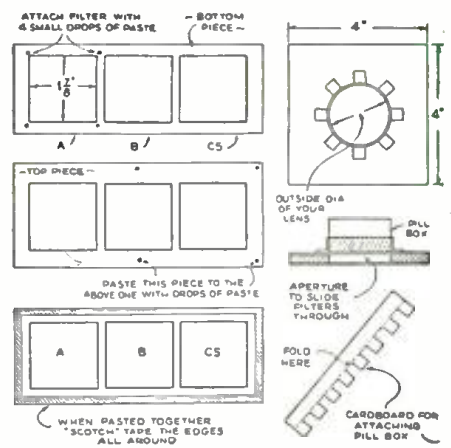
As I said, we shall not consider the making of the prints. First master the making of the negatives. If you do this you will have done plenty and you will be ready to hurdle the obstacles on the road. Now where do we start? We start by learning to make what is called *separation negatives*. These negatives are made in sets of three. Sometimes there are four. We give them the name *separations* because when we

photograph an object in color we really separate it into its fundamental colors. All colored objects in nature are the result of the artist's three primary colors—red, yellow and blue. For the photographer the three primaries are *red, green and blue-violet*. If we mix a color with a primary and the result turns out to be white, then that color is said to be complementary to the original primary.

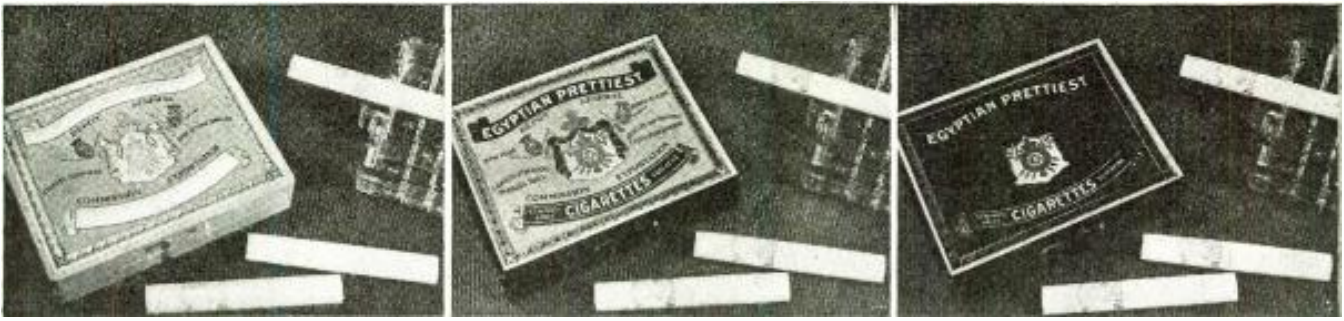
The making of separation negatives is not new. Way back in 1867 Du Hauron and Cros both experimented with them. We are fortunate! We can buy panchromatic film ready to use. In the old days, the color photographer had to color sensitize his own plates.

You will need panchromatic film. The faster super-sensitive panchromatics are usually preferred because of the softer negatives they produce. The fine grain pan films may be used with success, but *keep the contrast down* or you will find that you have a set of negatives that are impossible to print by any color process. Use one of the faster pan films, then, and you will avoid that trouble. Whether you use this panchromatic material in the form of roll film, cut film, film pack or plates will depend upon the type of camera you use.

And now a word regarding the camera. I recommend a small plate camera; 6½ x 9 or 9 x 12 centimeters are both good sizes. The best thing to use is a full size view camera; 8 x 10 inches is preferred. This means that you will be able to contact print your negatives instead of enlarging them and this, in turn, means greater detail. Most amateurs can't afford to buy plates for such a large camera, but if you can possibly borrow such a camera for a few



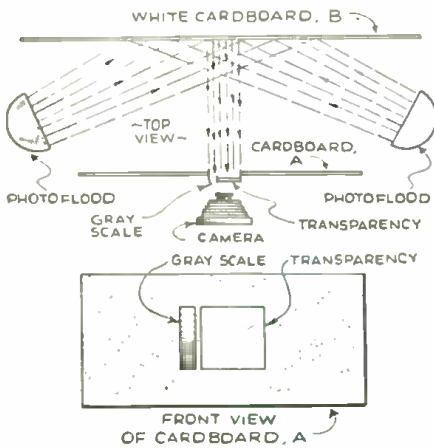
The holder for the 3 color filters is very easily constructed of pieces of cardboard. When attaching the delicate gelatin filters do not handle them with the fingers or spotting will result.



Prints made from the separation negatives. Notice the results of the various filters. Print No. 1, the blue printer, was made from negative No. 1. Print No. 2, the red printer, was made from negative No. 2 and Print No. 3, the yellow printer, was made from negative No. 3.

—without Headaches

Color prints of scenes and still lifes are easily made with any camera. The author of this article gives simple instructions for this most fascinating and profitable branch of photography.



Copying a color transparency with a camera. This method is preferred to projecting the transparency in the enlarger as it is more convenient. The gray scale in this case is transparent.

gether, which, by the way, is not the best technique.

A Few Words About Filters

Now let's talk about filters. Somehow there is a popular misconception floating about among the uninitiated in color photography to the effect that filters for color work are expensive. Wrong! They are *cheap*. Of course, if you want to, you may buy a set in optical flats—that will set you back about \$120. You don't do this, however; your filters will be purchased in the gelatin form. This way your first set should cost about *one dollar*, which is quite a difference. These gelatin filters go under the name of Wratten and Wrainwright (A), (B), and (C5). The first is red, the second green, and the third blue-violet—the primary colors of the photographer and engraver.

So far, so good; now a word in detail concerning your filters. *Handle with care!* Do not touch with the fingers or all is lost. You will have to make a holder out of heavy cardboard to hold the filters in front of the camera lens. All three may be pasted on a strip of cardboard and slid by the camera lens. Use the paste sparingly and handle the filters with gloves or paper. The accompanying diagram will serve to make this clear.

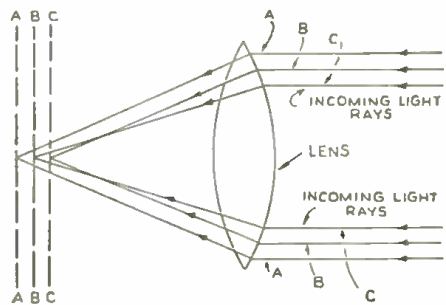
The purpose of the filters is to split the scene up into its primary colors. In the object we shall photograph, there is a certain amount of red, a certain amount of green, and also some blue. The primary filters allow only certain wavelengths of light to pass through to the panchromatic film in back. Thus the red will permit only a

shots, do so. Perhaps if some other bugs are interested, three or four of you can chip in and buy 8 x 10 inch glass plates. Plates, as you will see, are fool-proof. They cannot stretch in processing, and that is important.

You can use other cameras, though. Roll film cameras, miniature or otherwise, may be used. There are two disadvantages to these types of cameras. There is no ground glass upon which to compose your scene, and you must develop the negatives all to-

certain hand of light to pass through—ditto for the green and blue. The (A), (B), and (C5) filters are not what is known as sharp cutting filters, that is, they overlap into each other's specialized transmission band slightly.

Below: Why your lens must be color corrected. Light ray A is red, B violet and C yellow. Notice how each comes to a focus at a different point. A color corrected lens will bring all rays to a focus at the same point.



Tripod Must Be Sturdy

We come now to the tripod. This is the one instrument that can either make or break you as a color photographer. *It must be sturdy.* Don't go using one of these light weight metal tripods that gets the jitters merely by looking at it. The best type is constructed of heavy wood. Lacking the correct type, bolt the camera down to a board; it's the only other way to secure rigidity. (Later on, as we proceed, you will understand why I am so fanatical about this point.) Using the movable leg type of tripod, you must work out some system of bracing the legs and preventing them from sliding. *(Continued on next page)*

An outdoor shot in color demands a large gray scale. The gray scale below is about 72 inches in height. It was made from photographic paper by the method described in the text. Place the gray scale at the edge so that it may be margined off in the color print.



There are special devices which are available on the market for bracing tripod legs.

Lens: We could have discussed the lens when we talked about the camera but it is an important item and I feel that it warrants a special section for discussion. The lens must be *achromatic*. This means that it has been completely color-corrected. A lens that has not been *color-corrected* will not bring the various colors to a focus at the same point. If this happens, then trouble commences. A good *anastigmat* is necessary, not only to obtain sharp negatives but to obtain complete color correction. The shutter should be the type that permits of making bulb exposures, since it is more convenient to expose the negatives this way.

The "Gray" Scale Important

Before we start actual work, I must tell you of one thing more which is of utmost importance. This is what is known as the *gray scale*. It is nothing but a strip of photographic paper which has varying shades of gray, from dense black running through to pure white. It plays an important part in the scheme of things.

For a few cents it can be purchased, together with registration marks and color identifying squares. Without the gray scale,

it would be impossible to match the negatives together. As you know, each filter will produce a differently appearing negative. The filters have no effect on a neutral shade of gray; hence this appears alike on all three negatives—that is, if all has gone well.

A *light meter* is a requisite, the importance of which I cannot overstress. In work of this sort, the best meters are the photoelectric cell type. Color printing processes demand negatives of limited density and contrast. It is not the same as making a black and white print. In this case we have five contrasts of contact printing papers to choose from. Practically any negative can be made to yield a respectable black and white print. The color printing methods available today are not capable of such great manipulation. The negative must be of normal density and contrast for best results. That is why I say, *use a light meter*.

So much for explanations of equipment. Now let's make our first set of separations.

First we must choose a subject. This victim of the first experiment should preferably be shot indoors. Sunlight is deceptive. First, it is intense in its brilliancy, causing hard shadows which often can't be softened with reflectors. Then the second drawback lies in the fact that sunlight moves quickly—

more swiftly than you imagine. This would cause fringes of color in the shadows when the print was made. Because of its brilliancy, the basic black and white exposure would be very short, which when multiplied by the filter factors would produce illogical exposures. Therefore, stick to photoflood work for your first shots. I would suggest fruit for a starter. You will be exhausted after your work so you can turn on your subject and eat it.

Fruit is an old standby. It won't move, it won't object to the lights and it presents beautiful colors. You can build up a background of color from cloth remnants. Any dry goods store always has a lot of gayly colored pieces of material around. Aim for color contrasts. If the object is principally red, then don't use a red background but rather a green, since this would be the complementary color. Always use the complementary to make your principal object stand out. Cellophane can also be used for background purposes. It can be obtained in very gaudy colors.

Build your scene. Compose it carefully and, when you have done this, place the gray scale in on the edge of the picture in such a position that it may be trimmed off later. At opposite corners, place the registration marks and in another section place the color-identifying squares. Now you will see the advantage of the plate camera. Your ground glass won't deceive you. What you see there, you'll see on the finished print. Bring the camera into the proper position and stop down the lens for overall sharpness.

Your lighting should be flat. Avoid harsh shadows. Use photofloods screened down with diffusers. As I said before, get your contrast in color—not in black and white. Have everything in readiness. If you have a plate camera, have 4 holders loaded. If you're using a roll film camera, have it loaded and ready. After you have focused up and stopped down, anchor your tripod with the brace and set your shutter on bulb opening.

Now if you will look at the instruction sheet that came with your film you will find what is known as the filter factors for the (A), (B), and (C5) filters. Thus, for example, if you are using Isopan film you'll see that in photoflood light the factors are as follows: (A)—4, (B)—6, and (C5)—8. This means that the basic filterless exposure must be multiplied by this factor to compensate for the light absorption that takes place in the filters.

When everything is in readiness take a reading with the light meter and determine your exposure. Now make one shot without any filters. This will be your black and white record. If using a roll film camera, roll up the next exposure; if cut films or plates, place the next holder in the camera. This change must take place gently. Don't shake the camera or you will have to start over again. When you have changed films you will make your next exposure, but this time it will be with the red filter in front of the lens. Multiply the black and white exposure by the factor for the red filter. Thus if the first exposure was one second and the red filter factor for your film is 6 then the exposure for the (A) filter must be 6 seconds.

After this shot, change films and expose a fresh film through the green filter, multiplying exposure number one by the green filter factor. Another film change follows this and then the last exposure is made through the blue filter.

Use care. The camera must not be moved during this period. If you have made 4 exposures, one immediately following the other, and you have not bungled anything, the worst is over.

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H. Gernsback

Editor

NO. 1122

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SCIENCE PUBLICATIONS

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Developing the Four Negatives

Now we come to the development of these 4 negatives. All 4 negatives are not to be handled the same way. The negative exposed through the blue filter requires slightly longer development; about 35% to 50% extra time must be allowed. Blue violet light has more trouble penetrating the emulsion—that is why we must develop the blue filter negative longer; this increases its contrast. If you have roll film it is impossible to treat this negative specially. In this case you will have to compensate when you make the print.

Without reserve, I recommend the use of a tank for development. The tank development method is far superior to tray development in a multitude of respects. If you are using cut film, the first thing to do is identify the various negatives permanently so you won't confuse them. If you had color identifying squares in the scene, this will be taken care of automatically. You must know which negative was made through which filter. In my own work I do not use color identifying squares. As soon as I remove the cut films from the holders I punch holes in the edges with the holders I punch holes in the edges with a ticket puncher as follows: One hole for the first shot without filters, 2 holes for the red filter negative, 3 holes for the green filter negative, and 4 holes for the blue filter negative. If you adopt this system be cautious. Since you must punch the holes in total darkness you may accidentally punch them in the center, instead of the edges of the film. Some film packs have numbers on the films. This simplifies things. An experienced worker can tell the filter through which a negative was made, simply by looking at the negative. If you are beginning, you had better adopt some method of identification and stick to it. Glass plates may have nicks made in the edges with a file. When the normal tank development time is up, the black and white record is removed from the developer together with the red and green filter negatives. These three may be transferred to an Acetic acid bath and subsequently to the acid hardening hypo. Meanwhile let the blue filter negative continue to develop for at least 35% longer, at most 50%. At the end of this time the blue filter negative is to follow the others. Wash thoroughly, sponge, and hang up to dry . . . then we shall examine them.

First, check the filtered negatives for registration. Lay them down on an illuminated ground glass and try to superimpose the registration marks. All 3 negatives should line up. If they don't it means you will have to make them over and look for the cause. Your lens may not be thoroughly corrected, the distance between lens and film may have changed ever so slightly. If one negative does not register, they are all ruined. After the registration check comes the color balance test. Testing for color balance is accomplished in much the same fashion. Again lay the negatives on the ground glass. Now study the gray scales as they appear on each of the negatives. Do they match up box for box? They should, for best results. Each box should have the same density on each negative. The exact way to determine if they are equal is by means of a densitometer. Such an instrument costs too much for the average worker. The next best thing is to use a photoelectric cell light meter. Details can be obtained from any of the manufacturers.

Next Month

Tracy Diers tells the remaining steps, including how to make separation negatives from Kodachrome and Dufaycolor transparencies.

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GOLD SHIELD PRODUCTS

350 Greenwich St., RT640, New York City

Photography With a Purpose

(Continued from page 123)

known to Americans all over the country, I felt. I used to carry my camera wherever I went and got many unusual character portraits, pushcart peddlers, old men sunning on their doorsteps, mothers with their babies.

Today I guess I must have a truckload of equipment. My first love is a 16 millimeter movie camera. I started with a Cine-Kodak "K," and then after I'd worked with it for a long time, I bought the Special and all the gadgets that go with it. I have a 15 millimeter wide-angle lens, a 4-inch and a 6-inch telephoto and a Standard F 1.9 1 inch lens.

The still camera I use today is a Zeiss Contax, model 3, with an F 1.5 lens, but I've tried almost everything else. I have several telephoto lenses, including one of those new 180 millimeter F 28 lenses which is fitted to a gun stock. It's called an Olympic gun because it was designed for taking pictures of the Olympic games. I like to use it for shots of the East River from my terrace, because I can get a larger picture at a distance than with any other lens. Ted and I both have been taking a number of pictures with Kodachrome color film.

I don't know if my method of taking "pictures with a purpose"—as I call them—is at all a good idea for any other camera fan. I just know that I've found it very satisfactory and good practice, too. I have scrapbooks piled high in my closet now—one book just full of famous stars I've snapped at my Friday night CBS show—such people as Brian Aherne, Edward G. Robinson, Tyrone Power, Linda Darnell. I have books of flower pictures, and fire pictures, and New York City panoramas, and winter pictures at Lake Placid.

Tested by the Editor

ELKAY FILM PACK REEL. A film pack reel of this make was secured and tested in a number of tanks. It apparently fits all standard makes equally as well as do the roll film reels with which they come equipped. The reel, which is adjustable, is extremely easy to load and holds the film pack or cut film securely enough so that it is not displaced during agitation.

WESTON MASTER EXPOSURE METER. One of these meters was secured and given a thorough course of tests. It was found that its range was adequate to measure everything all the way from light too dim for all except the longest time exposures to beach scenes in brilliant sunlight. Its range of shutter speeds is adequate for every camera, as is its very excellent range of stop openings. Proof of its accuracy was had when the editor made a series of negatives ranging from dimly lit interiors to brilliantly illuminated exteriors. When the meter was used, all negatives were so even that enlargements were made from each in precisely the same projection time. One further advantage of this meter is that it has a two range scale which spreads the readings obtained in dim light, thus making accurate measurement easy. After all, accuracy is the prime requisite in photo meters. The meter is also usable for making light measurements when enlarging, printing, etc.

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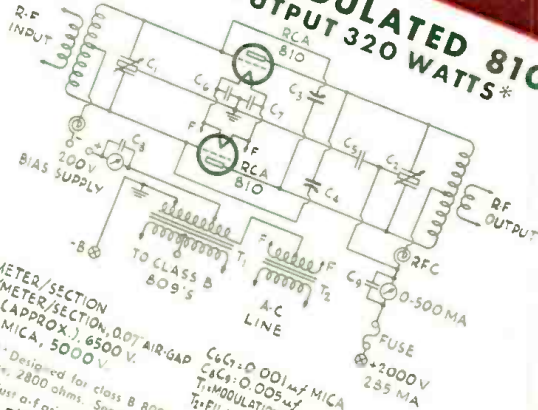
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FOR A

2-WAY SAVING



CATHODE-MODULATED 810'S
CARRIER OUTPUT 320 WATTS*



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C₃: 5 μf (APPROX.), 6500 V.
C₄: 0.002 μf MICA, 5000 V.
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T₂: MODULATION TRANSFORMER
T₃: RF TRANSFORMER
*Approximate. **Designed for class B 809's. Pri. impedance, plate-to-plate, 11600 ohms.
Cathode impedance, 2800 ohms. Secondary current rating, 300 ma. d. c.
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\$2.50 Amateur Net

RCA-810—High- μ triode
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Max. plate input 620 W.
\$13.50 Amateur Net

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When you start out with Cathode Modulation for economical radiotelephony, go all the way! Get double economy plus extra efficiency by using RCA high-perveance transmitting tubes. RCA Tubes last longer. They give you greater power output with less driving power for a given plate voltage. You can get not only 100% modulation, but also relatively high plate-circuit efficiency and high carrier output with the push-pull 810's shown in the circuit above.

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See *RCA HAM TIPS* (Jan.-Feb., 1940) for further data on Cathode Modulation. Ask your jobber for a copy—free.



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SKYRIDER DEFIANT covers 43.5 mc to 545 kc in 4 bands. Frequency meter tuning on 10, 20, 40 and 80 meter bands. Stages of preselection. Noise limiter. 6-point variable selectivity. Crystal phasing. BFO switch. ANL switch. Meter calibrated in S and DB units. Complete with tubes and crystal (less speaker) \$69.50



SUPER DEFIANT is the receiver with "everything." Covers 42 mc to 540 kc. 2 stages preselection. Calibrated bandspread dial for frequency meter tuning. Noise limiter. 8 watts output. 6-step variable selectivity. Oscillator compensation. Meter calibrated in S and DB units. Crystal phasing. BFO switch. ANL switch. 10-inch speaker in matching cabinet. Complete for \$99.50.



SKYRIDER 23 covers 44 mc to 545 kc. 8 bandswitch positions. Noise limiter. 6-step variable selectivity. Frequency stability both from temperature-humidity effects and line voltage variations. S-DB meter. ANL switch. Pitch control. Crystal phasing. Absolute reset accuracy. Complete with crystal \$115.50.



HT-6 25 WATT TRANSMITTER has a range from 1.7 to 60 mc. Coils for any three bands may be plugged in, pretuned and switched from the front panel. Only necessary to retune the final amplifier plate. Excellent voice quality with 100% modulation from any high level high impedance mike. With tubes, less coils and crystals, \$99.00.

LINE OF MARINE EQUIPMENT
 THE HT-8 25 WATT RADIO-PHONE is rapidly becoming the best seller for ship-to-shore work on both pleasure and commercial craft. Less only crystals, \$290.00.
 SKYRIDER MARINE is a special marine receiver. With built-in speaker, \$64.50.

HT-9 100 WATT TRANSMITTER. Exciter coils for 5 bands can be plugged in, pretuned and switched from front panel. Carrier hum at least 40 db below 100% modulation. Every function controlled from front panel. Less coils and crystals, \$199.50.

FM/AM RECEIVER
450 WATT TRANSMITTER
 MODEL S-27 is the first communications receiver to operate on either Frequency Modulation or Amplitude Modulation by throwing a switch. Complete \$175.00.

HT-4 450 WATT TRANSMITTER Complete with tubes, crystals, and coils \$695.00.

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