RADIO'S *Complete* MAGAZINE

RADIO & TELEVISION

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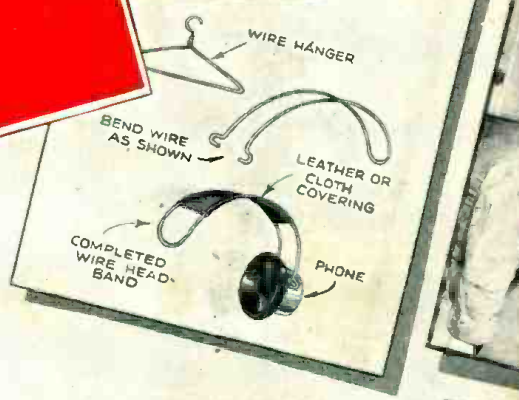

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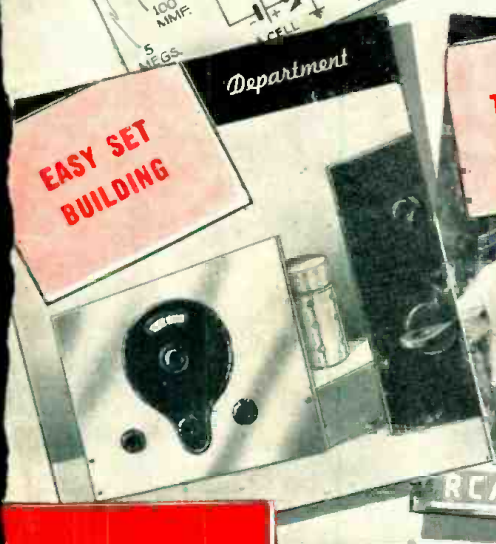

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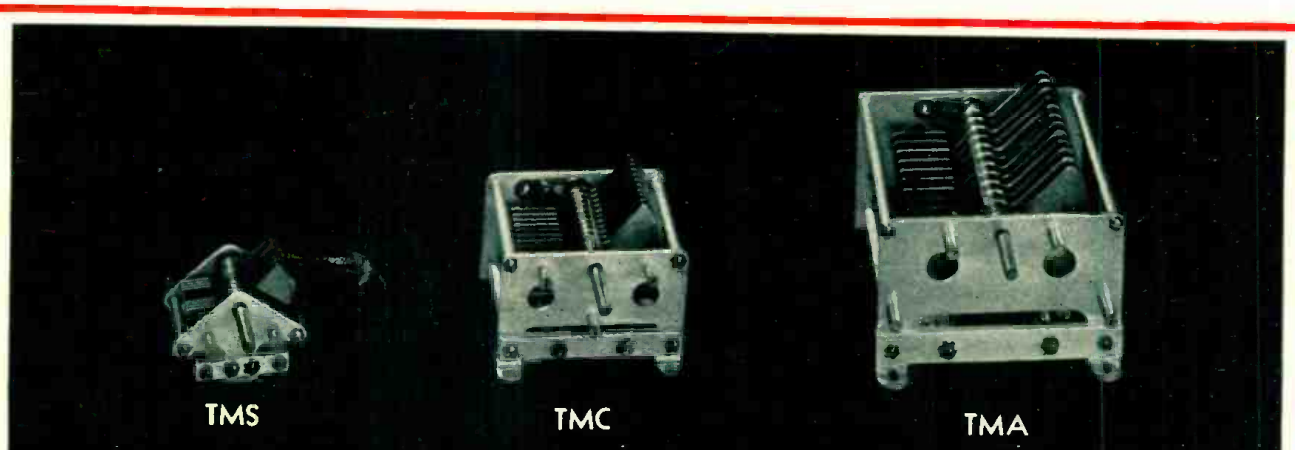
HUGO GERNSBACK
EDITOR

AMATEUR & EXPERIMENTAL RADIO SEPT.

CONSTRUCTIVE RADIO ARTICLES 1940



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RADIO & TELEVISION

The Popular Radio Magazine

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

September — 1940
Vol. XI No. 5

In October Issue

A 6-Tube Pocket Receiver—H. G. McEntee, W2FHP

Increasing the Power of the "R & T" Economy Transmitter, Part III—Herman Yellin, W2AJL

How to Build Latest Model F.M. Adapter

10" x 8" Television Image Reproducer —by Ricardo Muniz, E.E., S. M. Decker and Martin Rosenberg

A New "Inverted Beam" Antenna

In This Issue

Cover Composition by Hugo Gernsback and Thomas D. Pentz

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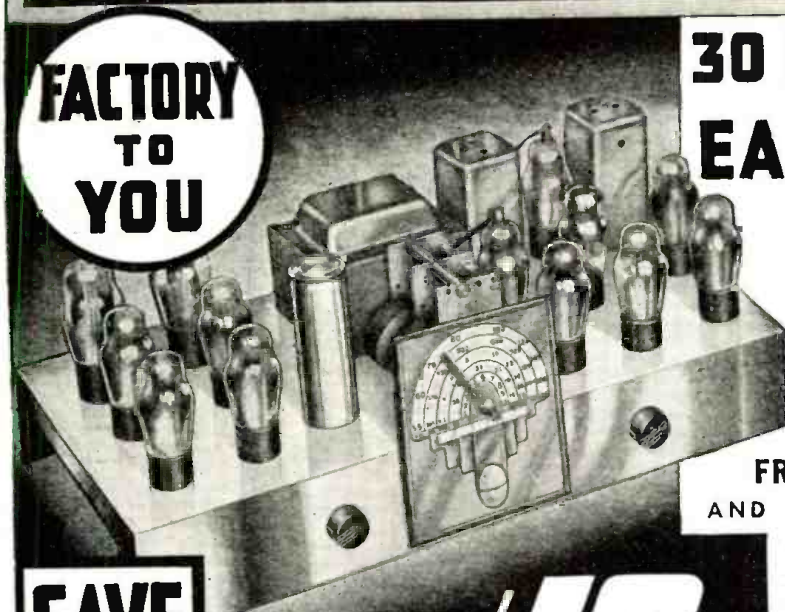

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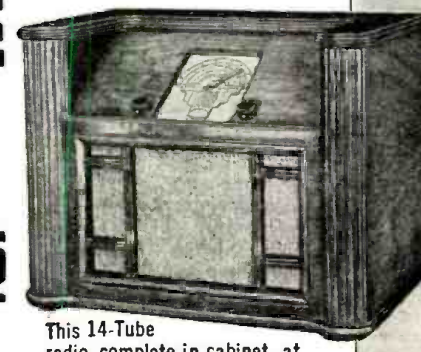

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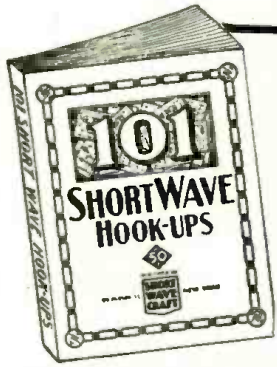

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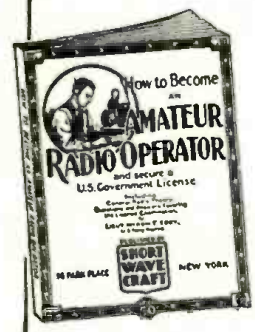

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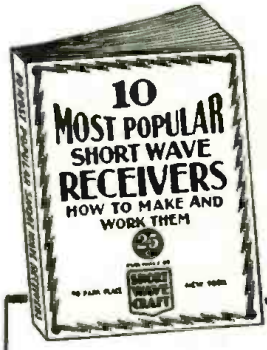

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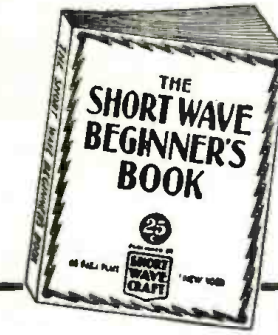

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Editorial

RADIO WARFARE

By HUGO GERNSBACK, Editor

I HAVE pointed out a number of times the tremendous rôle that radio plays in modern warfare. Indeed, it is quite impossible to carry on any major military campaign in which radio is not used in every branch of the army, navy and air corps. There is nothing new about this, in fact it is quite trite, but the point is that the obvious is usually paid little attention to. The Germans, with their characteristic thoroughness, have developed radio coordination as it never has been known or used before; so much so that there is not a single unit, nor even a single brigade, which does not have instant radio communication with the general staff. This made hitherto unknown coordination between all the units of the fighting forces and incidentally saved thousands of lives. The infantry, fully radio equipped, for this reason never found it necessary to expose themselves to the enemy's fire or attack till word was given by radio to advance and exactly *when* to advance. After the mechanized units composed of assault and smaller tanks had driven back the enemy, the infantry was then told by radio to advance. For this reason the losses of the German attackers were astonishingly low, against all rules of former warfare, when the attacking army always had a higher percentage of losses. Radio tactics have changed all this because no longer do we have the condition where units of an army move without coordination as a separate unit. Today field and air forces all work together as a single unit, directed from general headquarters. Indeed the control is so exact that field forces can not advance even for 10 yards without general headquarters being fully aware of what is going on. This is also true of motorcycle advance guards, who are radio equipped, and are therefore always in constant touch with their superiors.

I am reprinting below in full an editorial of mine which appeared in the October 1934 issue of this magazine. In view of the present European War I believe our readers will be interested in the prognostications made at that time. There is little contained in that editorial which does not hold true today.

Short Waves and the Next War

Reprinted from the October, 1934, issue

● IT IS NOT pleasant to talk about the next war, but all authorities are pretty well agreed upon the fact that war is with us to stay and that, for many thousands of years to come, war will be with us. The next large conflict is probably not so far away as many think, and it behooves us, in view of the circumstances, to look ahead a bit and see where short waves will fit in during the next struggle.

In 1912, several years before the World War started, I found it necessary to talk in a similar vein, and I was then mindful of the radio amateur and how he would fit in with the then coming struggle. At that time there was no broadcasting; so amateurs contented themselves with code and, when war finally came and the United States entered the conflict in 1917, my publications were responsible for recruiting many amateurs for military services abroad and at home.

Today, the amateur short-wave experimenter and the fan are in a similar position. The knowledge which they are gaining today may be priceless in a future struggle. Technical knowledge in short waves is most important because, in war, communication is of paramount importance.

In the World War, short waves, as such, were not very well understood. Signalling was crude because the vacuum tube was still imperfect, and radio was not the precise science that it is today.

In the future war, short waves will play a tremendous role—especially micro-waves, *which can be directed like a searchlight.*

It will become possible for armies to be in constant touch with each other without the enemy being able to overhear the signals, for by means of reflectors the waves will be directed, so that the signals cannot possibly go over into the enemy's camp. These micro-waves, also called "centimeter" waves, are of utmost importance for communication, and they will be used in portable sets not only by the infantry, but by men on horseback, by machine-gun platoons, by tanks, hy airplanes, etc. Remember that the war of the future will, in many respects, be a machine war. Not so many human beings will be sacrificed. Tanks, airplanes, and other armaments, will be dispatched toward the enemy *without a single human being on board the machines!* All the movements of these war machines will be conducted by *radio telemechanics*—a new radio art, whereby it is possible to direct not only the movement of the machine itself, but the sighting and firing of guns, all from a distant point, and by radio short-wave control.

It is possible today, to blow up fortifications or mined land, as well as explode sea mines, by means of short waves, to harass an advancing enemy.

Not so many years ago, the United States Navy sent out an obsolete battleship into the open sea without a single human being on board. Yet, the ship went through all the usual maneuvers; it could advance in any direction, it could even run in a circle or cut a figure eight. The boilers were stoked, guns were discharged, all without a single human being on board the ship. All this was accomplished by means of radio waves and radio telemechanics.

In the coming war, the same thing will be accomplished on a much vaster scale, and not only will we be enabled to send *unmanned* tanks into the enemy's camp, but we can do the same thing with torpedoes in the open sea and with submarines, all of which can be guided by short waves, without the loss of a single human being.

Such heroic exploits whereby a one-man torpedo, piloted by a single man against an enemy vessel and then exploded, resulting in the death of the operator, are no longer necessary. Such single torpedoes can be readily steered along a given course, without any human being on board, all by short waves. There are, of course, hundreds of other similar applications for war purposes, which will come about in the next war. Many of these instrumentalities are now being experimented with by various nations.

For communication between the different units, should they become separated, there is always the short-wave radio telephone using micro-waves, which waves are directed in such a manner that they do not reach the enemy. Thus, different regiments or platoons can keep in constant touch with each other. Such an episode as that of the "Lost Battalion," which happened in our own forces, during the World War, is therefore, unlikely to happen in the next war. By means of shortwave telephony, the forces would always be in touch with each other; and it should be noted that these short-wave transmitters and receivers are not cumbersome affairs, but weigh only a few pounds, and can be readily strapped around the waist or carried on the back, without encumbering the soldier on foot or on horseback.

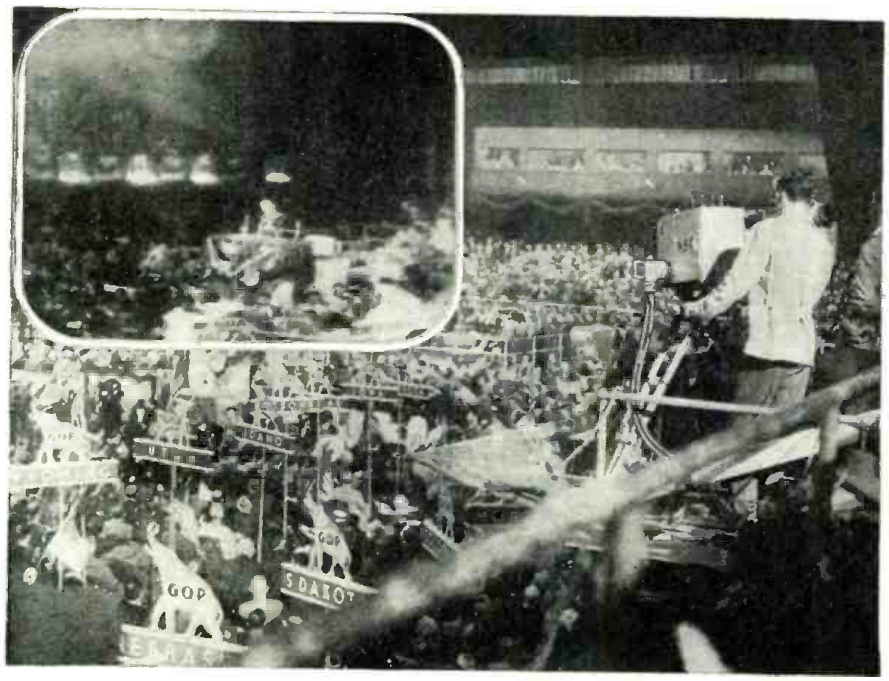
Republican Convention Televised

Above: What the iconoscope saw—and how the receivers reproduced it. Below: Set-up for catching the image shown in the insert.

High in entertainment value but low in technical excellence was the television transmission of the Republican National Convention direct from The Hall in Philadelphia. The accompanying photos show the best that the expert photographers of NBC were able to take from the screen of receivers set up at NBC headquarters.

The station not only had its cameras in the hall, as the general view picture shows, but also had a setup outdoors and in a brilliantly illuminated studio. Images from the two latter sources were comparatively excellent, but the lack of adequate lighting and the large stop needed on the "camera," afforded little detail when persons standing on the speaker's platform were televised.

The problem of lighting was impossible to solve as, even with the inadequate illumination possible, various delegates complained of the heat and even had the light shut off for a time. The long shot of the convention, inset in the general view, shows John D. M. Hamilton addressing the delegates. The pictures of Marian E. Martin being interviewed by Bill Lang show (top) how these people appeared on a photographic film and (below) how they were received by television. This pickup was made outside the convention hall.



The F.C.C. Mail Bag

Remember the story about the unfortunate radio listener who answered the phone and almost received a $1,000 prize but did not get it because, according to the "contest" rules, the award had to go to the person in whose name the phone number was listed, although he had moved away?

Anyhow, the Commission has received a letter from a Norfolk, Virginia, listener who wants help in collecting a $1,000 award which he believes is due him from a certain network. Of course, F.C.C. can do nothing.

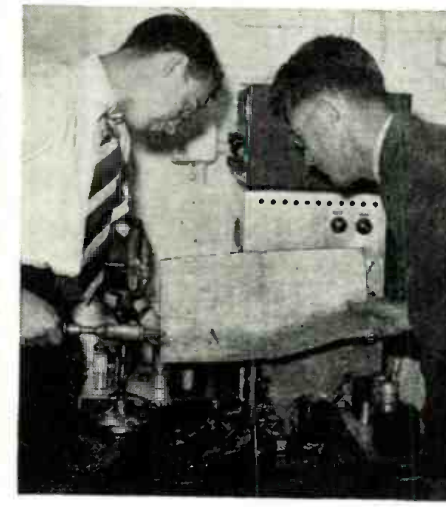
A radio fan who doesn't like baseball wants the commission to spank a radio station for cancelling network shows in order to put on baseball scores. No can do.

Another chap complains that he is being made the victim of "heat and death rays" and seems to hold radio stations indirectly responsible. While the Commission can not help him, they think that a doctor might.

And several garages in Tampa and Memphis have been bawled out by the F.C.C. for intercepting police calls in order to rush wreckers to the scene of accidents so they can solicit business. In case you're a garage man, you should know that there is a penalty for doing this.

WORKING HIS WAY THROUGH COLLEGE

Not by selling magazine subscriptions, or peddling gadgets from door to door, but by means of television is Gordon Jacobs (left) working his way through Union College where he is a freshman. Two hours



a night, three nights a week throughout the school year, young Jacobs, who holds a government television operator's license, goes to the General Electric television relay station, W2XB, in the Helderberg Hills. His duties consist of checking equipment. He is shown here looking at a diagram with Engineer W. J. Purcell.

MORE POLICE F.M.

Douglas County, Nebraska, is one of the latest areas to adopt F.M. (Frequency Modulation) communication for emergency service. A 250 watt General Electric frequency modulation transmitter has been installed at Clearview near the center of the county, to be operated by remote control from the sheriff's office in Omaha. Mobile units patrolling the roads of the county are

equipped with 25 watt F.M. transmitters. This equipment was chosen after exhaustive tests which proved it to have greater range and far more freedom from natural interference.

B.B.C. "DIGS IN"

Whether or not the Nazi bombers drop tons of explosives on Great Britain, England's radio voice will continue to be heard throughout the world. The B.B.C. has constructed *bomb-proof* studios deep underground at various secret locations in England. To defend this broadcasting system further, anti-aircraft batteries supported by machine-gun nests have been installed in the vicinity of the hidden studios.

These studios are protected by thick layers of reinforced concrete and are so sound-proofed that programs may be presented even during heavy artillery bombardments. Talks by cabinet members, members of parliament, etc., are being presented at frequent intervals. The stations are GSC 9.58 mc. (31 meters) and GSD 11.75 mc. (25 meters). The program schedule follows:

Regular Bulletins for North America

TIMES (Eastern Daylight Saving Time)	FREQUENCIES *Megacycles*	*Meters*
30-minute News Bulletins:		
7:30 a.m.	15.31	19.60
12:00 noon	17.81	16.84
5:45 p.m.	15.31	19.60
	11.75	25.53
12:00 midnight	11.75	25.53
	9.58	31.32
News Summaries:		
9:15 a.m.	17.81	16.84
4:50 p.m.	15.31	19.60
	11.75	25.53
9:00 p.m. (with commentary)	11.75	25.53
	9.58	31.32
10:45 p.m.	11.75	25.53
	9.58	31.32

HOME RECORDING OUTFIT

Did you hear Edward VIII in his abdication speech—King George VI in his war declaration—President Roosevelt's inaugural address? Do you ever wish that you had kept permanent records of them? Such recordings are possible with many of the new receivers, among which are the General Electric and several others. Many of these also have facilities for *home recording* so that voices and performances of members of the family can be preserved for all time. Several of these units are so built that blank disks can be used on them, a special cutting head and feed screw being provided.

Although there is a marked increase in amateur recording, the idea is not new for

RCA produced its model RAE84 home and radio recording phono-radio combination almost ten years ago. The new *home recording* outfits which also provide *radio* and *phono* entertainment are, however, far lower in price than the pioneering models, which required the use of pregrooved records. Photo shows G.E. recorder.

Facsimile on F.M.

During commencement exercises at the Massachusetts Institute of Technology photos were transmitted from Boston to Paxton and back again—a distance of 87 miles—by *frequency modulation*. Experts witnessing the demonstration gave half the credit to the General Electric receiver used

and half to exceptional propagation. One of the pictures sent, that of Wendell Willkie, Republican presidential nominee, is reproduced herewith.

The Walter Howey sound photo system used scans a photograph with an electric eye, unwinds it into a thread of 1800-beat pitch per second, which varies in loudness to correspond with variations of light and shade of the picture, sends it over a wire, and rewinds the thread at the receiver into the original photograph. This was used at WEOD four miles from the point of origin; the Howey machine took the photos from telephone wires and rebroadcast them 43 miles to W1XOJ at Paxton where they were rebroadcast again to the receiver at the M.I.T. lab. The other illustration shows a group of the engineers (with Howey at right rear) watching reception. Note fine reproduction above.

Airplane Radio Beacon

In the accompanying picture five 24" metal rods comprise the new Omnidirection Radio Range Beacon. This beacon so miniature in size that at first glance one takes it to be a model will, it is said, replace the present large antenna systems which utilize a like number of 125 controls spaced 600 feet apart. Dr. David G. C. Luck of the RCA Research Laboratories is chiefly responsible for the new system after four years of development.

The apparatus operates in the ultra high frequency wavelengths, avoiding static and achieving greater reliability in storms and other atmospheric disturbances.

Says Dr. Luck, "We have worked out a range which marks paths in all directions, reducing the need for a direction finder or radio compass. Further, we have eliminated the large antenna system required for the long wave range system, which uses 125-foot poles spaced 600 feet apart, and have substituted five little rods, two feet long and ten inches apart.

"Unintentionally, flying off-course would hardly be possible with omnidirectional ranges," Dr. Luck added. "The pilot looks at the face of a small indicator on his instrumental panel. He sees a circle of light around which an indicating mark moves in step with the motion of the plane around the radio beacon transmitter. This mark always points out the direction of the plane, as seen from the beacon, and the pilot looks at it instead of listening to a distinctive tone as he does with the older radio ranges.

"This works like a lighthouse that sends out two kinds of light, one a beam which sweeps around steadily and the other a flash sent out in all directions just as the beam points north. Time the interval from the flash until the beam sweeps over you, and

you know your exact direction from the lighthouse.

"In this new radio range the radio lighthouse is on the ground, and on the plane the indicating instrument automatically times the flash and beam. All this is done electrically and our lighthouse beam sweeps clear around 60 times each second."

Universal Phono Pickup

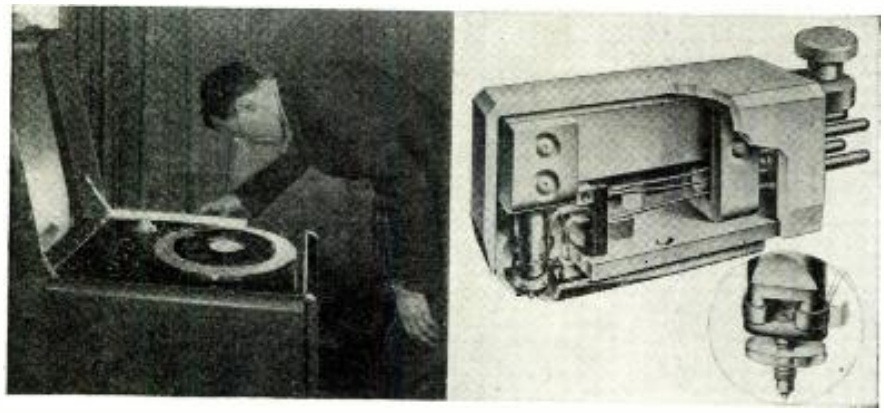
A *universal* phonographic reproducer which plays both the vertical cut (old style Edison cylinder hill and dale) and the lateral cut records of the modern disc type, has been announced by Bell Telephone Laboratory engineers who claim performance excelling the best single purpose reproducer commercially available today.

At the flip of a switch, the new reproducer may be converted for either type of "cut." This convenience simplifies operation and eliminates all chance of selecting an incorrect reproducer when shifting to records of different types because the transfer can be made without lifting the stylus of the reproducer from its groove in the record.

The new instrument is rectangular in shape, somewhat smaller than a safety-match box. The diamond stylus exerts a pressure of but 30 grams.

Response is essentially flat up to nearly 10.000 cycles for both types of recording. Most lateral cut records are made at a slightly higher level than those recorded by the vertical method.

The vibrating system differs basically from conventional dynamic reproducers in that it employs two adjacent voltage-generating coils instead of one. These coils are mounted on a common framework of duralumin and vibrate axially in a radial magnetic field. Supporting this structure and mounted midway between the two coils, is a flat triangular shaped spring that can flex up or down and twist axially but cannot flex sideways because of its wide cross section. Recorded sound vibrations, in the form of undulations in the record groove, impart motion to the coil structure through a thin duralumin tube which extends downward from the midpoint of the coil structure, and carries the stylus at its lower end.



During the reproduction of vertical records, the rise and fall of the tube carries both coils up and down simultaneously with it. Lateral cut records, on the other hand, swing the tube sideways like a pendulum. Consequently the coils continue to move up and down; but with lateral records they travel in opposite directions after the fashion of a see-saw. Hence, by switching the electrical connections of the coils (series aiding or series opposing, depending upon the "cut" of the disc), the reproducer becomes bi-functional.

The small insert shows an enlarged view of the vibrating system. An interesting refinement of design, seen in this view, is the circular vane of viscous material, carried by the stylus support, which damps out unavoidable high frequency resonances caused by the elastic properties of the record material. (Photo courtesy Western Electric Co.)

Where Hams and SWL's Can Help

The Federal Communications Commission has received numerous letters from amateurs and others who want to "do something to help the government". One offered to "monitor radio transmissions in my spare time"; another to form a "citizens' listening league to combat fifth column activities". The Commission is not assigning any duties but appreciates offers of aid and advises interested persons to communicate with the nearest F.C.C. field office to tell the Inspector in Charge of any unlicensed operation or other violations which they may know about. A list of such offices and their locations follows:

Atlanta (Federal Annex); Baltimore (Fort McHenry); Boston (Customhouse); Buffalo (Federal Building); Chicago (Court House); Cleveland (Old Post Office); Dallas (U.S. Terminal Annex); Denver (Customhouse); Detroit (New Federal Building); Galveston (Federal Building); Grand Island, Neb. (Central Frequency Monitoring Station); Great Lakes, Ill. (Naval Training Station); Kansas City, Mo. (Court House); Los Angeles (Post Office — Court House Bldg.); Miami (Federal Building); New Orleans (Customhouse); Newport News (Post Office—ships only); New York (641 Washington St.); Norfolk (New Post Office); Philadelphia (Customhouse); Portland, Ore. (New Courthouse); Port Arthur, Texas (Post Office—ships only); St. Paul (Post Office—Federal Courts Bldg.); San Diego (Customhouse—Court House Bldg.); San Francisco (Customhouse); San Pedro (Post Office—Court House Bldg.—ships only); Savannah (Post Office); Seattle (Federal Office Building); Tampa (Post Office).

Honolulu, Hawaii (Aloha Tower); Juneau, Alaska (Shattuck Building); San Juan, Puerto Rico (Ochoa Building).

RADIO COMMISSION ISSUES NEW RULES FOR HAMS

On July 5th the Federal Communications Commission announced six "new rules" affecting amateur radio stations and operators, effective immediately. These rules may be summed up as follows:

Communications containing obscene, indecent or profane words, language or meaning are forbidden;

Transmission of false or deceptive signals or use of call letters, not officially assigned to the station operating, are prohibited;

Licensed radio operators must identify all communications or signals, must not interfere with or cause interference to any radio communications, must not damage or permit to be damaged any apparatus on a licensed station;

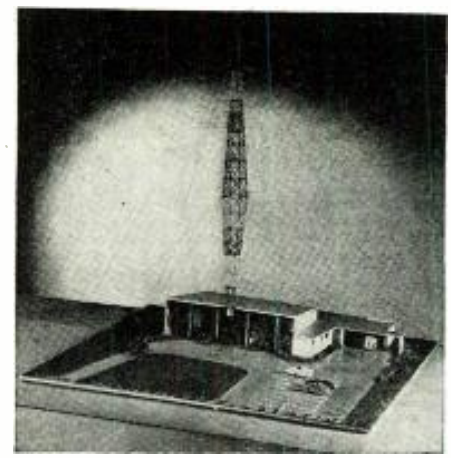
Nor may they obtain or help another obtain an operator's license by fraudulent means.

[*Why list these as "new rules"? Were such things permitted prior to July 5th?*]

PRIZE WINNING STATION DESIGN

The accompanying illustration was selected from a field of 91 entries in a national competition to secure an ideal structure for housing a 1.000 watt broadcasting station. The $250 award was won by Louis Shulman. Commenting upon this design J. Andre Fouilhoux, noted architect said: "The design prize has many qualities, simplicity and straightforwardness which are always essential in any good architectural design. It should be inexpensive to build, which will certainly appeal to clients. At the same time it will command the attention of the public in a dignified way."

Mr. Shulman, the first prize winner, was born in Greenwich Village, New York City, in 1910. He attended the public schools of New York City, graduating from George Washington High School. He won the



Henry Hornbostel prize for architecture at Carnegie Tech and continued his education at Columbia and New York Universities, enrolling from the latter. He acknowledges the assistance of J. R. Seltz in the preparation of his design. Mr. Seltz is a graduate of Ecole des Beaux Arts in Paris.

DEMOCRATIC CONVENTION TELEVISED—THE HARD WAY

Televising the Republican National Convention was a relatively easy job for station W2XBS, New York, because that city was linked with Philadelphia, the Convention city, by means of coaxial cable. Images picked up in the hall were transmitted as explained elsewhere in this section.

The Democratic National Convention, which took place in Chicago, offered a more baffling problem; no coaxial line linked Chicago with New York. Still the NBC was determined to give the Democrats at least partial coverage of their convention. There was neither the time nor the money to install coaxial cable between the two cities. Neither was it possible—for the same reasons—to erect some dozen or more relay stations to bring the images eastward.

Ingenious engineers and program men hit upon an economical and effective solution. A newsreel company was engaged to take 1,000 feet of convention film daily for exclusive use of the television station. This reel was flown to New York by airmail and rushed to the studio. Each afternoon and evening televiewers in the metropolitan area were thus enabled to see important moments of the preceding day's convention activities.

Radio & Television Magazine's observers found the technical excellence of these images far superior to that of those picked up directly in Philadelphia. However, they found a decreased entertainment value, due to the fact that the Republican convention was seen as it happened while the Democratic convention was seen a day late. "It was," they said, "much like reading a yesterday's newspaper."

MOBILE TELEPHONE BOOTHS

Five telephone booths are carried from place to place in a large truck owned and operated by the New York Telephone Company. Besides the booths this truck contains a switchboard with operator and seats

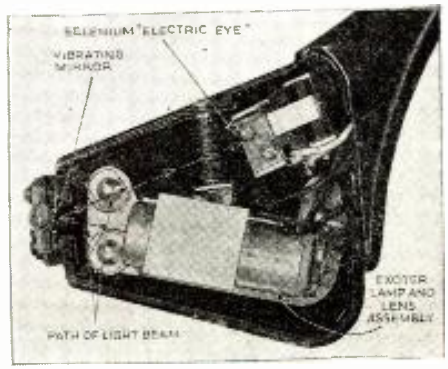
for persons waiting to make calls. The truck is equipped with special leads to be tapped into overhead and underground telephone wires. It made its New York début at the Louis-Godoy "fight". It is also designed for emergency use to afford police, fire and other authorities and newspaper men with ready access to telephones.

NO PALEY "AMATEUR" AWARD

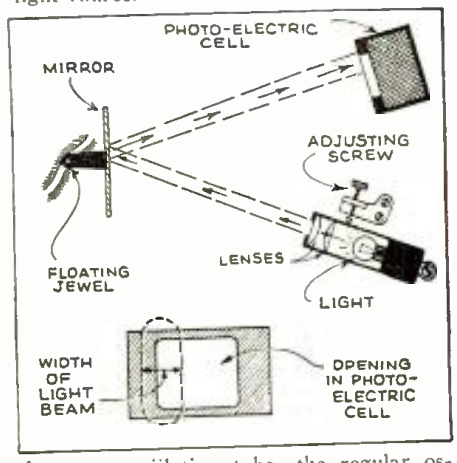
● SELECTION of the winner of the Paley Amateur Radio Award for 1939 has been waived by the board of judges, due to the fact that no outstanding amateur for the year could be found. As a result, Mr. William S. Paley, president of the Columbia Broadcasting System, has requested the judges to broaden the scope of the award, so as to ascertain annual winners without interruption.

Photo-Electric Pickup Uses Light Beam

A *new type* of photo-electric pickup for which many nice things are claimed has been developed by Philco engineers. One of the features is that the pickup may



be dropped on the record without damage to the stylus, as this is a small sapphire point mounted on a spring strip, which is able to flex vertically though rigid horizontally. This stylus drives a mirror, which measures about ⅜ by ⅝", and is pivoted top and bottom. A beam of light from a special concentrated filament bulb is brought through a pair of condenser lenses and cast upon the mirror. From there it is reflected to a photo-electric cell, the end of which is so masked that about half the light beam strikes the sensitive portion of the cell. When the stylus causes the mirror to vibrate as driven by the grooves in the record, a greater or lesser amount of light falls on the P.E. cell and thus generates a fluctuating voltage which is fed into a high gain amplifier. In order that there be no AC or rectified DC ripple in the filament of the light source, this filament current is taken



from an oscillating tube—the regular oscillator put into a special circuit when the "phono" is switched on. The pickup exerts only 1.1 ounces pressure on the record.

TELEVISION TAKES VACATION

August, the month of vacations, saw an enforced vacation for television in the New York area. The NBC station was ordered to a new wavelength by the Federal Communications Commission, being assigned the channel formerly held by CBS. The latter was shifted to a new band outside the range to which most television receivers sold in that area could be tuned. At the same time it was announced that the station would return to the air with images containing about 20% more detail than those previously transmitted—a 507 line scan instead of 441 lines. It was estimated that the shut-down would last at least a month. By an odd coincidence it was noticed that the tentative time set for renewal of broadcasting is approximately when F.C.C. approval of commercial television programs may be expected. Some industry heads hazarded a guess that it might take longer than a month to get the station back on the air—especially if commercialization does not come through.

While most of the better commercial receivers are equipped to pick up the newly assigned NBC channel and to cover the higher frequency scan, it is said that the manufacturers will replace chassis now in use with others which have been rebuilt in the factory to take full advantage of the changed standards.

Miniature Networks Demonstrate F.M.

Two miniature networks, operating on the same principle as great broadcast stations, are being used in demonstrations by D. Lee Chesnut, General Electric engineer in the company's Philadelphia office, to dramatize and simplify frequency modulation for radio station personnel as well as general audiences. Fashioned in his own home workshop, Mr. Chesnut's set-up utilizes a Golden Network, consisting of frequency modulated Stations GEFM and KXFM, and a Green Network with Stations GEAM and KXAM airing on amplitude modulation.

The main point of attraction is a completely collapsible midget house with a cutaway front disclosing two radio receiving sets—an FM set on one side and an AM on the other. Illuminated lettering below each receiver indicates which is in operation. On either side of the structure are control panels, one controlling all things relating to FM broadcasting and the other AM. An aerial, made up of two collapsible automobile aerials, towers over the roof.

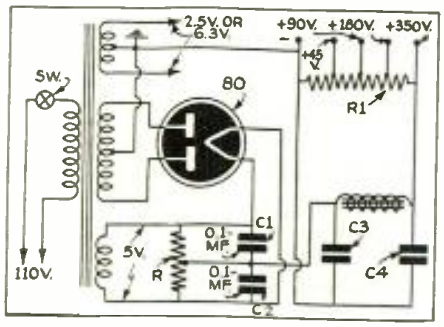
A few feet away from the house on each side, "broadcast stations" and miniature towers have been set up on tables; on one side GEAM and GEFM, on the other KXFM and KXAM.

In the demonstrations that have already been presented to enthusiastic groups, such troublesome interference-makers as the electric razor, the violet-ray machine, and a spark coil operated from a battery have been used to show how FM minimizes interference.

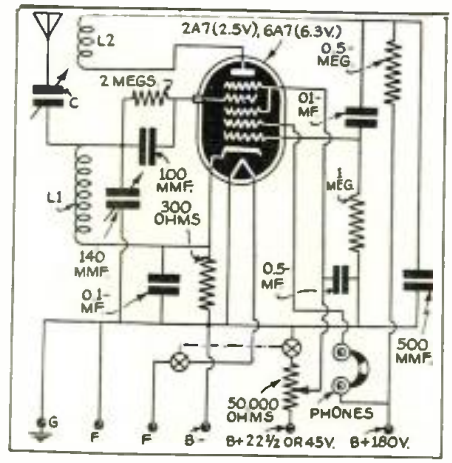
Even more striking than this demonstration of FM's noise-free performance is the demonstration proving the "freedom-from-station-interference" claims for FM. Stations GEFM and KXFM are adjusted to broadcast different programs on the same frequency—with the stronger signal from station GEFM. First, the KXFM program is operated alone—then the GEFM program is switched on. Without fuss or ado, the FM receiver selects the GEFM broadcast—and rejects the weaker KXFM station's broadcast.

ONE-TUBE ALL-WAVE RECEIVER AND POWER PACK

● A SMALL regenerative receiver to operate with plug-in coils for all-wave reception is described in *Radio Tecnica* (Buenos Aires). A single-pole, double-throw switch is used to break both the A and the B battery circuits. This is necessary with this particular hookup in order to avoid drain on the B battery when the set is not in use. The



circuit is rather a straightforward one, employing either a 2A7 for 2½ volt operation or a 6A7 if 6.3 volt operation is preferred. These voltages are given because some power-packs provide either one voltage or the other. A power supply to afford electrification of the set is also shown. While this supply affords a maximum of 350 volts, it is not necessary to employ this voltage on



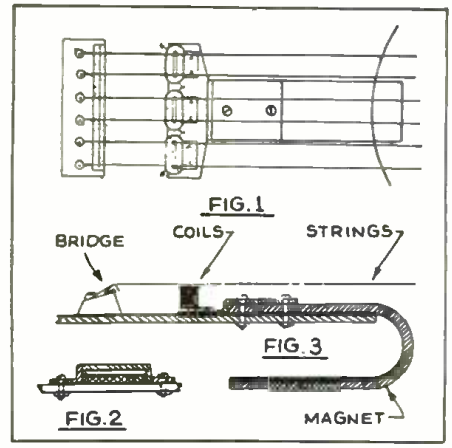
the receiver; it can be used if an amplifier is subsequently added. A coil winding table follows.

Wave Length: Meters	*GRID COIL Turns*	*Wire #*	*Spacing*	*TICKLER Turns*	*Wire #*	*Spacing*	*Spacing Between Coils*
10-20	4½	22	6x	4	31	None	3/32
20-40	11½	22	12x	6	31	None	3/16
40-80	22	22	16x	7	31	None	3/32
80-200	52½	22	40x	17	31	None	⅛
200-350	68½	28	None	28	31	None	⅛
350-500	132	32	None	32	36	None	⅛

NOTE: x indicates number of turns per inch.

ELECTRIFIED GUITAR

● A SIMPLE means of electrifying a guitar is described in *Radio and Hobbies*, an Australian publication. This little device makes use of 3 iron core windings which may be taken from a discarded head-phone. They are mounted on an iron bracket the other end of which is fastened to one pole of a powerful horseshoe magnet, taken from an old auto magneto or telephone ringing generator. The windings of these electro-



magnets are connected in series and the two outer terminals are led to the input of a high gain amplifier.

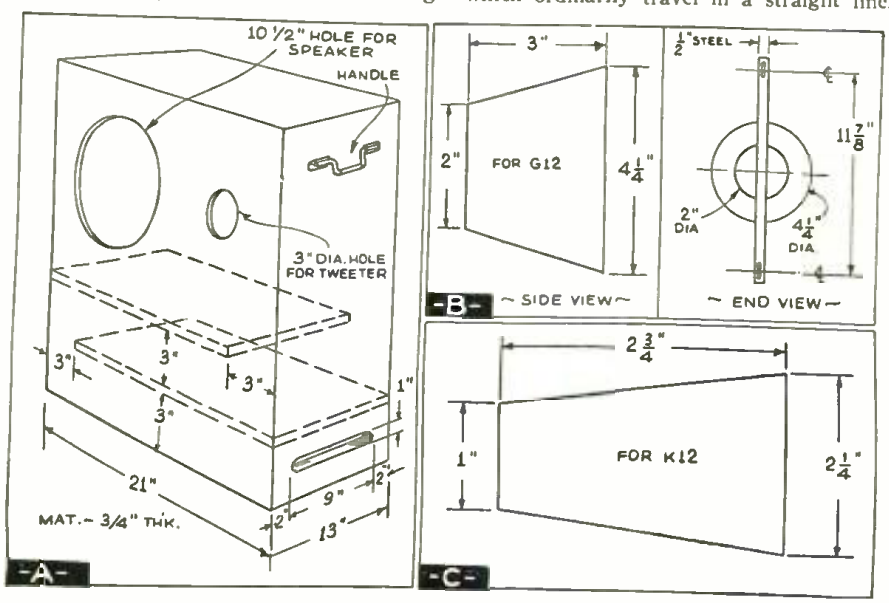
After the unit has been assembled it may be found that the tones derived from one or more strings are appreciably weaker than those from other strings. This may be rectified by cutting or filing the bridge of such strings a trifle more deeply in order to bring the strings closer to the iron core coils. Obviously this will work only on instruments which make use of steel strings; gut strings of course will not affect the magnetic fields of these coils.

LABYRINTH "HI-FI" SPEAKER CASE HELPS RESPONSE

● A LOUD SPEAKER cabinet designed for use with high fidelity receivers is described in *Australasian Radio World*. This cabinet makes use of a modified version of the "labyrinth" principle made so popular by a leading American manufacturer of quality radio receivers.

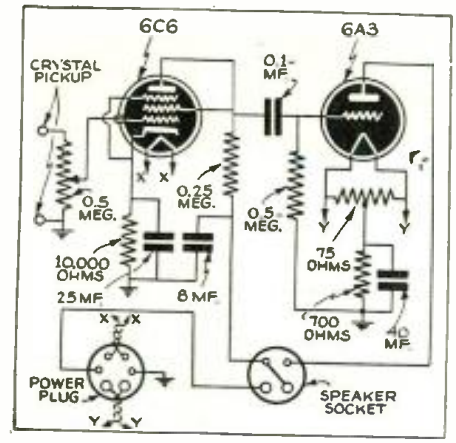
The author of the article suggests using a 12" speaker as the "boomer" and a 4" speaker as the "tweeter". The cabinet measures 13" deep by 21" wide by 24" high and is lined with felt or celotex. The shelves inside it are made of ¾" celotex. Two are required and they are arranged as shown in the diagram. This provides a path approximately 4 ft. long for the sound wave coming from the back of the speaker diaphragm. A percussion effect is avoided by use of a 1" by 9" slot cut in the side of the cabinet at the bottom, in the corner farthest from the "boomer." The diagram shows construction details of the speaker cabinet.

Figure A, below, illustrates construction of the cabinet. Figures B and C show a special type of high note diffuser which can be used with a standard speaker. The unit, in either case, is made of sheet metal, bent to form an open-ended cone. The one illustrated at C is to be equipped with the same sort of mounting bracket as shown in B. These units help to spread the high notes, which ordinarily travel in a straight line.



A SMALL AMPLIFIER UNIT

● A GENERAL utility amplifier unit of low cost and low output—but sufficient to operate a 12" dynamic speaker with good volume—is described in the *Australasian Radio World*. This 2-tube unit, providing low gain,



is said to have so low a hum level that absolutely no hum can be heard when the volume control is fully advanced and no record is being played. Its output is 3½ watts which is said to be ample for the average home, though your editor prefers 10 watts or more in order to get good bass response.

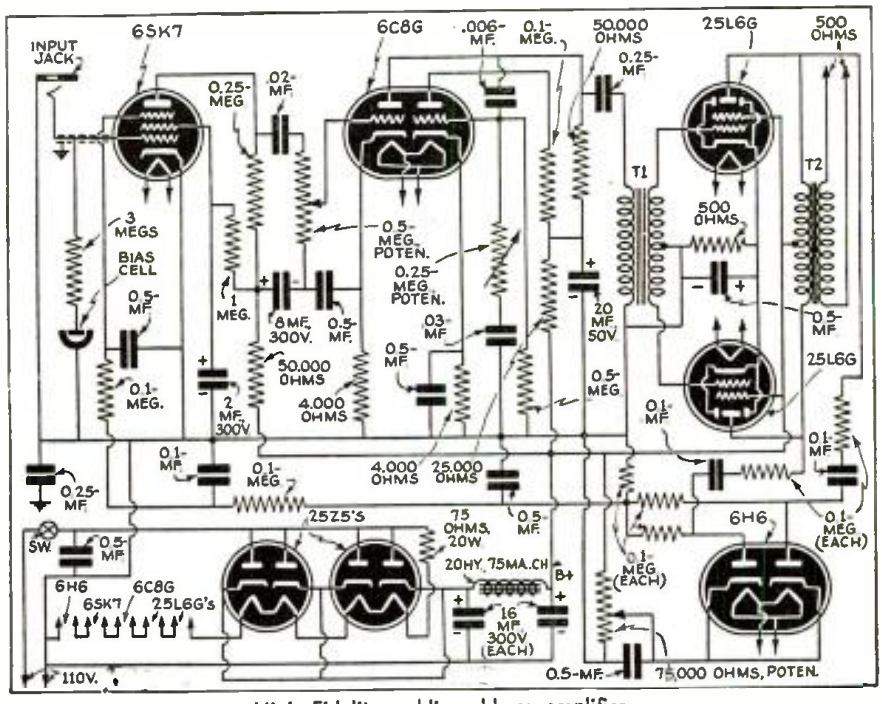
TWO-TUBE PHONO AMPLIFIER OPERATES 12" SPEAKER

● THIS little two-tube phono amplifier, taken from *Radio and Hobbies* of Australia, will operate a 12" speaker with a 2500 ohm field. The circuit is simple and straightforward, the tubes used being a 6V6G as amplifier and output, with an 83 as rectifier. The speaker field is connected into the positive B lead to serve as part of the filtering system. The volume control which is used as the crystal pickup input connection, is rated at 500,000 ohms; the primary of the speaker output transformer should have an impedance of 5,000 ohms to match the output of the 6V6G. While the .004 mf. condenser reduces the high notes a trifle, it is necessary to compensate for the lack of feedback. The author suggests that by leaving about 50 ohms of the 150 ohm cathode resistor unbypassed, harmonic distortion may be decreased, although volume will also fall off slightly.

A simple tuning unit to go ahead of this unit, thus making it suitable for radio reception, is also shown. This diagram was taken from a past issue of *Wireless Weekly*, also Australian, and adapted to use the 6.3 volt tubes.

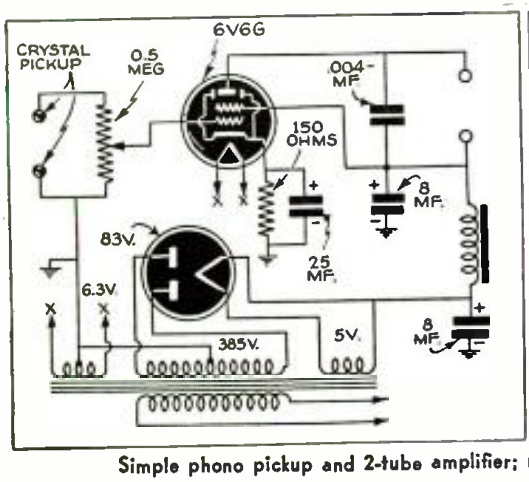
You will notice that a single 6F7 is employed to afford a stage of tuned R.F. and non-regenerative detector. The 5000 ohm potentiometer acts as a sensitivity control, varying the voltage on the cathode and the third grid of the 6F7's R.F. section. A single-pole single-throw switch permits the set to be used for radio or phono reproduction.

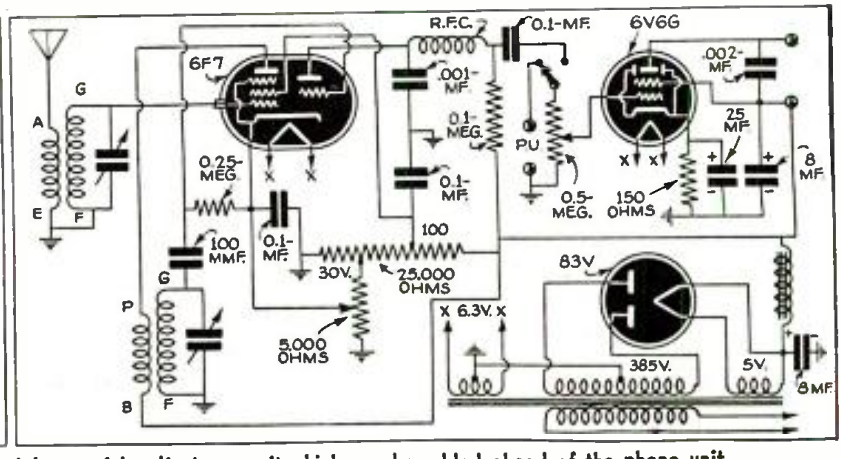
High Fidelity Public Address System



High Fidelity public address amplifier.

● *RADIO REVISTA* of the Argentine shows a diagram of a high fidelity public address amplifier which utilizes a 6SK7, 6C8G. 6H6 and 2 each of 25L6's and 25Z5's. It operates directly from the 110 volt A.C. line, without the use of filament or power transformers; the heaters of the tubes are connected in series. A single open-circuit jack is provided for input; bias on the first stage 6SK7 is obtained from a midget bias cell. According to the author the entire unit may be built on a chassis only 10½"x5"x3".





Simple phono pickup and 2-tube amplifier; right—useful radio tuner unit which can be added ahead of the phono unit.

Can YOU Answer These Radio Questions?

1. Describe briefly the various steps followed in picking up television images of the G.O.P. Convention in Philadelphia. *(See page 262)*
2. Is it possible to do the work of six ordinary tubes with only 3 tubes, and if so, explain the function of the various tubes. *(See page 272)*
3. What is a TRF receiver and how does it work? *(See page 278)*
4. What is the purpose of a volt-ohm-milliammeter? *(See page 281)*
5. How does the modulator work in a transmitter? *(See page 282)*
6. How does a F-M transmitter differ from an amplitude modulation type? *(See page 286)*
7. Can you describe three types of questions liable to be asked radio amateurs when applying for their government license? *(See page 292)*
8. How and what is the signal tracer? *(See page 296)*
9. How can gates or doors be caused to open by radio at the approach of a motor car? *(See page 298)*
10. To what grid of a 6A8G tube would you connect a crystal phonograph pickup? *(See page 302)*

A Modern 5 & 10 Meter Converter

Charles R. Leutz

This converter is really a first-class piece of apparatus; a very excellent feature is the fact that the chassis, cabinet and other parts are available in kit form. A special switch enables the operator to select quickly any one of three aerials.

● WHILE a 5 and 10 meter converter is ordinarily regarded as an instrument for amateur radio communication purposes, many *broadcast* and *short wave* listeners are finding these units an extremely useful and interesting adjunct for "DX" adventure.

The range of 5 meter signals is generally considered as limited, due to the propagation characteristics of these short waves and the curvature of the earth. However, where the transmitter or receiver, or both, are operated at relatively high altitudes, extended range is obtained and recently new distance records for these 5 meter signals have been established. In many other cases, the transmitted signals follow unorthodox propagation rules and here again unusual distances are covered.

On the 10 meter band, *world-wide range* is possible, day or night. While recent federal rules prohibit American amateurs from communicating with amateurs located in foreign countries, it is still possible at least to receive signals from all parts of the world without any restrictions.

Many receivers, a year or more old, include provision for the reception of 5 and 10 meter signals. The results in most cases are not satisfactory due to the limitations of the earlier type tubes and other factors which exclude the possibility of obtaining circuit stability.

The converter to be described is a standard manufactured product. For the benefit of experimenters, the manufacturer has given the author permission to release the circuit used. In the factory-built set, the various coils are machine and fixture wound to insure obtaining exact duplicates. Handmade coils always vary in value and their application requires extra adjustments and experimenting. Accordingly, in building this converter, it will simplify matters greatly if the coils and associated parts are obtained as a factory assembled unit. This unit consists of the selector switch, coils and trimmer condensers mounted and wired ready to use. The balance of the parts are standard and are listed in the bill of material by manufacturer's number.

Some experimenters prefer to wind their own coils for experience; accordingly coil data is given in this article. This coil data is not the same as for the machine wound units, but affords a satisfactory equivalent suitable for hand winding.

This new converter design includes the following desirable features:

1. Use of new tubes having low noise characteristics.
2. High signal gain and low noise level.
3. Tuned R.F. output.
4. High C Oscillator.
5. High circuit stability.
6. Adjustable gain control.
7. Single control tuning.
8. Antenna selector switch.

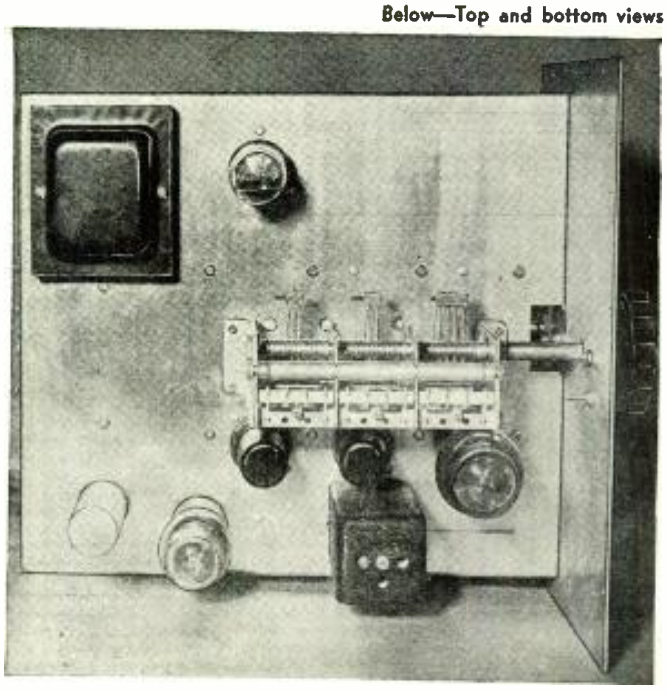
Accompanying illustrations show exterior and interior views of the completed converter; a complete schematic wiring diagram with values indicated is also included.

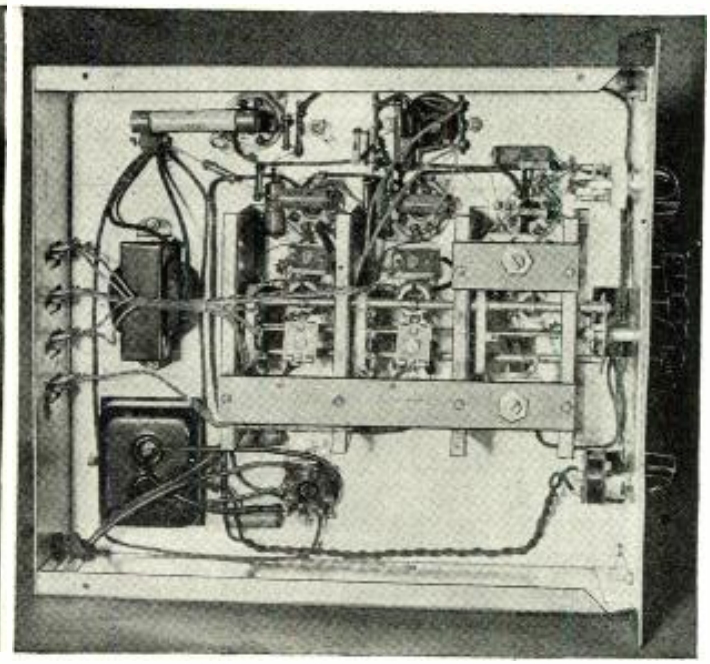
It will be noted that the tube array consists of a 6AC7/1852 direct tuned R.F. amplifier, a 6AC7/1852 mixer and a 6F6G oscillator. The power rectifier is a 6X5 and the high voltage regulator tube a VR150-30. The 6F6G is ordinarily used as a power audio pentode output tube. However this tube has characteristics which allow it to be used very effectively as a high-C high frequency oscillator for the 5 and 10 meter bands.

The schematic wiring diagram clearly shows the function of the Antenna Selector switch, which permits the use of a separate antenna, if desired, for the 5 and 10 meter bands. A third position permits connecting a general purpose antenna direct to the associated main receiver when the converter is not in use.

The converter can be used effectively with any good tuned radio frequency or superheterodyne receiver that can be tuned to the 40 meter band. As a matter of fact, the associated receiver should be tuned to a position just outside the 40 meter band; 7315 kc. is suggested as that frequency is practically free from any interfering signals. The possibility of the main receiver picking up in-

Below—Top and bottom views of the 5 and 10 meter converter.





terference directly is largely eliminated by using a small shielded concentric cable for the connections between the converter and the receiver input.

The output transformer (T-4), contributes a lot toward the outstanding performance of this converter. The primary is designed for the plate circuit of the 1852 mixer and is tuned to resonance with the main receiver frequency setting of 7315 kc. (which becomes the intermediate radio frequency). The secondary of the R.F. output transformer is designed to match efficiently the average receiver input impedance value. Adjustment of the output transformer trimmer (C-19) for maximum energy transfer is important in improving the signal-to-noise ratio, especially if the associated receiver does not have any direct R.F. amplification and accordingly is automatically handicapped by a high tube noise in the main receiver mixer. Furthermore, even if the main receiver does have one or two stages of direct R.F. amplification, substantial improvement in signal-to-noise ratio is obtained by adjusting the converter for maximum gain, conversion and output and using correspondingly less gain in the main receiver.

One important contributing factor toward high stability is due to the VR150 regulator tube, which controls and maintains the R.F. mixer and oscillator plate and screen grid voltages constant. Ceramic insulated coils and condensers also contribute their part toward the high degree of stability obtained. Re-alignment of the entire unit, after the initial alignment, is seldom necessary unless tubes are changed.

Construction

Assembly of this instrument is quite simple, as the chassis is of liberal size and all the necessary parts are inserted without crowding. After fastening the tube sockets in place, the heavy parts can be mounted including the power transformer, filter choke, filter condenser, R.F. output transformer, volume control-switch and the front panel controlled trimmer (C-18).

At this point wiring can be started, including leads to and from the power transformer, the filament leads, power supply filter. The cathode and screen grid resistors and associated by-pass condensers can then be connected, using insulating tie lugs as required.

The assembly consisting of the selector switch, coils and associated trimmers is then inserted and the connections made between this wired unit and the main circuit. For the experimenter using hand-wound coils, it must be noted that seven switches are required (all controlled by one shaft), each switch having a 5 meter, a 10 meter and an "off" position. A three gang switch is required, the first gang having three circuits each of three positions. The second gang is the same as the first. The third gang need only have one circuit of three positions, making a total of 7 switches, all of the non-shorting type. The remaining small parts can now be inserted and the circuit completed.

Coil Data

Forms for T-1, T-2 and T-3 are tubes ½" diameter by 2" long, thin wall Steatite, Amphenol 912B, or Millen High Q.

T-1 Secondary 7 turns No. 18 B & S Copper Wire, Silver Plated, turns spaced ⅛" between centers, taps at 4 and 7 turns. Primary, 4 turns No. 24 B & S d.s.c. copper wire, wound between secondary turns.

T-2 Secondary, 9 turns No. 18 B & S Copper Wire, Silver Plated, spaced ⅛" between centers, tap at 6 and 8 turns.

Primary, 5 turns No. 24 B & S d.s.c. copper wire, wound between secondary turns.

T-3 Secondary, 8 turns No. 18 B & S Copper Wire, Silver Plated, spaced ⅛" between centers, tap at 1 and 8 turns.

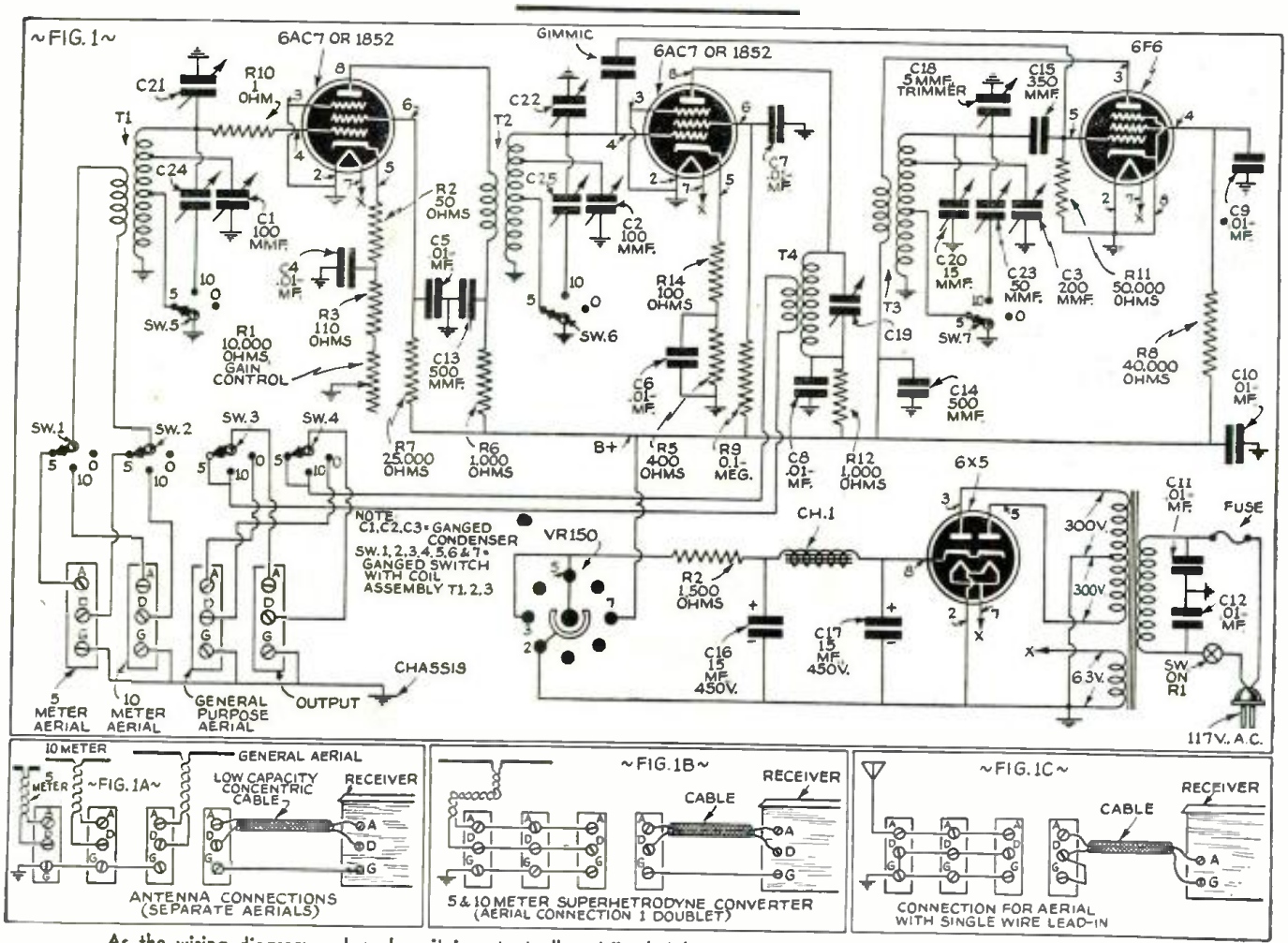
Primary, 3 turns No. 24 B & S d.s.c. copper wire, wound between secondary turns.

T-4 Primary (Plate) 20 turns No. 22 B & S d.s.c. copper wire, wound in ⅞" space on a form ⅝" in diameter and 1½" long.

Secondary, 4 turns No. 22 B & S d.s.c. copper wire, wound on slightly smaller diameter and slipped inside the above form.

Antenna

For best results, separate 5 meter di-poles or doublet, and a separate 10 meter doublet should be provided for the converter. In addition, a general purpose antenna can be connected to the main receiver for the reception of frequencies other than 28 and 56 megacycles. When only one doublet is available, the connections should be as shown in Fig. 1B. For use with an ordinary aerial with a single wire lead-in, the proper connections are shown in Fig. 1C. If the receiver does not have a doublet input, the converter output terminals D and G must be connected together and the connections



As the wiring diagram makes clear it is not at all a difficult job to construct this excellent 5 and 10 meter converter.

made as shown in Fig. 1C. The most efficient arrangement of aerial connections is given in Fig. 1A.

Alignment

Alignment of the assembled converter can be accomplished using a local source of oscillations from a signal generator or from actual 5 and 10 meter received signals. The converter is first connected to the main receiver and the latter set at 7315 kilocycles (just outside the 40 meter band). The main receiver is set for average gain adjustment. The converter gain control is set about 50% full on. The output of the converter is adjusted for maximum energy transfer at C-19, regulating same for maximum "noise level."

Check tuning condenser and main dial setting. With the condenser fully closed, the dial setting should be "0." The trimmer control C-18 is a fine adjustment condenser on the oscillator section of the gang condenser; set same at "0."

A 60,000 kc. signal should come in at about 84 on the main dial. Leaving the dial set at 84, adjust the 5 meter oscillator trimmer (C-20), which is a 5-plate air condenser on the switch assembly. The 60,000 kc. signal should be tuned to resonance with C-20 about 25% meshed. The antenna trimmer C-21 and R.F. trimmer C-22 can now be adjusted to resonance; these are the ceramic base mica trimmers on the coil assembly.

During these adjustments, the main receiver gain control should be set low enough so that the AVC is inoperative.

The converter is then switched to the 10 meter position and aligned using an incoming signal of 30,000 kc. The oscillator trimmer (C-23), a large air trimmer on the coil assembly, is first adjusted, and the 30,000 kc. signal should be brought in with the trimmer plates about 75% meshed. The 10 meter antenna trimmer, C-24 and R.F. trimmer C-25 are then adjusted; these are the two mica trimmers on the long insulating strip in the coil assembly.

Obviously, either the 5 or 10 meter bands can be aligned at any frequency in the vicinity of the high frequency end of the gang tuning condenser, but during these operations the receiver tuning must be kept constant and the output transformer C-19 first adjusted for maximum "noise level."

Once adjusted, the main receiver frequency should not require any change. On the main receiver, the R.F. gain and audio gain controls are regulated in the conventional manner. Best overall results are obtained when the converter is adjusted for maximum gain and by using correspondingly less gain in the main receiver.

List of Parts

MEISSNER

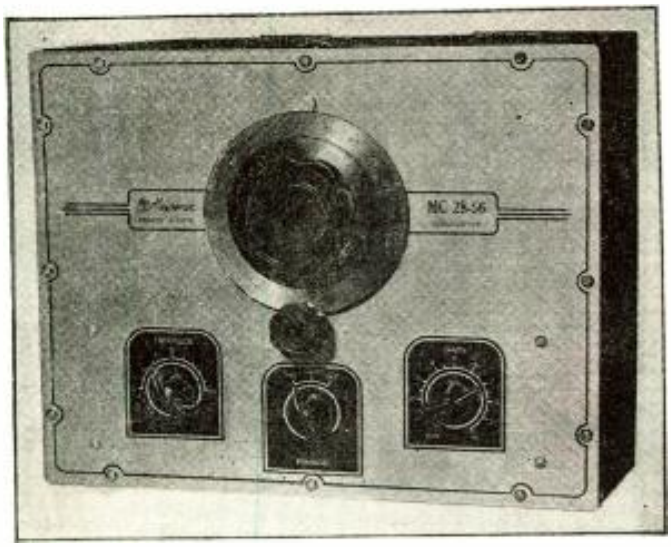
1—Cabinet, steel, black crackle finish, 11¼" wide x 9" high x 11½" deep, No. 9510
1—Panel, steel, satin chrome plated finish, .11¼" x9", No. 9943
1—Chassis, steel, chrome plated, 9⅛" x 11¼" x 3¾", No. 9941
1—Complete tuning assembly consisting of coils T-1, 2, 3, seven-section three-position switch S-1, 2, 3, 4, 5, 6, 7 and trimmers C-20, 21, 22, 23, 24 and 25, No. 9960
1—Three-gang tuning condenser, ceramic insulated, C-1, 2, 3, No. 17172
3—Ceramic octal sockets, No. 25-8437
1—VR150 socket, No. 9867
1—6X5 socket, No. 8149
1—Power transformer T-5, 110 volt 60 cycle primary, secondary 300-300 volt and 6.3 volt, No. 19465
1—Filter choke, 15 hy. 40 m.a., No. 19466
1—15-15 mf. 450 volt electrolytic condenser, C-16, 17, No. 16124
1—Trimmer condenser, air, C-18, 5 mmf., No. 17173
1—Trimmer condenser, mica, 100 mmf. max., C-19
1—Dial, 0-100, 4" diameter, German silver, with vernier drive, No. 19522
1—Sensitivity control R-1, 10,000 ohms and switch SW-1, No. 19391
3—Bar knobs, No. 25-8222

RCA (Tubes)

2—6AC7/1852
1—6F6G
1—6X5
1—VR150-30

MISCELLANEOUS

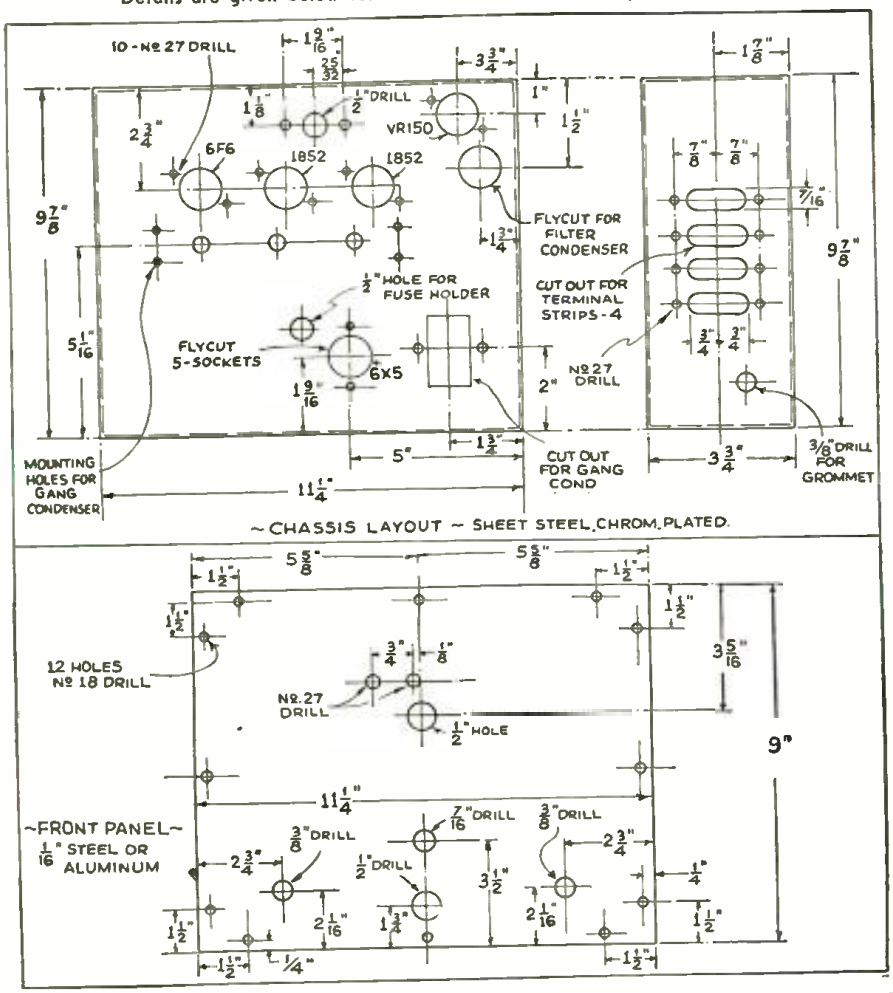
9—.01 mf. 400 volt paper condensers, C-4, 5, 6, 7, 8, 9, 10, 11, 12
1—1500 ohm 3 watt resistor, R-2
1—110 ohm ½ watt resistor, R-3
1—100 ohm ½ watt resistor, R-4
1—400 ohm ½ watt resistor, R-5
2—1000 ohm ½ watt resistors, R-6, R-12
1—25,000 ohm ½ watt resistor, R-7
1—40,000 ohm ½ watt resistor, R-8
1—100,000 ohm ½ watt resistor, R-9
1—1 ohm ½ watt resistor, R-10
1—50,000 ohm ½ watt resistor, R-11
1—Fuse extractor post and 1 ampere fuse, Littelfuse
2—.0005 mf. mica condensers, C-13, C-14
1—.000035 mf. mica condenser, C-15
1—A/C line cord and plug
1—Rubber grommet ⅝" diameter
4—Rubber feet ⅜" diameter
4—3 contact insulating tie lugs
1—4 contact insulating tie lug
2—2 contact insulating tie lugs
20—No. 6/32 hex brass nuts and lock washers
3—No. 8/32 rd hd brass mach. screws ⅛" long
18—No. 6/32 rd hd brass mach. screws ¼" long
4—¼" insulating washers, micoid
4—No. 6/32 rd hd brass mach. screws, ⅜" long
12—Phillips rd hd drive screws, ¼" long, chrome plated
1—Roll push back hook up wire, No. 20 B & S
1—¼ lb. roll rosin core solder



A front view of the 5 and 10 meter converter—note the swell appearance of the front panel, which is of metal. The dial is large and easily read and all in all this makes a piece of apparatus one may be proud of.

The capacity of the gimmic condenser in diagram, page 270, is from 5 to 10 mmf.

Details are given below for the chassis and the front panel layout.



We Will Pay

regular space rates for good construction articles giving novel and original ideas for building such simple radio apparatus as short wave converters, receiving sets, television and frequency modulation receivers, recording equipment, power supplies, simple set and tube testers, facsimile recorders, etc.

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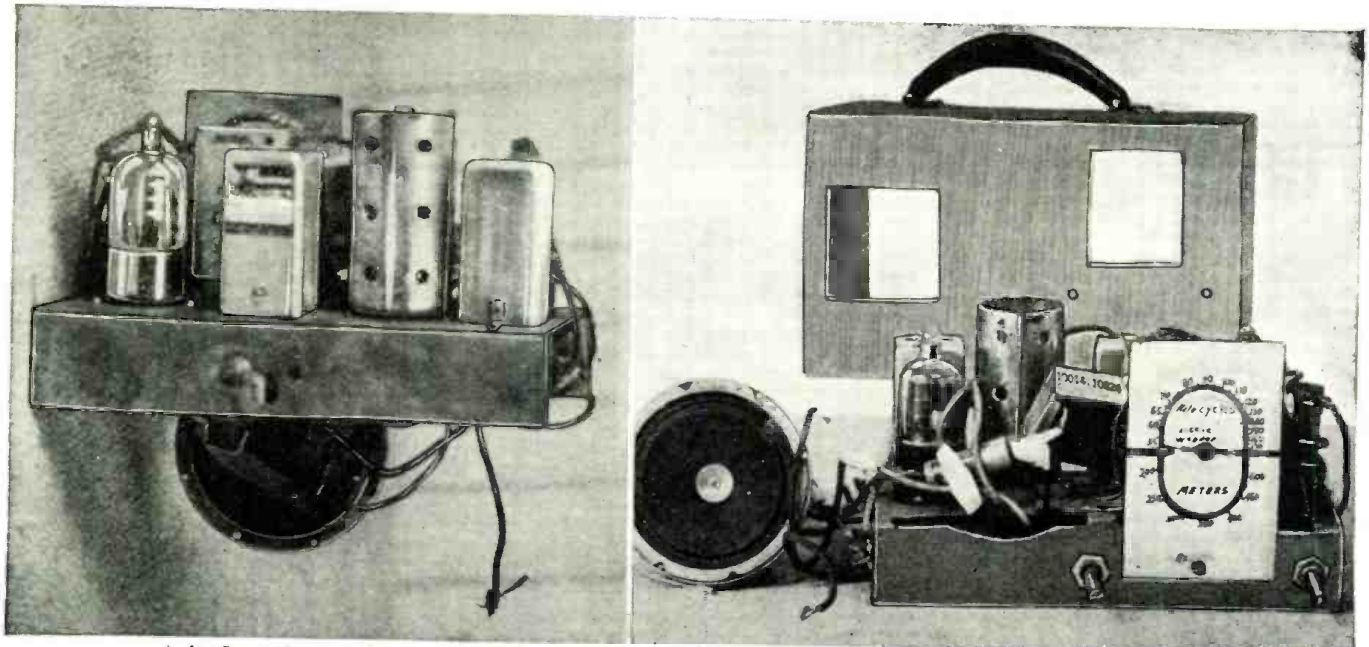


Left: Rear view of chassis and speaker. Background: The unfinished cabinet. Right: Front view of chassis.

3 Tubes=6 in This Superhet

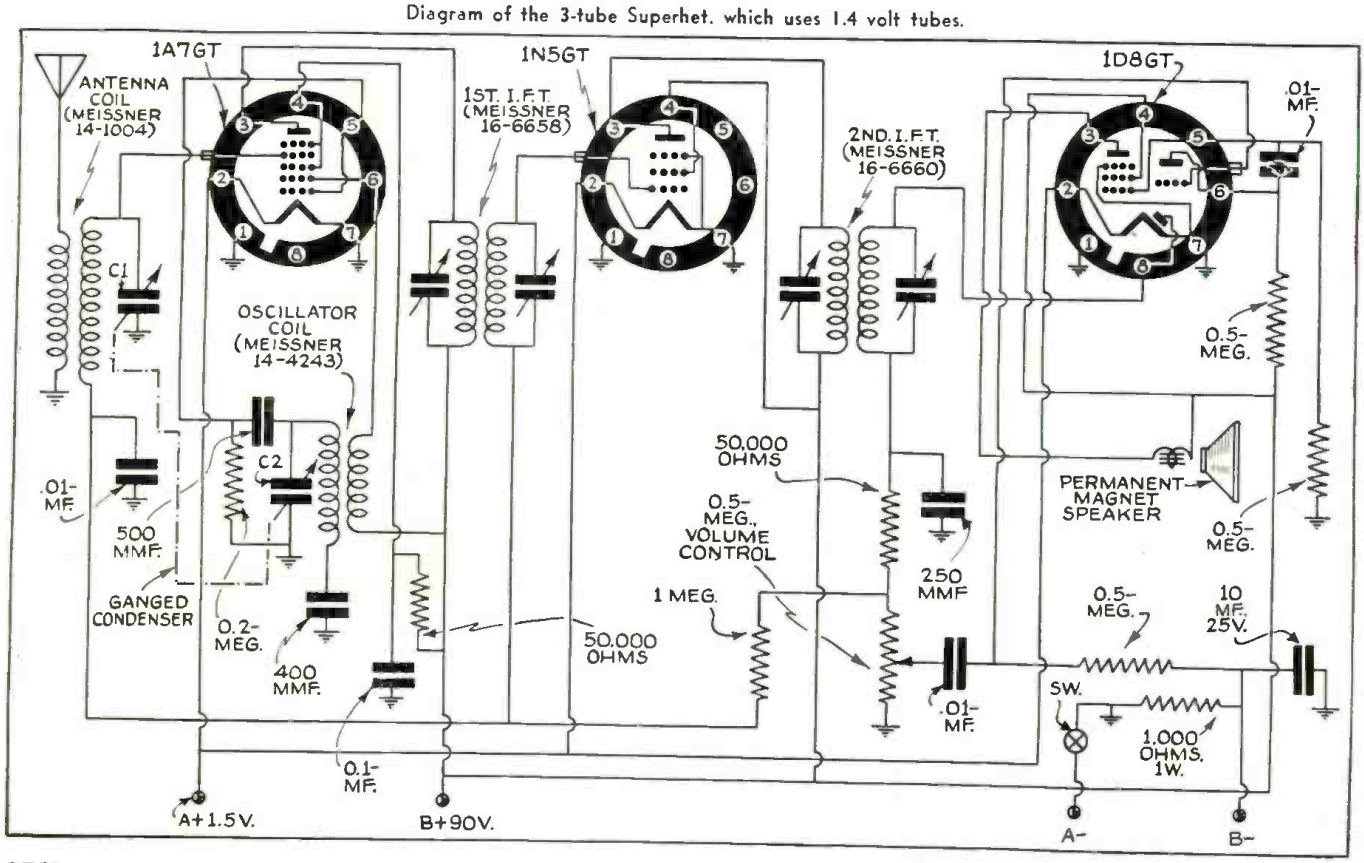
Lee Garrison

● THERE is a story behind the building of this set, which might interest future builders.

On the night that Joe Louis fought Paychek, we had a four tube portable receiver of popular make, in the store here to listen to the fight with. The electric light line having gone out we could not use the regular A.C. set. The set was so insensitive that it would not get KEX, a station about fifty miles away, in Portland Oregon, with sufficient volume for the boys to listen to the fight, without putting their ears right in the speaker.

Being the only radio service man in town, one of the boys asked me if I did not have a *battery set*. I told them I had one, a regular A.C. midget converted to run on a six volt battery; but, having built it just

Diagram of the 3-tube Superhet, which uses 1.4 volt tubes.



as an experiment, I had removed too many parts for it to work. Just as many experimenters will do, get a set to working just right and then use the parts on another set. I told them that I was building a set to take with me when I went camping, a regular *portable;* and that I believed it could outplay the set they were trying to use.

I knew, to get the volume and sensitivity that I wanted, I would have to use something more than the customary loop antenna. So I looked through my parts and found that I had a type No. 14-1004 Meissner antenna coil and a type 14-4243 oscillator coil on hand. Using those coils as a basis for my set I got to work and soon had a bread-board model built.

Using a 1A7GT pentagrid converter tube and a 1N5GT R.F. pentode and the 1D8GT first detector, first audio and pentode power output tube, I believed I could cut down the A current supply about fifty ma.

The bread-board model did not work as good as it might, due to too many stray wires around. But when I put the set on the base I intended to use, carefully shielding the first audio grid lead, the set worked fairly well. After dark it had a whistle, which could be killed by retarding the volume control. So I put in a filter network in the A.V.C. lead and the whistle was removed.

In the intermediate amplifier, I desired to obtain as much gain as possible, so I used a Meissner No. 16-6658 plastic input transformer, and their No. 16-6660 plastic output transformer. These transformers being very small and shielded, were just the thing for the work they were called upon to do. Using them, I got plenty of gain and plenty of selectivity.

I only use about twelve feet of wire for an antenna, as this seems to be about the right length for the antenna coil I am using.

The only increase in volume noted, is when a ground is attached to the set; then the volume increases about fifty per cent.

I have taken this set into a hop yard, wires being strung all over the yard to support the hops, and the set played with fair volume. I have taken the set into the forest, with trees all around from 100 to 150 feet tall and higher, and the set gave an excellent performance. It played as well as a *six-tube* battery super which one of the loggers at a nearby logging camp had. In fact, any place I take it I get good results. The results are as good or better than some of the *four-tube* portables I have listened to.

If one uses ordinary care in building this set, he need not expect any trouble with it. But it must be tuned properly and aligned right, if it is to play like the one I am using now.

The total cost of the set, including batteries, tubes and everything need not exceed sixteen dollars and seventy-five cents.

For an "A" supply, I am using a Willard No. 6 dry cell and get about 150 hours service; the No. 6 costs forty cents, so the "A" supply costs about one quarter of a cent an hour.

If you experience any trouble with this set, I will be glad to answer any questions you may have to ask. Write me in care of this magazine and please send a self-addressed, stamped envelope for a reply.

All condensers are Aerovox 200 volt type, with the exception of the mica padding condenser, which is a .0004 mf. plus or minus 3% Miller padder.

The bypass condenser in the B minus lead is an Aerovox 10 mf., 25 volt size.

The tuning condensers are Meissner .000365 mf. midget size.

The speaker is Vita-vox five-inch dia. magnetic speaker.

The volume control, as are the fixed resistors, is a IRC.

The oscillator grid condenser is a .0005 mf. mica; this may seem to be a little large for a grid condenser, but it was all I had on hand when I started to build this set so I used it.

Three-Tube Superhet. Parts List

INTERNATIONAL RESISTOR CO.

1—1000 ohm one watt
2—50,000 ohm one-half watt
1—75,000 ohm one watt
1—250,000 ohm one-half watt
3—500,000 ohm one-half watt
1—2 megohm one-half watt
1—500,000 ohm volume control with A.C. switch

AEROVOX CONDENSER CO.

2—.05 mf. 400 volt condenser
3—.01 mf. 400 volt condenser
1—.00025 mf. 400 volt condenser
1—.1 mf. .400 volt condenser
1—.0004 mf. mica condenser
1—.0005 mf. mica condenser
1—10 mf. 25 volt electrolytic condenser

VITAVOX

1—5 inch magnetic speaker

NATIONAL CARBON CO. (Eveready)

2—#482 Minimax "B" batteries
1—#6 Willard dry cell

MEISSNER

1—#16-6658 plastic I.F. transformer 456 kc.
1—#16-6660 plastic I.F. transformer 456 kc.
1—.000365 mf. VC #21-5214 tuning condenser
1—#23-8227 5-inch slide-rule dial
1—#14-4243 osc. coil 456 KC 190-550 meters
1—14-1004 antenna coil, 190-550 meters

SYLVANIA

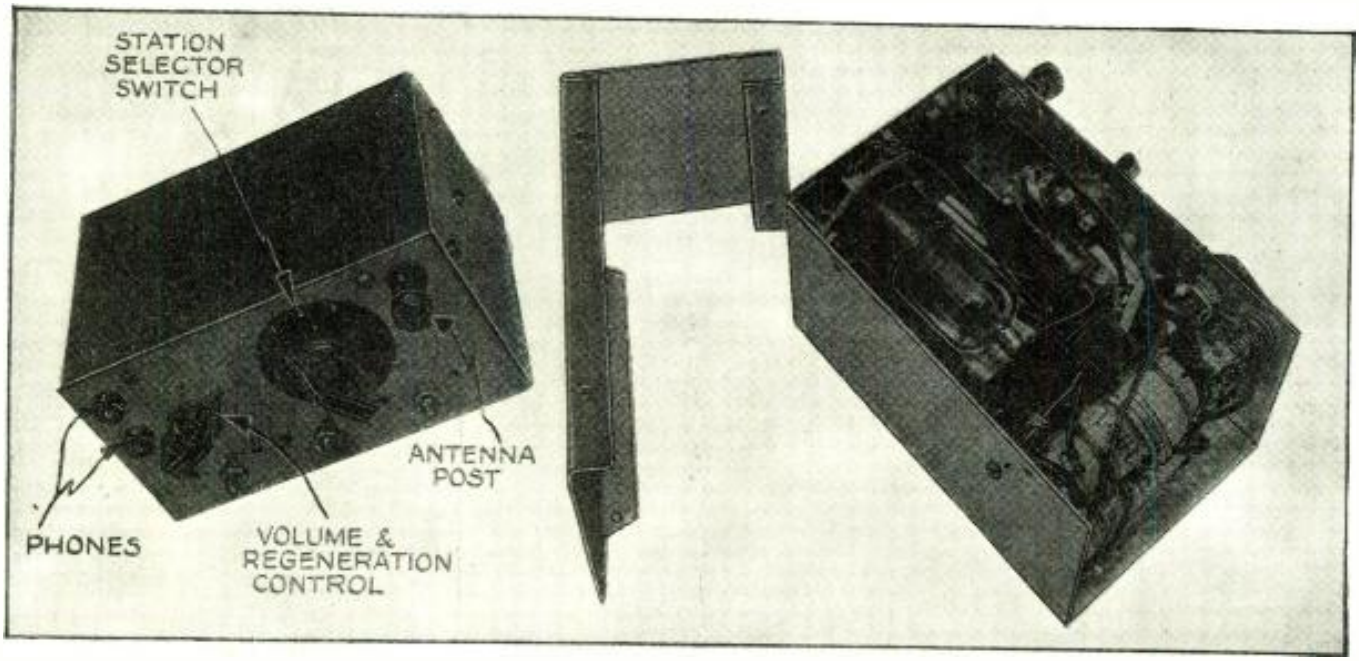
1—1N5GT tube
1—1A7GT tube
1—1D8GT tube

How to Learn Code

● IN the amateur bands you will find many stations sending slowly. Listening to one station call another is very good practice, since the call letters of both the station called and the station transmitting are transmitted several times and the beginner can usually make out the call letters correctly. There are many short-wave commercial stations that send press from 15 to 25 words per minute at a smooth, even rate of speed, and these offer an ideal chance for prolonged practice in receiving code.

The operator learning the code who already knows the correct "touch" system of typing will learn to copy on the typewriter much more rapidly.

But, learning to take down code on the typewriter is something to be done AFTER the student engineer has learned the code and can receive it with pencil on paper, with perfect copy, at a minimum speed of 20 words per minute. To attempt to *"copy on the mill"* before this speed is attained is disastrous.—*(c) by First Nat'l Television.*



1-Tube "Select-Ur-Station"

Pocket Set

L. M. Dezettel*

● HERE is a compact 1-tube set that operates like the big push-button multi-tubers. It can be used anywhere with a short length of antenna wire. You can use it while boating or fishing—while cycling—at picnics—or at the ball game. A flip of the switch gives you a choice of 3 pre-tuned stations, yet this set is small enough to be carried in the coat pocket.

The circuit employs a low-drain, high-gain pentode tube, type 1N5GT. This tube requires but 1½ volts as filament supply and offers good results when operated from a single 45 volt "B" battery. Regeneration is obtained by means of an extra tickler winding and is controlled with a midget-type volume control.

The first step in building the receiver is mounting the parts which will be used. All of the larger parts should be mounted first, since the smaller resistors and condensers can easily be installed a little later in the process. The batteries should not be placed in the case until the wiring has been completed.

Wiring may be done in any fashion you prefer, just so long as the leads connecting the various parts are kept as short and as direct as possible. It is a good idea, also, to use a colored pencil to check off on the diagram each lead that has been completed. In this way you will avoid the possibility of overlooking any necessary connection. If you have had any previous experience in wiring radio sets, the schematic diagram should be followed, and the pictorial diagram may be used merely as an aid in placing the parts correctly. However, if you are a beginner, you will probably find the pictorial diagram useful in assisting you in the wiring process.

*Engineer, Allied Radio Corporation.

When the wiring has been completed, and you are certain that all connections have been correctly made, the batteries may be connected to the correct leads. Then the tube may be placed in its socket. And, now, you are ready for the initial test.

With headphones (or single headphone, if desired) on and antenna connected, turn the volume control a little toward the right. This will put the switch for the receiver in the "on" position. As you advance the volume control a little farther, you should hear a whistling in the headphones.

Next, set the station selector switch to Point 1, and, keeping the volume control at the point where the oscillation is just ready to begin, turn the screw trimmer adjustment for the first condenser until a local broadcasting station of your choice, operating at any frequency between 1200 and 1600 kilocycles, is properly received. When this adjustment has been completed, you may shift the station selector to Point 2 and repeat the adjustment for another station which transmits on any frequency between 900 and 1200 kilocycles. Following this, switch to Point 3 and repeat the adjustment once more for a third station which transmits on a frequency between 600 and 900 kilocycles.

For best reception, the radio should be operated with as long an antenna as you can possibly install. If you intend to use the receiver at a considerable distance from a broadcast station take along a wire about 50 feet long which you can uncoil when you reach the place you are heading for. However, if you use this portable set locally on a bicycle or in a car, a 6- or 7-foot bumper pole antenna may be employed.

If you do not obtain oscillation when the regenerative control is advanced, you may possibly have connected the tickler coil backwards. Reverse the connections to this coil and repeat the test.

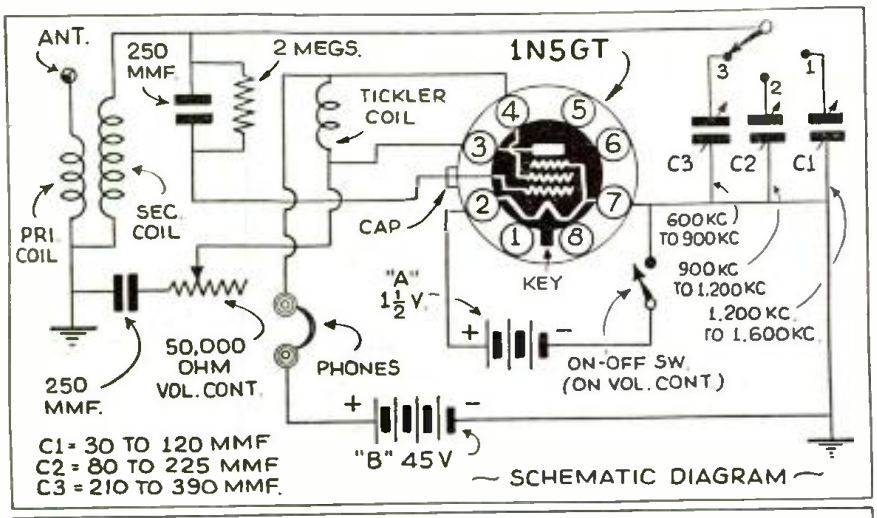
The correct connection of the "A" battery can be checked by noticing whether the filament of the tube is lighted. Since the filament requires only a little power, it will glow very faintly when it is in operation, and, so, it is best to make this examination in a room that is fairly dark.

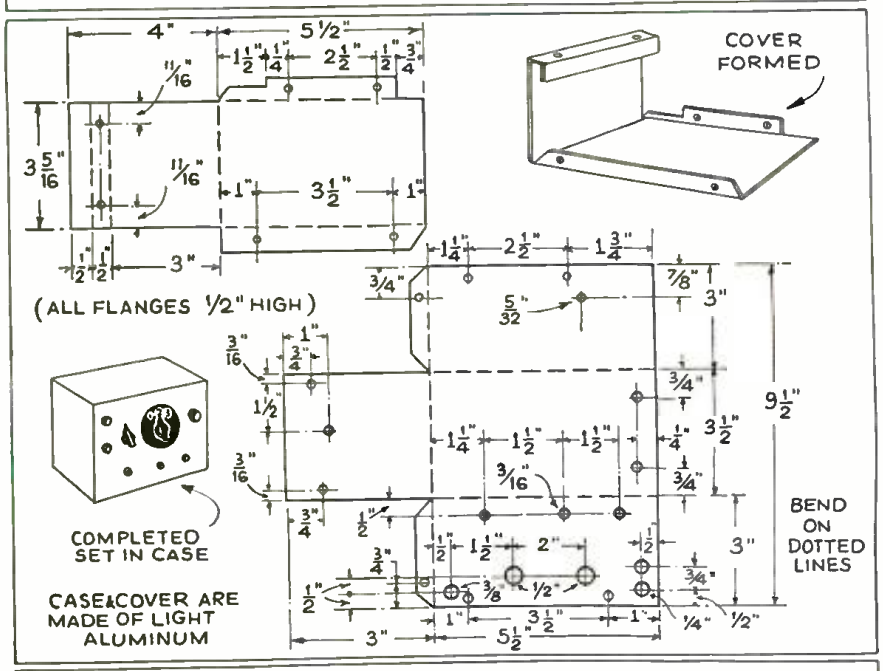
(One of the tiny hearing aid type headphones can be used, if desired; it should be of the high impedance type—1000 ohms impedance at least. More stations can be prepared for by adding extra padding condensers of suitable capacities and setting them for the desired stations.—Editor)

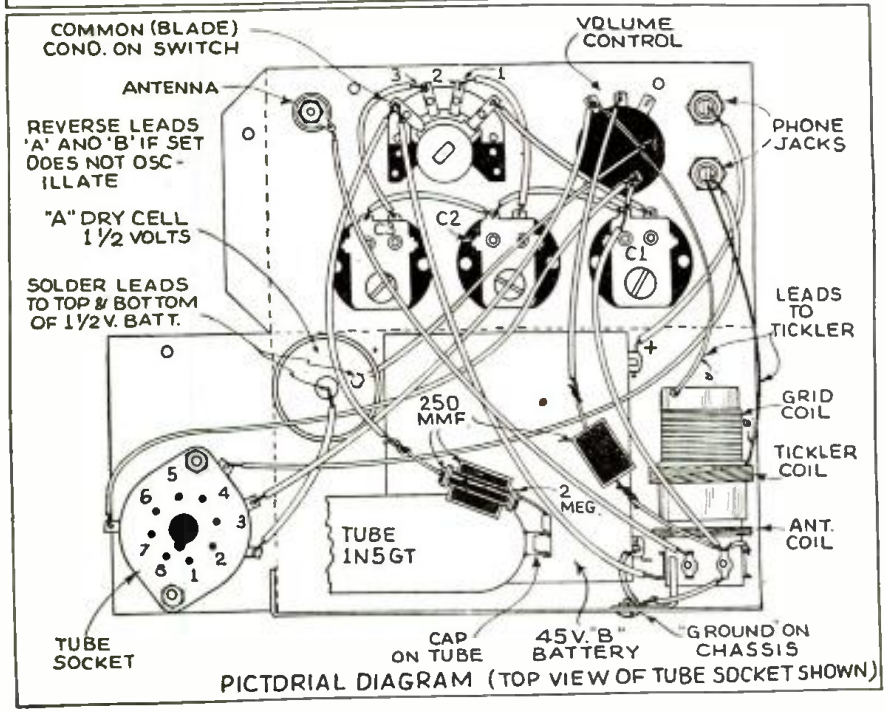
Parts List—"Select-Ur-Station" Pocket Set

1—Octal socket, wafer type
1—Antenna coil, unshielded
1—Extra primary winding, used as tickler
2—Pointer knobs
1—Antenna binding post
2—Insulated pin jacks
1—50,000 ohm midget control with switch
1—Grid cap
1—Raytheon 1N5GT tube
1—Flashlight 1½ V. battery No. 2 size
1—Midget 45 volt battery
2—.00025 mf. mica condensers
1—2 megohm resistor
1—3 position switch
1—Yaxley plate 1 to 3
1—25-100 mmf. padder condenser (tuning)
1—75-225 mmf. padder condenser (tuning)
1—175-500 mmf. padder condenser (tuning)
Hardware consisting of:
2—Brass bushings
3—¾" 6-32 screws
2—Fibre extended washers
7—Self-tapping screws
4—6-32 nuts
Aluminum for case (case is available)

If you prefer to try home-made coils, the coils can be made by winding 110 turns of No. 36 enameled wire on a ¾" dia. form for the grid coil, 50 turns of the same wire, lump-wound at the *cold* end for the antenna coil, and 50 turns, lump-wound at the grid end for the tickler. (Lump-wound means random wound in a narrow space, the turns overlapping and piling up in pancake fashion.)







The diagram and other details of the one-tube set as given above, make it a very simple matter for even the veriest tyro to construct this efficient little set.

The "Battery-4" Portable

Allan Stuart

● YOU'VE heard so much about these battery portables—how popular they are and how many are being sold! Here then is your opportunity to *build* one.

The circuit is extremely simple, and if you can use a soldering iron and follow a diagram, you should be able to throw this receiver together in about three evenings—and have a lot of fun doing it.

You will notice from the schematic diagram that the circuit is that of a 4-tube superheterodyne utilizing a type 1A7G tube as the oscillator pentagrid converter; a 1N5G as the I.F. amplifier; a 1H5G as second detector, automatic volume control and first A.F. stage; and, finally, a 1C5G as the power output tube. These are all 1.4 volt tubes, each consuming only 50 milliamperes—a trifling amount.

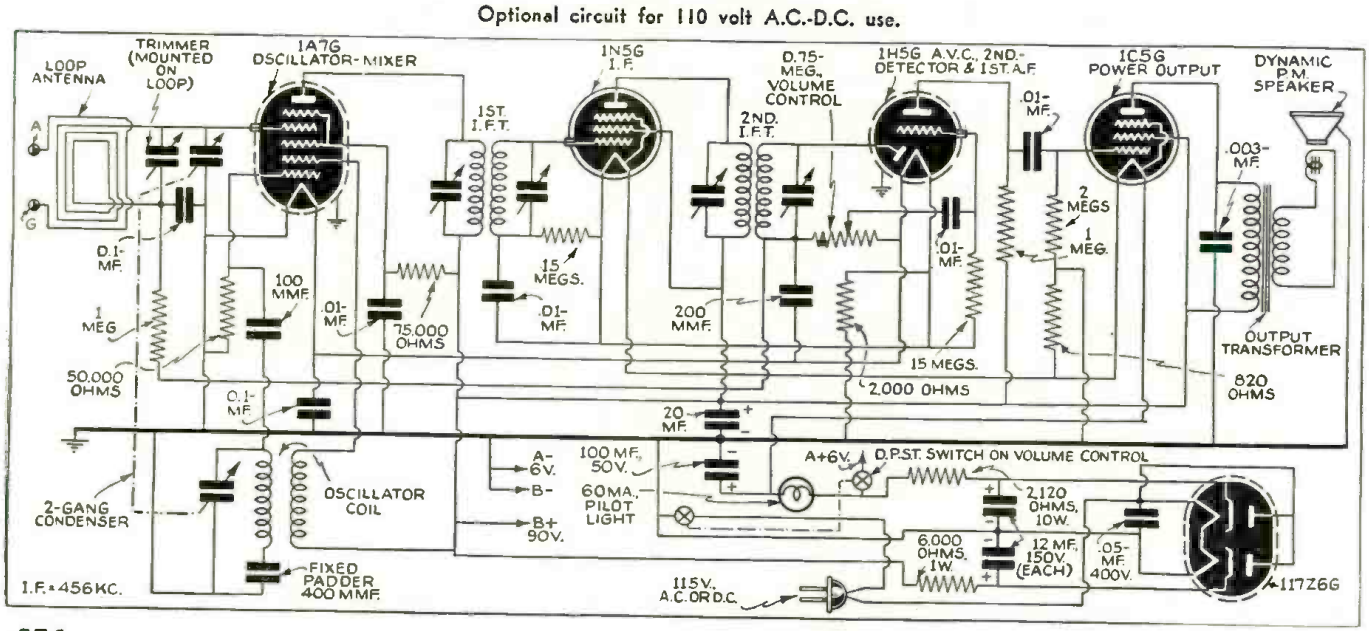
For those readers preferring a "3-way" portable—that is, a receiver which will operate from self-contained batteries as well as from the 110-volt A.C. or D.C. power line—an optional schematic diagram is given. Aside from the addition of a simple power-supply very few changes are required in the circuit.

It will be noticed that in adding the power-supply the filaments of the receiver tubes are wired in *series*. If only batteries are to be used, then the tubes are connected in *parallel* for simplicity. If a 3-way portable is desired, then the tubes are wired in series and left that way permanently, using a 6-volt "A" battery to furnish filament current when operating from batteries. This article, however, confines its discussion to that of strictly *battery* operation.

The first step is to collect all the parts shown in the list at the end of the article. It is best to obtain the loop antenna, oscillator coil, both I.F. transformers, the 2-gang tuning condenser and the tuning dial from the same manufacturer in order to be assured that they are perfectly matched to each other. (The set shown was built around a Miller portable set kit, containing the above items, also the chassis, already drilled.) However, if you are particularly fond of getting "bugs" out of a newly constructed receiver, use any of the units you

Left—Front view of 4-tube portable: right—rear view with lid open, showing batteries.

Optional circuit for 110 volt A.C.-D.C. use.



may happen to have in your "junk box" (the author doesn't like "bugs").

The question of chassis size remains for the individual to decide. If you like to work on a large chassis without danger of burning your fingers when soldering or bruising them when replacing batteries, then use a larger chassis. If you are a "midget-ite", then get the smallest chassis possible commensurate with the parts of the receiver. The chassis used by the author measures 5½" long x 4½" wide x 1½" high. Mount the two I.F. transformers, tuning condenser and tuning dial on top of the chassis, as shown in the illustrations. All other parts mount underneath the chassis. The volume control shaft should line up with the tuning shaft—being directly below it.

Follow the schematic circuit very carefully in wiring. For those who prefer pictorial diagrams, one is here given. Pay particular attention to the wiring of the oscillator coil, since the reversal of any of these connections may result in non-oscillation. The loop antenna has an extra single turn wound around it (terminals Nos. 3 and 4) terminating in *antenna* and *ground* binding posts. These are for use with an outside antenna when using the receiver at any great distance for broadcast stations or when DX reception is desired.

Alignment

When all wiring has been completed and thoroughly checked, proceed to align the I.F. transformers as follows. Feed a 465 kc. signal from a test oscillator to the grid of the 1N5G through a .002 mf. condenser and adjust both trimmers of the second I.F. transformer for maximum response in the loud speaker. Follow the same procedure for the trimmers of the first I.F. transformer, feeding the signal into the grid of the pentode section of the 1A7G tube. For final alignment of the I.F. channel, short the rotor and stator plates of the oscillator section of the 2-gang condenser with a jumper wire, and feed a 465 kc. signal from the test oscillator into the loop antenna inductively; that is, connect two turns of any size wire to the output terminals of the oscillator and bring them within close proximity of the receiver loop. The 465 kc. signal will then be heard in the loud speaker. Carefully readjust all I.F. trimmers for maximum response.

To adjust the oscillator parallel trimmer, set the dial pointer to 1400 kc. Remove the jumper wire from the oscillator tuning condenser, and switch the signal generator output to 1400 kc. (The generator remains inductively coupled to the receiver loop during this operation.) Adjust the oscillator trimmer (on top of the oscillator section of the 2-gang condenser) for maximum response. The set does not employ a variable series padder trimmer, hence the set cannot be aligned at 600 kc. However since all tuning components are *matched*, this operation is not necessary. The set should now "perk" beautifully if all wiring has been correctly done and all the alignment procedure carefully followed as described.

List of Parts

MILLER

1—Tuning Kit comprising:
1—2-gang variable tuning condenser
2—I.F. 456 kc. transformers
1—Oscillator coil
1—.0004 mf. mica padding condenser
1—B'cast band Loop Antenna
1—Drilled chassis
4—Octal wafer sockets
1—Tuning dial
1—Loop Antenna

I.R.C. (Resistors)

1—75.000 ohms ½ w.
1—250.000 ohms ½ w.
3—2 meg. ½ w.
1—½ meg. ½ w.
1—820 ohms ½ w.
1—Volume control, 1 meg., with D.P.-S.T. switch

NATIONAL UNION (Tubes)

1—1A7-G
1—1N5-G
1—1H5-G
1—1C5-G

SPRAGUE (Condensers)

2—.05 mf. tubular
1—.0005 mf. mica
1—.0001 mf. tubular
1—.0001 mf. mica
2—.01 mf. tubular
1—.003 mf. tubular
1—8 mf. electrolytic, 250 volts

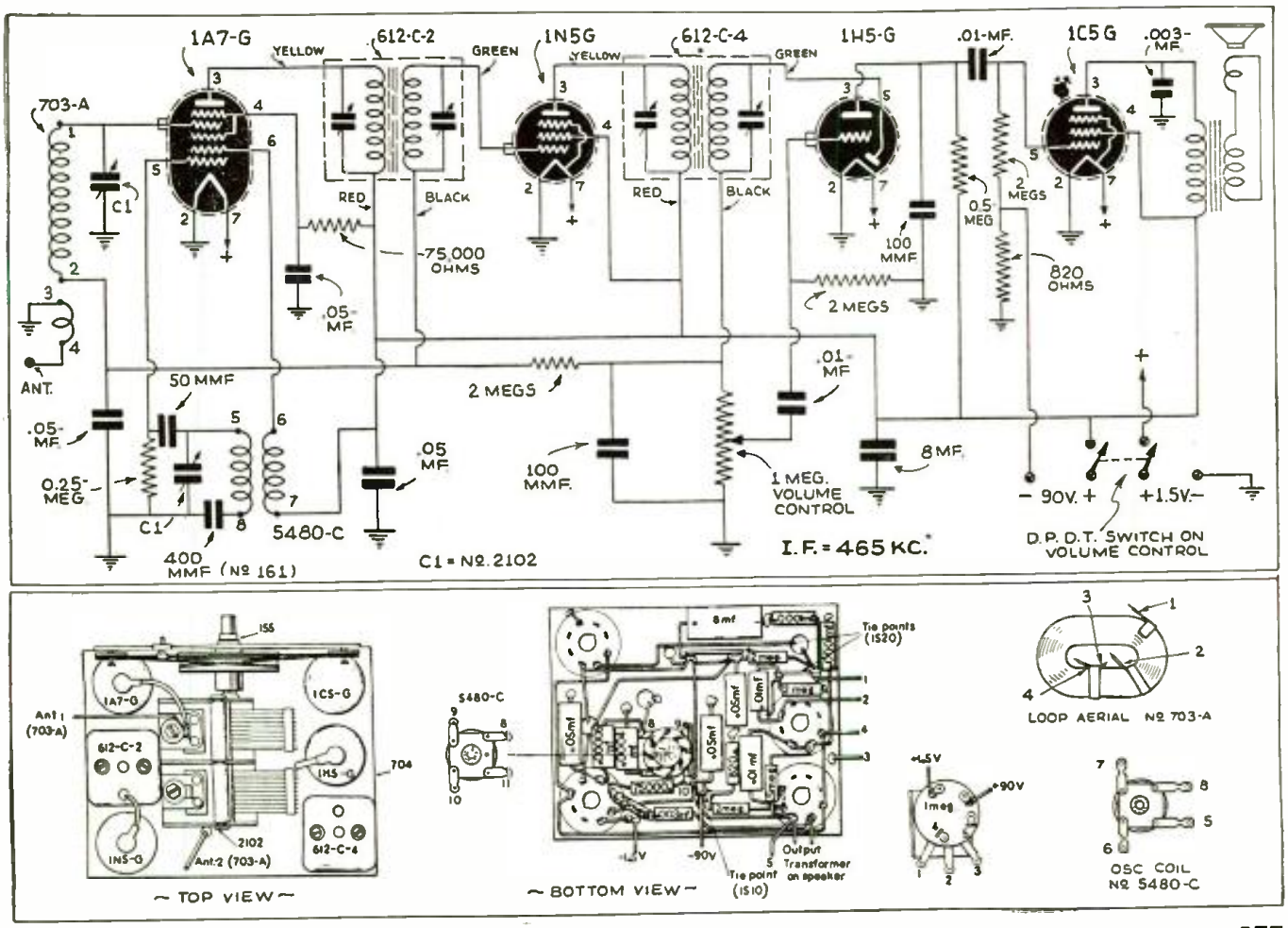
UTAH

1—4" P.M. Dynamic speaker and output transformer with 9,000 ohm impedance primary

EVEREADY (Batteries)

2— 45 vt.-"B"—Type 482
1—1½ vt.-"A"—Type 745
1—Any suitable carrying case (approx. 7½" x 12" x 10" inside measurements)

Below—Diagram of portable set as wired for battery operation—it covers the broadcast band, 540 to 1700 kc. Top and bottom views of chassis are also shown.



T.R.F. "Broadcast" Receiver

for the Ham or Fan

William D. Hayes, W6MNU

Front view, showing the placement of the tubes and transformers. The under-chassis view illustrates the extreme simplicity of the wiring.

● ALTHOUGH amateurs speak of the BCL (broadcast listener) as if he were some weird monster from another world, a large percentage of these same amateurs are using their *communications* receivers for *broadcast* reception as well as for the higher frequencies. A few of the higher priced receivers are designed to provide excellent reception of broadcast programs by incorporating a wide-range selectivity control and adequate audio power together with a large speaker. However, the majority of the communications receivers in the medium and low priced field are not really satisfactory for *broadcast* reception. In many cases the speakers are very small and insufficiently baffled, and the audio output stage furnishes only a few watts with relatively high distortion. Frequently the hum level in the output is surprisingly high, and the only reason it is not objectionable is that the speakers are not reproducing the lows to any appreciable extent. Most of the lower priced receivers provide no means of widening the selectivity characteristic, and the highs suffer as a result. It is common practice to use a single pentode in the output stage with consequent high harmonic distortion.

Needless to say, all this is nothing against the low priced communications receivers inasmuch as they are designed to do a joh of pulling in the signals, and they do tha' job remarkahly well.

The average home-built short-wave super is subject to very much the same ills as its commercial brethren with regard to broadcast reception, plus the fact that it may be the unhappy custodian of several of those persistent idiosyncrasies known as "bugs". I think it is evident, then, that a separate broadcast receiver would be of advantage to the BCL-ham, unless, of course, he is fortunate enough to own one of the deluxe communications jobs mentioned above.

Push-Button Tuning

The receiver described in this article is *not* designed for high-fidelity reception. It is merely intended to provide the ham with good broadcast quality and to do it as simply as possible. In the interests of simplicity and convenience, *push-button tuning* is employed. This eliminates the need for ganged condensers and the accompanying problem of tracking. A Meissner 6-button unit permits the tuning of five stations which is adequate for most purposes. Here in the San Francisco-Oakland area, for instance, there are two N.B.C. stations, one C.B.S. station, and one Mutual station. These four stations carry all the programs of any importance, and are probably listened to about 90% of the time by most people in this area. This still leaves one button for tuning in the favorite local record-playing station. However, if more stations are desired, an 8-button tuner is available.

These push-button units are complete with condensers, escutcheon, and call letter sheets, and are equivalent to a two-gang condenser. If any of the desired stations are near the low frequency end of the broadcast band, it will probahly be found necessary to connect a mica condenser of about 100 mmf. across the secondary of each R.F. transformer so as to parallel the capacity introduced by the push-buttons. These two auxiliary condensers are shown in the wiring diagram as C_2 and C_7.

The Circuit—T.R.F.

The receiver is a four-stage, five-tube T.R.F.; the T.R.F. circuit was chosen because of its simplicity and freedom from such things as "tweets", and also because two tuned R.F. circuits provide just about the right amount of selectivity for the elimination of interference without serious cutting of the outer sidebands.

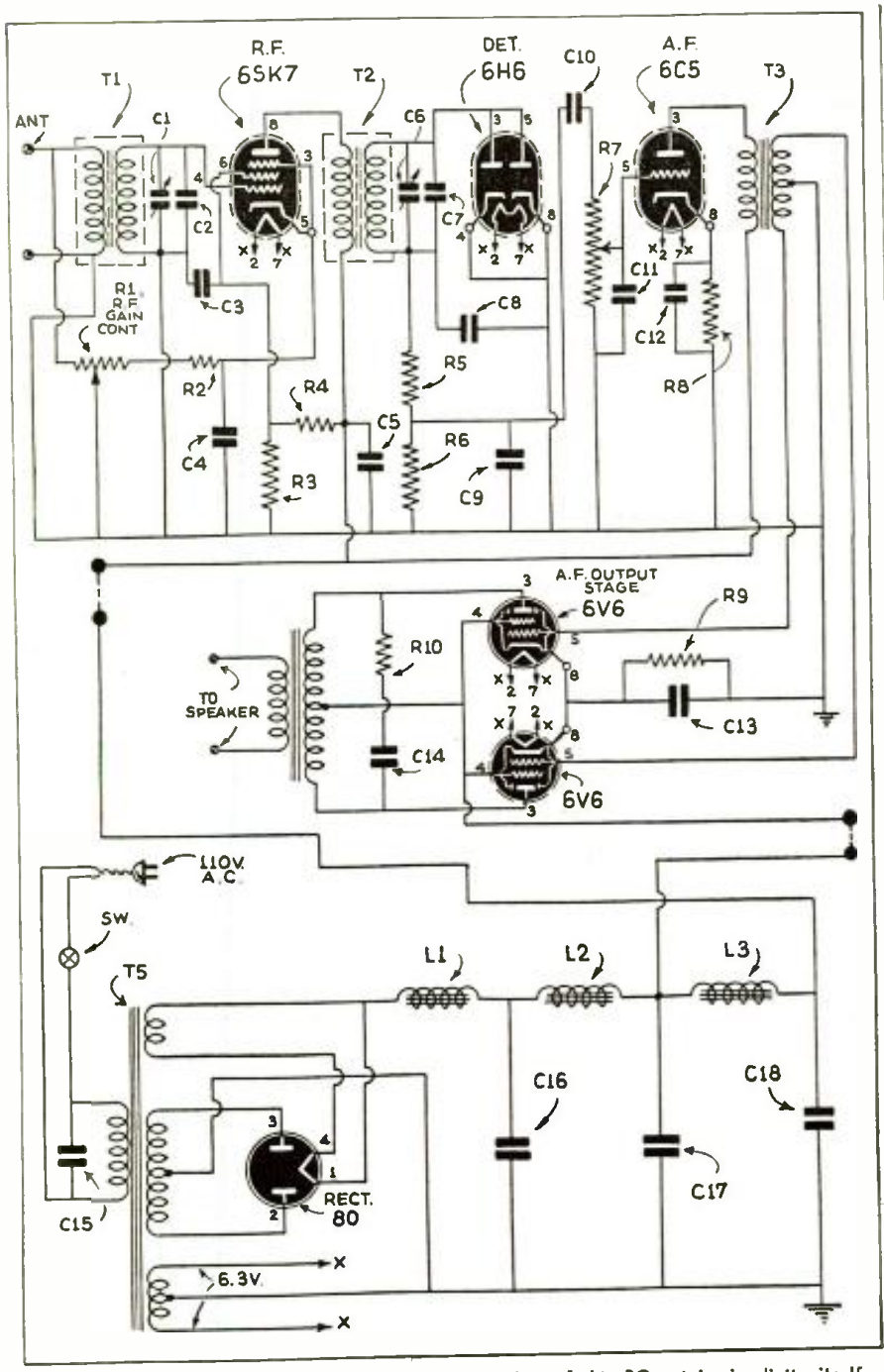
The R.F. stage uses one of the recently developed single-ended tubes, the 6SK7, which eliminates the nuisance of a flexible grid lead to the top of the tube. It is coupled to the antenna through an iron core R.F. transformer (Meissner Ferrocart). Gain is controlled by the conventional method of simultaneously varying the grid bias and the input voltage (antenna shunting). A minimum resistance of 300 ohms remains in the cathode circuit at all times.

The 6SK7 is coupled by means of another iron core R.F. transformer to the detector which is a 6H6, diodes in parallel.

●

Excellent quality of reception on the broadcast band is assured with this T.R.F. receiver. Any one of six BC stations can be instantly selected by simply pushing a button. The set is very simple to construct — only six tubes are used — all the ports are standard and available from your radio dealer or supply house.

●



The diagram makes it apparent that the construction of this BC set is simplicity itself.

The detector is standard and needs no comment. Its output feeds a 6C5, the grid potentiometer serving as an *audio gain control*. Operation of the receiver has shown that this control is not really necessary, so it could just as well be replaced by a fixed resistor of 500,000 ohms. The condenser, C_{11}, by-passes to ground any R.F. which may get through to the grid of the 6C5. The 6C5 in turn is transformer coupled to the output stage with a 1:3 step-up transformer (10,000 ohm plate to push-pull grids).

A.F. Output Stage

Occupying the output stage is a pair of 6V6's push-pull, Class A, with a power output of about eight watts at two per cent harmonic distortion. The high second harmonic distortion, characteristic of the 6V6, is cancelled by the push-pull arrangement. The resistance-capacity filter connected across the primary of the output transformer improves the quality by correcting to some extent the frequency distortion caused by the high plate resistance of the 6V6's. No tone control is incorporated because the ordinary tone control does more harm than good, merely being used to cut out the highs. Anyone desiring the effect can get it easily enough by shorting out R_{10}. However, if a simple tone control is desired, a variable resistance of about 25,000 ohms can be substituted for R_{10}. The output transformer secondary is tapped so that it can be connected directly to the speaker voice coil or to a 500 ohm line.

Construction Hints

The receiver is built on a large chassis, which measures 17 inches long by 8 inches wide by 3 inches deep. This over-size chassis has three advantages: it permits the

push-button tuning unit to be mounted below deck; it allows the parts layout to be entirely straightforward, from the antenna to the output terminals, thereby discouraging regeneration; and lastly, it makes the wiring a pleasure.

Nearest the front of the chassis is the antenna transformer, and behind it the 6SK7. Across the rear from left to right is the detector R.F. transformer, then the 6H6, the 6C5, the interstage audio transformer, the 6V6's, and the output transformer. The left-hand knob is the R.F. gain control, and the right-hand knob is a dummy put on for the sake of symmetry. The audio gain control is at the rear, but as explained previously, it is unnecessary.

As is to be expected at *broadcast* frequencies, the parts layout is not at all critical as long as it is kept reasonably straightforward. The under-side view of the chassis shows the placement of the smaller parts. About the only precaution necessary in the construction is to space the holes for the push buttons accurately so as to avoid binding.

The tuning condensers can be adjusted easily by ear; with one button depressed, *both* condenser sections corresponding to that button should be alternately peaked several times until the maximum response is obtained from the desired station. Then the same procedure is followed for each of the other buttons. Detailed directions for the installation and adjustment of the push-button tuner are furnished with the unit itself by the manufacturer, and hence will not be given here.

Power-Supply

The power-supply for the receiver must be capable of supplying about 120 ma. of well-filtered D.C. at 250 volts. Filtering of the type shown in the wiring diagram is desirable because it isolates the output stage from the preceding stages, and also permits the final choke to have a current rating of only 15 ma. There is no necessity for a bleeder in the power supply itself, because the voltage dividing is accomplished in the circuit of the receiver proper.

The reason for not including the power-supply on the main chassis was to eliminate any possible hum pick-up by the audio transformers and wiring. The expedient proved well worth while, for the output of the receiver is *absolutely hum-free.*

Performance

As with any piece of apparatus, the ultimate test of a receiver is in the performance, and in the case of this particular receiver, the performance is eminently satisfactory. In this location about five feet of antenna is sufficient, although at greater distances from the broadcasting stations a longer antenna would probably be necessary, or at least advantageous. The set has been operating within about half a mile of a local broadcasting station without a trace of interference; however it is not recommended for use next-door to 50 kw.

The speaker being used at present is a twelve inch permanent magnet type (Jensen PM 12-B) which has quite a good response up to 7500 cycles. It is mounted on a large flat baffle of ¾ inch plywood about five feet square. The bass response is especially satisfying, notably on dance music of the Gene Krupa variety, and the power available is ample to fill a good-sized hall if necessary.

Actually the distortion on a complex, steep-fronted wave is considerably greater than would be indicated by the harmonic distortion ratings in the tube manual. The performance of the output stage could be improved by the introduction of inverse feedback, but this would complicate the circuit slightly, and one of the primary features of the receiver is its extreme simplicity. About the only time that the quality is noticeably poor (i.e. noticeable to a critical listener) is on a passage of music in which percussion instruments are being played vigorously in the middle and high frequencies. For instance on the Kraft Music Hall recently J. Scott Trotter was playing a particularly strenuous passage on the piano and there was a perceptible roughness on the loud crashes. However, it is doubtful if the average BCL would have noticed the effect at all.

In actual listening tests with a variety of program material the quality was described as "excellent", "very natural", etc. When used with an adequate speaker, the set provides really enjoyable broadcast quality, which, although still not high-fidelity, is certainly a marked improvement over the quality obtainable from a small communications receiver.

Parts List

I.R.C.
R2 300 ohms, ½ watt
R3 60.000 ohms, ½ watt
R4 50,000 ohms, 1 watt
R5 50.000 ohms, ½ watt
R6 250.000 ohms, ½ watt
R8 1000 ohms, ½ watt
R9 150 ohms, 10 watts
R10 12,500 ohms, ½ watt

SPRAGUE
C12 10 mf. 25 volt electro. ("Atoms")

THORDARSON
T3 10.000 ohm plate to push-pull grids, 3:1, (T-57A41)
T4 10.000 ohms plate to plate, to 4-8-15-500 ohms (T-75-S75)
T5 700 volts c.t. at 145 ma., 5V-3A, 6.3V-4.5A c.t. (T-70R62)
L1 and L2 12 henries at 150 ma. (T-17C00-B)

CENTRALAB
R1 20.000 ohm pot. (72-119)
R7 500,000 ohm pot. (72-105)

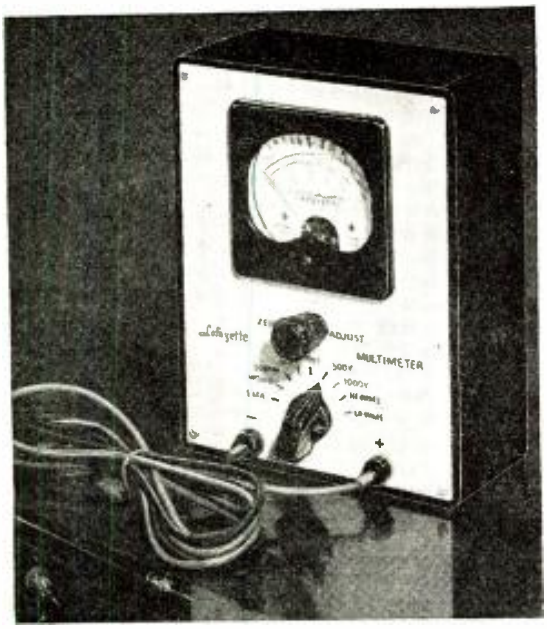
AEROVOX
C2 100 mmf. mica
C3 and C4 .1 mf. paper
C5 .1 mf. 400 volts
C7 100 mmf. mica
C8 and C9 250 mmf. mica
C10 .05 mf. 400 volt paper
C11 100 mmf. mica
C13 25 mf. 50 volt electro. ("Dandee")
C14 .03 mf. paper
C15 .01 mf. 400 v. paper
C16. C17, and C18 three section electrolytic, 8 mf. per section, 450 volts working

MEISSNER
T1 iron core R.F. transformer, antenna (14-1496)
T2 iron core R.F. transformer, detector (14-1497)
C1 and C6 push-button tuning condensers (Meissner)

STANCOR
L3 50 henries at 15 ma. (Stancor C-1515)

MISCELLANEOUS
Sw1 S.P.S.T. toggle switch (on power supply)

Next Month—
An Important Article on the INVERTED BEAM ANTENNA
Don't Miss It!



Note the handsome appearance of this testing instrument. It measures D.C. voltage, current or resistance.

An Economical Volt-Ohm Milliammeter

John T. Wilcox*

● A GOOD volt-ohm-milliammeter is practically a necessity for the service man, experimenter and set builder. With the nine ranges incorporated in this meter, D.C. voltage, current, and resistance can be measured with a very high degree of accuracy. To keep the cost low and still insure accuracy by using good components, only *useful* ranges were decided on. No A.C. ranges were included because usually there is no need to read the A.C. voltages in sets and amplifiers, as the D.C. voltages applied to the tubes are the logical ones to test for trouble or for reference.

The building of the meter is simple and only a word of caution may be needed; that is when wiring in the 100 and 500 m.a. shunts, make sure that *good soldered connections* are made. It is best to tin the lugs on the shunts first to make sure a good connection will be made. When finished with wiring, *check very carefully* every connection again with the diagram for, if a mistake has been made, *you may burn out the meter!*

The panel markers can be inked in with India ink or better still the range plate may be cut out of this magazine article and put on the white panel with clear lacquer. Paint the lacquer over the top of the paper to match the gloss of the white panel, this will also prevent it from getting worn or soiled in a short time. Due to the fact that this is drawn to actual size it can also be used as a template for drilling the panel.

In the use of the meter a few pointers will prove helpful; always use the highest range on the meter for the test to be made and if this is too high, a lower range may then be used. This procedure will eliminate the chance of burning out the meter in the event the current or voltage is much higher than figured. Always check the switch to see that you have the proper range for the test to be made, as when working on a job you may make a mistake by being preoccupied.

The low ohms position, when selected, works on the back scale method but the adjustment remains the same as for the high ohms; that is, set to full scale, this saves time in switching between the two ohms ranges.

The many jobs that this instrument will save you time on, will easily repay the little time and cost that its construction will entail. The parts used, as listed below, should be adhered to. This will insure accuracy comparable to the original model.

Parts List

LAFAYETTE
1—0-1 ma. meter K10696
1—Meter box K10531

CONTINENTAL
1—White panel K10532
1—Resistor 9950 ohms
1—Resistor 100,000 ohms
1—Resistor 500,000 ohms
1—Resistor 1 meg. ohms

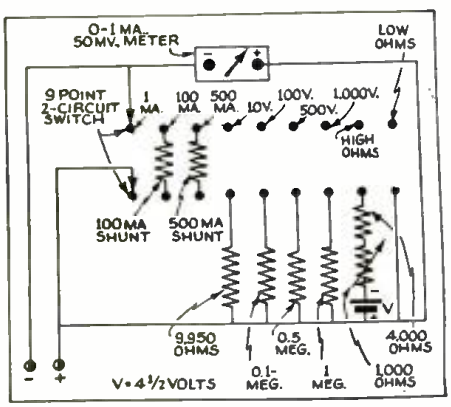
RADIO CITY
1—100 ma. 50 mv. shunt
1—500 ma. 50 mv. shunt
1—Trutest 4000 ohm resistor K4263

YAXLEY
1—9 point 2 circuit switch 3129J
1—1000 ohm potentiometer C1MP

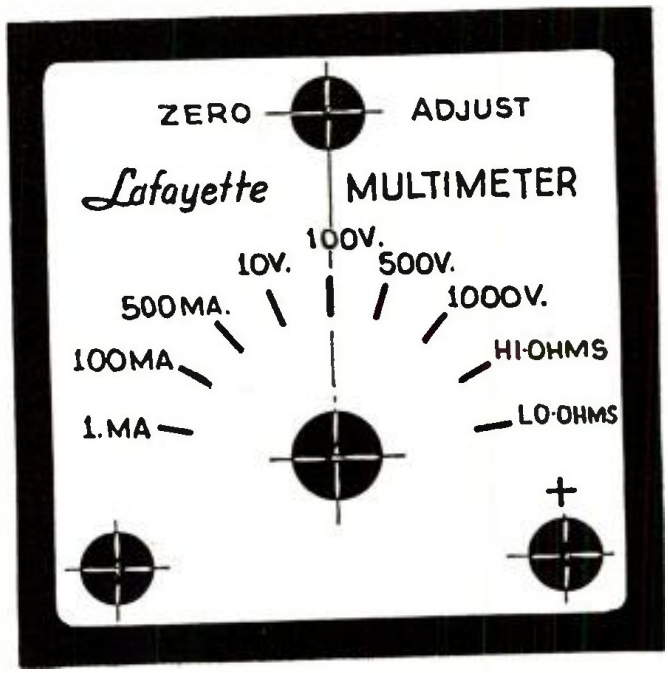
MISCELLANEOUS
2—Tip jacks
1—Small knob

NAT'L CARBON CO.
1—Eveready battery 4½ v. No. 781
1—Misc. asst. wire, solder, etc.

*Technical consultant, Radio Wire Television, Inc.



Left—Wiring diagram of the volt-ohm-milliammeter. The parts required are of nominal cost and easy to assemble. ➤



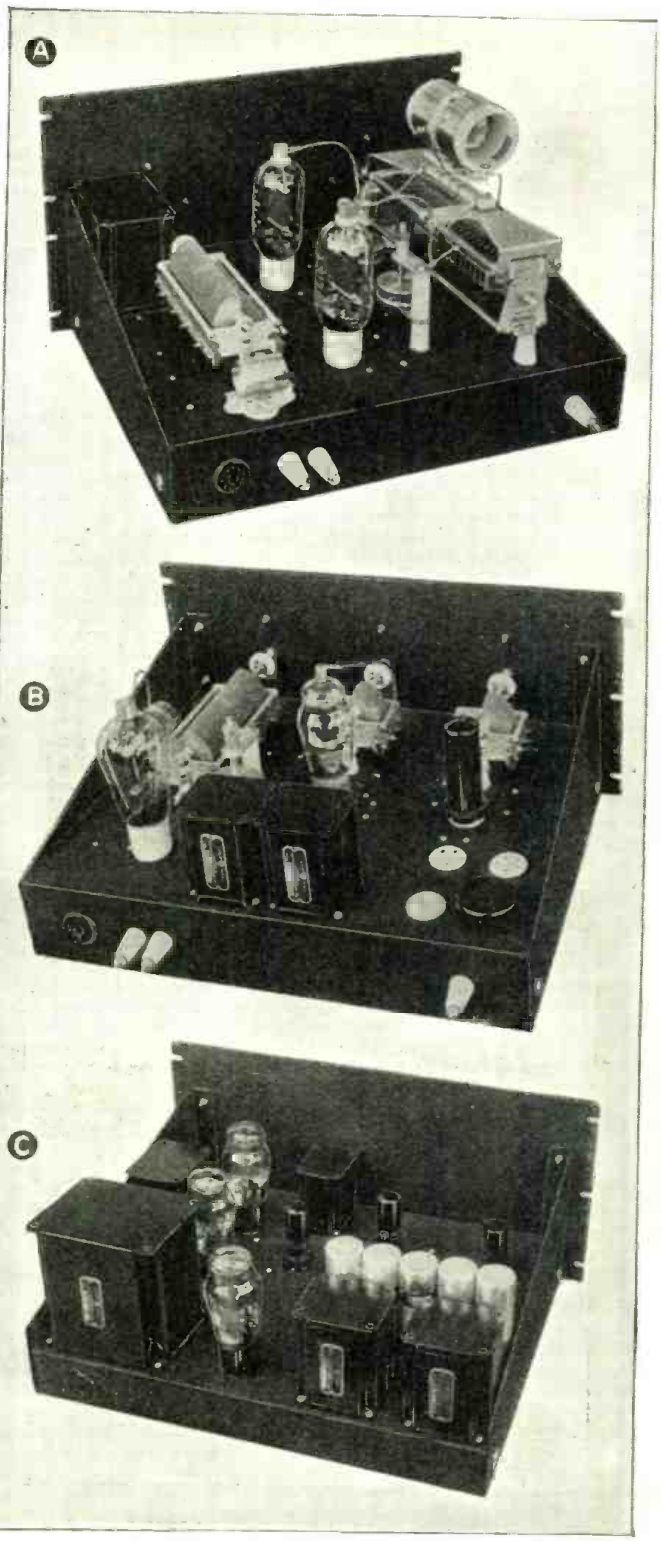
Right—Full size scale—a copy of this one is readily made and pasted on the meter scale. ➤

THE EDITORS WANT

Good Construction Articles on Simple Test Apparatus which the Student, Average Set-Builder and Ham can build. Photos, diagram and "uses" should accompany article.

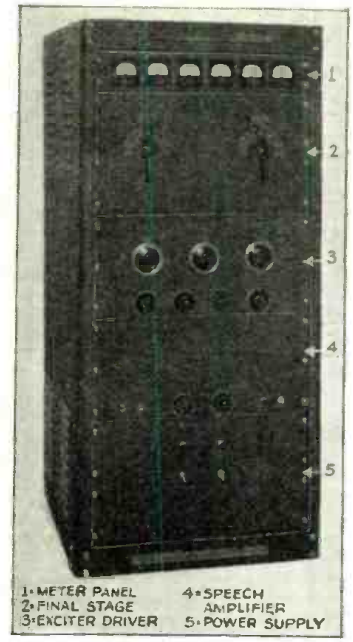
Phone or CW Hot on this 250 Watt Transmitter

C. T. Kolz, Jr.—W2BKZ*



Left—Rear views of respectively Final Stage; Exciter-Driver Stage, and Speech-Amplifier unit.

Front view of complete 250 watt CW and phone Transmitter. It has band switches.



● NOT so long ago, at one of our more interesting "Bull sessions," the discussion became centered around one item on which there was no available data. That unknown was the proper relation of physical cabinet size to the final stage power input of the well designed plate modulated phone transmitter. As one can readily see, there are debatable points in the question even at this early stage. Firstly, what was meant by a well designed transmitter? These conclusions were arrived at and constituted the basis of a good ratio of transmitter size to final stage input power. A well designed unit for phone work had to have:

1. Three or more stages in the R.F. section depending on crystal frequency, frequency of operation, and power output desired. No more than necessary to accomplish an end.
2. Component parts (transformers, condensers, coils, resistors etc.), rated well above the voltages and currents present in the circuit with careful consideration towards surges, peaks and higher than normal primary power source.
3. Proper selection and application of vacuum tubes, with careful observation of their dissipation, element voltages and other incidental precautions usually contained in the manufacturers' tube characteristic sheets.
4. Good layout from mechanical as well as electrical viewpoint—shortest possible leads where necessary (i.e.—R.F. tank and ground circuits).
5. Best possible insulation (i.e., polystyrene, mycalex or good ceramics) in R.F. circuits.
6. Complete assembly within an enclosure with a thought to the proper ventilation of all component parts by the use of louver, screening or fans.
7. Precautionary measures for both man and instrument alike in the form of relays, circuit breakers and door switches.

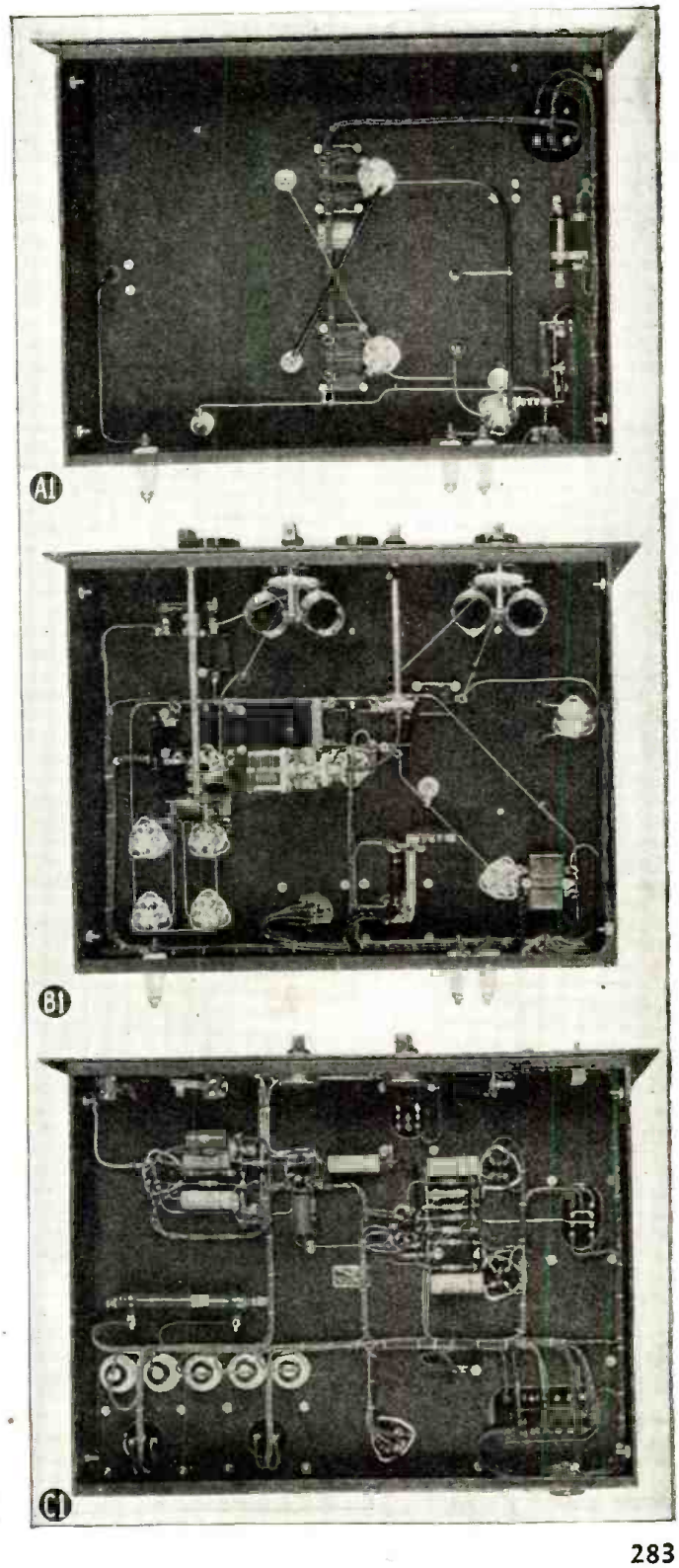
Generally speaking, good design is dependent on these seven points. With this in mind a number of various power, well designed transmitters were examined and the following conclusions on a fair ratio between physical size and final stage power input were drawn. Inputs from 1000 to 250 watts required a space of .03 to .04 cubic feet per watt input. For powers below 250 watts the space requirements increased to .09 cubic feet per watt input to the final stage, indicating a waste of space as the power was

*Kenyon Transformer Co., Inc.

Rear view of complete transmitter—Power-supply is built-in at bottom of cabinet.

Right — Looking downward—bottom views of Final Stage unit; Exciter-Driver, and last—the Speech Amplifier.

A first-class CW and phone transmitter—rated at 250 watts—all-band coverage. This transmitter was specially built for use at amateur station W2USA, New York's World Fair. It represents a well-designed, high-quality amateur transmitter, with separate power supplies for the stages requiring them.



reduced. Again we repeat, these findings are for *plate-modulated phone transmitters,* CW units obviously requiring less cubic area.

Stage Line-Up

Consequently, with this information in hand, a 250 watt transmitter was designed and built which gave all the desired results and was, at the same time, a commercial looking unit of mechanical simplicity, as can be seen from the photographs. All the components are distributed on four chassis, three removable and the fourth, the power supply, is built into the cabinet base. The three detachable chassis, reading from top to bottom, are the *final stage,* the *exciter-driver,* and the *speech amplifier.* All necessary meters are grouped on a separate 3½" panel at the top of the cabinet. The final stage consists of a pair of T-40's in push-pull. Location of all parts is apparent from photographs. The only machine work necessary besides the drilling of the chassis, was the fabricating of a pair of brackets to support the plate inductance. This was fashioned from a piece of scrap 1/16" aluminum, an item usually found in most hams' junk boxes. The brackets are bent, drilled and mounted so as to position the Johnson mounting bar directly over the center of the final tank condenser, making certain that there is sufficient clearance between the bottom of coil plugs and the condenser stator plates. The use of this particular type of neutralizing condenser makes for a neat above-deck arrangement, in that the grid connections of the neutralizing condensers are taken from the retaining nuts below the deck connectors directly to the grid prongs of the final tubes beneath the chassis. The exciter-driver is mounted on a similar chassis right below it and consists of a 6L6, tetrode crystal oscillator with provisions for four crystals. A switch on the front panel allows quick selection of the desired quartz plate. An RK-39 follows and may be utilized as either a straight amplifier or a frequency doubler, depending on the crystal frequency and the final stage frequency. It is advisable though, to operate the stage in the latter capacity due to the ease with which beam tubes go off into self-oscillation when operated as straight amplifiers. Shielding of the tube was found unnecessary.

Band-switching is employed in both the 6L6 and RK-39 stages, with switching done by means of controls on the front panel. There is also a variable coupling capacity between these stages to take care of the excitation requirements when changing from band to band. The driver to the final is a neutralized T-20. Link coupling is employed between the driver and the final grid circuit. Filament potentials are taken from separate transformers mounted on their respective chassis, thereby eliminating unnecessarily long interchassis leads, with the usual voltage drop and subsequent reduction of tube life.

Speech Amplifier

The speech amplifier chassis is a self-contained unit with its own power supply employing a 5Z3, and in a pinch, may be

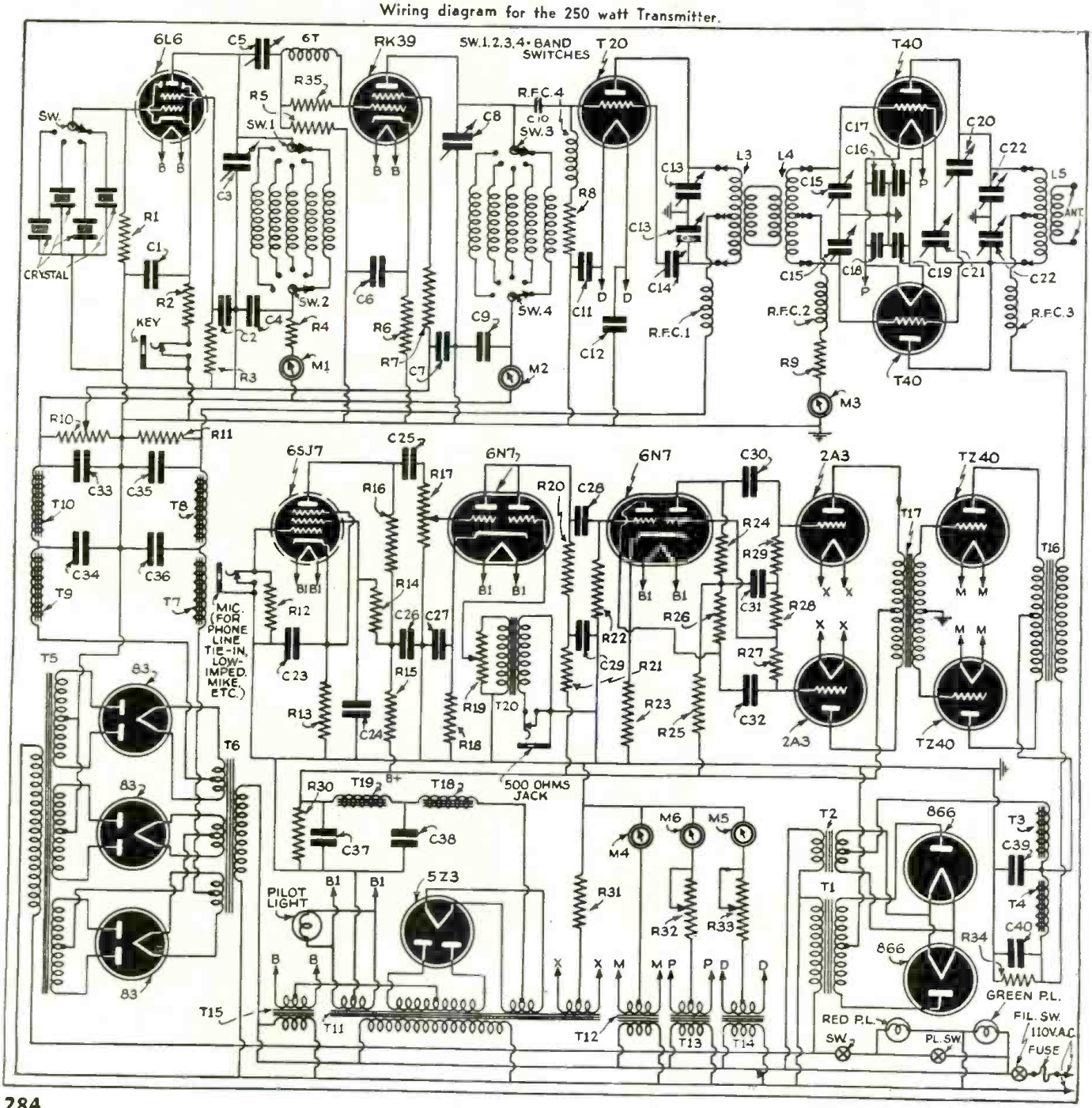
removed from the transmitter for other applications. The tube lineup consists of a high gain 6SJ7 resistance coupled to a 6N7. Provisions for a high-level low-impedance input is included and fed into the second grid of the 6N7. A separate gain control regulates the level to the grid. A phase inverter 6N7 follows, energizing the grids of the 2A3's. A pair of shielded leads from the driver transformer on this chassis carries the audio to the grids of the TZ-40 modulators, mounted on the power chassis where the other power components are also located. Utilizing the base of the cabinet as a chassis not only eliminates the extra chassis cost but provides space for larger and heavier duty transformer units. Connections to the six meters are neatly made, cabled and clamped at various places.

A few words might not be amiss, at this point, regarding constructional details. When wiring the exciter unit, it is of *utmost importance* to mount R.F. components so that all ground returns actually return at the same point within that particular stage. They should then be soldered to a chassis ground at that point with a common ground bus connecting all such spots. All variable tuning condensers (even though indicated on the schematic as being at ground potential) should be mounted on standoff insulation with their rotor plates returned *directly* to the ground point within the stage. This also means that all shafts will require insulated flexible couplings. These precautions may seem somewhat severe, but experience has shown that long indirect ground paths can be more than troublesome in the proper operation of vacuum tubes regardless of the application.

Tuning Up!

In tuning up for the first time, plate voltage to the T-20 and final stages is removed by disconnecting high voltage leads found on the right rear of both the exciter and final chassis. This is done to facilitate neutralizing of these two stages. First, selection of the desired crystal and coil setup is made by rotating the crystal and band-switching switches to the correct positions. The variable coupling condenser is set arbitrarily and the oscillator tank condenser resonated. At resonance, the plate current should be in the neighborhood of 25 to 35 ma., depending on the frequency and condition of the crystal. After resonating the RK-39 plate circuit, neutralization of the T-20 should be completed. The same procedure is duplicated for the final stage. Plate current for the RK-39 should be about 60 to 70 ma., with the T-20 and final stage drawing about 90 and 250 ma., respectively, under load. The correct position of the variable coupling condenser can be determined by increasing the capacity from

Wiring diagram for the 250 watt Transmitter.



minimum towards maximum and observing the RK-39 plate current. A steady rise in current will be noted until a point is reached where it will remain stationary, regardless of further increase in capacity. It will then probably start to drop off due to over-excitation causing a saturation of its grid. When this occurs the output of the tube falls off rapidly. Obviously then the position for the coupling is at a point where the tube has reached its highest plate current or at a point where sufficient power is present to drive the following stage. As the coupling is increased, it will be necessary to retune the oscillator plate tank due to the loading effect of the coupling device. The 4500 ohm tap on the modulation transformer secondary is proper for the load presented by the final stage when connected to an external load. The variable antenna *link* coil may be fed to any low impedance type of line directly to the antenna or antenna network. The complete transmitter operates in an exceptionally efficient manner, is self-contained, and compact in that it occupies only .04 of a cubic foot for every watt input to the final stage. At a quarter of a kilowatt input that's packing up a lot of watts into a small space.

Parts List for 250 Watt Transmitter

CORNELL-DUBILIER

C1	4-6D2	.002	Mf.
C2	4-6D2	.002	Mf.
C4	4-6D2	.002	Mf.
C6	4-6D2	.002	Mf.
C7	4-6D2	.002	Mf.
C9	4-12D2	.002	Mf.
C10	4-12T2	.0001	Mf.
C11	4-6D2	.002	Mf.
C12	4-6D2	.002	Mf.
C16	4-6D2	.002	Mf.
C17	4-6D2	.002	Mf.
C18	4-6D2	.002	Mf.
C19	4-6D2	.002	Mf.
C23	BR102AS	10	Mf.
C24	DT4P1	.1	Mf.
C25	DT6S1	.01	Mf.
C26	EP9080	8	Mf.
C27	BR102AS	10	Mf.
C28	DT6S1	.01	Mf.
C29	EP9080	8	Mf.
C30	DT6S1	.01	Mf.
C31	EP9080	8	Mf.
C32	DT6S1	.01	Mf.
C33	TLA 6040	4	Mf.
C34	TLA 6040	4	Mf.
C35	TLA 10020	2	Mf.
C36	TLA 10020	2	Mf.
C37	EP9080	8	Mf.
C38	EP9080	8	Mf.
C39	TJU15040	4	Mf.
C40	TJU15010	1	Mf.

CARDWELL

C3 MR 150 BS
C5 ZR 50 AS
C8 MR 150 BS
C13 MO 180-BD
C15 MO 180-BD

BUD

C14 NC853
C20 NC853
C21 NC853
6—436 Feedthru insul.
1—CR1771 cabinet
2—PS1254A Panels
2—PS1255A Panels
1—PS1251A Panel
1—CB659 chassis
2—CB660 chassis
3—MB460 brackets
RFC CH569 choke

I.R.C. (Resistors)

		Ohms	
R1		100.000	½ Watt
R5		75.000	2 Watts
R7		100	½ Watt
R12		3 Meg.	½ Watt
R13		1000	½ Watt
R14		1 Meg.	½ Watt
R15		50.000	½ Watt
R16		50.000	½ Watt
R17	13-133	500.000	Pot.
R18		1000	½ Watt
R19	13-133	500.000	Pot.
R20		250.000	½ Watt
R21		50.000	½ Watt
R22		500.000	½ Watt
R23		1000	½ Watt
R24		250.000	½ Watt
R25		50.000	½ Watt
R26		250.000	½ Watt
R27		250.000	½ Watt
R28		25.000	½ Watt
R29		250.000	½ Watt
R35		300	½ Watt

WARD LEONARD

		Ohms	
R2	507-397	200	10 Watt
R3	507-341	5000	10 Watt
R4	507-436	5000	20 Watt
R6	507-334	500	10 Watt
R8	507-341	5000	10 Watt
R9	507-433	2500	20 Watt
R10	507-356	15000	50 Watt
R11	507-361	50000	50 Watt
R30	507-458	25000	50 Watt
R31	507-335	750	10 Watt
R32	507-243	200	25 Watt
R33	507-333	400	10 Watt
R34	507-227	25000	100 Watt

KENYON (Transformers and Chokes)

T1 T-671
T2 T-360
T3 T-521
T4 T-167
T5 T-658
T6 T-355
T7 T-165
T8 T-165
T9 T-152
T10 T-152
T11 T-214
T12 T-359
T13 T-359
T14 T-353
T15 T-351
T16 T-467
T17 T-271
T18 T-154
T19 T-154
T20 T2

BROWNING LABS.

L1—BL-5P
L2—BL-5P

BARKER & WILLIAMSON (Coils)

L3— 10 MCL 10 meter band
20 MCL 20 meter band
40 MCL 40 meter band
80 MCL 80 meter band
160 MCL 160 meter band
L4—Same as L3

JOHNSON "HI-Q"

L5—669 Mounting base
660 10 meter band
661 20 meter band
662 40 meter band
663 80 meter band
664 160 meter band
RFC1 Johnson 750 choke
RFC2 Johnson 750 choke
RFC4 Johnson 750 choke
C22 100 ED 45
2—224 sockets

TRIPLETT

M1—227A 0-100 Ma. Meter
M2—227A 0-150 Ma. Meter
M3—227A 0-100 Ma. Meter
M4—227A 0-150 Ma. Meter
M5—227A 0-150 Ma. Meter
M6—227A 0-500 Ma. Meter

AMPHENOL

1—SS8 socket
5—SS5 socket
3—SS4 socket
8—S4 socket
3—S8 socket
3— S11 socket
3—PM11 plugs

MISCELLANEOUS

5—BUD FC795 couplings
2—BUD JL1695F Pilot lights
2—10 amp. Toggle Switches
4—BUD J1325 Csld. ckt. jacks
5—BUD TC490 Tube caps
1—4 Pos. Isol. Rotary switch
3—BUD D1732 Dials
11—BUD indicator plates
6—BUD dial plates
1—BUD 1270 switch (interlock)
1—BUD 1348 switch bracket

TAYLOR

2—TZ40 Tubes
1—T-20 Tubes

RAYTHEON

3—83
1—6L6
1—RK39
1—5Z3
2—2A3
2—6N7
1—6SJ7

Principles of Frequency Modulation

Part II

Ricardo Muniz, E. E.*

● LAST month we discussed the general principles of *Frequency Modulation* and studied the differences between it and our present *Amplitude Modulation* system. We also took up the principles of the *Frequency modulation* receiver. We saw that differences in loudness are transmitted as changes in transmitted frequency—the louder—the greater the change or deviation. We also saw that differences in pitch were transmitted as differences in the rate at which this deviation took place. We saw that the *limiter* in the receiver "ironed out" all signals to the same amplitude—thus correcting distortion in the I.F.'s; fading; and removing most noise. The *discriminator* stage, we saw, does not respond to amplitude modulated signals (such as noise) but does convert Frequency Modulated signals into conventional Audio Frequencies.

This month let us look into the various methods available for producing a *frequency modulated* wave, and also study the principles upon which these are founded.

BASIC PRINCIPLE: The Basic Principle involved in producing a frequency modulated radio wave with the characteristics spoken of above is extremely simple. Looking at Fig. 1 we see a simple radio oscillator. Notice that in place of the usual tuning condenser, we have a *condenser microphone.* With no sound impinging on the diaphragm, the capacitance between the plates of the condenser microphone connected across the main tank inductance *tunes the oscillator to a definite frequency.* This frequency we will call the *rest* frequency or "steady state" frequency. This frequency corresponds to the carrier frequency of the Frequency Modulation broadcaster. Now imagine a sound striking the diaphragm. The sound causes the diaphragm to vibrate back and forth. As the diaphragm comes closer to the back plate the capacitance of the condenser microphone *increases.* As the capacitance increases the tank is tuned to a lower frequency. *The stronger the sound the greater the movement of the diaphragm and the deeper the dip in frequency of the oscillator.* As the diaphragm moves further away from the back plate (than it was at the rest position) during the other half of its vibration cycle—the capacitance of the condenser microphone is *reduced* and the frequency of oscillation of the oscillator *is increased in proportion to the amount of movement of the diaphragm in this direction.* Thus with this simple analogy we have explained the production of *frequency modulation* radio waves.

In actual practice this simple method is never applied, because the actual frequency variations are too small. The fact that the microphone is an integral part of the transmitter, is also an inhibition to the use of this system. The systems actually used, however, perform exactly the same function. Practical systems are far more complex in their detailed principles of operation. We will take them up in the order of their complexity.

SIMPLEST "HAM" FREQUENCY MODULATION: The amateurs have used in their simpler F-M transmitters a system of producing frequency modulation known as a *reactance modulator.* In broadest terms a reactor tube is used which is connected in such a manner that the inductance of its plate circuit is made to vary with the variations of voltage input to the reactor tube from the speech amplifier system. This variation in plate circuit inductance is caused to control the frequency of an oscillator. This inductance is *not* in the form of a coil and is therefore a little difficult to conceive. *The vacuum tube circuit does, however, behave like an inductance!* Remember that in an inductance the current *lags* the voltage. If we can make the plate current lag the plate voltage in a vacuum tube, the plate circuit will behave like an inductance.

In practical reactance tube modulators the R.F. voltage developed by the oscillator is fed to the plate of the reactance tube. Some of this voltage is also fed to the grid of the

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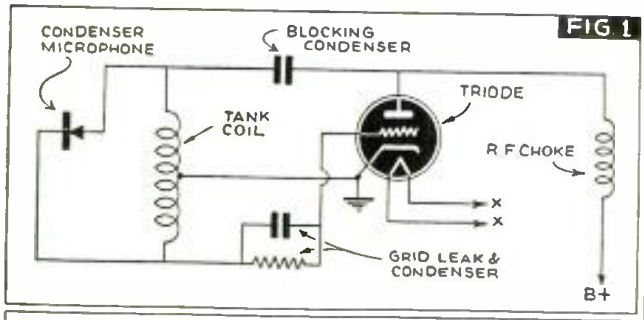
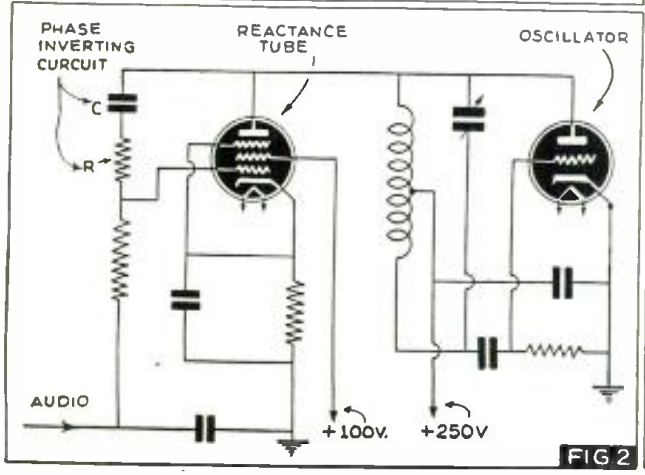
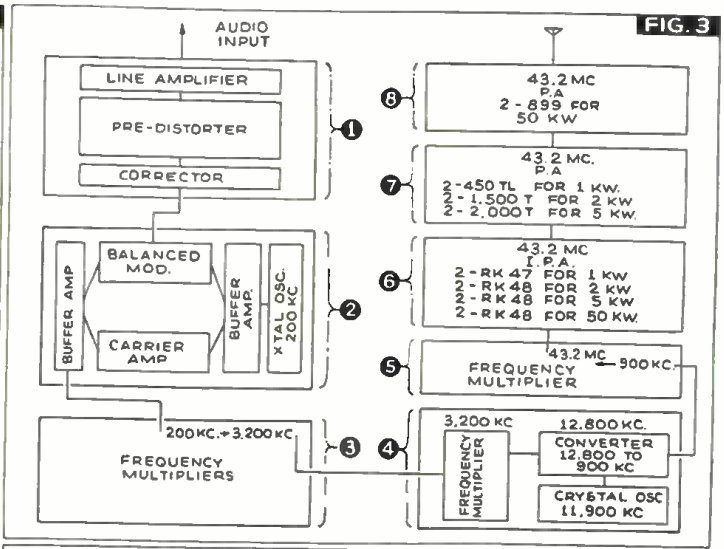
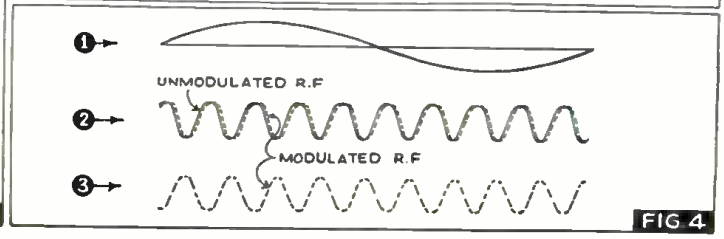
Fig. 1—Elementary frequency modulation transmitter circuit with condenser microphone. Fig. 2—Transmitter with reactance tube modulator. Fig. 3—Armstrong's F-M transmitter with frequency multiplier circuits. Fig. 4—Comparison of unmodulated and modulated R.F.









reactance tube through a phase shifting R-C circuit so that the voltage applied to the grid of the reactance tube lags 90 degrees behind the voltage being applied to the plate *but is of the identical frequency.* The plate current of a tube is always in phase with the grid voltage; therefore the plate current will lag the plate voltage 90 degrees. The plate circuit will take on the characteristics of a pure inductance. By applying variable D.C. to the grid from the speech amplifiers, the magnitude of the plate current can be varied. This appears in the plate circuit as a *variation in the inductance* presented by the reactance tube to the oscillator. Thus the tank coil of the oscillator has, *in effect, connected across it a variable inductance.* Since the resultant inductance of two inductances in parallel is equal to the reciprocal of the sum of the reciprocals of each, the resultant inductance in the tank circuit will be varied due to the reactance tube inductance variations. This modulation of the tank inductance will produce corresponding variations in the oscillator frequency. The magnitude of the dips or rises of frequency will be proportional to the magnitude of the D.C. voltage applied to the grid of the reactance tube from the microphone and the speech amplifiers. The rate at which these dips and rises will take place is proportional to the rate of change of the D.C. voltage applied to the grid of the reactance tube—therefore to the frequency of the sound impinging upon the microphone. We have therefore accomplished frequency modulation of the oscillator. The disadvantage of the system lies in the fact that some *amplitude modulating* does take place as well. This makes it undesirable for commercial applications or for the better amateur applications. (See Fig. 2 for circuit of reactance modulator.)

Another disadvantage of the reactance tube modulator is that the oscillator *cannot be crystal-controlled.*

THE ARMSTRONG SYSTEM OF FREQUENCY MODULATION: The best system of Frequency Modulation available today appears to be Major Armstrong's system. Other systems are in existence but little is known about them outside the laboratories where they were developed. Western Electric has a system differing from Major Armstrong's. The National Broadcasting Company's R. E. Shelby has developed a different system. We will restrict ourselves in this article to the *Armstrong system,* since this is the only one finding wide application at this time. Even in describing this system we must needs be sketchy because of the tremendous complexity of detail involved in this system.

First let us take a general look at this system. Refer to block diagram Fig. 3. First we see the audio system. Here we find a line amplifier, which is standard except for the fact that its "flat" frequency response extends to 15,000 cycles! Next a pre-distorter. The pre-distorter amplifier emphasizes the higher audio frequencies to help override noise-level at the receiver. A corrector network in the receiver "undistorts" the highs. The next unit in the audio system is a corrector amplifier which insures that frequency deviation will be independent of modulating frequency and directly proportional to the amplitude of the modulating sound. Its output is inversely proportional to the frequency.

The next unit we see is the Modulator. It contains a crystal-controlled oscillator and its buffer amplifier. A balanced modulator whose output is zero with no modulation, but with modulation produces only side-bands. A buffer-amplifier in which the side bands produced by the modulator are mixed with the output of a carrier amplifier which follows the buffer of the oscillator. The phase shift between the modulated and unmodulated currents in this amplifier are a small but exactly proportional replica of the wave finally transmitted.

The Frequency multipliers follow and are shown as the next unit in the block schematic. These multipliers increase the initial frequency (usually 200 kc.) and also increase the phase shift proportionally. The *phase shift* represents, of course, a *frequency difference.* The frequency output of this unit is 12.8 mc.

In the following unit another temperature-controlled crystal-oscillator is found, which is employed to heterodyne the 12.8 mc. down to 1/48 of the assigned frequency of the *frequency modulation* broadcasting station in question.

The next unit (#5) contains further frequency multipliers. These are four doublers and a tripler. This beat-back system, making use of the heterodyne reduction in frequency, permits the initially very small, but linear, *phase shift* to be increased sufficiently to accomplish the required wide frequency band of deviations for F-M operation. The output of this unit is 10 watts of F-M.

Unit #6 is usually a 300 watt screen grid intermediate power amplifier. Unit #7 contains a well designed Class C power amplifier stage of the required capacity.

The Armstrong type *phase-shift* frequency modulation broadcast transmitter is a very complex looking aggregation of units. Its complexity is an illusion created by the large number of tubes and parts. The principles of operation are not unduly complex, however, and most of the tubes are small receiving set size tubes. Only the *power amplifiers* use large tubes.

THEORY OF OPERATION OF ARMSTRONG SYSTEM: It will be noted that in the Armstrong system outlined above, *PHASE SHIFT* is the basis from which the final *frequency modulated* wave is produced. The system is frequently referred to as *Phase Modulation.* It is really *frequency modulation,* however, because when we shift the phase of one component of a wave with respect to the other components, we have at that instant changed the frequency of the wave. A study of Fig. 4 shows that we have made instantaneous changes in the frequency of the original wave by shifting the phase at various times. The amount of *phase shift* varies in various parts of the wave to correspond to the original audio voltage supplied to the speech amplifier—thus the new frequency of the radiated wave is changed to correspond to the original audio voltage. Again—the rate of change of frequency of the radiated wave depends upon the audio frequency, while the total deviation attained for any one audio cycle depends upon the audio volume being transmitted. We have therefore in the Armstrong system genuine *frequency modulation.*

The need for the *Corrector* amplifier in the audio system of the transmitter is easy to understand, if we take the following facts into consideration. In the *phase modulation* system, unless corrective measures are applied, the frequency deviation produced is controlled by *both* the *amplitude* and the *frequency* of the modulating voltage. The fact of the matter is that the higher modulation frequencies give us the faster rates of change of phase shift and tend to give the greatest frequency deviation. We want the high frequencies to produce a high rate of change of transmitted frequency (in order to get a greater number of deviation "bumps" per second, to correspond with the audio frequency) but we do *not* want this greater rate of change of frequency to produce a greater total change of frequency.

There is an easily understandable tendency for something which is changing faster to change further if allowed. This tendency is compensated for by a carefully designed *corrector amplifier,* which has the *opposite* characteristic, and reduces the amplitude of the higher frequencies of the audio with respect to the lower ones just enough.

List of Publications Concerning Major Edwin H. Armstrong's System of Wideband "Frequency Modulation"

Proceedings of The Institute of Radio Engineers, May, 1936.
Electronics Magazine, March, 1939 and subsequent issues.
World-Radio (London), February 17, 1939.
Wireless World (London), May 4, 11, 18, 1939.
Technology Review (Massachusetts Institute of Technology), early 1939.
General Electric Review, May, June, July, 1939.
Fortune Magazine, October, 1939.

"B. C." Reception Area Greater with F-M

● THE area of good broadcast reception area with *frequency modulated* radio is 33 times greater than with amplitude broadcasting, according to tests and calculations announced by G.E. engineers.

These calculations were made by I. R. Weir, G-E radio engineer, using two amplitude and two frequency modulated transmitters operating on the same wave length and placed on level ground 15 miles apart. First the two amplitude transmitters each operating on 1 kilowatt were calculated to operate simultaneously. The area served without interference about either transmitter was limited to a radius of 1½ miles. Next the two frequency transmitters on the same 1 kilowatt of power were calculated. The area covered without interference was 33 times greater.

In the second condition the power was increased to 10 kilowatts on one transmitter and remained at 1 kilowatt on the other. With amplitude, the clear reception area of the 1-kilowatt station was reduced by interference from the stronger station to one-third its size, and the area of the 10-kilowatt station increased to about 3 times. When a switch was made to frequency modulation, under the same conditions, the clear area for the 1-kilowatt station was reduced one-fourth, whereas with the 10-kilowatt station the area was increased about 3 times.

Here's the amplified beginner's transmitter in action—a neat job — and economical to build.

The first part of this series, in the July issue, described how to build a low-priced *beginner's transmitter*; in this, the second part, the author describes how to add a few more parts and another tube, and thus produce greater power.

How To Get Increased Power from the R & T "Economy" Transmitter

Herman Yellin, W2AJL

● DID you build the simple one tube "Economy" transmitter described in the July issue? Well then, here is a second unit to add to the oscillator which will result in quite a respectable *all-band* transmitter. If you didn't build the oscillator unit, you can still build the two unit transmitter on a single chassis, since the oscillator unit will be briefly described here.

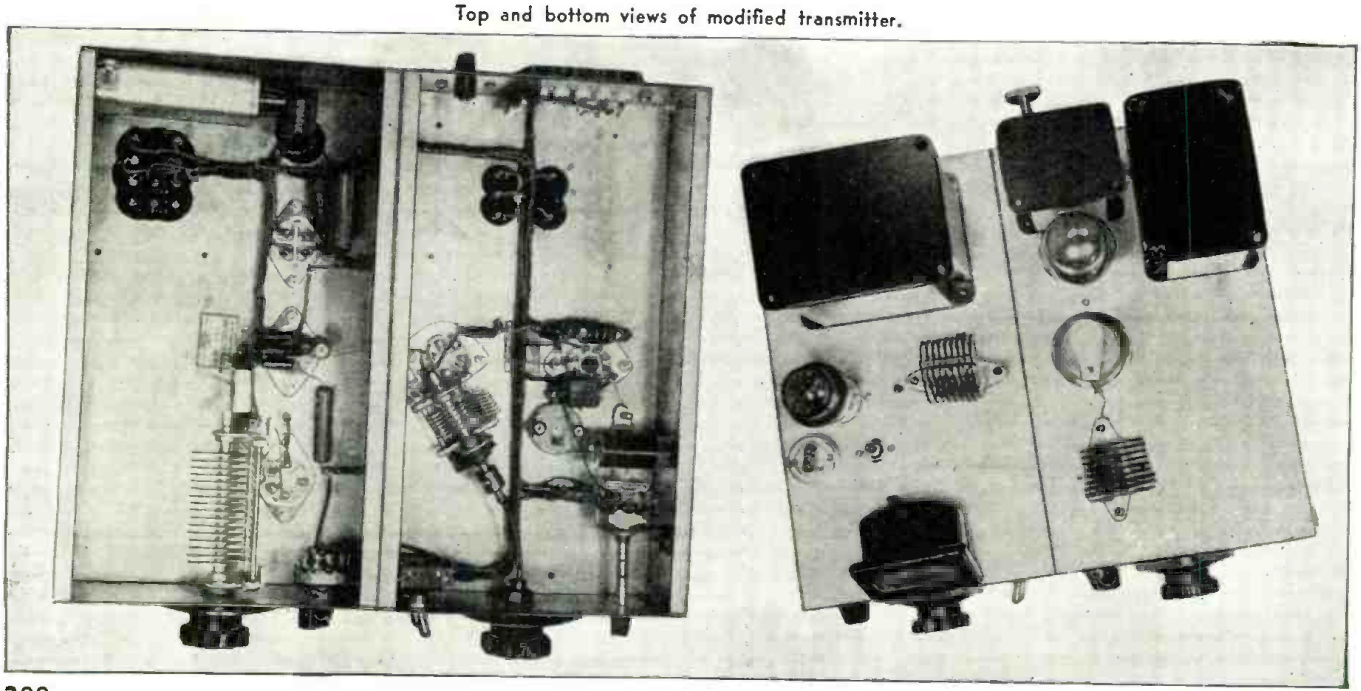
The oscillator unit described in the preceding article consisted of an 807 Tri-tet oscillator, employing a tapped fixed-tune cathode circuit, with a rotary switch to select the desired band corresponding to the crystal in use, thereby removing the tendency to mistune this circuit (since this seems to be the greatest source of trouble for beginners—and advanced amateurs, also). The plate circuit employed plug-in coils to obtain *all-band* coverage.

Adding the second unit—which is an amplifier section—will require a few slight changes to be made in the oscillator. Originally, the oscillator employed an 807 tube, but this tube is now to be used in the amplifier and is replaced by a 6V6G tube, necessitating the substitution of the 5 prong socket with an octal tube socket. The circuit remains the same as does all parts values, so the changeover is really not difficult. As an amplifier, the 807 will have an input of 70 watts (although the tube will stand greater inputs) and will furnish better than 55 watts of R.F., more than could be obtained as an oscillator, while the transmitter will have better frequency stability and have complete freedom from antenna reaction on the oscillator frequency.

Full Output on 10 Meters

The amplifier circuit is quite simple and straightforward. An isolantite based 2-35 mmf. mica trimmer condenser couples the oscillator plate to the untuned 807 grid circuit. This condenser should be adjusted for the minimum amount of capacity neces-

Top and bottom views of modified transmitter.



sary to adequately drive the 807. Too much capacity will result in overdriving the tube and will cause the control grid to run red-hot. This condition will occur with the condenser screwed up tight. If a 0-10 milliampere meter is available it can be temporarily connected between the ground end of the 15,000 ohm grid-leak and ground, and the trimmer condenser adjusted so that the meter indicates about 3 milliamperes. The oscillator output is quite large and with a 40 meter crystal, more than sufficient power is available from the oscillator to drive the 807 to full output on 10 meters.

Plug-in coils of the same type as used in the oscillator section are used in the amplifier plate circuit. Because of the higher plate voltage in the amplifier, a double spaced 100 mmf. tuning condenser is used.

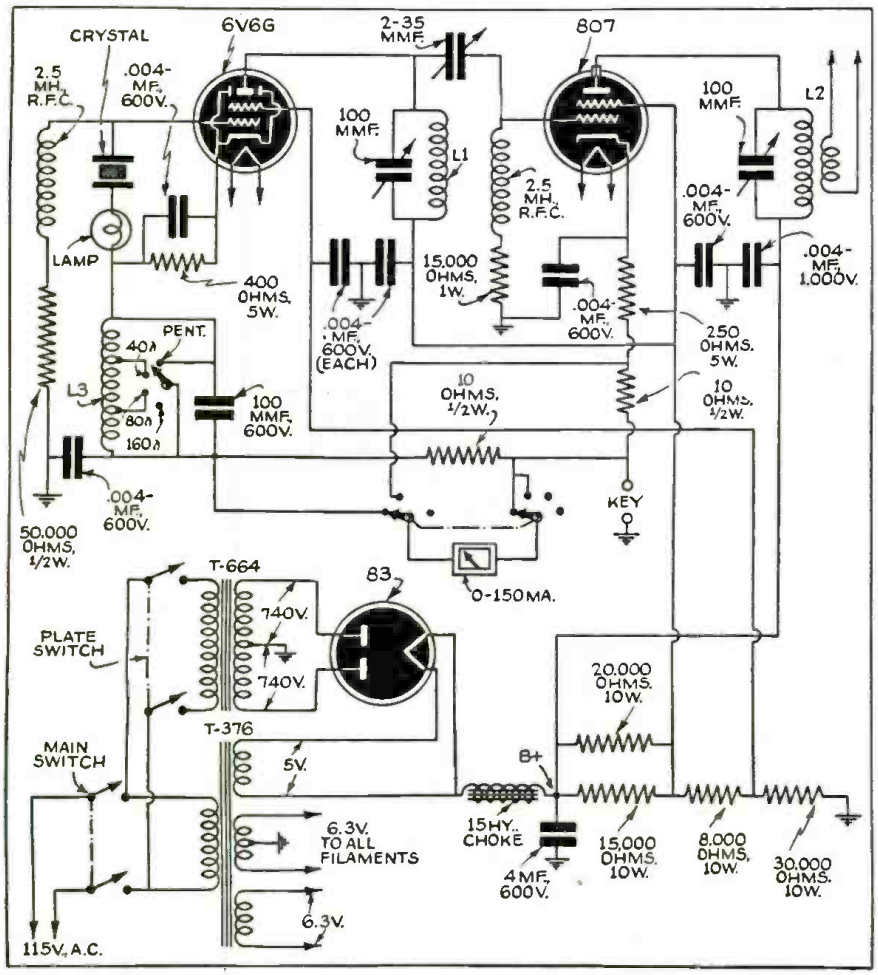
Meter Switch Is Useful

A two-pole rotary switch is employed for switching the 150 ma. meter to either the oscillator or amplifier cathode by switching the meter across permanently installed 10 ohm resistors. These small resistors have no effect on the circuit and avoid the need for a special switch to break into the desired circuits. Placing the meter in the cathode instead of the plate circuit keeps the meter *cold*, thereby reducing the possibility of a shock. However, it should be remembered that the screen current will be read *in addition to the plate current*, and therefore the meter reading will appear higher than if the meter were simply in the plate circuit. However, this is of small moment since the screen currents are quite low compared to the plate currents.

Built-in Power-Supply

The built-in power supply furnishes a maximum of 650 volts, which is applied to

Hookup of "Economy" transmitter, as modified to provide increased power.



the 807 plate and by means of the voltage divider, reduced voltages are applied to the other circuit elements. Sufficient filament supply is also available for the third unit, a high-power final stage which will be described in the next issue. Should it be desired to keep the power-supply separate and perhaps combined with the high voltage supply needed for the high power final, both the oscillator and 807 amplifier can be easily placed on just one chassis without any undue crowding.

In this "built-in" power supply, separate plate and filament transformers were used. This was done because it was desired to incorporate a filament supply for the high-power final. If the final stage is not to be added later, then this filament transformer should not be used hut a combined plate and filament transformer such as the Kenyon T-246 could be used instead; although if the constructor desires, he can use the same plate transformer employed by the writer and a small filament transformer such as the Kenyon T-386, containing a 5-volt rectifier winding and a 6.3-volt winding.

83 Can Take It!

Although some surprise may be exhibited at the application of so high a voltage (740) to the '83' rectifier, extended experience with this and other transmitters has shown that the '83' will stand up and is much cheaper than a pair of 866's.

Reference to the diagram will show that two resistors have been connected in parallel in the voltage divider. One of these, the 15,000 ohm unit was used in the oscillator and instead of getting a 25 watt resistor of the needed value, a 20,000 ohm resistor was paralleled across the old one. A 9500 or 10,000 ohm, 25 watt unit could have been used instead of the two.

Chassis Details

Both chassis are the same size—7" x 12" x 3" and are bolted together with four small bolts. Before fastening the two chassis together, all the necessary holes should be drilled or punched out—as their size may determine. Don't forget the holes in the side walls of the two chassis to allow for the passage of the *inter-connecting* wires. Three openings will be needed; one near the meter switch, another near the center of the side wall for the lead between the oscillator plate and the 807 control grid, and a third at the rear of the chassis for the power-supply leads.

Additions to the oscillator chassis consists of two toggle switches to control the built-in power supply. The new amplifier chassis contains not only the amplifier stage, but also the rectifier tube, filament transformer and filter choke and condenser, as well as the switch for connecting the meter into either the oscillator or amplifier cathode circuits. The plate transformer is mounted on the oscillator chassis.

Inspection of the photos will show the existence of some unused space in the amplifier chassis. If desired, a small antenna tuning unit can be installed, but this will depend on the type of antenna or antennas the constructor wishes to use.

By placing the key in the common lead to the cathodes of the two tubes, the keying of both tubes simultaneously is accomplished, permitting quite effective break-in. Keying was exceptionally clean-cut and devoid of any of the numerous keying difficulties that can make CW operation such a headache.

Tuning for Maximum Results

There is little to be said concerning the tuning of the two tube transmitter, since tuning of the oscillator was already described in the July article. The oscillator plate circuit is tuned for a dip in plate current (either at the second or fourth harmonic of the crystal frequency, or on the fundamental with the cathode coil "shorted") and then the amplifier plate circuit is similarly tuned for minimum plate current. Naturally, the meter must be switched to the tube being tuned. After tuning the amplifier plate circuit, the antenna can be attached and should cause the plate current to rise. Antenna coupling should then be adjusted to give normal plate current for the plate voltage being used, not forgetting that the meter is also reading screen current.

The link coil specified for the plug-in coils can be used with any antenna having a low impedance transmission line, such as a twisted pair line or a concentric line. Other types of tuned lines or high impedance lines will require some sort of tuning device between the link coil and the line. The single wire type of line used with the end-fed Hertz can be coupled through a condenser right onto the coil, the proper point being found by experiment. The tap on the coil can be brought down through the unused prong on the coil plug.

Parts List

(Besides parts already used in the oscillator unit)

BUD RADIO
1—7" x 12" x 3" chassis type #793
1—100 mmf. double-spaced condenser #MC-941
1—2¾" dial #D-1732
1—2½ mh. R.F. choke #CH-920W
1—set of end linked coils 10-160 meters type OEL
1—shield for 807 tube #278
2—double-pole single-throw toggle switches #1119

SPRAGUE PRODUCTS (Condensers)
2—.004 mf. mica condensers 600 volts type #1FM-24
1—2-35 mmf. trimmer condenser #TX-45A
1—8000 ohms, 10 watts type 10K
1—20,000 ohms, 10 watts type 10K
1—250 ohms, 5 watts type 5K
1—4 mf. 1000 volt filter condenser type CR-41

KENYON TRANSFORMER CO. (Transformers and Choke)
1—740-740 volts, 155 ma. plate transformer #T-664
1—filament transformer, 5 v. @ 3a; 6.3 v. @ 4a; 6.3 v. @ 4a; #P-376
1—filter choke—15 henry 165 ma; #T-154

RCA MFG. CO. (Tubes)
1—6V6G
1—83

AEROVOX CORP.
1—.006 mf. 1000 volt mica condenser #1650

I.R.C. (Resistors)
2—10 ohm, ½ watt, type BW½
1—15,000 ohm, 1 watt type BT-1

P. R. MALLORY & CO.
1—2 circuit, 6 contact rotary switch #3226J

JAMES MILLEN MFG. CO. (Sockets)
1—octal socket #33008
1—5 prong socket #33005
1—4 prong socket #33004

Coil Winding Data

L1 L2	Diameter	Length	Wire Size	Link Coil (wound at end) Turns	of L2 only)
160	1⅝"	1¾"	#24	56	4 turns
80	1⅝"	1¾"	#19	32	3 turns
40	1⅝"	1¾"	#16	18	3 turns
20	1⅝"	1¾"	#14	9	2 turns
10	1⅜"	1⅜"	#14	6	2 turns

NOTE—L1 and L2 are identical, except that the link coil may be omitted from L1 if home-made.

Cathode coil (L3)—53 turns #24 enameled on ¼" dia. form, tapped at 24 turns from ground end for 80 meter crystal, and tapped at 10 turns from end for 40 meter crystal.

3-Band Operation from Old Transceiver

C C. Erhardt, W2HNJ

● SAY, all you fellows who would like multi-band operation from your present rig, dig deep into that junkbox, dust off that old 5 meter transceiver, and put it back to work in the shack.

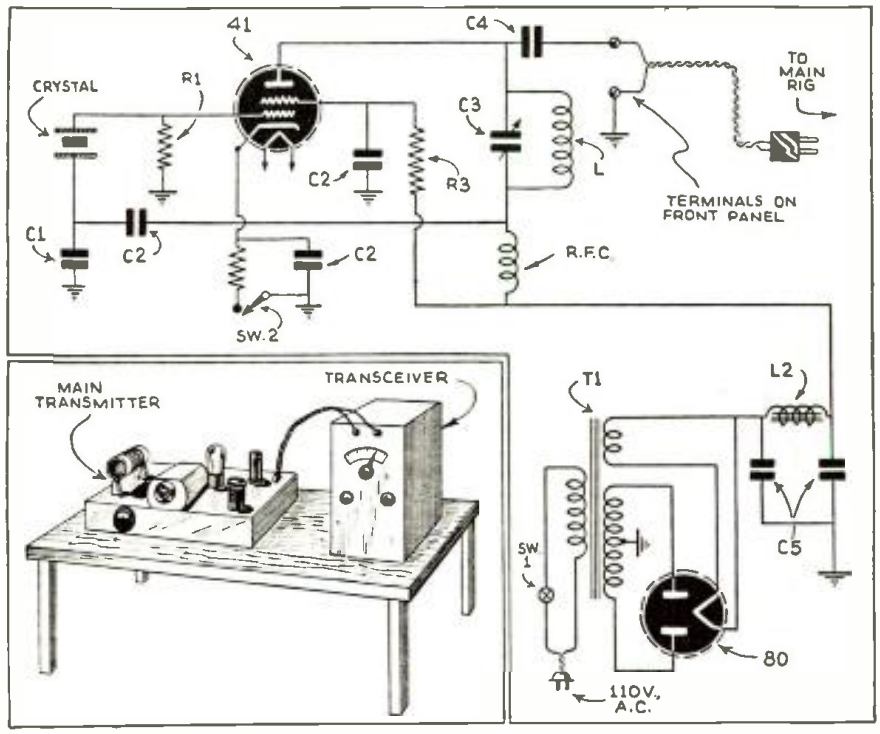
Many of the boys have been limited to one-band operation because they cannot afford more crystals, or, because of constructional difficulties, cannot add a doubler stage to their rig. For you gents, the arrangement to be described here will provide an answer to your problem.

Since most of the old *transceivers* are self-powered and fairly well shielded, they can be made into dandy plug-in type oscillators for two- or three-band operation.

The "blooper" used at W2HNJ was of the standard variety using type 76 and 41 tubes and built-in A. C. supply. The audio and R. F. sections were ripped out and the 41 hooked up in a "sure fire" oscillator circuit, which will really deliver, with about 200 volts on the plate. Use is made of both switches found in the transceiver. SW1 is used as previously to turn the power on and off, and SW2 (the former send-receive switch) is used to cut the B– during standby operation. Doubling is also accomplished in this circuit by using a tank coil which will hit two bands with the condenser specified. Capacity coupling is used between the oscillator and the following stage and no ill effects were noticed by using a feed line two or three feet in length. A piece of flexible lamp cord will serve very nicely. The feed line is connected to the former antenna posts and terminates in a 5 prong tube base. Connections should be made to the two pins which correspond to the proper terminals on the crystal socket.

Hooking up the oscillator is simplicity itself. Remove the crystal from the main rig and place in oscillator stage. Place the 5 prong plug in what was formerly the crystal socket. Our former oscillator stage on the main rig now becomes a doubler. Place a coil in the doubler stage which will tune to the crystal harmonic, tune 'er up. and you're all set. Due to the circuit isolation of the oscillator stage, keying is exceptionally clean cut and free from thumps and clicks.

Incidentally, should you ever require use of a portable rig, just mount a handle on the oscillator case, and you have a complete, self-contained transmitter, ready for instant use.



How old transceiver was re-wired to make plug-in oscillator.

List of Parts

C1 500 mmf. Condenser.
C2 .004 mf. Condenser.
C3 140 mmf. variable Condenser.
C4 100 mmf. Condenser.
C5 Dual 4 mf. Condenser.
R1 100,000 ohm Resistor.
R2 400 ohm Resistor.
R3 5,000 ohm Resistor.
L2 30 henry filter choke.
T1 250 volt transformer.

Coil Data (L)

Range (meters)	*Turns*	*Wire Size*	*Spacing*
160-80	40	22 D.S.C.	2"
80-40	20	18 D.C.C.	2"
40-20	8	18 D.C.C.	1¼"

All coils wound on 1½" forms.

Ultra-High Frequency Propagation Through Woods and Underbrush

B. TREVOR

● SINCE the use of frequencies above three or four hundred megacycles is finding increased usefulness the question naturally arose concerning the effect of foliage on the propagation of these frequencies. We might ask two questions:

1. What is the attenuation introduced by woods and underbrush by transmission through such a mass?

2. What effect does the foliage have on the indirect ray reflected from ground when the direct ray is in the clear above the underbrush?

A few experiments have been made in an attempt to partially answer these questions. A square patch of woods 500 feet per side on level ground was found which allowed a small 500-megacycle oscillator to be set up at one corner of the woods. The radiating antenna was nearly six feet above ground. The receiver in a car was driven from the remote corner of the woods along its edge, passing the corner of the woods 500 feet from the transmitter, and emerging in the clear in order to observe the difference in signal intensity as propagated over flat ground as compared with propagation through the trees and undergrowth. The receiving antenna was about 7 feet above ground. Measurements were made in July with full foliage out and again in November with no foliage present.

The results of these tests showed no appreciable difference between vertically and horizontally polarized transmissions in summer and an attenuation of 17 to 19 db. due to the trees as compared with transmission over plain ground.

In November somewhat lower attenuations were obtained since the foliage had dropped off. Using vertical antennas the attenuation was approximately 15 db. and with horizontal antennas 12 db.

The growth of vegetation was sufficiently dense to obstruct the view of the transmitter even with no foliage present.

Also in November a similar test was made on a frequency of 250 mc. In this case the attenuation was measured to be 14 db. with vertical and 10 db. with horizontal antennas. Summer measurements on this frequency have not been made.

It should be pointed out that the accuracy of these measurements is not very great due to the bad standing wave patterns in space which were observed on the far side of the woods. The values shown above represent the best average that could be obtained.

In July 500-mc. transmissions were observed over a 500-foot span of level ground and compared with transmissions of 500 feet over low scrub pines. The antennas were about 8½ feet above ground and the height of the undergrowth was approximately 5 or 6 feet. The ground at this location was nearly pure sand. With vertical antennas transmission over the vegetation showed a loss of 8 db. compared with transmission in the clear. With horizontal antennas the attenuation was 6 db.

Conclusion: From these measurements we conclude that there is considerable attenuation of ultra-high-frequency waves in passing through woods and underbrush and that there is little difference between vertically and horizontally polarized waves. Also there is a noticeable difference in the attenuation between summer and winter conditions due to the absence of green foliage in winter. There is an indication that the horizontally polarized waves are attenuated somewhat less. particularly under winter conditions.

Since the signal was attenuated with transmission over low scrub pines we are led to conclude that the indirect ground ray was reflected from a level above that of the sand ground rather than absorbed by the vegetation. Under the conditions of measurement an absorption of the ground ray by the vegetation would have given an increase in signal.—*Courtesy RCA Review.*

Amateur Radio Operator

LICENSE EXAMINATION STUDY GUIDE

(Courtesy Federal Communications Commission)

GENERAL INFORMATION

The paraphrased questions herein are representative of the scope of the questions contained in the amateur radio operators license examination and embraces radio theory, practice, laws and regulations with which the applicants for. and the holders of amateur radio operators licenses, should be familiar. The questions are given separately for the Class A and Class B examinations. the Class "B" examination questions also serving for the Class C examination.

The actual questions as given in the examination will appear in the short answer form such as multiple choice or simple diagrams and computations, etc.

The questions comprising the amateur examination do not. under any circumstances, require or permit an essay or explanatory type of answer; this will not exclude the labeling of component parts or the values which may be given in diagrams. In answering the type of question in which several choices are given, the applicant must choose one (and only one) of the answers shown. The numeral preceding the answer which is selected as correct must be inserted in the space which is provided. to the right of the question.

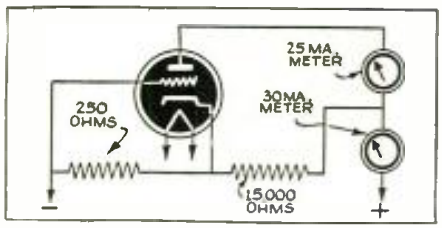
All paper necessary for the examination will be furnished by the Commission. Personal notes and texts must be left with the examining officer prior to the beginning of the examination and no note or text shall be referred to during the examination; failure to comply will result in the confiscation of the examination paper of the person involved.

The applicant must sign his name in the space which is provided on each sheet of the examination. Before beginning the examination the applicant should read carefully all instructions attached to the examination.

PARAPHRASE QUESTIONS

Class A

1. In the diagram below:
   (a) What is the d.c. plate voltage?
   (b) What is the d.c. grid bias?
   (c) What is the supply voltage?



2. What undesirable effects may result from a self-oscillating buffer amplifier in a transmitter?
3. What type amplifier and class of operation is usually preferred for a frequency doubler?
4. Why is it advisable to use a separate plate power supply for the oscillator of a multi-stage transmitter?
5. What is the most useful operating characteristic of a "push-push" type of amplifier?
6. What are the operating characteristics of the electron-coupled type oscillator with regard to frequency stability?
7. What circuit conditions will minimize the harmonic components in the output of a r.f. power amplifier?
8. What is the principal disadvantage of using a grid leak as the only source of bias in a Class-C r.f. power amplifier stage?
9. What are the relative merits of triodes and screen-grid tubes as r.f. amplifiers?
10. Show by a diagram the sinusoidal modulation envelope of an amplitude-modulated wave:
    (a) Modulated approximately 75%.
    (b) Modulated 100%.
    (c) Modulated more than 100%.
11. Draw the diagram of a plate-neutralized triode r.f. amplifier stage.
12. Draw the diagram of a coupling system between two audio-frequency amplifier stages, employing resistance elements.
13. What are the principal reasons for using a choke-input type filter in a power supply system employing mercury-vapor rectifier tubes?
14. Would mercury-vapor or high-vacuum type rectifier tubes of equivalent ratings be preferable for a power supply in which filament and plate voltages must be applied simultaneously? Give the reason for your choice.
15. What visible operating characteristic distinguishes mercury-vapor rectifiers?
16. Why are mercury-vapor type rectifier tubes more critical as to observance of anode voltage rating than high-vacuum type rectifiers?
17. What advantage has a push-pull audio-frequency amplifier over a single-tube Class-A amplifier of similar excitation requirement and equal power output?
18. What are the distinguishing operating characteristics of a Class-A type amplifier?
19. What improper operating conditions are indicated by upward or downward fluctuation of Class-A amplifier plate current when signal voltage is applied to the grid? What correction should be made?
20. Why is bias voltage generally necessary on the grid of an audio amplifier tube and what is the principal result of improper bias?
21. What improper operating conditions are indicated by grid current flow in a Class-A amplifier?
22. What is the principal advantage of a Class-B audio amplifier as compared to other types?
23. How should the average plate current vary in a properly designed and operated amplitude - modulated radio - frequency power amplifier?
24. What are the notable efficiency and distortion characteristics of a Class-B modulator employing two triodes in push-pull?
25. How do the excitation requirements of a Class-B modulator compare with those of a Class-A modulator having equal grid-voltage swing?
26. What would happen if the grid-bias supply of a Class-B modulator was suddenly short circuited?
27. What is the ratio of modulator audio power output to Class-C amplifier unmodulated plate power input in a plate-modulation system:
    (a) With a sinusoidal signal?
    (b) With a two-tone signal equivalent to speech?
28. Define amplitude modulation.
29. What are sideband frequencies?
30. What radiotelephone transmitter operating deficiencies might be indicated by downward deflection of the antenna r.f. current meter during modulation of the final r.f. amplifier?
31. Draw a schematic diagram of a combination heterodyne frequency meter and monitor.
32. Draw a simple schematic diagram of a peak modulation monitor which will indicate when 100% modulation occurs or is exceeded.
33. Draw the trapezoidal type patterns showing 50% modulation, 100% modulation and overmodulation as they would appear on the screen of a cathode ray oscilloscope properly connected to a 'phone transmitter.
34. Draw a diagram of an absorption-type frequency meter including a resonance indicator.
35. Draw a simple schematic diagram of a radio-frequency doubler stage driving a neutralized push-pull power amplifier using triodes, showing the method of interstage coupling and indicating the relative resonance frequencies of the grid and plate circuits.
36. Draw a schematic diagram of a two-stage r.f. amplifier using screen-grid tubes, showing a suitable method of interstage coupling.
37. Using a frequency meter with a possible error of 0.75%, on what whole-number kilocycle frequency nearest the low-frequency end of the 14,000-14,400 kc. band could a transmitter safely be set?
38. Using a frequency meter with a possible error of 0.75%, on what whole-number kilocycle frequency nearest the high-frequency end of the 14,000-14,400 kc. band could a transmitter safely be set?
39. What particular precaution should be observed in using a battery-operated heterodyne frequency meter?
40. What particular precaution should be taken in using an absorption-type frequency meter to check a self-excited oscillator?
41. What are the undesirable operation characteristics of a Y-cut crystal and what precautions should be taken when it is to be used for transmitter frequency control?
42. What is the purpose of using a quartz crystal in a transmitter?
43. What are the desirable operating characteristics of an A-cut crystal?
44. What particular physical characteristic distinguishes an X-cut crystal from Y- and A-cut crystals of the same frequency?
45. What would be the visible results of a short-circuited filter condenser in a plate power supply with high-vacuum rectifier tubes and an unfused primary circuit?
46. What precaution should be taken to protect filter condensers connected in series?

47. Why is a full-wave rectifier preferable to a half-wave rectifier?
48. Two filter chokes have the same inductance, current and insulation voltage ratings but one has twice the resistance of the other. Which would be preferable for use in a transmitter power supply and why?
49. What constructional precaution should be taken to insure stable operation of a transmitter having one or more neutralized amplifier stages?
50. Explain the purpose of using a center-tap return connection on the secondary of a transmitting tube's filament transformer.
51. On what amateur frequencies is frequency modulation of the emitted carrier permissible?
52. Draw a schematic diagram of a simple device for checking carrier shift of a radiotelephone transmitter.

Class B

1. Name the basic units of electrical resistance, inductance, capacitance, current, electromotive force or potential difference, power, energy, quantity, magneto motive force, and frequency.
2. Name the instruments normally used to measure (a) electric current; (b) potential difference; (c) power; (d) resistance; (e) frequency.
3. How may plate power input of an amplifier be determined when the plate voltage and plate current are known?
4. Explain the purpose of using a center-tap return connection on the secondary of a transmitting tube's filament transformer.
5. If the high-voltage secondary of a plate transformer was changed from a full-wave center-tapped to a bridge rectifier connection, what would be the relative voltage and current output ratings as compared to those for the full-wave center-tapped connection?
6. Why is it advisable to use a plate power supply for the oscillator of a transmitter separate from the final amplifier plate power supply?
7. How does a swinging choke operate to improve the voltage regulation of a plate supply filter system?
8. Why is full-wave rectification generally preferable to half-wave rectification in a power supply?
9. What are the relative advantages and disadvantages of mercury-vapor and high-vacuum rectifiers of equivalent filament ratings?
10. What are the principal output voltage ripple frequencies with half-wave and full-wave single-phase rectifiers, in terms of the a.c. supply frequency?
11. What is the principal reason for using a filter in a plate power supply system?
12. What would be a suitable type and the approximate capacitance of the filter condensers in a typical 1000-volt transmitter plate supply system?
13. What would be the visible operating results of a short-circuited filter condenser in a plate power supply with an unfused primary circuit?
14. Why should a fuse be used in the transformer primary circuit of a power supply system?
15. Why is a bleeder resistor connected across the output circuit of a high-voltage power supply system?
16. What would happen if the primary of a 60-cycle power supply was connected to mains carrying continuous direct current?
17. What is the principal advantage of a screen-grid type r.f. amplifier tube over a triode of equal output rating?
18. What tube rating indicates the maximum safe heat radiation capability of the anode of a vacuum tube?
19. In the classification of tubes according to the number of elements, how many grids has each of the following types: (a) diode; (b) triode; (c) tetrode; (d) pentode; (e) heptode.
20. Describe the adjustment procedure for proper neutralization in a radio-frequency power amplifier using an r.f. indicator coupled to the plate tank circuit.
21. Why is it necessary to neutralize a triode radio-frequency power amplifier operating with input and output circuits tuned to the same frequency?
22. What undesirable effects may result from operation of an unneutralized triode r.f. amplifier in a transmitter?
23. What undesirable effects result from frequency modulation of an amplitude-modulated carrier wave?
24. What operating conditions would be favorable for harmonic generation in a radio-frequency doubler or frequency multiplying amplifier?
25. Where is link coupling applicable in an oscillator-amplifier type transmitter?

(To be continued)

FURTHER HINTS AND KINKS ON THE R & T "FM" CONVERTER

RICARDO MUNIZ* and
WARREN OESTREICHER**

● WE have been listening in on our R&T FM receiver for over a month now and it certainly is entitled to be called a "musical instrument" instead of just a radio.

Because of the fact that we never are really finished experimenting with our projects, we are able from time to time to give the constructor hints which may help him to obtain better results from his job.

The following is some further information on construction aligning and tuning procedure which you may want to apply to your FM Converter.

The 6K8 oscillator and mixer is a swell high frequency tube, but one must remember that the oscillator section does not require very much feedback to oscillate. About two turns on the tickler, spaced one half inch from the main coil will do. If trouble with the receiver's stability is encountered, due to faulty wiring or other reasons, you will find that a plate-tuned oscillator will provide more stable operation.

If, at high audio level, the signal is distorted (and the audio system is OK) then the I.F. transformer windings are not close enough together. This means that the passed band is too narrow for high percentage *frequency modulation*. If the signal is accompanied by background hiss you will find that the oscillator is too tightly coupled or poorly aligned. If the limiter has no *noise-silencing* action, check the 6SJ7 plate and screen voltages. They should be equal, and between 70 and 95 volts. One should find about fifty volts (depending on the input signal strength) across the limiter control when a signal is tuned in (measured with a 1000 ohm/volt meter).

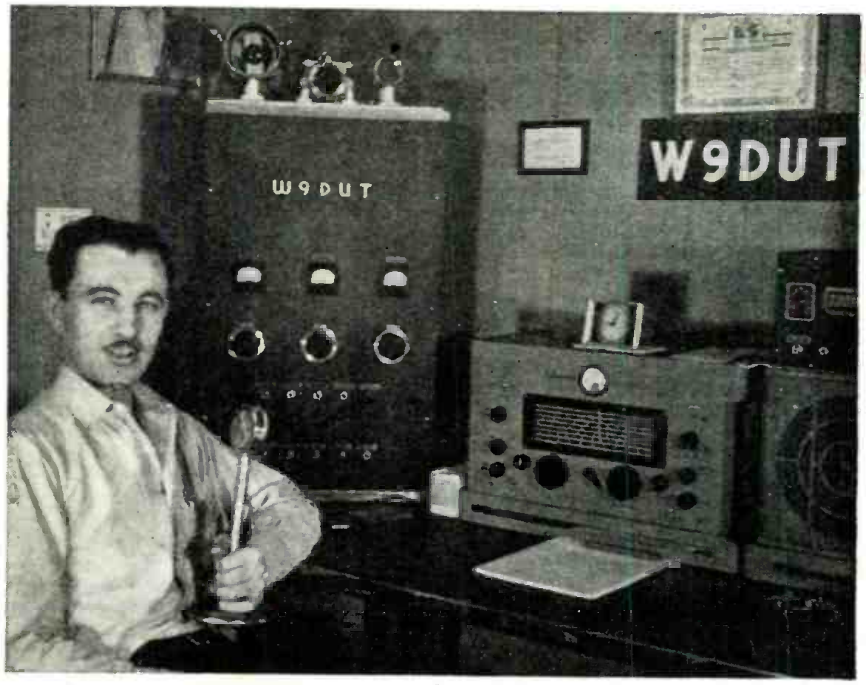
Antenna coupling of our FM receiver is quite critical. A single turn wound around the tuning coil, cemented in place after careful adjustment, was found to be even more suitable than the tapped method shown in our original article. The antenna used at our testing location is a tuned di-pole with Bassett concentric feeder as shown in the first article.

Remember that an extra hour spent in careful construction and layout, is as good as ten hours of trouble-shooting on a poorly or hastily constructed job.

*Engineer WNYE; E.E.
**Student Elect. Eng. Cooper Institute of Technology.

Television and "FM" Hounds! Attention!

Don't forget to send the Editors articles, with diagrams and photos describing your method of receiving television images, frequency modulation, or facsimile! All articles accepted and published will be paid for at regular rates.



"Honor" Plaque Awarded

To John Wonsowicz, W9DUT

For Best HAM Station Photo

My transmitter is a very efficient low-power outfit; it employs a 6V6 crystal osc., 807 buffer and 809 in the final. The R.F. section operates on 40 watts input. The R.F. unit can be operated on 160, 80, 40, 20, and 10 meters with a quick change-over of coils. It is modulated with a pair of 6L6's in class A-B, using an Astatic D-104 mike. The antenna is a half-wave doublet 246 ft. long, and is also used on all bands.

The receiver is an all-band Silvertone Precision, 12-tube super-heterodyne, with a speaker to match.

In the past 10 months of operating I have worked 42 states and all reports are as good as rigs running about 150 to 200 watts.

I am a lumber salesman and radio is my hobby, which I enjoy very much.

JOHN WONSOWICZ,
2546 West 12th Ave.,
Gary, Indiana.

●

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

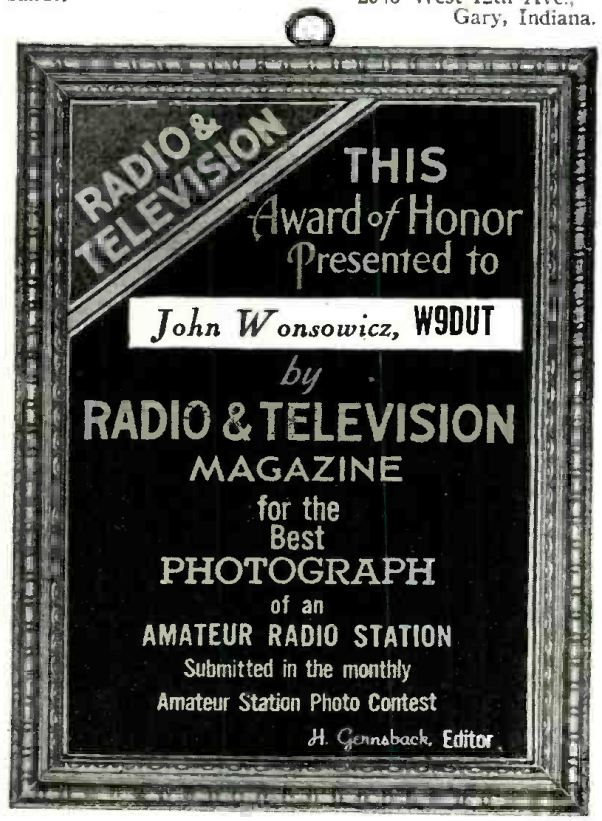
Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name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

State briefly the number of continents worked, the total number of stations logged or contacted, and other features of general interest. Mentjon 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.



Use as An Output Indicator

Connect in same manner as a VTVM but to point K. The eye shadow will vary according to the strength of signal when aligning the I.F.'s with a signal generator.

Use as An Audio Oscillator

Connect a mica condenser of about .0001 mf.-.0005 mf. from the output terminal to the input jack. This will result in an audio note being generated. To check the audio system of a receiver, connect a lead from output jack to the input of the amplifier and a lead from the ground jack to the receiver chassis.

Measuring Small Capacities

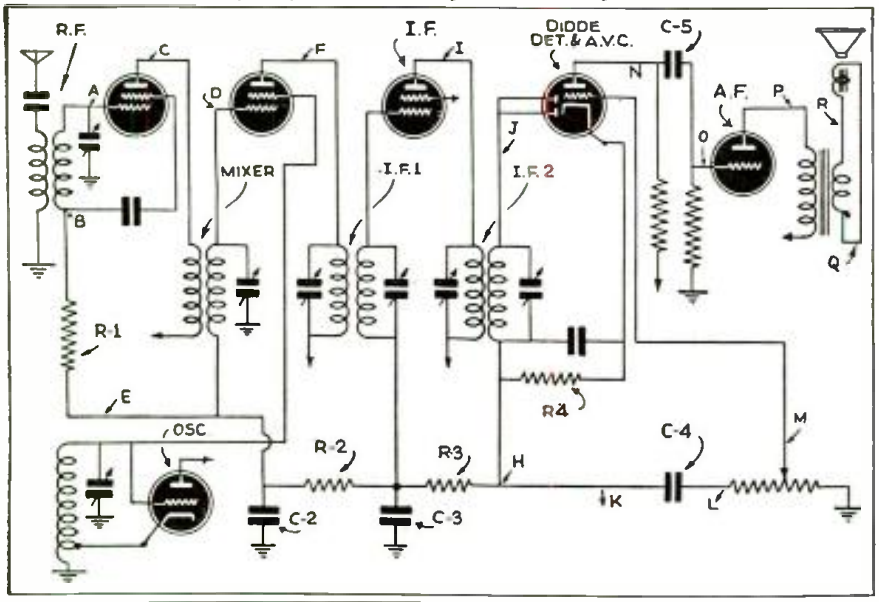
Connect as audio oscillator but substitute the unknown with a standard capacity. When you get a value that gives an identical note to the standard, you will know the value of the unknown. The limit of measurements is up to about .1 mf.

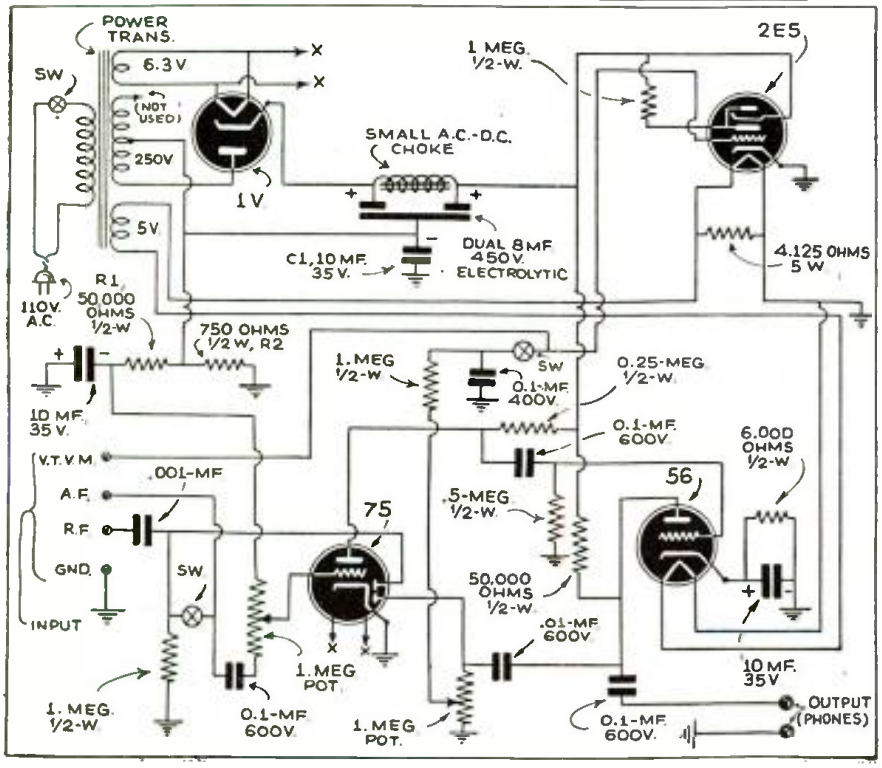
Controls on "Signalyzer"

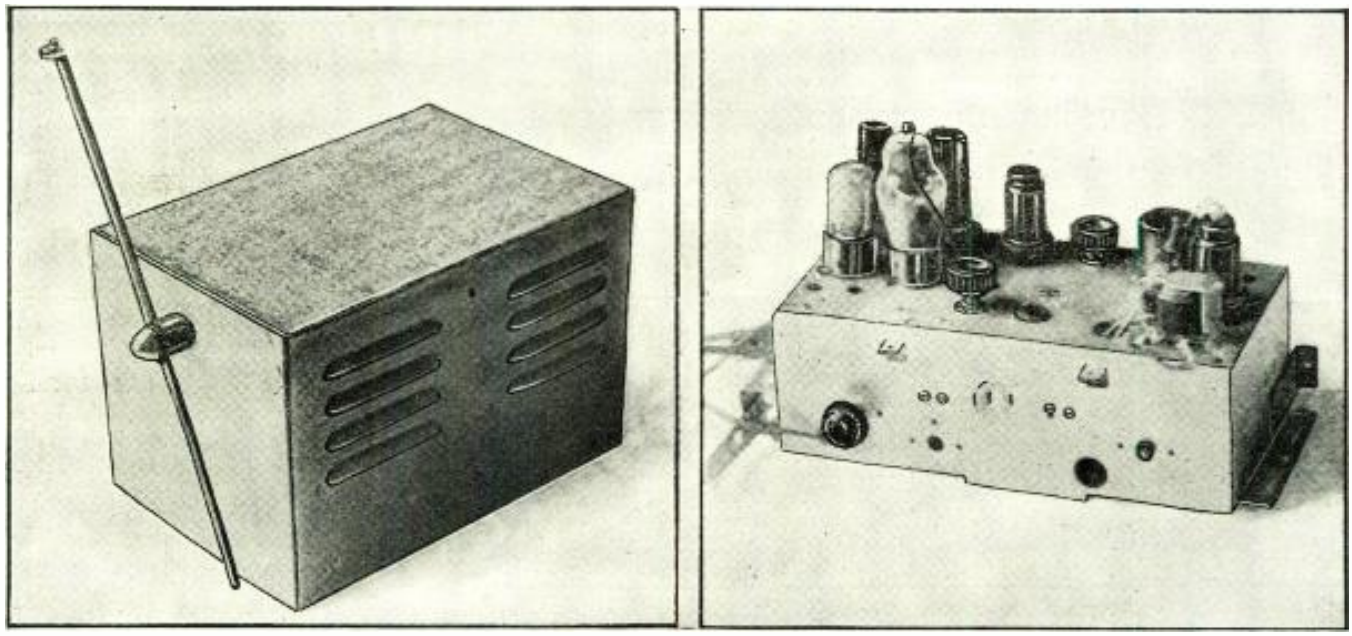
There are three switches on the panel namely: on-off switch, eye switch, and R.F. switch. Volume control adjusts limit of volume admitted to phones. When turned up too much on strong signals there will be distortion. This is due to the amplifier input being overloaded. The eye sensitivity control determines how much the eye will close and it is out of the circuit when used as a VTVM.

A metal cabinet should be used. It became necessary to shield the section of the cabinet near the input jack with tinfoil. With no input and with eye sensitivity on maximum, the eye tube will show an indication. This is due to currents set up when the electrons strike the diode in the 75 tube. Use a good eye switch and insulate the VTVM jack with a porcelain bushing or there will be leakage to ground.

Wiring diagram for the "signal tracer" is given below.







Photos show external appearance of the special radio receiver which operates on waves radiated from automobile engine; chassis at right.

Radio Device Opens Doors

H. G. Cisin, M.E.

● REMOTE CONTROL of various devices may be accomplished in many ways. Photo cells are often used to operate a relay by intercepting a light beam with an opaque object. A balanced capacity system accomplishes the same purpose merely by upsetting the electrical balance when an object is brought within the operating range of such a system.

Such a problem was presented when it was desired to actuate a relay only upon the approach of a motor car, and *not* when approached by any other non-motor operated vehicle or object.

It can readily be seen that the discriminating device of this nature has many obvious advantages. For example, such a device may be used to open the garage doors upon the approach of the automobile. Furthermore, it may be tuned so that it will be energized only by one particular type of car. It may be used to flash a signal when a motor vehicle passes within a certain distance of the device, but will not operate when other objects come within the range of this particular system. In this case the system is made broad tuning, so that any make of motor vehicle will actuate it. A device of this kind lends itself to numerous practical purposes and also to many advertising stunts, suitable for service stations. Thus, it may be used to notify road-house attendants of the approach of a car, etc. Such a device may also be employed for certain military purposes involving the approach of motor vehicles.

Operates on "Ignition" Wave

The method employed in accomplishing the desired result is to construct a special *short-wave* receiver capable of tuning in the *noise frequency* of the *ignition system of the automobile*. The diagram shown in Figure 1, illustrates the way in which this is done. The circuit employed consists of a regenerative detector using a 6J7 tube, a first audio stage employing a 6C5 tube, the latter feeding by resistor-condenser coupling into a 38 output tube. The relay is connected directly in the plate circuit of the 38, being shunted by a 10 mf. electrolytic condenser. The power supply is a standard A.C.-D.C. circuit employing a 25Z6 rectifier. Filtering is accomplished by means of a 20 henry, 300 ohm choke, bypassed at either end by a 20 mf. electrolytic condenser. The detector circuit is a tuned circuit employing the familiar plug-in type short-wave coil, tuned with a 0.00014 mf. variable condenser. A 2-32 mmf. trimmer condenser is also used in the antenna circuit.

The arrangement of parts is shown in the front and top view sketches. The chassis used is 10" by 5" deep by 3½" high. The tubes, relay, switch, tuning control, plug-in coil and antenna trimmer are fastened to the chassis deck. The sensitivity control, antenna pin jack and external (signal device) outlet are mounted on the front chassis wall. The chassis is arranged to fit into a black crackle finished metal cabinet, 12¼" by 8¼" by 9¼" high.

Receiving Circuit Is Broad

The circuit is broad tuning in its effect, in order not to discriminate between the various makes of motor cars. The device picks up the *noise frequency* with all four short wave coils over a band having a range of from 17 to 200 meters. However, most *positive* results are obtained by using the *highest frequency* (lowest wavelength) coil. The tuning control is used, therefore, merely to give finer adjustment. Under ordinary conditions, the adjustment of the antenna trimmer need not be changed. Its chief purpose is for adjustment where the length of the antenna is to be varied.

A short metal rod is mounted at the end of the metal cabinet, but insulated from the cabinet. The rod may be obtained by cutting down a Philson Phantom automobile antenna to a length of about one foot. A Fahnestock clip is then soldered to the outer end of this rod to permit facile connection to the external antenna. No external ground should be used. The other end of the rod connects to an insulated lead-in. A phone tip is soldered to this lead-in which is within the cabinet. The phone tip is inserted in a phone jack in the side wall of the chassis and this completes the connection to the antenna trimmer.

To place the device in operation, the pin from the antenna rod is inserted in the jack and the power supply plug is inserted in any 110-120 volt outlet. The plug from the device to be actuated by the relay is inserted in the outlet on the chassis side-wall.

Adjusting Sensitivity of the Device

After the tubes have heated up, the signal light or other signalling device will be switched on due to the closing of the relay. The sensitivity control is then turned back to the point where the light will just go off. If it is not possible to make the light go off by adjusting the sensitivity control, additional antenna wire must be connected to the clip on the end of the antenna rod and enough wire must be used to permit the light to go off by adjusting the sensitivity control. To increase or decrease the operating distance between the ignition system of the automobile and the device, increase or decrease the length of the antenna. The antenna should be of bare copper wire, either solid or stranded, well insulated from ground and at any convenient height. If

there is undue sparking across the relay contacts, the optional condenser C13 may be connected in the circuit. Use a 1 mfd. paper condenser.

The relay used is a standard single-pole, double-throw, plate circuit relay, having a resistance of 2500 ohms and set to fall "in" from six to eight mils (ma.) and to drop "out" at from three to five mils. It is recommended that a high quality relay be used, having adjustments not only for spring tension but also for the contact points.

List of Parts for Electronic Device

HAMMARLUND
(Condensers, Coils and Sockets)

1—19 Plate, 140 mmf. Variable Tuning Condenser Mc-140-M (C2)
1—Trimmer Condenser, 3 to 35 mmf., type EC-35 (C1)
1—Set Short Wave Plug-in Coils, 17 to 270 meters, type SWK-4 (L1)
1—4-Prong Isolantite Coil Socket, type S-4
1—5 Prong Socket, type S-5
4—8 Prong Isolantite Coil Sockets, type S-8

CORNELL-DUBILIER (Condensers)

1—Mica Condenser, .0001 mf., type 1W (C3)
1—Mica Condenser, .0005 mf., type 1W (C5)
2—.1 mf. Tubular Condensers, type DT-4P1 (C4, C7)
2—20 mf. 250 volt dry electrolytic capacitors, type BR-2025 (C11, C12)
2—10 mf., 25 volt electrolytic condenser, type BR-102 (C10) (C9)
2—.01 mf., 400 volt paper tubular condensers, type DT-4S1 (C6, C8)
1—1 mf., 400 volt paper tubular condenser, type DT-4W1 (13) (Optional)

I.R.C. (Resistors)

4—1 meg. ¼ watt Fixed Resistors (R1, R4, R7, R2)
1—10,000 ohm, 1 watt Resistor (R9)
1—20,000 ohm, 1 watt Resistor (R11)
1—120,000 ohm, ½ watt Resistor (R3)
1—240,000 ohm ½ watt Resistor (R6)
2—1250 ohm, ½ watt Resistors (R5, R8)
1—3000 ohm Potentiometer (R10)

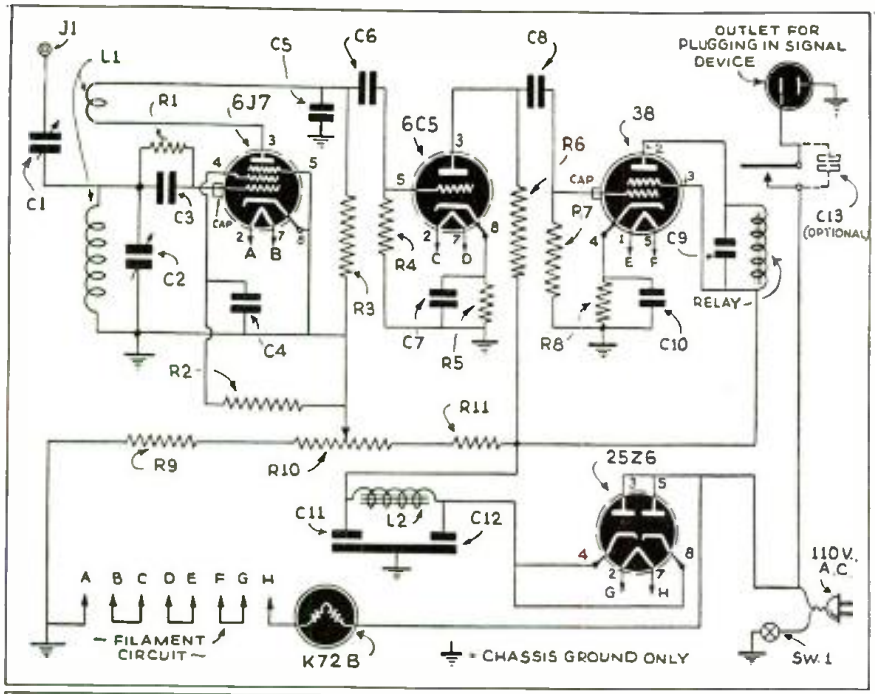
TUBES

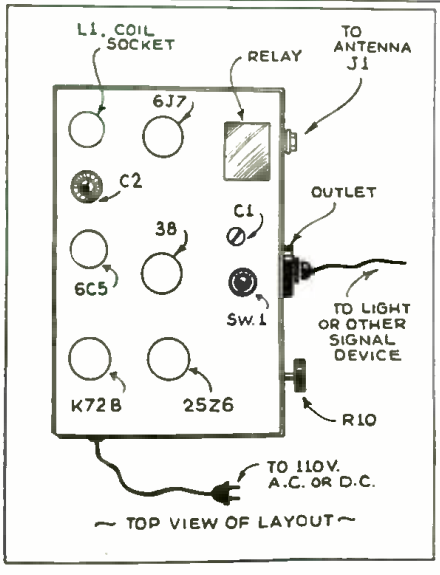
1—6C5 Tube
1—6J7 Tube
1—38 Tube
1—25Z6 Tube
1—K72B Ballast Tube

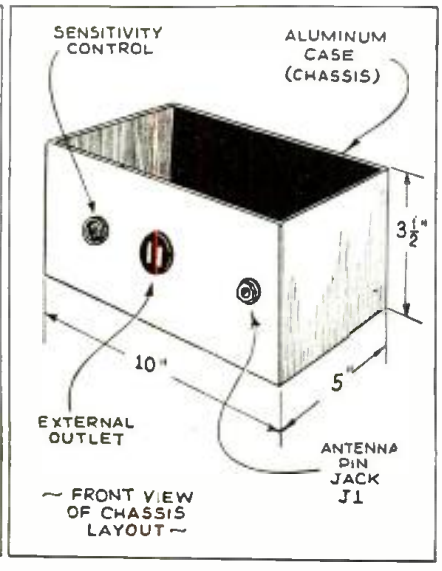
MISCELLANEOUS

1—Relay Plate Circuit, 2500 ohm
1—20 henry, 300 ohm choke (L2)
1—Metal Chassis, 10" x 5" x 3¼" high
1—Metal Cabinet, 12¼" x 8¼" x 9¼" high
1—Philson Phantom Automobile Antenna

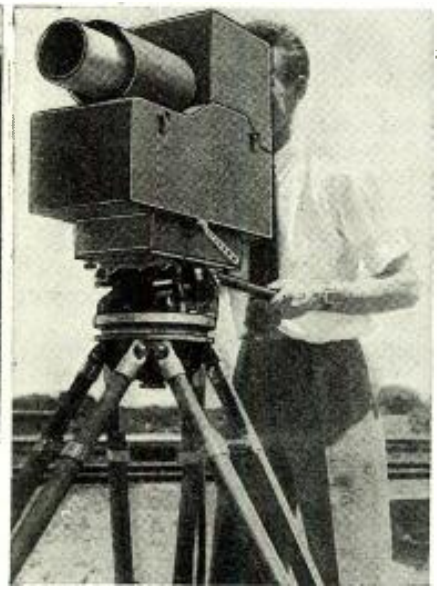
Here are the connections of the special receiver devised by Mr. Cisin for opening garage doors on the approach of a motor vehicle.

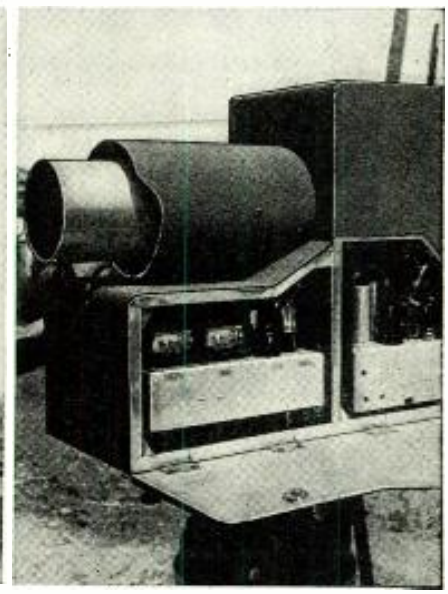






New Portable Television Pick-up





The photos show the new Du Mont television pick-up camera, which is extremely portable and can be quickly set up anywhere, thanks to the specially devised tripod shown in the photo. The necessary amplifiers and other apparatus are arranged in portable cases, and the whole television pick-up camera outfit can be dispatched anywhere on short notice, in an ordinary automobile.

● AS compact as a movie sound camera and just as easy to operate, the latest Du Mont portable television equipment is certain to extend the range of television program material by encouraging many more outside pickups. Indeed, the entire pickup equipment, exclusive of the ultra-high-frequency relay transmitter and transmitter power supplies, comprises the camera and seven units which can be readily carried in any sedan automobile. Thus television reporting assumes a new simplicity which is bound to be reflected in future programs.

The Du Mont camera is of the iconoscope type. The image is focused by means of an f:2.5 9¼" focal-length lens on the mosaic screen of the iconoscope tube. The camera contains the preamplifier for building up the video signals which are passed through a heavy shielded coaxial cable to the separate intermediate amplifier unit. Measuring 8¾ x 26 x 16½" overall, the camera weighs but 45 lbs. It is mounted on a sturdy movie tripod and can be swung instantly in any direction.

The camera power supply unit provides all required potentials with the exception of scanning signals, for the camera tube and the video preamplifier. This unit measures 9 x 17 x 10 inches, and weighs 45 lbs. The intermediate amplifier and iconoscope scanning-voltage generator unit operates as a video intermediate amplifier and also generates scanning voltages necessary for operation of the iconoscope camera. It measures 14½ x 20 x 8 inches, and weighs 37 lbs.

The power supply for the intermediate amplifier and the scanning unit is still another separate unit, weighing 52 lbs. and of the same size as the camera power supply.

The line amplifier delivers the video signal through a coaxial transmission line either to the main transmitter or to an ultra-high-frequency relay transmitter. This amplifier contains its own built-in power supply, weighs 45 lbs., and is of the same size as the intermediate amplifier.

The video monitor contains a 5" teletron monitor tube, and also the necessary image controls. It measures 8 x 20 x 13¾", and weighs 54 lbs. The image picked up by the camera can be followed on the monitor screen. To facilitate viewing the monitor image in bright sunlight, the unit is provided with a deep shadowbox hood.

The synchronizing-signal generator consists of two units each measuring 14½ x 20 x 8", one weighing 38 lbs. and the other 43 lbs. This generator equipment supplies all synchronizing signals for proper operation of the television transmitter.

Two operators are required for the proper operation of this portable television pickup equipment. The camera operator can focus the image directly on the iconoscope mosaic by glancing through the hooded peephole at the rear of the camera. Meanwhile, the second operator is in charge of power supplies and amplifiers, and monitors the video signals by means of his monitor screen image. If an ultra-high-frequency relay transmitter is being used, an extra operator may be required.

Developed and built by the Allen B. Du Mont Labs., Inc., of Passaic, N.J., this new portable television pickup equipment has been receiving a thorough workout in conjunction with the company's own experimental transmitter at Passaic, as well as in the preliminary tests of the company's new television station being built at 515 Madison Avenue in New York City. Such equipment is also being made available to other television broadcasters and can be built to order.

Flexible Reception on New Television Set

● ANTICIPATING the early scheduled operation of the Du Mont television transmitter in New York City, as well as other transmitters that may deviate from present R.M.A. television-signal standards, the latest Du Mont 20-inch television receiver, Model 195, is designed for flexible reception. In other words, this receiver incorporates a switch allowing selection of two pre-set combinations of line and frame frequencies. Since automatic circuits are difficult to build to accommodate both the R.M.A. synchronizing signal and the more recently proposed Du Mont signal with the high-frequency vertical pulse, it was deemed best for this transition period at least, to provide for both R.M.A. and the Du Mont types of synchronizing signals. This is most practically done by an actual selector switch. The range of the sweep controls of this receiver is sufficient to cover line and frame combinations from 625 lines at 15 frames to 507 lines at 30 frames, so as to be able to accommodate all reasonably logical transmissions which are expected in the near future. Meanwhile, this receiver handles all-wave broadcast reception as well as synchronized television sound.

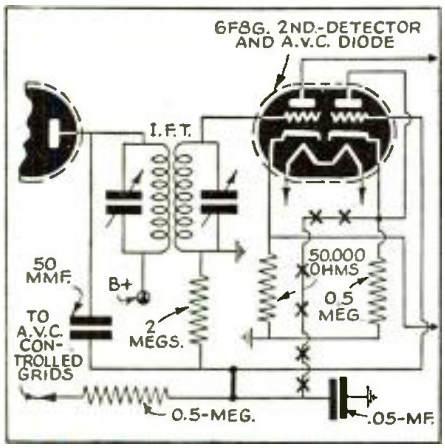
NATIONAL TELEVISION SYSTEMS COMMITTEE TO SPEED STANDARDS

● IN following through its promise of May 28th that it stands ready to confer with the television industry and otherwise assist in working out television's remaining problems, the Federal Communications Commission is cooperating in the organization of a *National Television Systems Committee* to function under the auspices of the Radio Manufacturers' Association. Such a committee, it feels, should be of value in the advancement of television to a satisfactory level of performance that will insure a general and widespread public service.

The Commission recently paved the way for an increased number of television stations throughout the country with a view to crystallizing their experimentation with different systems into a uniform standard.

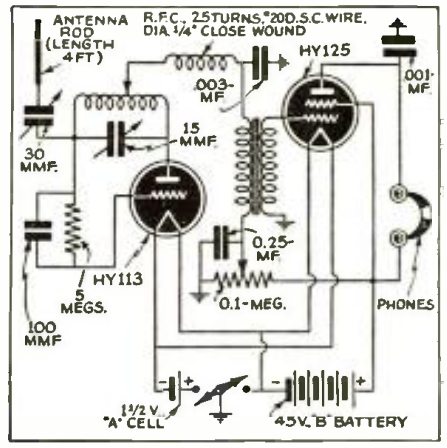
to the Radio Experimenter

Infinite-impedance Detector



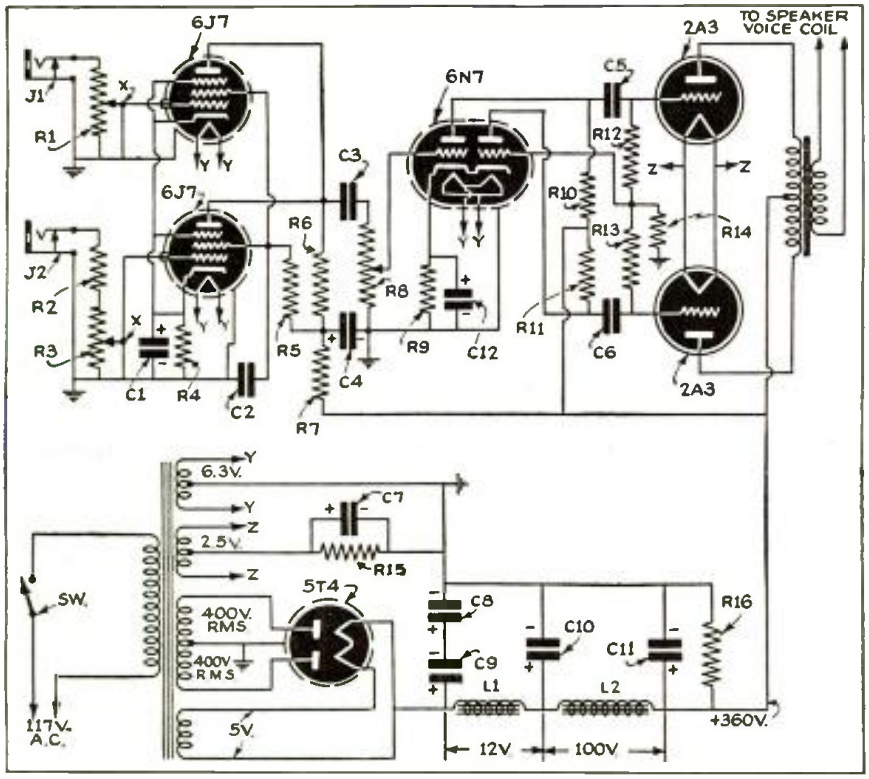
Last month a circuit for an infinite-impedance superhet second detector was shown. An error was made in the circuit and the correct hookup of the second detector and AVC diode is given herewith. X's indicate wire to be omitted.—Harvey Gernsback.

Front Cover Diagram



2-tube receiver for 2½ and 5 meters. Only 45 volts "B" and a single dry cell for "A" power required. Ant. coil—8 turns No. 14 on ½" dia., 1" long, for 5 meters; 4 turns spaced to 1" for 2½ meters.—Harold Mills.

Microphone and Phonograph Amplifier



C_1 = 10 μf electrolytic, 25 v.
C_2 = 0.1 μf paper, 400 v.
C_3 = 0.005 μf paper, 600 v.
C_4 C_{11} = 8 μf electrolytic, 450 v.
C_5 C_6 = 0.01 μf paper, 600 v.
C_7 = 50 μf electrolytic, 100 v.
C_8 C_9 = 8 μf electrolytic, 250 v.
C_{10} = 8 μf electrolytic, 475 v.
C_{12} = 25 μf electrolytic, 25 v.
R_1 = 1 megohm potentiometer
R_2 = 0.5 megohm, 0.5 watt
R_3 = 20000 ohm potentiometer
R_4 = 800 ohms, 0.5 watt
R_5 = 1.2 megohms, 0.5 watt
R_6 R_{10} R_{11} R_{12} R_{13} = 0.25 megohms, 0.5 watt
R_7 = 50000 ohms, 0.5 watt
R_8 = 0.5 megohm potentiometer
R_9 = 1500 ohms, 0.5 watt
R_{14} = 0.1 megohm, 0.5 watt
R_{15} = 780 ohms, 10 watts
R_{16} = 20000 ohms, 15 watts
T_1 = Power transformer; 400—0—400 v. RMS, 100 ma.
T_2 = Output transformer; 5000 ohms plate-to-plate impedance
L_1 = Filter choke; 12 henries, 120 ohms, 100 ma.
L_2 = Speaker field; 1000 ohms, 10 watts
J_1 = Jack for high-impedance crystal microphone input, 0.023 peak volt
J_2 = Jack for high-impedance crystal phono pickup input, 0.6 peak volt
X = Shielded lead

*Voltage gain of microphone channel up to 2A3 grids is better than 2700. Courtesy R.C.A.

"GETTING THAT VERI . . ."

by Harold B. Clein

● THIS business of hopefully dashing out to meet the postman every day, then returning with nothing but a long face is one of the most pathetic misfortunes that can befall any ardent DX'er. But—is it entirely the fault of the radio station personnel, upon whose head the disappointed DX'er is now heaping maledictions? I believe not. Getting right down to brass tacks, I wonder just how many discouraged QSL card collectors have taken the trouble to analyze the unanswered reports they have sent out?

At this point I believe I should say that this article is not intended for the experienced DX'er, whose reports pull in veri after veri, practically without fail. Neither is it meant for the pest whose only claim to the title "DX'er" is a stack of freshly printed SWL cards, and whose *"I Hrd Ur Sigs R9 Plus, Pse QSL"* has brought near apoplexy to radio operators all over the world! If you are a radio listener, interested in verifying your DX catches, but have not had the percentage of replies you believe you should have had, then this article is written for you, not with the smug idea of giving advice, but with the hope that you will be able to discover the flaw in your methods of reporting. There must be a flaw somewhere, or the verifications would be coming in!

Right about this time, I can see the hair on the back of your neck beginning to bristle, and you're probably muttering, "Who the deuce is this Harold Clein that he thinks he can tell me anything!" I agree; there is nothing I can tell you about reporting a radio station that you do not already know. However, sometimes when a thing is put into writing, you refresh your memory on many points that have been lying dormant—half forgotten. As to qualifications, I humbly submit my well over 100 different countries verified (no C.W.) to show that I have actually written for a QSL or two, and am not just a *theory* writer. Then, too, I have been unusually fortunate in being able to examine incoming reports from short-wave listeners, received by a well known West Coast high frequency broadcasting station. About 90% of these SWL reports prove the writer knew little or nothing about the kind of reports the station wanted.

This brings up the question, *"Do short-wave broadcasting stations want reports?"* For some strange reason, practically every DX writer in the country has at one time or another stated that radio stations are doing the SWL a great favor by sending a verification in answer to a correct report. This is pure nonsense. A short-wave broadcasting station could not exist without a constant stream of incoming listener reports. How else can the personnel tell if their programs have a listening audience, and if the signals are getting out? Short-wave broadcasting stations *do* want reports. They want *good* reports, and most SW stations (excepting, perhaps, the Daventry stations and RV-15 in Siberia) are not only willing but happy to send a token of their appreciation in the form of a verification card, or letter. It is a pretty cheap way to get the information they need! You don't believe me? Well, if every listener in these United States would suddenly stop sending reports to Daventry, for instance, in just one month you would hear the BBC pleading with their best Oxford accent for reports. Two months, and you could probably expect a gilt-edged QSL via Transatlantic Clipper ship! A listener is doing the radio station personnel the biggest kind of favor by sending a report. But—it must be a *good* report.

(To Be Concluded)

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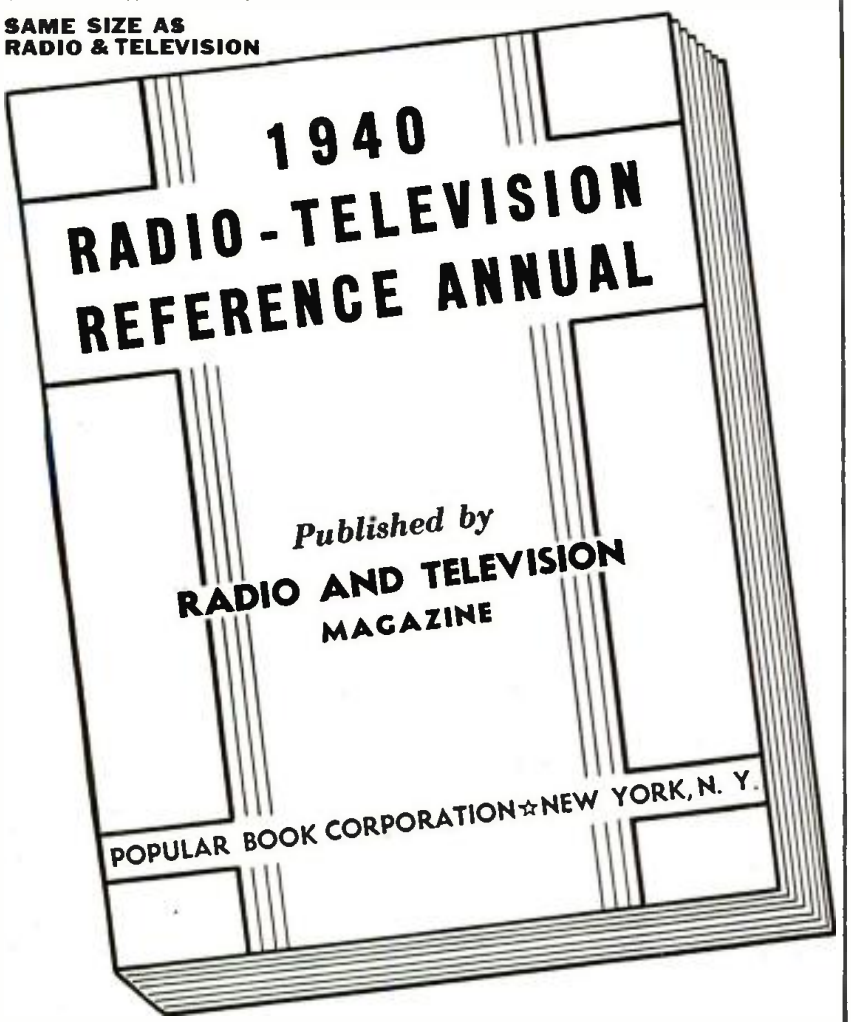

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(approximately)

45 ARTICLES

(approximately)

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68 BIG PAGES

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A DX "Pepper-Upper"

To boost those weak signals—frequently lost with the average receiver—you need an R.F. Booster such as the one here described. Easy to build and of low initial cost.

● NOT only are distant stations brought in much louder but the selectivity or sharpness of tuning is also greatly improved by the use of this regenerator preamplifier (signal booster). Many otherwise satisfactory superhet receivers of the modern type can be made to yield much more satisfactory results, so far as DX reception is concerned, by the addition of a preselector amplifier of the type here shown. By utilizing regeneration in this booster stage, selectivity is improved along with amplification of the weak signals, and, surprising as it may seem, this particular type of booster is equivalent to an ordinary preamplifier using two or three stages without regeneration.

The constructor may build the preamplifier in any type of cabinet he desires and in some cases, where there is space for it, the builder may elect to install the preamplifier in the same cabinet as the receiver, keeping in mind the fact that it should not be placed too close to the receiver chassis and that an additional tuning dial is necessary. The dial may be one of the small vernier types such as the 3" ones available on the market. If the booster is placed in the same cabinet with the receiver, it would be well to enclose the preamplifier in a metal shield box of its own. In view of the fact that this preamplifier uses but one tube, a 6SJ7, the heater and plate current may be taken from the receiver in most cases. Otherwise the current supply for the booster stage may be furnished by batteries or a separate power unit. The 6SJ7 tube with 6.3 volt heater is recommended, but the constructor may use any other suitable tube which he has at hand.

As will be seen, the circuit employed is of the electron-coupled type and the plate circuit is left free to provide the R.F. output to the receiver proper. Instead of tapping the grid coil, as is often done in electron-coupled circuits, the present hookup utilizes a separate coil in the cathode circuit; this permits placing the biasing resistor and its bypass condenser in the low potential side of the circuit; this method is preferred in this case to the grid-condenser and grid-leak method. The circuit is similar to a regenerative detector and parallel voltage feed is employed. No radio frequency bypass condenser is used in this case, as we desire the R.F. signal to be present in the plate circuit, so that we can feed it into the input terminal of the receiver.

The two output terminals of the booster marked *antenna* and *ground*, respectively, are connected to the antenna and ground posts of your present receiver. In order to control regeneration, we vary the voltage applied to the screen grid of the tube. The experimenter may find that the number of turns in the cathode (tickler) coil may have to be increased or diminished in order to obtain the smoothest feedback. If there are too many turns in this cathode coil, the screen grid voltage will be too low with the tube in a non-oscillating condition and the booster will lack sensitivity.

It is suggested that a simple single wire antenna 50 to 60 feet long or more, and a ground connection, be used with this booster. If it is desired to use a doublet antenna, a non-regenerative stage should be added ahead of the present booster.

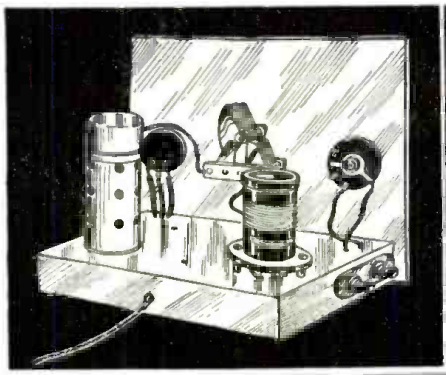
The construction of this booster is not at all difficult and even the most inexperienced S.-W. fan should be able to obtain results. Wire it as shown in the diagram and make sure that all connections are correctly made and soldered thoroughly.

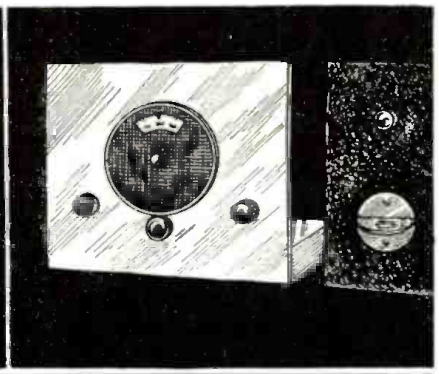
How It Is Used

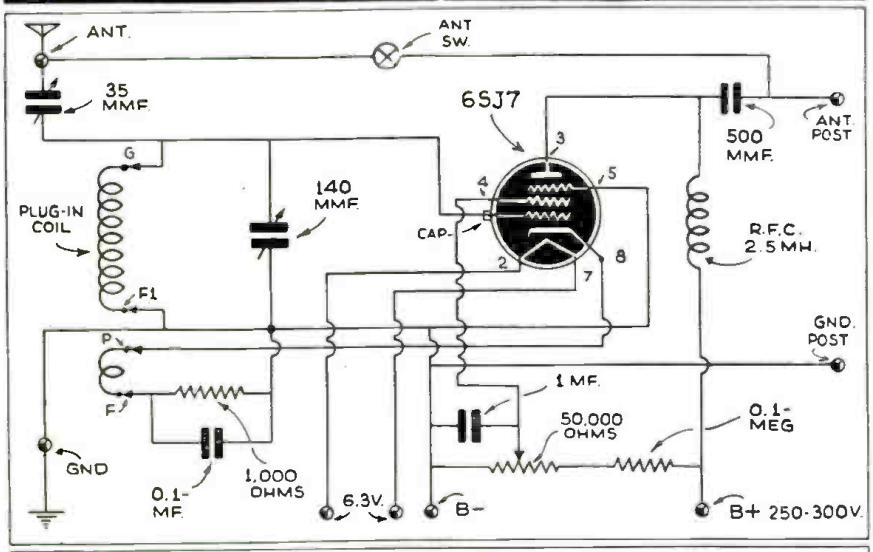
Make all leads as *short* as possible; long leads never did a piece of radio apparatus any good. An antenna "change-over" switch is incorporated in this booster, so that it can be shut off and the set used without it. In many cases the booster is unnecessary. For instance, there is no reason for having the booster running when tuning in a short-wave station, or when the operator is searching for stations or tuning across the band. The booster is just another control and should be left off until a station is located, or until the receiver is tuned to the approximate frequency of the desired station. After the station has been located, the booster can be brought into play and a decided increase in signal strength will be immediately noticed. The reason we advise leaving the booster off until it is really needed, is because any station that can be tuned in with the booster will be heard loud enough to locate at least. In other words, the booster won't bring in stations that are absolutely inaudible without it. It does however "bring up" those stations which are heard, but which are too weak to be easily understood.

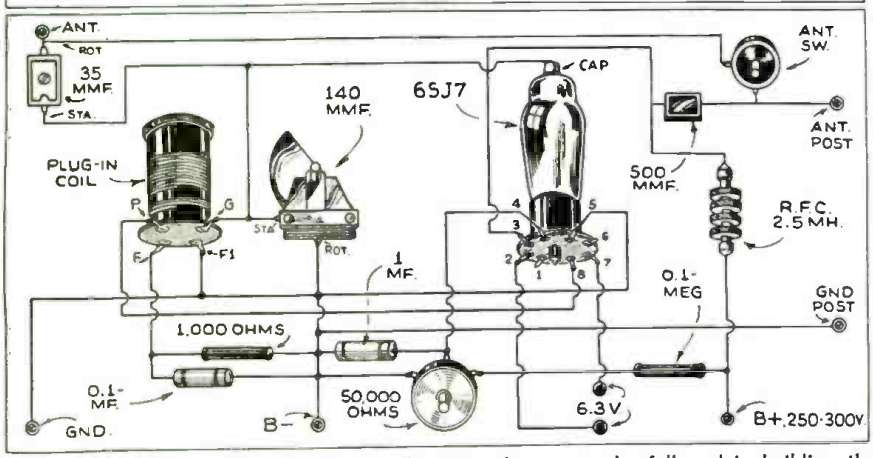
The regeneration control of the booster should be advanced till it is very near the point where the tube will break into oscillation. The setting of the regeneration control will depend upon the weakness of the received station. Do not operate it with the regeneration control so far advanced that the tube frequency breaks into oscillation with static crashes or other disturbing noises. The background noise is amplified terrifically when the tube is just on the point of oscillation. This regeneration control can also serve as a volume control to a certain extent.

Does the booster reduce background noise? Well, that is dependent upon what we really mean by that question. The booster actually increases the background noise but the ratio between the signal and the background noise is in favor of the









The general appearance and also the simple wiring diagram to be followed in building the preamplifier are here illustrated.

wanted signal. Therefore we can say that the booster is a decided advantage, inasmuch as we can bring the wanted station up to a level that our set will efficiently cope with.

This booster is very selective and tunes rather critically, especially when we operate it close to the point of oscillation. The closer to the oscillating point it is adjusted, the sharper it becomes! So tune as carefully as you can and set the regeneration control at a point that gives best results. This adjustment will depend on the strength of the station you want to receive and the level or degree of the background noise.

Parts List for Booster

1—140 mmf. tuning condenser
1—35 mmf. Isolantite trimmer
1—.1 mf. by-pass condenser
1—1 mf. by-pass condenser
1—.0005 mf. mica condenser
1—2.5 M.H. R.F. choke
1—Set of 4 plug-in coils
1—50,000 ohm potentiometer
1—100,000 ohm resistor
1—1000 ohm resistor
1—6-prong Isolantite socket
1—4- or 5-prong Isolantite coil socket
1—Antenna switch SPST
2—Antenna ground binding post strips
1—Tube shield
1—Dial, type B
1—Metal chassis and panel. Blan
1—4 wire power cable
1—R.C.A. Radiotron tube

Plug-in Coil Data

Meters Wave-length	Grid coil turns	Tickler turns	Distance between 2 coils
200-80	52 T No. 28 En. Wound 32 T. per inch.	19 T. No. 30 En. Close wound (C.W.)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3-32" bet. turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3-16" bet. turns	7 T. No. 30 En. C. W.	⅛"

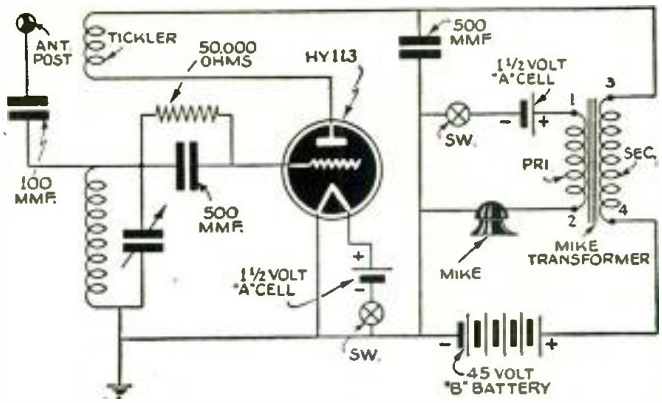
Coilform—2½" long by 1¼" dia. 4-pin base.

Edited by Herman Yellin, W2AJL

"Parlor" Transmitter

Can you furnish me with a diagram of the Parlor Transmitter mentioned in a recent issue of your magazine?—R. Henderson, Electra, Tex.

A. The Parlor Transmitter, originally described by H. McEntee, is a small broadcast band modulated oscillator used for talking through one's broadcast receiver, without the use of any interconnecting wires to the receiver. The original coil was a 175 kc. oscillator unit, but any midget broadcast oscillator coil may be employed, provided a larger tuning condenser is used. A small mica trimmer condenser will do quite nicely. Only a couple of feet of wire need be connected to the antenna post and the entire unit can be assembled in a small space, Mr. McEntee having built his unit inside a tin talcum powder box.



A very simple "Parlor" Transmitter. (No. 1228)

License Required for 5-Meter Operation

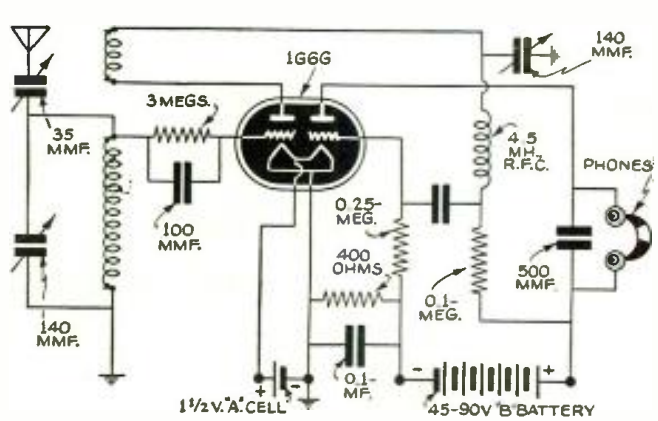
Is it necessary to know the code to go on five meters with a phone transmitter?—V. Kinard, Big Spring, Texas.

A. Yes. Operation of any amateur station, either phone or code, requires the possession of an amateur license, requirements for which include a knowledge of sending and receiving code at thirteen words per minute. Incidentally, recent changes in the license examination make the test much easier, in that the applicant merely has to check off the correct answer to each question; a number of possible answers appear already printed after each question—but only one of these answers is the correct one.

Twinplex Receiver

Will you please show the diagram of the Twinplex 1-tube receiver?—G. Stenquist, Perth Amboy, N. J.

A. The diagram of this popular receiver is here shown, using a 1G6-G twin triode tube. The coils can be any set of two-winding (grid and tickler) plug-in coils. With a judicious choice of parts the entire receiver can be built to occupy very little space.



One tube does the work of two in the "Twinplex." (No. 1229)

Wireless Phono Oscillator

Have you a wiring diagram for a wireless phono oscillator with provision for microphone operation also?—R. E. Kacher, Baltimore, Md.

A. A diagram of such an oscillator appeared on page 143 of the July issue, besides several others in older back issues.

"Dead-Spots" in Receiver

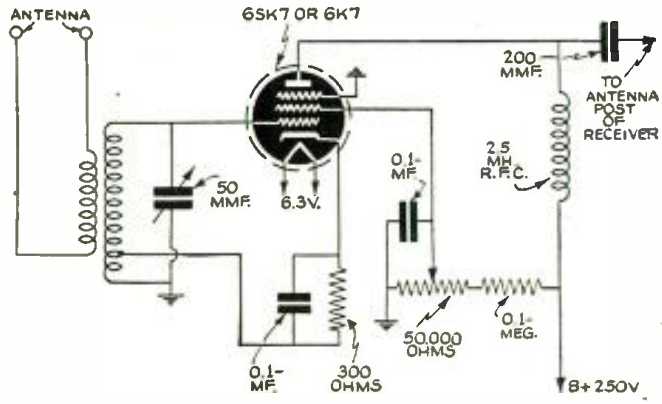
I recently completed a regenerative short-wave receiver, with the antenna coupled to the grid coil through a condenser. However, on some portions of the dial I cannot get the detector to regenerate.—D. A. Weiler, New Orleans, La.

A. Your antenna is too tightly coupled to the detector, causing "dead-spots" on your dial. This can be eliminated by decreasing the capacity of the antenna condenser. An R.F. stage, even an untuned one, will eliminate any effects of the antenna on the detector. These "dead-spots" occur at the antenna's natural frequency and its harmonics.

Regenerative Pre-Selector

Please publish a diagram of a simple regenerative pre-selector to use with a superheterodyne receiver.—S. H., New York.

A. The pre-selector shown makes use of a tapped grid coil, the tap located about 10 per cent up from the ground end of the coil. The coils can be either of the plug-in variety or a set mounted on a band-switch. Additional selectivity and sensitivity could be obtained also by employing a tuned plate circuit, but the ganging difficulties might prove too great.



An easy-to-build 1-tube Pre-Selector. (No. 1230)

Cost of Building Receivers

The Question Box editor is in receipt of numerous inquiries requesting the cost of building various receivers and other equipment described in Radio & Television *magazine.*

Since the cost will generally vary with the source of supply and the quantity of parts already in the constructor's possession, the best way would be to procure a catalog from the nearest mail-order house, and note the price of each part to be purchased opposite the "parts list" appended to each constructional article. Their summation will furnish a good approximation of the cost of the constructor.

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.*

Frequency Modulation

? *Since my old transceiver was so well frequency modulated, can I use it on the frequencies recently set aside for frequency modulation on the 56 mc. band?*

A. No! The F.C.C. specifically stated in their recent ruling opening up the 58.5 to 60 mc. band for frequency modulation that no simultaneous amplitude modulation would be permitted when frequency modulation was used. Incidentally the deviation ratio (ratio between maximum frequency deviation to maximum audio frequency) can be anything desired, since the frequency deviation is not specified. Merely keep your center frequency sufficiently inside the band, so that the maximum deviation will not stray outside the allocated band.

Interference from Ignition

? *I am experiencing a good deal of interference on my television receiver, caused by the ignition systems of passing automobiles. Can this be remedied?*

A. Yes. By so orientating (pointing) the antenna system that the pickup from the noise source is a minimum. The antenna should be as high up as possible and as far away from the auto filled street as one can get it. A twisted-pair lead-in should not be used for lengths of more than fifty feet. Frequently a long twisted pair lead-in results in a greater loss than is gained by placing the antenna in a noise-free location. The antenna should be orientated for maximum response to the desired signal, while the response to the noise is at a minimum. A reflector behind the antenna and perhaps a director in front will greatly increase the signal strength.

Diathermy Apparatus

? *I have built a diathermy apparatus of medium power and do not seem to obtain any heat; at least it seems that way. I. P. Townlee, New Brunswick, N. J.*

A. With regard to the trouble you have experienced with the diathermy hookup, would suggest that the reason why the 210 tubes ran hot was undoubtedly due to the fact that too much plate voltage was applied to these tubes, and not over 600 volts in any case should be applied to 210 tubes. Also the wrong grid-leak value was probably used for the tubes in question.

With regard to the heating effect not being noticeable when the patient is placed between the electrodes or pads, a number of patients have mentioned to us that when doctors treat them with diathermy apparatus they do *not* always experience a noticeable heating effect, even when powerful diathermy machines are used. However, you can satisfy yourself as to the heating effect if that is what the customer wants, by placing a piece of bread or a frankfurter between the electrodes and a toasting effect should be noticed very shortly.

The fact that current is passing through the condenser field between the electrodes can also be shown by connecting a suitable meter in series with one of the wires leading to the electrodes. Still another way to demonstrate that there is current passing through the treatment electrodes, is to place a one or two turn coil between the electrodes and connect the terminals of this coil to a 110 volt incandescent lamp and the lamp will light up, showing that current has been induced in the coil due to a high frequency field being established between the electrodes. It might in some cases be advisable to try reversing the leads to the electrodes. You can also demonstrate the presence of a high frequency field between the electrodes by inserting a neon lamp between them.

Modulator

? *Will you please print a diagram of a modulator to use with a 6L6 crystal oscillator?—A. Snook, Belleview, Fla.*

A. Modulating an oscillator will almost always produce noticeable frequency modulation, and since this is not permitted under the Federal Communications Commission regulations, we cannot recommend that you modulate your oscillator. Why not add another 6L6 in an amplifier stage and modulate this amplifier. Incidentally a good check to determine whether frequency modulation occurs may be made by zero-beating the carrier with an oscillating receiver. Distortion of the received signals will indicate the presence of frequency modulation. The F.C.C. employs this method as a criterion in judging whether frequency modulation is present.

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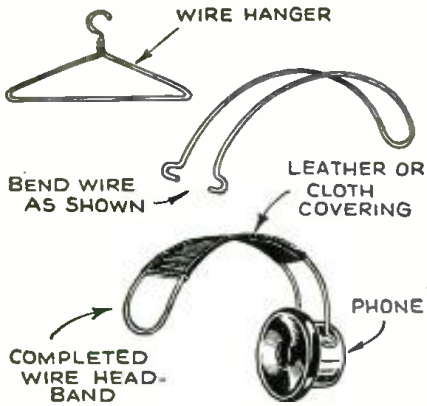
The Cover Kink
First Prize Winner

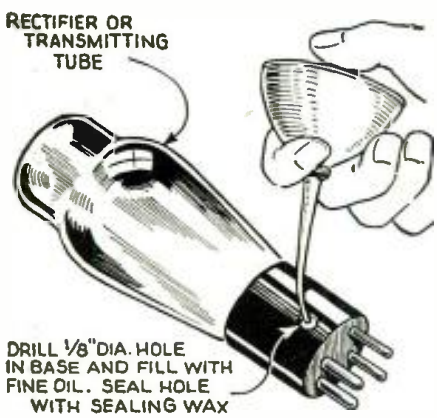
Improvised Head-Band

Sometimes one finds need for an extra head-band for one reason or another. Take an old clothes hanger, straighten it out, and cut a piece about 20 inches long. Bend this piece in half, having the two sides about one inch apart. Now about 2" from the open end curve as shown in diagram and make little hooks at the end to clamp on the side of the headphone. Then take a piece of thin leather or heavy cloth about 6" long and 2½" wide and place over head-band. Sew along the center. This band may be made sturdier by bracing the ends with short pieces of wire fixed between the two sides.—*Francis Sterk.*



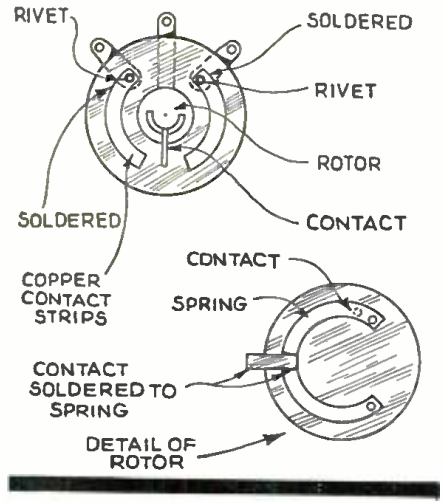
Increasing Tube Life

I sometimes find that rectifier or transmitting tubes are over inside the base when used at very high voltages. I have tried a plan to combat this and find that it works very well. I simply drill a ⅛" hole through the base, just deep enough to break through the bakelite. In drilling this hole be careful not to let the drill slip or it may cut one of the lead wires. When the hole is drilled I insert the spout of an oil can and fill the base with light machine oil. After this is done I seal the hole with sealing wax and the job is finished.—*W2MPT.*



Making a SPDT Switch

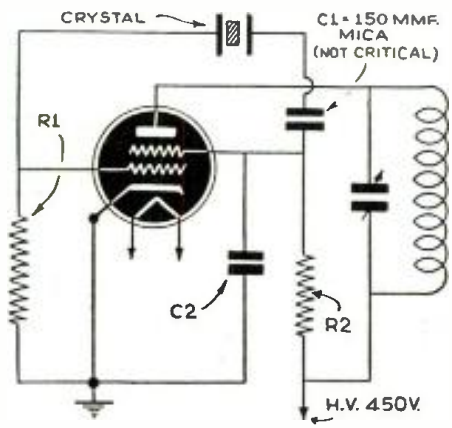
A single-pole, double-throw switch can be made from an old volume control—preferably one of bakelite. The accompanying sketch shows the back view of the switch and detail of the moving blade. The stationary contacts are made of sheet copper or brass, and are soldered to the rivets which hold the lugs that are provided in the body of the control housing. If little



space is left between their ends, the switch will not have to be turned very far to make and break contact.—*Donald Birch, Jr.*

Crystal Oscillator

Here is a circuit for a crystal oscillator which I have found very useful and it is a new one with me. A small condenser is connected in series with a crystal to prevent damage to it. The plate has a suitable coil and condenser combination, which will tune to the crystal frequency. A 6L6 or a 2A5



was used, depending on the available heater voltage. I have used 450 to 500 volts on the 6L6G without experiencing any trouble and any type of crystal will oscillate in this circuit. The power output is very good and the note steady.—*Allan Ford, VE2PF.*

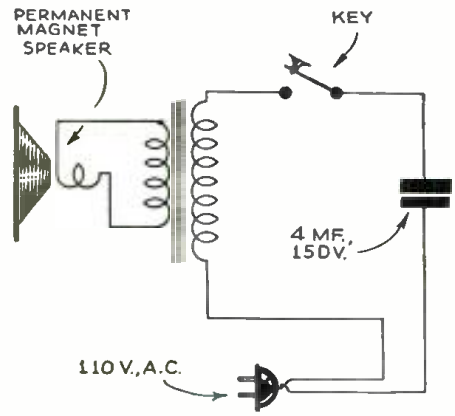
Scratch Obliterator

Recently I built a new transmitter on a black krinkle finish steel panel and chassis. Upon completion of the rig I discovered that during construction I had allowed my drill to slip while boring the necessary holes, making a long ugly scratch across the face of the panel. Also there were several unsightly scratches on the chassis.

I went to a local 5 and 10c store where I purchased a ladies' black eyebrow pencil. With this pencil I carefully went over the scratched places. This completely covered the marks and blended in beautifully with the rig finish, and it is now impossible to tell that the scratches were ever there.—*Frank Courtney, W4FDX.*

Code Practice Set

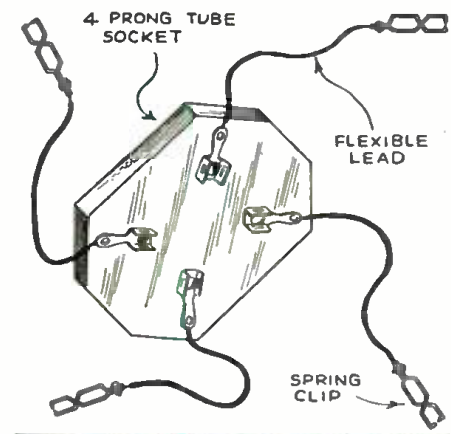
Here is one of the simplest code practice circuits which I have seen; all you need is a fair sized condenser. say about 4 mf. and a key, together with a small loud-speaker, or even a headphone will do. Every time the key is pressed you will hear a buzzing tone



in the speaker or headphone. The signals are clear-cut and I think the student operator will find it one of the simplest and most satisfactory code practice circuits he has yet tried.—*Harold Borton.*

Experimental Socket

For the radio experimenter the following kink will be found most useful; simply solder four spring clips to flexible wires connecting with the terminals of the socket. Many times you wish to try out a new connection; this socket equipped with the spring clips will be found quick and handy for the purpose.—*Thomas Eddy.*



RADIO KINKS

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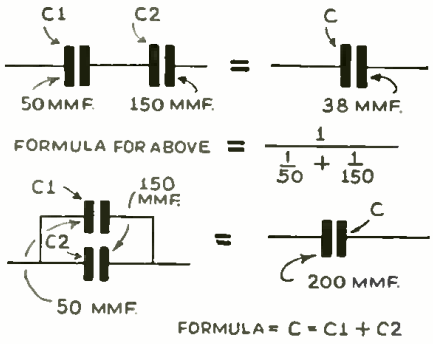
Odd Condenser Capacities

Recently, while constructing a short wave set, I discovered that the only antenna trimmer that I possessed was of too high capacity to cause the regenerative set to oscillate



over all portions of the 20 and 40 meter bands. Having only the one trimmer, I was confronted with a problem; however, I finally hit upon the idea of using a fixed mica condenser in series with the trimmer, as shown in the accompanying diagram. This idea may also be used to increase the capacity of condensers by shunting the desired capacitors to add up to the desired capacity.—*Junius Reynolds.*

Soldering Iron Holder

Holders for hot soldering irons have been published galore, but I think the accompanying sketch will win your favor, as it shows how to make a very simple yet effective iron holder from an old metal wire spool or better still, two of them. All you need is a pair of strong pliers, so as to bend both sides of one of the spool flanges and presto—you have your iron holder.

"CQ" Record Never Tires

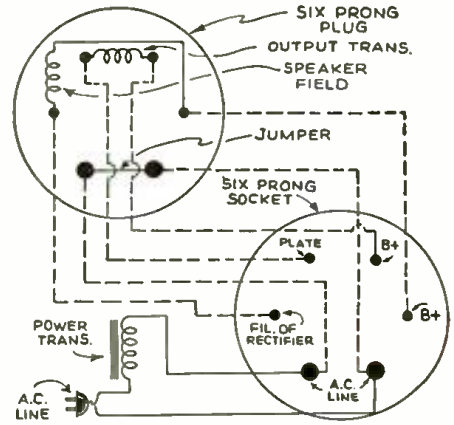
How many horsepower radio amateurs have used up in calling "CQ" over the air in the past 20 years or so, no one will ever be able to calculate—but here's the way out! Instead of using up barrels of energy calling CQ, CQ, CQ, followed by the station call, why not dictate this to one of the new phono recording devices now so popular, and make up a couple of records and have them in the ham shack? With proper timing and a simple push-button and relay arrangement, you can put the "CQ and station call" record into operation whenever you wish to start calling, without having to speak a word yourself.—*Logan Lawson.*

Makeshift Resistor

Did you ever find yourself at a loss for a resistor of a certain value? While experimenting I often need a resistor but cannot find one of the correct ohmic value in my kit. Instead of waiting 3 or 4 days until I can get said resistor, I set a potentiometer of correct wattage to the desired resistance and tentatively wire it into the circuit. Of course, the potentiometer should have a higher resistance than is needed. When I finally get the resistor I need I merely connect it in place of the potentiometer.—*Daniel Teitler.*

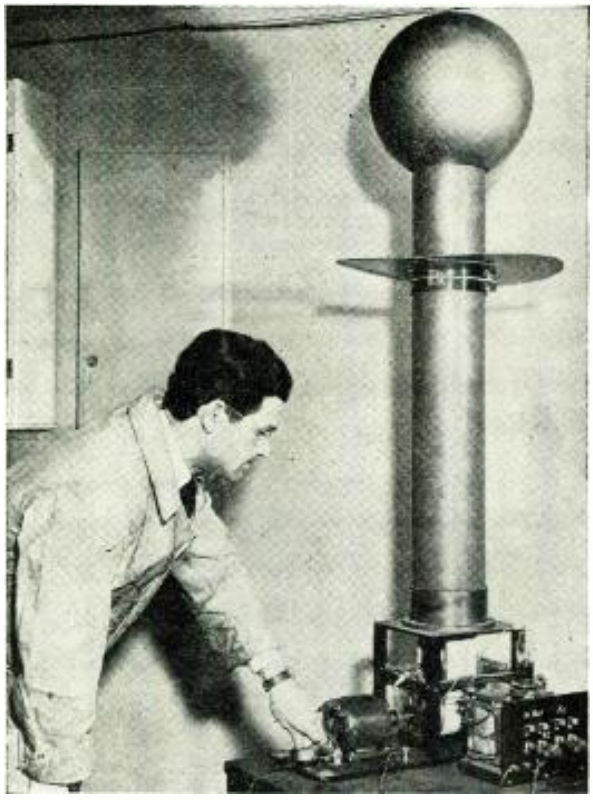
Condensers Safety Kink

Many filter condensers have been blown because the speaker field has not been replaced after repairing or moving the set. This little kink will avoid this expensive error; all that is needed is a speaker plug and socket, that have two more connections than are needed for speaker connections. The two extra prongs of the plug are connected together with a wire jumper. One side of the A.C. line is brought to one of the extra socket terminals, and from the other extra socket terminal, that side of the A.C. line is connected wherever it should be. Thus when the plug is in, the A.C. circuit is completed through the jumper in the plug. When the plug and speaker field is out, the A.C. circuit is broken and the set will not operate, therefore the condenser can not be ruptured.—*Morris Jerome.*



An Experimental "Atom Smasher"

Here are the details for constructing a high-voltage Van de Graaff generator, of the type used in the Westinghouse "Atomic Gun".



The Van de Graaff generator, described in the accompanying text, is being demonstrated here by Mr. Ralph Regalbuto, lecturer's assistant, Physics Department, Columbia University. The disc mounted on the column is merely for protection and is not essential.

● TO demonstrate how the "Atom Smasher" works, any alert student can build a Van de Graaff generator similar to the one shown in the accompanying photograph. This is used for classroom demonstration and experimental work at Columbia University, Physics Department. The construction of the original project, shown here, was supervised by Professor Bergen Davis. A somewhat simplified construction is illustrated in the diagrams.

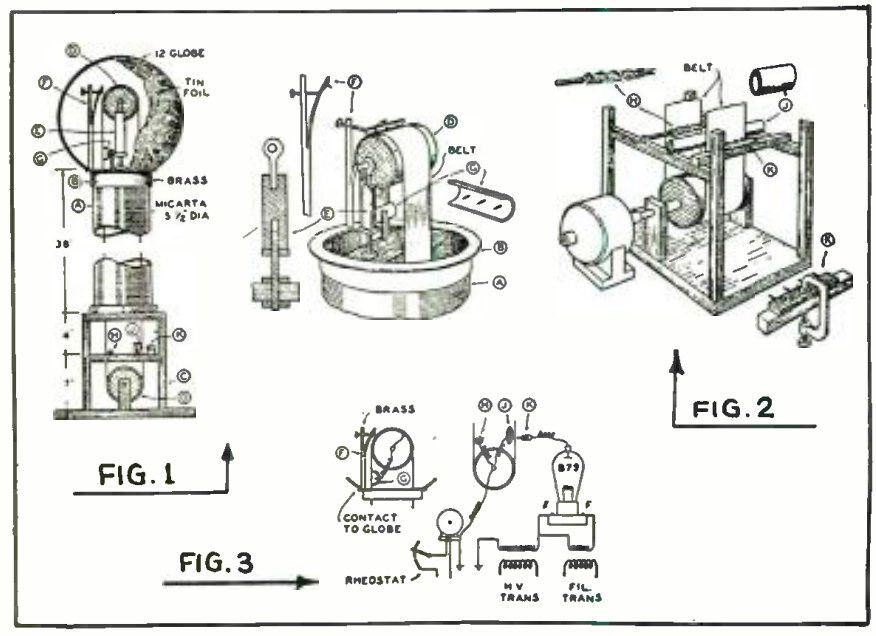
Fig. 1 shows the general arrangement; "A" represents a Micarta tube, 36 inches long, secured to a base and fitted with a brass cover "B." This tube need not be Micarta; it can be an ordinary mailing tube of equivalent diameter treated with paraffin or shellac. "C" represents the support for the apparatus which may be bakelite, hard rubber or even wood. In the original construction "D" is an aluminum pulley, but for simplification, this pulley may be a brass tube plugged with a block of wood and fitted with a metal shaft. A piece of wire is then soldered to the inside of the brass tube and the shaft. The pulley inside the globe, also indicated by the letter "D," is made in exactly the same manner. "E" is a simple support, the details of which are given, and this permits adjustment for the height of the upper pulley and, therefore, regulates tension on the belt. "F" is a split-brass rod to which is attached a horizontal strip of lead into which three needles have been forced. The needles must be of exactly the same length. A tapped hole and a screw permit of regulation here. "G" is a half section of brass tube also fitted with needles. "H" is a brass rod, adjustable latterly, and wound with Christmas-tree tinsel. "J" is a section of flattened brass tubing and "K" is a piece of lead, hammered over and fitted with needles, as illustrated in the detail. The belt used in this apparatus is a strip of ordinary adding-machine paper. One must be careful in overlapping and gluing this to make sure that the needles "K" will not dig in or catch on the joint.

The driving system for this equipment is a one-fifth horsepower motor which runs at 3,200 r.p.m. In the construction described here, a 200-ohm resistor is connected into the motor circuit so that three speeds are made possible. This is accomplished by the switching mechanism. Because the circuit may not be suitable to every motor, it is recommended that a tapped resistor be used instead. The purpose of the resistor is merely to bring the paper belt up to full speed without danger of tearing it, which would happen if full torque of the motor were applied instantly.

In operation, the electrical charge is sprayed on the belt by transformers connected to an 879 tube, as illustrated in the diagram. It is recommended that switches be placed in the primary side of the filament transformer and in the primary of the high voltage transformer. The circuit diagram is given in Fig. 2. When the apparatus is to be set into operation, it is important that the paper belt be brought up to its maximum speed first. The circuit to the filament of the tube is then closed, after which the high voltage (2650 volts) circuit is completed. The operator will see the charge being sprayed upon the belt from pins "K." These charges are picked up at the top by "F" and conveyed to the globe. It is not unusual to get sparks 12 inches long from this equipment.

Although it would be advisable to have an all-metal globe at the top (and this might even be larger than the twelve inches here specified), the experimenter will find that an ordinary cardboard globe, either metallized or covered with tinfoil, will serve the purpose quite as well. When the mechanism is to be stopped for adjustment, make sure **that the high voltage transformer is turned off first, otherwise, if the belt should stop, the sparks would set it on fire!**—*Courtesy Science Observer.*

Below—Details of construction, showing arrangement of paper belt, collectors, etc. Fig. 2 shows high-voltage circuit with rectifier tube.



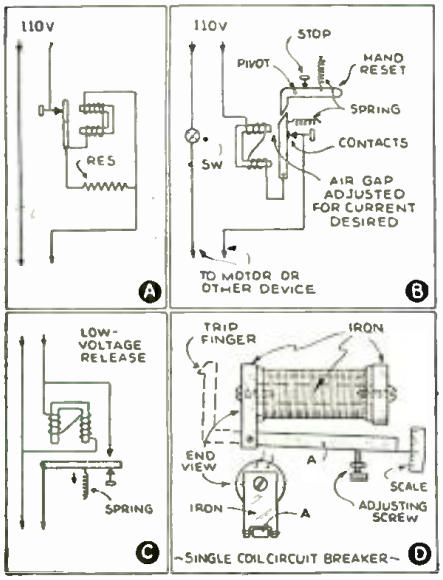
HOME-MADE CIRCUIT-BREAKERS

● AUTOMATIC circuit-breakers which will open a circuit when overloaded often come in handy and they can be made from old telegraph sounders or electric bell parts. Diagram A shows a simple overload circuit-breaker made from an old bell and a resistance of value to be determined by experiment. The lower the ohmic resistance of this shunt, the stronger the current that we may pass through the circuit. By changing the tension of the spring on the armature, and adjusting the contact screw in front of the armature, the circuit-breaker may be set so that at a certain pre-determined current in amperes, its armature will be pulled away from the contact screw—thus breaking the circuit. The breaker shown at A buzzes when overloaded and thus gives notice that too much current is passing through the circuit.

At B a different type of circuit-breaker is shown, which has a hand re-set trigger. When this circuit-breaker opens a circuit, due to a pre-determined current overload, the armature contact remains open until the re-set trigger is released by hand.

In the breaker shown at C, a state of low voltage (subnormal voltage) in the circuit causes the armature to remain open, but as soon as the voltage builds up to the normal value, the armature is attracted and the output circuit is fed with current. The circuit-breakers used on automobile battery charging systems use this principle. For the low voltage release breakers, C, the coils should be rewound with much finer wire, if you happen to be using a pair of old bell or similar magnets for the purpose. For example the magnets might be rewound with about No. 30 or No. 31 insulated magnet wire for operation on 6 to 8 volt circuits.

Fig. D shows a substantial form of home-made circuit-breaker and here the iron armature is pivoted in a slot cut in the iron yoke. A fixed scale, made by scribing marks on a piece of brass, is mounted at one end of the armature (in a stationary position) and by making a few measurements you can calibrate such a scale so that the armature air gap can be adjusted for different current strengths in amperes.—*H. W. S.*



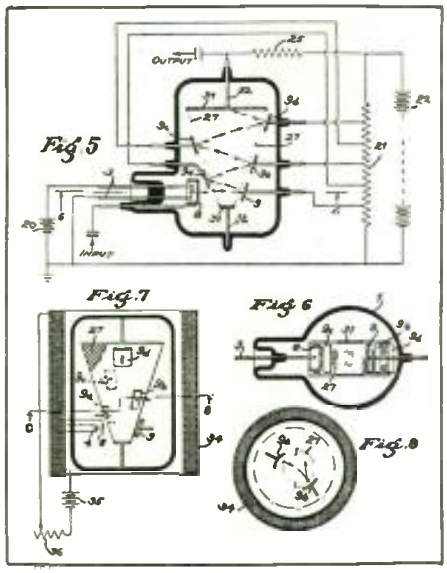
Digest of Recent Radio Patents

ELECTRON MULTIPLIER

FRONT COVER PATENT

● THE patent illustrated on our front cover this month and also in the accompanying drawing relates to electron multipliers, of the type wherein the electrons are directed to successively impact a series of surface elements, so as to produce a current augmented or intensified by secondary emission at each impact. This patent (2,204,479) was issued to Philo T. Farnsworth and assigned to the Farnsworth Television and Radio Corporation. A further object of this invention as outlined by Mr. Farnsworth, is the provision of a means and method whereby electron multiplication may take place with high efficiency and in which electrons may be made to follow predetermined paths between impacts with minimum collection. It also provides a method of adding to the field produced by the elements themselves an additional field, which insures that electrons strike each element with a velocity sufficient to emit secondary electrons at each impact. To quote the inventor: "Broadly, as to apparatus, my invention comprises a series of surface elements energized to successively increasing positive potentials, and means for directing electrons emitted from one element onto the element of the next higher potential. In order to ensure electrons impacting the surfaces with the proper velocity, I may desire to insert operatively between each pair of elements an accelerating electrode energized to a potential higher than either of that specific pair, and I thus provide an accelerating field graded as the elements themselves are graded, the accelerating field being higher at all points than the element to which the electrons are being accelerated.

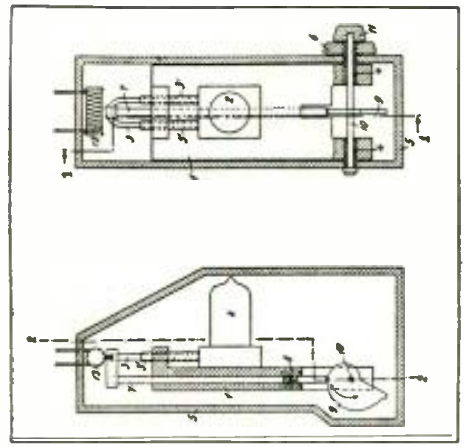
"Specifically as to directional structure, I find that successive cylinders or tubular conduits may be used to create an electrostatic focusing system, these cylinders enclosing the path of the electrons between respective pairs of surface elements, and I may make use of a Faraday space between surface elements."



This patent was issued to Philo T. Farnsworth and covers a new type of electron multiplier.

HIGH FREQUENCY TUNER

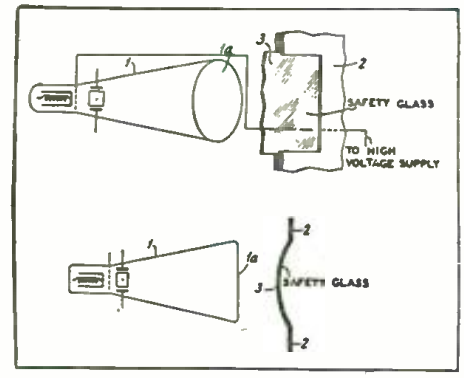
● IN ultra high frequency receivers of the type which uses a short metal bow, Joachim Goldmann of Berlin has devised a novel means of affording variability of coupling between such bow and the antenna coil. In his patent, which has been assigned to a German manufacturer, he points out that detuning often takes place when coupling is changed. In his method, however, both a variation of *coupling* and a continuous *frequency* variation are obtained. As the illustration shows, a cam is used to raise or lower the mechanism to enable the bow-shaped element to be slid into or out of a pair of metal tubes, much in the manner of a trombone. This is the tuner. Coupling is varied by rotating the entire base plate in relation to the coupling coil or vice versa. (No. 2,203,329)



A novel high frequency tuner.

EXTRA SAFETY FOR C-R TUBES

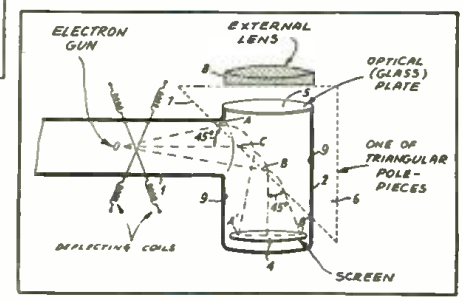
● WHEN a large cathode ray tube breaks —if it ever does—the explosion has considerable force. These tubes are protected by being enclosed in metal or wooden cabinets, the screen being visible through safety glass. A further safeguard is secured under a new patent devised by Alfred Aubyn Linsell of London, England, and assigned to RCA. One method suggested by Mr. Linsell is to imbed in the glass a thin conductor in series with the high voltage lead of the tube. Thus, if the tube blows and breaks the glass, the high voltage is automatically disconnected. In another method Mr. Linsell stretches a silken thread behind the glass and uses this to hold a switch closed. If the thread breaks, the circuit is opened. His invention also makes use of a concave rather than a flat glass in order to diminish surface reflection. (No. 2,202,390)



If the protective glass breaks the high voltage circuit to the C-R tube is opened.

CATHODE RAY TUBE

● THIS patent was issued to Geo. B. Banks of England and assigned to RCA; No. 2,203,483. This patent covers a new type of cathode ray tube for television or other purposes, and as the drawing shows the electrons are deflected or bent at right-angles to the electron gun 0, so as to strike the screen as shown. The cathode ray is caused to scan across the screen in the usual way by suitable coils. The rays are bent in the manner shown by means of a special electromagnetic field, generated by an electromagnet having triangular pole-pieces, only one of which is shown by the dotted triangular line in the picture. This triangular magnetic field acts in a similar manner to that of a prism in optics.



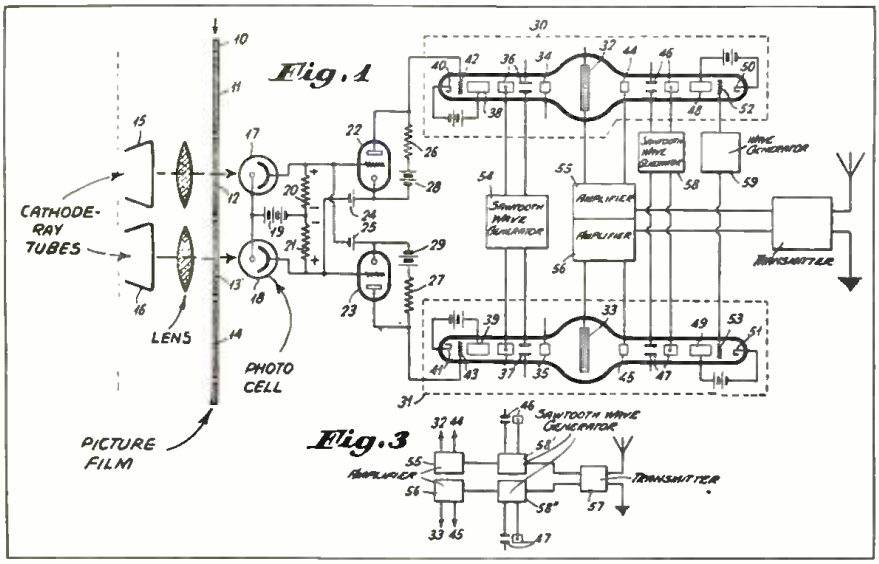
The cathode ray is bent at right angles.

TELESCOPIC RADIO ANTENNA

Jos. F. Courtney of Chicago, Illinois, has obtained patent No. 2,205,846 on a telescopic antenna, suitable for use on a motor vehicle. Means are provided for extending the antenna above the roof of the vehicle and also for retracting it.

Television System

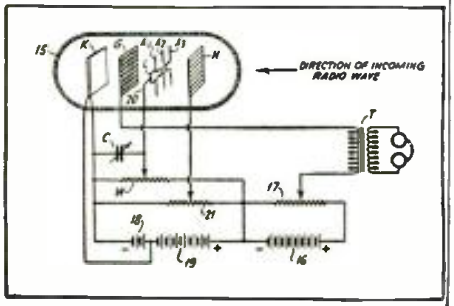
● THIS patent No. 2,202,605 has been issued to Fritz Schröter of Berlin, Germany, and assigned to the Telefunken Co. This invention, it is claimed, will make it possible to transmit a satisfactory television image over a greatly reduced frequency channel width or, on the other hand if the same channel width is used as for present television transmission, then it becomes possible to transmit a much greater wealth of detail. As the diagram shows a differential arrangement of cathode ray tubes, photo cells and integrating modulator tubes are used, so that only the *differential* values of light and shade are transmitted at any given instant. In other words, where a portion of the image retains the same color or tone value for several frames, no signal current is transmitted for this particular spot on the picture, but only when a change in the color or tone value occurs. In this way it will be observed that a great saving in the frequency band required is effected. In the operation of this interesting television system a specially devised receiver is employed, which will properly interpret the *differential* television signals transmitted. The receiver may employ either a mechanical or a cathode-ray switching mechanism for the purpose of properly coordinating the received signals and passing them into the associated apparatus.



In this television system only the differential signal is transmitted; thus a narrower frequency band may be used.

ULTRA HIGH FREQUENCY RECEIVER

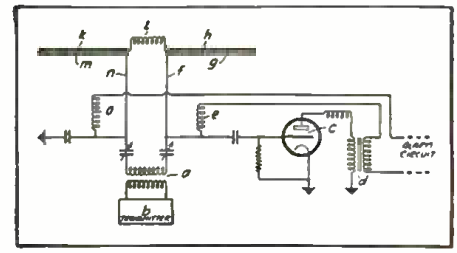
● THIS patent (No. 2,205,475) covers an interesting circuit and output arrangement for ultra short wave reception; an electron discharge tube having a cathode, a reticulated electrode and a plurality of other electrodes. The potential which is highly positive with respect to the cathode, is applied to the reticulated electrode; two of the other electrodes in the tube serve as complementary energy collectors. Means are also provided for potential biasing, so as to cause the last mentioned electrodes to serve also as retard electrodes; a signal detecting device is connected in circuit between the reticulated electrode and the cathode.



Unique high frequency receiver tube.

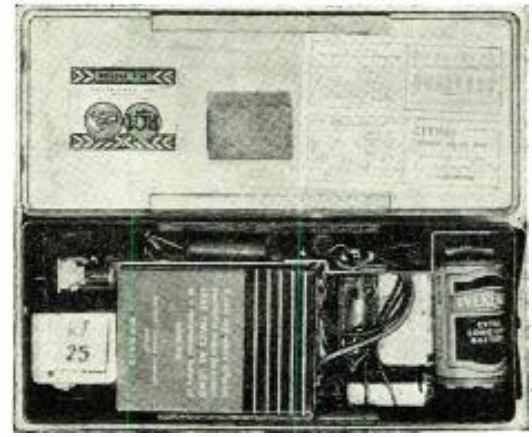
ANTENNA SYSTEM

● THIS invention covers in combination with an antenna and a transmission line for connecting the antenna to a source of high frequency energy, a means for rectifying a portion of this energy and applying it to a series circuit including one conductor of the transmission line, the antenna and the other conductor of the transmission line. Further, there is a means or device provided which will be responsive to a change of current in the circuit, for the purpose of energizing an alarm.

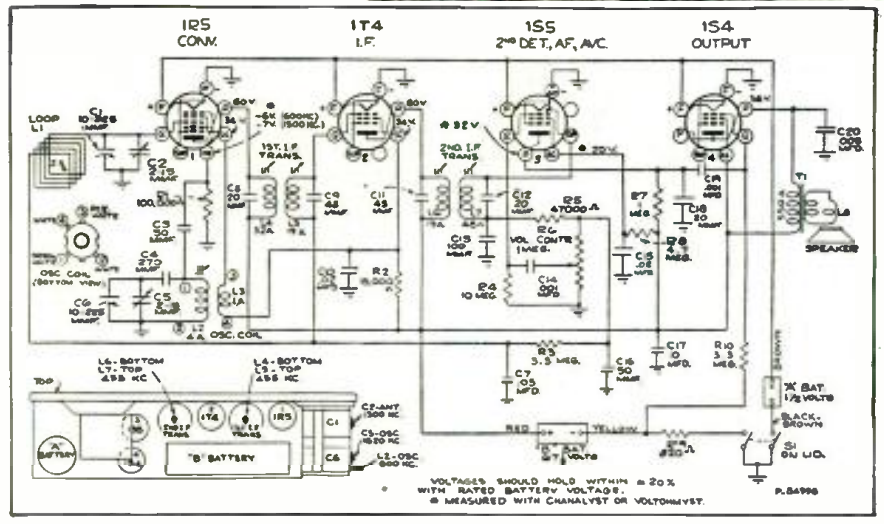


New "Personal" Radio

It fits your hand.



Below—Hookup of the portable receiver.



• A NEW "personal" radio has been introduced by RCA Victor which can be carried with a strap slung over the shoulder, if desired. The set is very small and measures only 3 11/16" x 8⅞" x 3" and weighs only 4¼ pounds. The "A" battery is a single flashlight cell, which can be picked up in any electrical or hardware store. The set uses 4 of the new mini-tubes, which are about 1/5 the size of a standard tube; as two of the tubes used in the set are twin-tubes, 6-tube performance is obtained from 4 tubes. Two edgewise dials permit quickly tuning in the station and adjusting the volume of the loud-speaker built into the set. A 3" permanent-magnet dynamic speaker is used. A built-in loop antenna is concealed in the lid of the set. The specially designed tiny amplifying coils have iron cores and are iron shielded. Styrene insulation is used in order to give the highest insulation efficiency. The National Carbon Co. developed for this set a new 67½ volt "B" battery of small size, giving twice the life of any previous battery of its size. A superhet circuit is used as the diagram discloses.

The SX-28 Receiver

• AN interesting new model of Communications receiver is the model SX-28 introduced by Hallicrafters. The frequency range is 540 kc. to 43 mc. in six bands. The receiver has two stages of pre-selection, high fidelity push-pull audio amplifier, band pass audio filter, and calibrated bandspread. The receiver has a standard size relay rack panel ⅞" thick; the cabinet is finished in machine tool gray wrinkle finish and is well ventilated.

A beautiful and efficient receiver—the new Hallicrafters model SX-28, for the "Ham" or Advanced short wave "Fan."

Frequency Range

Band 1—540 to 1650 kc.
Band 2—1.5 to 3.2 mc.
Band 3—3.0 to 6.2 mc.
Band 4—5.5 to 12.0 mc.
Band 5—11.0 to 23.0 mc.
Band 6—21.0 to 43.0 mc.

Tube Lineup

1—6SK7 1st R.F. Amplifier
1—6SK7 2nd R.F. Amplifier
1—6SA7 Mixer
1—6SA7 H.F. Oscillator
1—6L7 1st I.F. Amplifier—noise limiter
1—6SK7 2nd I.F. Amplifier
1—6B8 2nd Detector and meter
1—6B8 AVC Amplifier
1—6SK7 Noise Amplifier
1—6H6 Noise Rectifier
1—6J5 B.F.O.
1—6SC7 1st Audio Amplifier
2—6V6GT Push-Pull Output Amplifiers
1—5Z3 Rectifier

Controls

Micrometer scale main tuning inertia controlled. Calibrated bandspread inertia controlled. Tone and A.C. ON-OFF. Beat Frequency Oscillator. A.F. Gain. R.F. Gain. 6 Position band switch. Antenna Trimmer. 6 Position selectivity control. Crystal phasing. Adjustable noise limiter. Send-Receive Switch. A.V.C.-B.F.O. Switch. Bass boost switch. Phone jack.

Mechanical Features

New type inertia-controlled back lash. free dial mechanism on both main tuning and bandspread dials. This mechanism is preloaded and the main shafts are supported at both ends with ball bearings.

Other Features

Band pass audio filter. Wide angle "S" meter. Phono jack. Adequate headphone output. Improved signal to image and noise ratio. 80/40/20/10 meter amateur bands calibrated. Temperature compensated high frequency Oscillator.

New Microphone Switches

• A NEW series of microphone switches for crystal, dynamic and velocity microphones is announced by the American Phenolic Corporation.

The No. MC1S crystal microphone Switch is part of the well known MC1 group of microphone connectors, and couples directly to the microphone.

Switch is of the "Press-to-Talk" type, a slight downward movement of the thumb locking it in the "On" position. Has a coupling ring at one end, with coupling threads at the other end, machined to fit standard MC1 microphone connectors. Switch spring is silver-plated for low resistance contact and continued noise-free operation.

Two and three contact switches fit the MC2 and MC3 series of microphone connectors which are so widely used on dynamic and velocity microphones.

Condenser and Resistor Analyzer Has Built-In Meters

• A NEW, De Luxe Tel-Ohmike Condenser and Resistor Analyzer, just announced by the Sprague Products Company, includes built-in voltmeter and milliammeter with switch and pin-jacks provided so that the meters may be used for measurements external to the instrument.

Meter ranges, selected through an 8-position switch, are 15. 150. 500, 1500 volts DC, and 1.5, 15. and 50 Ma. DC. An "off" switch position is provided between the voltage and ma. ranges, and the ranges are graduated downward on either side of this for maximum meter safety. A rugged, double-pivot meter movement and a broad, easily-read meter scale are used.

A handy test instrument for the Service Man, experimenter or set-builder.

Otherwise, the new de luxe model is the same as the Standard Tel-Ohmike. Owners of Standard Tel-Ohmikes can have them converted into De Luxe Models, including the meters, at nominal cost.

The new test instrument paves the way for complete, accurate tests of *all* condenser and resistor characteristics. It measures leakage current and power factor of electrolytic condensers; measures insulation resistance up to 10,000 meg.; and analyzes all condenser types at their exact working voltages. Capacity measurements range from .000010 mf. to 2000 mf., and resistance measurements from .5 ohms to 5 megohms. All balance indications are given by a "magic eye" tube and all measurements are taken from large, direct-reading scales. An important feature is that the instrument indicates open and short-circuited condensers, and shows up *intermittent* open condensers and resistors. Size 17½ x 9 x 6 inches. Carrying weight 12¾ pounds.

A New Choke for the Ham Bands

● THE new National Company R-175 transmitting R.F. choke is suitable for parallel-feed as well as series-feed circuits in transmitters of up to 3000 volts modulated plate supply. Without plate modulation of the transmitter, they are suitable for 4000-volt amplifiers.

Use of pie-wound R.F. chokes in parallel-feed circuits resulted in decrease of transmitter R.F. output—often as much as 15%. The decrease with the R-175 is less than 1%.

In contrast to conventional R.F. chokes, the inductive reactance of the R-175 is high throughout the 28- and 14-mc. bands as well as the 1.7-, 3.5-, and 7-mc. bands.

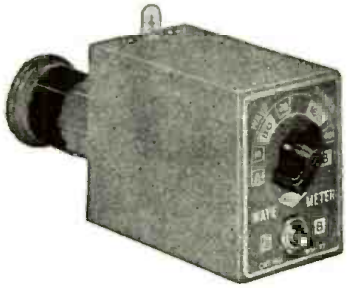
The characteristics of this new choke are:

Ratings: Voltage breakdown to metal base, 12,500 volts; D.C. Resistance, 6 ohms; D.C. Current Rating, 800 ma.; Inductance, 225 mh.; Distributed Capacity, 0.6 mmf.

●

New Wave Meter

● A NEW Wave Meter primarily intended for identifying the various amateur bands has been recently introduced by Bud Radio, Inc. This wave meter is particularly intended for adjusting the various stages of a transmitter to the desired wavelength. It consists of an accurately calibrated coil



and condenser combination together with a suitable pilot bulb for resonance indication, and band switching is employed enabling the unit to cover all amateur bands from 10 to 160 meters. Calibration is indicated on an etched nameplate, and the case of the unit is finished in attractive Grey Crackle.

Wireless Phonograph Oscillator

● AN improved and very compact Wireless Phonograph Oscillator has recently been announced by Bud Radio, Inc. This unit is primarily intended to adapt standard wired record players for wireless operation with a minimum of effort and expense. Measuring only 4½"x2½"x2", the oscillator may be attached *inside* the case of most record players, thereby eliminating the usual nuisance of unsightly external apparatus and wiring.

The improved circuit incorporated in the new oscillator utilizes only one tube. The unit operates from either 115 volts A.C. or D.C. and is very easily installed according to furnished instructions. By equipping a record player with this oscillator, records may be played through any radio receiver at distances up to 50 or 75 feet.

H.F. Aircraft Sets

● HYTRON CORP., Salem, Mass., is experimenting with portable high frequency transmitters for use in mobile and aircraft installation. Universal Microphone Co. aircraft microphones, a single-button carbon in three degrees of sensitivity, are being used.

New Tubes

827-R—Transmitting Beam Power Amplifier

• THE new RCA-827-R is an air-cooled radiator type of transmitting beam power amplifier having a maximum plate dissipation rating of 800 watts in class C telegraph service. The tube is designed especially for operation at maximum ratings at frequencies as high as 110 megacycles. For this reason, the 827-R is particularly suitable for use in *frequency-modulation* and *television* transmitters. Design features include multiple-ribbon filament leads, two multiple-ribbon grid leads to minimize the effect of lead inductance, and an entrant metal header. The header serves not only as a low-inductance terminal for the screen but facilitates isolation of the input and output circuits. As a result, neutralization is usually unnecessary except at the very high frequencies.

TENTATIVE CHARACTERISTICS AND RATINGS

Filament Voltage (A.C. or D.C.)	7.5	Volts
Filament Current	25	Amperes
Filament Starting Current: Filament current must never exceed 50 amperes, even momentarily.		
Grid-Screen Mu-Factor	16	
Direct Interelectrode Capacitances:		
Grid-Plate (with external shielding)	0.18 max.	μμf
Input	21	μμf
Output	13	μμf
Terminal connections (*See Outline*)	Special	
Type of cooling	Forced Air	

MAXIMUM CCS RATINGS AND TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service

As R-F Power Amplifier—Class B Telephony

Carrier conditions per tube for use with a max. modulation fact. of 1.0

	CCS		
D-C plate voltage	3500	max.	Volts
D-C screen voltage (Grid No. 2)	1000	max.	Volts
D-C plate current	400	max.	Ma.
Plate input	1200	max.	Watts
Screen input	100	max.	Watts
Plate dissipation	800	max.	Watts
Radiator temperature	150	max.	°C
Typical Operation:			
D-C Plate Voltage	3000	3500	Volts
D-C Screen Voltage	800	800	Volts
D-C Grid Voltage (Grid No. 1)*	−75	−75	Volts
Peak R-F Grid Voltage	165	150	Volts
D-C Plate Current	320	340	Ma.
D-C Screen Current	10	12	Ma.
D-C Grid Current (Approx.)	30	25	Ma.
Driving Power (Approx.)*	50	38	Watts
Power Output (Approx.)	350	400	Watts

*See end of tabulation.

117N7-GT
RECTIFIER—BEAM POWER AMPLIFIER

The 117N7-GT is a multi-unit tube containing a half-wave rectifier and a beam power amplifier in the same envelope. It is designed with a heater for connection directly across a 117-volt supply line.

TENTATIVE DATA

Heater Voltage (A.C. or D.C.)	117 Volts
Heater Current	0.09 Ampere
Maximum Overall Length	3-7/16"
Maximum Seated Height	2-7/8"
Maximum Diameter	1-5/16"
Bulb	T-9
Base	Intermediate Shell Octal 8-Pin
Mounting Position	Any

RECTIFIER UNIT (HALF-WAVE)

Peak Inverse Voltage	350	max.*	Volts
Peak Plate Current	450	max.*	Ma.
D-C Heater-Cathode Potential	175	max.*	Volts
With Condenser-Input Filter:			
A-C Plate Voltage (RMS)	117	max.*	Volts
Total Effective Plate-Supply Impedance†	15	min.*	Ohms
D-C Output Current	75	max.	Ma.

AMPLIFIER UNIT

Plate Voltage	117 max.*	Volts
Screen Voltage	117 max.*	Volts
Plate Dissipation	5.5 max.*	Watts
Screen Dissipation	1 max.*	Watt
Typical Operation and Characteristics—Class A1 Amplifier:		
Plate Voltage	100	Volts
Screen Voltage	100	Volts
Grid Voltage□	−6	Volts
Peak A-F Grid Voltage	6	Volts
Zero-Signal Plate Current	5-1	Ma.
Zero-Signal Screen Current	5	Ma.
Plate Resistance (Approx.)	16000	Ohms
Transconductance	7000	Micromhos
Load Resistance	3000	Ohms
Total Harmonic Distortion	6	Per Cent
Max.-Signal Power Output	1.2	Watts

†When a filter-input condenser larger than 40 μf is used, it may be necessary to use more plate-supply impedance than the minimum value shown to limit the peak plate current to the rated value.

□Type of input coupling used should not introduce too much resistance in the grid circuit. When the grid circuit has a resistance not higher than 0.25 megohm, fixed bias may be used; for higher values, cathode bias is required. With cathode bias, the grid circuit may have a resistance as high as, but not greater than 1.0 megohm.

*Design value for 117-volt line.

VR75-30; VOLTAGE REGULATOR

The VR75-30 is a cold-cathode, glow-discharge tube. It is intended for use as a voltage regulator in applications where it is necessary to maintain a constant d-c output voltage across a load, independent of load current and moderate line-voltage variations. Like other glow-discharge tubes, it may be used as a relaxation oscillator and for spark-over protection. The VR75-30 maintains a d-c operating voltage of approximately 75 volts.

TENTATIVE RATINGS

D-C Starting Supply Voltage (Min.)	105	Volts
D-C Operating Voltage (Approx.)	75	Volts
D-C Operating Current (Min.)	5	Ma.
D-C Operating Current (Max.)	30	Ma.
Maximum Overall Length	4-1/8"	
Maximum Seated Height	3-9/16"	
Maximum Diameter	1-9/16"	
Bulb	ST-12	
Base	Small Shell Octal 6-Pin	

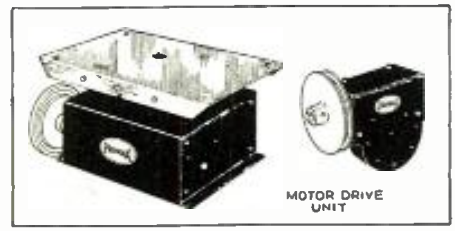
INSTALLATION AND APPLICATION

The *base* of the VR75-30 fits the standard octal socket. Pins No. 3 and No. 7 are connected together within the base. This connection may be used as a switch to open the primary of the power-supply transformer when the regulator is removed from its socket.

Sufficient resistance must always be used in series with the VR75-30 to limit the current through the tube to 30 milliamperes when no load current is drawn from the rectifier.

Beam Aerial Rotators

• THE accompanying illustration is an interesting type of beam antenna rotator developed by the Premax Co. One of the models introduced is known as the Worm Drive Rotomount. The sturdy reinforced platform revolves on 44 steel ball bearings; the worm drive gears have a reduction ratio of 20 to 1. The drive may be hand-operated by means of a belt passing over a V-type pulley, mounted on the end of the mount shaft. The opposite end of the shaft is designed to connect with a special electric motor transmission unit, the necessary holes being already tapped in the housing of the mount to accommodate the motor. For those desiring the electric motor attachment for rotating the beam a specially designed motor and worm gear unit is furnished. The gear ratio of this motor unit is 40 to 1, thus giving a total gear reduction ratio between motor and aerial platform of 800 to 1. By belting this unit to a 1¾" diameter pulley on a driving motor, a total reduction of 2,000 to 1 is obtainable—an ideal rotating speed for a 20 meter beam.



New Beam Rotating unit and motor drive.

Improved Silver Mica Capacitors

• CORNELL-DUBILIER announces an improved line of silvered mica capacitors for applications in electronic circuits where the utmost in frequency stability is essential. They find wide use in I.F. tuned circuits where the L-C product must be maintained within close limits, in fixed-capacitor tuned push-button selector, in high-frequency oscillator circuits and in the circuits of receivers that are subject to severe temperature variation or high humidity conditions.

In the manufacture of these capacitors a heavy silver coating is bonded directly to mica of the highest quality. This avoids capacity change with time and provides a uniform and low capacity-temperature coefficient. Thorough wax impregnation insures excellent humidity characteristics.

This assembly is moulded in low-loss red Bakelite which further aids in maintenance of unchanging electric characteristics.

These capacitors are available in values from .000001 to .0025 mfd. with d.c. voltage rating of 500; and in capacities from .003 to .005 mfd. at 300-volt rating.

These units are available in three sizes—medium, small and ultra-compact. All are equipped with tinned, brass wire leads. Catalog No. 160T describing these capacitors free upon request.

Silvered mica capacitors favor frequency stability.

New Square-Wave Generator Announced

• A NEW "square-wave" generator which simplifies and speeds up the study and recording of the response of electrical circuits was described by Dr. E. H. B. Bartelink, of the General Electric general engineering laboratory, to the communications section of the American Institute of Electrical Engineers Summer Convention in Swampscott, Mass.

Instead of producing a voltage wave shape corresponding to the usual wave-like line with rounded tops and bottoms, as produced in power circuits, this generator, a vacuum-tube device, causes a sequence of virtually square figures on the screen of an oscilloscope. These voltages are applied to the circuit under test, and its response is observed on an oscilloscope. The range of frequencies covered is much wider than possible with previous equipment.

"For many purposes in communication work a square-wave generator delivering square voltage waves of variable frequency and pulse width is a valuable instrument," explained Dr. Bartelink.

"It can be used for testing and adjusting of complete telegraph, telephone, radio, and television equipment, or parts of such equipments, such as filters or amplifiers. The considerable distortion produced in a square wave by even small amounts of phase-distortion makes it an ideal instrument for use in testing and aligning television circuits. In power circuits it can be used to determine the response to unit stop voltages of lines, transformers, and other components.

"In all these cases the response can be viewed direct, and thus immediate correlation with the results of unit step calculations is obtained. Given a wide frequency range of the square-wave generator and an independent scanning frequency in the oscilloscope, it is possible to study either coarse or fine structure of the response. The constant repetition of the phenomenon permits photographic registration."

Dr. Bartelink explained that the square wave form is obtained by the use of a multivibrator used as an oscillator in combination with a "clipper" tube. He said that the generator had a frequency range from below 2 to above 200,000 cycles per second. This is covered in 10 ranges by a selector switch while a coarse and vernier control provide continuous adjustment in each range.

"One single instantaneous measurement with square waves," said Dr. Bartelink, "can give us an amount of information which we could otherwise obtain only by the laborious process of determining the complete amplitude and phase response curves as a function of frequency."

The new square-wave generator is completely self-contained and requires no outside power supply or oscillator. A terminal is provided to permit synchronizing with an external source. The waveform is materially square up to 50,000 ops. The output is 5 volts in 1000 ohms. A switch permits selection of 10 or 50 per cent pulse width, while a vernier is provided for finer adjustments.

The controls on the front panel are: synchronizing amplitude, pulse width vernier, frequency-range selector, pulse-selector switch, coarse frequency adjustment, and fine frequency adjustment.

Recorder Kit

● UNIVERSAL MICROPHONE CO. has now announced a Universal Recorder Kit for all types of disc recording. The assembly includes the "KO" model microphone, which eliminates the use of an equalizer in the amplifier, a medium powered amplifier, Universal "Precision" cutting head, Universal lead screw, and the presumption is that the buyer will utilize his own electrical phonograph turntable. A copy of "Advanced Disc Recording", 23 page booklet, furnishes complete instructional data.

New Catalogs

● GENERAL CEMENT MFG. CO. has issued its 32 page Catalog No. 141, describing radio chemicals and products. Among such items are contact cleaner, insulating varnish, record lubricant, spaghetti, scratch remover, knobs, etc. Seven pages are devoted to a useful chart showing the stock dial drive belts required by various makes and models of radio receivers.

● J. F. D. MFG. CO.'s new 24 page catalog features this manufacturer's well-known auto radio control cables and antennas. Also shown are low loss leads, spark and static noise reducers, home antennas, dial belts, ballast tubes, FM and television antennas, and a host of sundries.

New Amphenol Catalog

● AN interesting new 40 page Blue Book Catalog No. 62 for the Radio, Electrical and Aircraft industries has just been released by the American Phenolic Corporation. In addition to a complete listing of this company's many products such as sockets, plugs and connectors, coaxial cable and connectors, insulators and insulating materials, this new catalog also contains a great deal of information on properties of insulating materials, fahricating methods, etc.

Public Address Catalog

● SUN RADIO COMPANY, New York City, has just released a lavishly illustrated 24 page public address catalog that should prove of interest to all in the sound field. Amongst the equipment described and illustrated are amplifiers and sound systems of every type and classification, including portable systems, mobile systems and complete indoor and outdoor installations suitable for the smallest auditorium or the largest arena or stadium. In addition, a number of pages are devoted to such P.A. accessories as microphones, speakers, pick-ups, phono motors, tuners, recorders, etc. A copy of the catalog will be gladly sent to interested persons upon request to this department. Ask for catalog No. 117A.

Radolek Catalog

● THE RADOLEK CO., of Chicago, have brought out a very handsome catalog of 164 pages with covers in color. This catalog is very complete and among the hundreds of radio items illustrated and described we find supplies and apparatus of every description from magnet wire to tube sockets. A complete line of resistors, condensers and other radio parts are described; also a large variety of test sets for servicemen and set-builders. All of the standard makes of radio receivers, including Communications types, are illustrated and described—also radio apparatus of interest to Hams, including beam antennas, speed keys, etc. P.A. apparatus is included in a large variety of styles and units.

BOOK REVIEW

MOTOROLA AUTO RADIO SERVICE MANUAL—1941 edition, size 8½ x 11 with stiff paper covers, 96 pages. Published by Supreme Publications, Chicago, Illinois.

This Auto Radio Servicing Manual will be found of great value and interest to every serviceman, and also to students of radio, as the diagrams give a liberal education in just what is used in modern automobile radio receivers. The various chapters deal with connections from the vibrator power supply, special arrangements of car antennas, etc., which are both interesting and instructive. Diagrams for all the usual automobile sets are given and also a section on Service Hints, including instructions on how to adjust the electric automatic tuner, etc.

THE A.R.R.L. ANTENNA BOOK, by George Grammer and Byron Goodman, 6½x9½, 140 pages, published by the American Radio Relay League, West Hartford, Conn.

An indispensable book to every radio amateur and student interested in erecting an efficient antenna system, whether for transmitting or receiving. The book is divided into chapters on important elements of antenna construction and includes Ground Effects, Feeder Systems, Half-wave Antennas, Long Single-wire Antennas, Multi-band Antennas, Driven Arrays, Parasitic Arrays, "V" Antennas, Rhombics, etc.

COMMERCIAL NOTICES 10¢ A WORD

Under this heading only advertisements of a commercial nature are accepted. Remittance of 10c 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.

CODE MACHINES

AYERS ALL ELECTRIC CODE Practice Machines. Low monthly rental. 50,000 words practice tapes. World's Champion code machine designed by T. R. McElroy, World Champion telegrapher. Write N. C. Ayers, 711 Boylston St., Boston, Mass. Dept. C.

CORRESPONDENCE COURSE

USED CORRESPONDENCE COURSES and Technical Books Bought, Sold or Rented. Catalog free. Vernon Exchange, Henagar, Alabama.

DIATHERMY MACHINES

DIATHERMY, SHORT-WAVE Therapy, and ultra short-wave therapy machines custom-built by radio engineer at considerable saving over commercial machines; 6 meters, 16 meters or any other frequency specified can be furnished. Machines substantially built with high patient safety factor, 250-300 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 list. Life of Napoleon, 3 de luxe volumes $3.00. $10.00 New Cyclopedia of Science, 1300 pp. $4.50; Hopkins "Experimental Science," 2 vols. $3.50. Harry Ackerson, Box 322, Ramsey, N. J.

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, Allwine & Rommel, 436 Bowen Building, Washington, D. C.

SWL—CARDS—QSL

SWL'S—QSL'S. COLORFUL, ECONomical. W9KXL, 819 Wyandotte, Kansas City, Mo.

FOR SALE (NON COMMERCIAL) 3¢ A WORD

Under this heading we accept advertisements only when goods are offered for sale without profit. Remittance of 3c 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.

RECONDITIONED GUARANTEED Receivers. Nearly all models of Hallicrafters, National, Hammarlund, RME, others cheap. Same guarantee as new sets. Ten day free trial. Terms. Write for free list. W9ARA, Butler, Missouri.

FORCED TO SELL: BRAND NEW Stancor 110 C.M. Transmitter. Used one month. Or would trade for fast camera with flash gun. W9DSK, Camby, Indiana.

DON'T BUY A RECEIVER UNTIL you get my free list of reconditioned, guaranteed Receivers! Practically all models at money saving prices. Tradeins. Time Payments. Send for list. W2AVA, 12 West Broadway, New York.

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, Television and Photographic fields for Radio, Photographic and other merchandise; therefore we charge only 1c a word. Each word in a name and address is counted. Remittance should accompany order.

Only one advertisement can be accepted from any reader in any one issue.

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. Describe anything you offer accurately 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.

Copy should reach us not later than the 10th of the month for the second following month's issue.

HAVE A KEYSTONE 16 M.M. PROjector and movie camera to match. Trade both for a DB 20 preselector in good condition. Herman Fischer, 626 Carlton Ave., Brooklyn, N. Y.

WANTED: FOUR TUBE PORTABLE broadcast receiver. R meter, and call book. Have 50 mm. camera, cash. Newton Dillman, Sidney, Ohio.

TRADE AUTO, MIDGET OR FLOOR model radios, new or used, for cameras or equipment. Fred Harvey, 4553 Sheridan Road, Chicago, Ill.

HAVE PAIR OF BRAND NEW W.E. 211Es, want a pr. xtal fones, xtal mike or 10-20 meter xtal. W9KYR, New London, Iowa.

WILL TRADE 1130-S SUPERIOR tube tester and allmeter for Argus AF camera and case. Also have Gernsback manuals to 1935, R.C.A. manuals, Zenith data book 1938 and '39 Make trade offer. Merlin Upshaw Hominy, Oklahoma.

WANTED—CRYSTAL MIKE, GENemotor, T-40's, crystals. Swap—arc welding generator, amplifier, photo cell, Shure mike, transmitter, Triplett meters, multimeter, Raymond Glasnapp, Armstrong, Iowa.

WANTED CRYSTAL HEADPHONES. Rider's Manuals 7 and 8, crystal and dynamic mike and other radio parts. Emerick J. Sepic, 2510 Harrison Ave., Eureka, Calif.

WANT SUPER-PRO OR RECEIVER of the larger type, condition not important. Have smaller short wave receivers, testing equipment and other items or pay cash. Send for list. T. G. Watt, Chanute, Kans.

CASH FOR BEST OFFER ON RAdio Physics. State condition. Also want other radio and electrical books. E. Smith, Box 612, Spindale, N. C.

WILL TRADE XYLOPHONE, CAMeras, trap drums, Sky Challenger, rifle for transmitter, parts or good receiver. Also have National Code Oscillator and McElroy "bug" to trade for parts. For details, write William McKnight, W8UMZ, Brookville, Pennsylvania.

WANT REC-O-KUT ASSEMBLY, READO, small oscilloscope. Have cash, test equipment, HY60, Zitta, 28-26 47 St., Astoria, N. Y.

HAVE UNIVEX MOVIE OUTFIT INcluding camera with optical view finder and case, Projector, screen, splicer, reels and extra lamp. Trade for Sky Buddy or other good amateur radio. R. A. Wilson, 400 28th Ave., San Francisco, Calif.

WILL EXCHANGE NEW RADIO receiving and transmitting parts, tubes, receivers, Rider's Manuals, etc., for old U. S. stamps. Major Fred Luther Kline, Kent, Ohio.

HAVE L. E. S. RADIO ENGINEERing Course and radio manuals. Exchange for Candler System Code Courses, Code Machine, Hi-Speed Typewriting Course. Will pay cash. Wilburn Vernon, R-1, Henagar, Ala.

HAVE LATE S-19R SKY BUDDY, perfect condition, guaranteed. Make trade offer. Wayne Wenger, Wellman, Iowa.

WANTED: TESTING EQUIPMENT, factory built communications receiver, xmitter, meters, camera and projector equipment. Must be modern. No junk. Exchange lists. W. C. Jensen, 330 Aberdeen, Rochester, New York.

SWAP—8MM UNIVEX CAMERA, transmitting receiving parts, tubes, voltmeter, QST, IRE, Radio Engineering, etc. Want 10 meter crystal. Don Buck, 43 Hazen Ave., N. Tonawanda, N. Y.

WANT SKYRIDER, 4-WAY KAdette, Browning Sweet Sixteen, 32/20 and 38/40 or 44/40 Remington rifles. Have 410 Skeet Winchester, sights, parts, books, magazines. Lake resort lots, R. Welker, 406 No. Harvey, Oak Park, Ill.

HAVE PHONOGRAPH PICKUPS, motors, old and late phonograph records, old radio magazines, all kinds radio parts, photographic magazines. Write your needs. Norman M. Wray, 3307 Tenaya Avenue, Lynwood, California.

SWL EXCHANGE

This department is for the benefit of all short wave listeners who wish to exchange SWL cards and correspondence. Remittance of 1c a word for each word in the name and address should accompany order.

UNITED STATES

O. BARNESON, 2838 Moss Street, Los Angeles.

KAZUO KANAI, R.F.D. Box 84, Auburn, California.

BOB LARSON, 618 North June Street, Hollywood, California.

MIKE MORRISSEY, Sharpsburg, Ky.

JACK SEALE, 510 Idlywood Dr., Longview, Texas.

JAMES SUGIYAMA, R.F.D. Box 151, Auburn, California.

JACK WELSH, JR., Kingston, Illinois.

CANADA

C. COWPER, 2463 Gerrard St. E., Toronto, Ontario.

Besides confirming its previous tentative approval of construction of a San Francisco station by Don Lee, the Federal Communications Commission authorizes this network and NBC to use the new television channel No. 1 (50,000-56,000 kilocycles).

Stations W2XBS (NBC) and W6XAO (Don Lee, Los Angeles) operated on the former television channel No. 1 (44,000-50,000 kilocycles) which was removed from the television band. The Commission's approval of the use of the new No. 1 channel was conditioned upon showing of acceptable programs of research and development.

Both Don Lee stations will experiment with transmission using 525 lines, 30 frames interlaced, or 441 lines, 30 frames interlaced.

Index to Advertisers

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

What Do YOU Think?

News from England

Editor,

As an English reader of RADIO & TELEVISION may I congratulate you on the production of such an attractive and informative magazine—your style and treatment of radio news is quite different from that of English technical journals.

You will know that owing to the War all Ham radio activities in this country have been closed down—at least so far as transmitting is concerned—and the operators of many Ham stations are "with His Majesty's Forces". The various amateur radio organizations are making efforts to maintain interest in the research side of the hobby and there is much enhanced interest in receiving. The American broadcast and amateur stations come in very well . . . some of the U.S. Hams will have to brush up their Spanish if they want to make easy contacts with South America. . . .

Very few British firms make "Communications" receivers and generally radio sets cost a good deal more in England than in the United States. We have no counterparts of the midget AC/DC receivers which sell in the U.S. for a few dollars, and only the more expensive sets tune the *short wave* band.

In the Press here suggestions have been made that pocket receivers might be designed for wartime reception of broadcast programs. A recent report from the United States declared that within ten years every individual will have his or her individual radio station in a watch case . . . sounds as if Jules Verne will be right after all . . . some very small receivers were described in *Short Wave Craft,* but so far none have been produced on a *commercial* scale. The introduction of 1.4 volt low drain multi-purpose tubes should assist the design of pocket sets. Will American or British manufacturers be first with a Pocket Portable?

ALAN G. CLARKE,
175, Bacup Road,
Cloughfold,
Rossendale,
Lancashire,
England.

Nine Years a Reader

Editor,

I have been a reader of your magazine for the past nine years. During these years your magazine has taught me *more than all the other radio publications I have purchased.* The articles are well written and I have no trouble following any of the diagrams, because they are so easy to wire from!

Mr. H. G. Cisin certainly "knows his stuff". His simple circuits certainly work right off the bat. I have spent many an enjoyable evening listening to the world, thanks to him.

The classified advertising column is a great help to me as I am able to get many things through the column that are not being sold at present.

Your magazine has always kept up with the times.

I. S. KOFSKY,
156 Taylor St.,
Brooklyn, N. Y.

This HAM Will QSL if You Will Send Report

Editor,

Having been a constant reader of your magazine for the past few years, I would appreciate going on record with you as an amateur who will answer all SWL cards and who would like to receive them. So any SWL's who should happen to hear W6QFR on the air, and would like a QSL, your letter or SWL card will bring my QSL to you.

I operate on all bands, using a power input of 500 watts down to 16 watts; four transmitters are maintained at the regular QTH and one for mobile operation on 10 meters. The 20 meter phone band is the one most frequently used. Frequencies being 14.158, 14.216, 14.222 and 14,242. On ten meters mobile 29,042 and 29,142 are used, and to date just three states are needed to complete WAS on ten mobile. C.W. is mostly done on 40 meters, the frequency being used 7285; code speed of not more than 20. On 75 phone the frequency is 3917 and on 160 it is 1825. The other ten meter phone, not portable, is 28,700; power input 80 watts.

The above bands are used daily, conditions permitting.

THEO. F. BRIX, W6QFR,
Brix Bldg.,
Fresno, Calif.

Australia—New Stations

● TWO UNITS have been added to the Macquarie network in Australia. Both are 2,000 watters, one in Central and the other in Northern New South Wales. 2GZ, at Orange with transmitter at Amaroo, was established in 1935; while 2NZ is at Inverell with transmitting plant in Little Plains and it was formed in 1936.

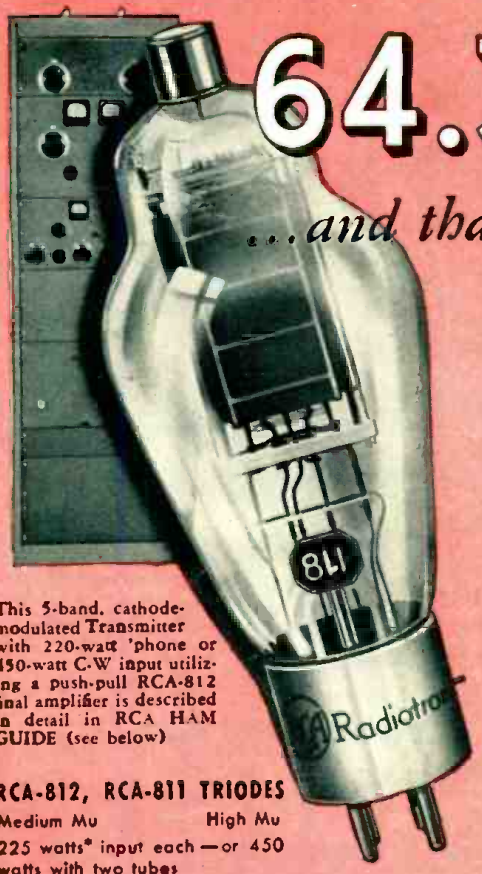
Answers to "What's Wrong with This Diagram"

(See page 302)

1. **Condenser C is not connected across coil L so as to tune it properly.**
2. **Grid leak G1 is wrongly connected.**
3. **Condenser C1 blocks the plate current.**
4. **Transformer T plate and grid windings are reversed.**
5. **Plates and grids are shown in wrong order in first tube.**
6. **Grid of second tube is "floating."**
7. **Filter choke is shown as an *air* core instead of an iron core type.**
8. **B+ line is connected to the plates instead of the filament of the rectifier tube.**
9. **"F" filament transformer has no primary winding.**
10. **Ground connection "G1" superfluous.**
11. **Phone jack is improperly connected.**
12. **Filament type tubes shown; heater type tubes should be used on A.C.**
13. **No regeneration shown—very necessary in a simple circuit like this.**

64.3 INPUT WATTS* PER DOLLAR

...and that's only part of the story!



This 5-band, cathode-modulated Transmitter with 220-watt 'phone or 450-watt C-W input utilizing a push-pull RCA-812 final amplifier is described in detail in RCA HAM GUIDE (see below)

RCA-812, RCA-811 TRIODES

Medium Mu — High Mu

225 watts* input each—or 450 watts with two tubes

Max. plate dissipation, 55 watts*

170 watts output with only 6.5 watts of grid drive

60-Mc operating at full ratings—up to 100 Mc at reduced input.

$3.50 EACH, Amateur Net

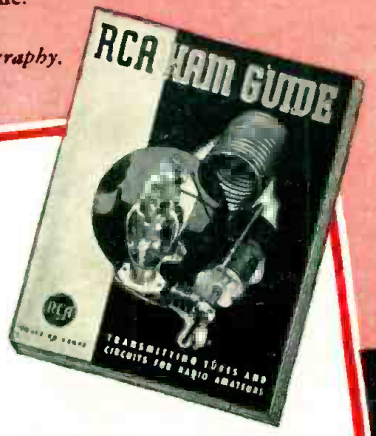
Listen-in to conversations on the air. Tune in on the talks across jobbers' counters. Ask other hams the next time your gang has a get-together. You'll find that, in a few short months, RCA-811 and RCA-812 Triodes have won a popularity that is unique among tube developments of recent years.

At rated values, these tubes offer just about all that any amateur could ask for—just the thing for present day conditions where most amateurs are looking for maximum results at an absolute minimum outlay of cash. But don't forget! Outstanding as their ratings are, they are still conservative. The new Zirconium-coated plates not only have very exceptional heat-dissipating qualities, but also function as highly effective "getters". Thus, the tubes can stand stiff temporary overloads and still come back for more. They not only give you real performance, but above all, they bring you the full measure of protection and dependability for which RCA Transmitting Tubes have long been famous.

No wonder many thousands have already been sold to set a new RCA sales record. No wonder the 811's and 812's are continuing as the most popular tubes in Radio's best-known line.

*ICAS Ratings for Class C Amateur Telegraphy.

Here's the Data You Want ...the Way You Want It!



Now ready—the RCA Ham Guide! Contains 48 richly illustrated pages chock full of timely new circuits, new construction features and complete data on all RCA Amateur Transmitting Tubes—all compiled in handy, easy-to-use form that any ham can put to immediate use. Tells what to do and exactly how to do it. Has plenty of help for the newcomer plus a whale of a lot of indispensable material for the old-timer. It's the Guide they're all beginning to talk about—a "must" item for every shack.

RCA HAM GUIDE

15c Amateur Net Price

Available through RCA Power Tube Distributors, or direct from RCA Commercial Engineering Section.

RCA Transmitting Tubes

For PERFORMANCE PLUS

RCA MANUFACTURING COMPANY, INC., CAMDEN, N. J. • A Service of the Radio Corporation of America

New DIRECTION FINDER

Model S-30 Radio Compass and Direction Finder covers from 200 to 3000 kc (1500 to 100 meters) on 3 bands—Beacon, Broadcast and Marine. Has provision for external speaker. Welded aluminum cabinet houses the receiver and supports the rotatable 12-inch loop antenna. Power supply in separate cabinet. Operates from 6 volts. $99.50 NET

the hallicrafters inc.
CHICAGO, U. S. A.

USED BY 33 GOVERNMENTS • SOLD IN 89 COUNTRIES

New PORTABLE COMMUNICATIONS RECEIVER

Model S-29 Sky Traveler operates on 110 volt AC or DC or from self-contained batteries. Covers from 542 kc to 30.5 mc (553 to 9.83 meters) on 4 bands. Built-in collapsible antenna extends to 5 feet. *Battery life prolonged through self-contained charging circuit.* Automatic noise limiter, electrical bandspread, built-in speaker, etc. $59.50 NET