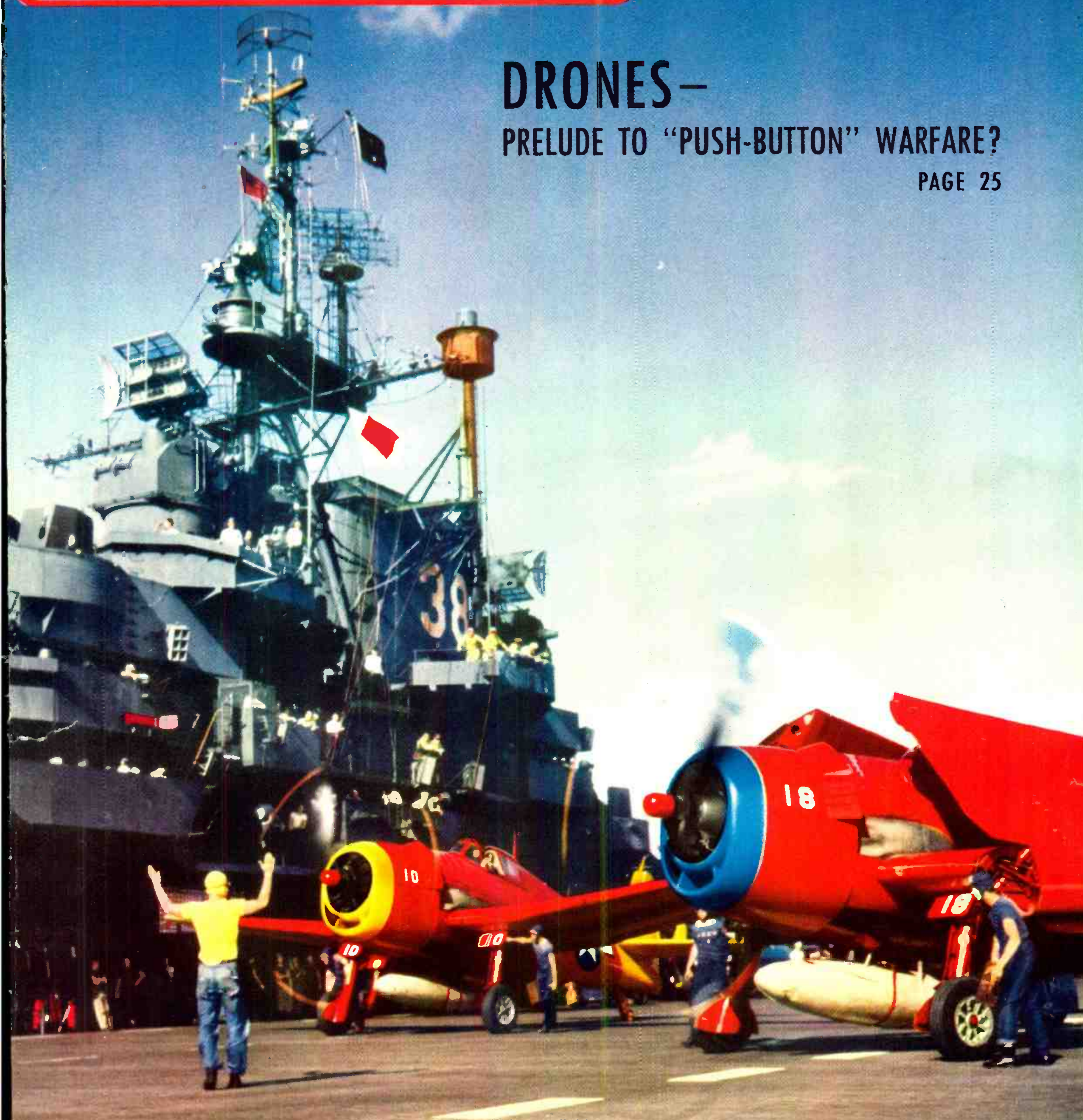
RADIO NEWS

OCTOBER
1946
35c
In Canada 40c

DRONES—
PRELUDE TO "PUSH-BUTTON" WARFARE?
PAGE 25



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RADIO NEWS

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First in radio

OCTOBER, 1946
VOLUME 36, NUMBER 4

Average Paid Circulation over 130,000

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COVER PHOTO
BY U. S. NAVY

Ready for the takeoff. Navy Hellcats warm up before leaving the flight deck of the Shangri-La to take part in Operation Crossroads Able Day atomic bomb test.

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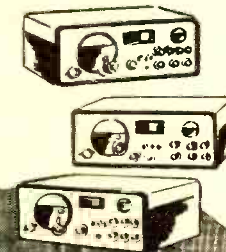
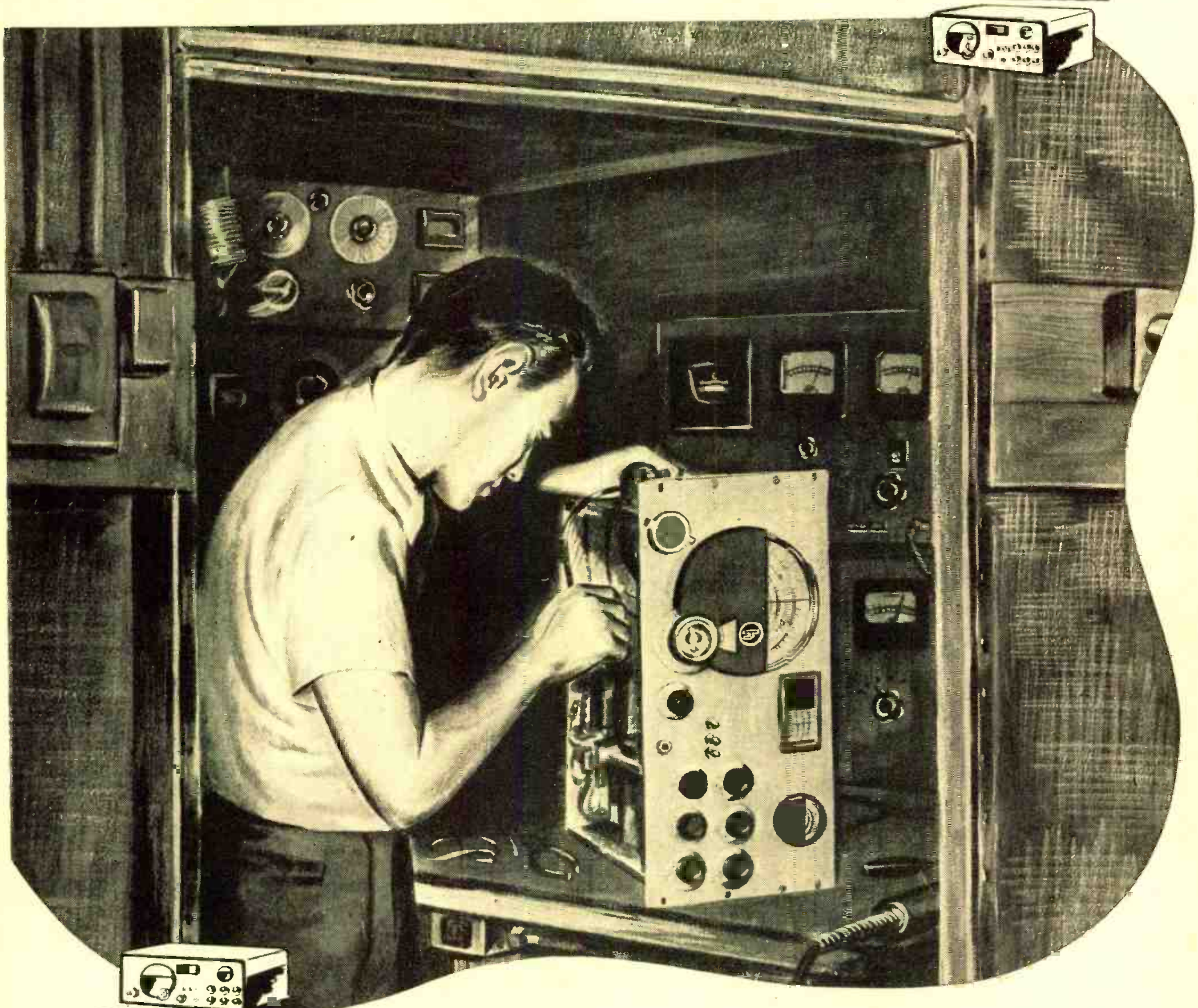
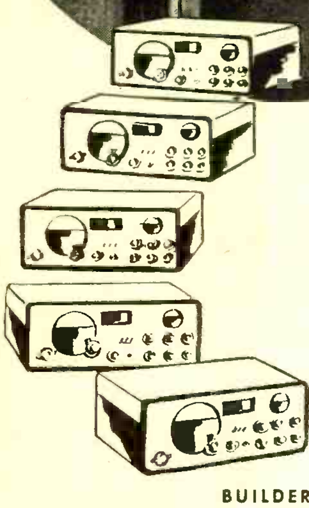
The first hundred sets are the hardest...







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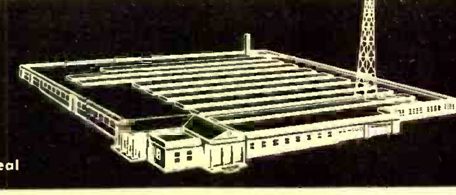

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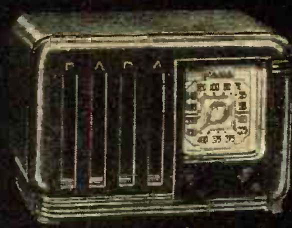

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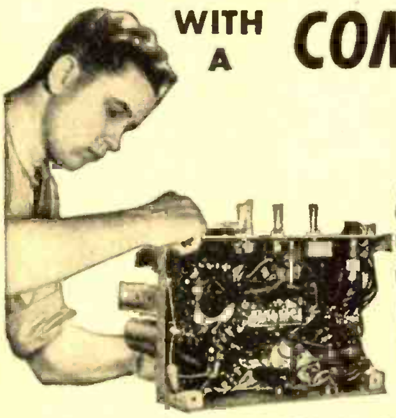

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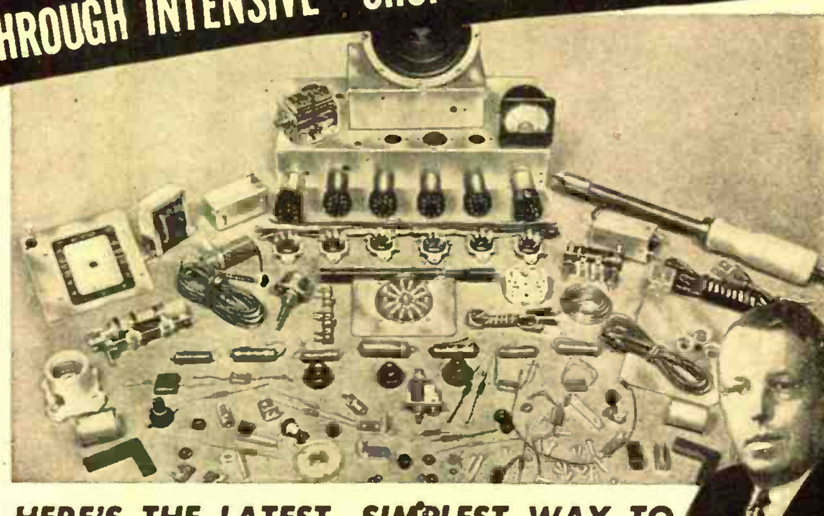

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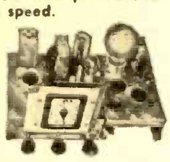

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For the RECORD

BY THE EDITOR

AMONG the handful of correspondents and observers that accompanied me via air to Bikini for Operation Crossroads, was Jack Rice, W6RTH, ace photographer for the San Francisco office of Associated Press. Jack was stationed aboard Admiral Blandy's flagship, the Mt. McKinley on Able Day. My fellow "ham" and companion shot many of those terrific pictures (AP) that many of you saw in your local newspapers but a few hours later. They were developed, printed and sent via radiophoto to the United States (after censorship by JTF-1).

I am satisfied that it won't be too long until satisfactory pictures will be transmitted by "hams" on their own channels and through equipment of their own of compact design.

It would be good news to all of us amateurs to read an announcement by some aggressive manufacturer that a kit was now available including basic mechanical parts for constructing experimental units.

SPEAKING of equipment reminds me of the three-man crew from Universal Broadcasting Company that hauled 500 pounds of recording gear to the Bikini area in order to cut some discs of background material, interviews, etc. to be sent back to the States for delayed broadcast purposes. Allan A. Kees, in a recent article, concludes his writing of the trip with the following:

"The equipment will be lighter next trip!"

By comparison—your editor (not an overly husky brute) easily carried a sixteen pound wire recorder on the 18,000 mile trek to Kwajalein, Bikini and return. The difference between their 500 pound and my 16 pound load prompted me to get out the "slip stick" and compile some figures.

I used three small spools of medium carbon steel wire. Each spool includes 66 minutes of recording. This, then, is a total of 198 minutes or three hours and eighteen minutes (the equivalent of seven 16" discs). The three spools cost $3.04 each, a total of $9.12. Seven discs, by comparison, would cost $2.00 apiece or $14.00.

However, the above figures apply only if all discs and wire were satisfactory and acceptable without any erasing (of wire), editing, dubbing, breakage, or mechanical failures. But one does not travel such distances without taking an adequate supply of discs, microphones, cutting styli, microscopes, spare parts 'n stuff. Furthermore — a second recorder is required (disc) if anything over fifteen minutes is to be cut without interruption. For long continuity then, one tiny spool of wire has plenty of recording time for a full hour show.

If, on a spool of wire, we encounter lulls or wasted recorded intelligence, we need only to erase the sound and use the wire over again. In fact, we can reuse the wire hundreds of times if we wish.

A bad disc can only be tossed away and its life is over. So—we'd need plenty of spares. This would represent additional cost, bulk, and weight. That is the one thing I wanted to avoid on the trip.

My compact equipment consisted of a new model wire recorder, weighing sixteen pounds, four small aluminum spools filled with carbon wire of .004" diameter, weighing a total of 48 ounces; one lapel crystal mike, 1½ ounces; one portable dynamic mike, 15 ounces; 50 feet of extension cord. 9½ ounces; and a kit of small screws and spare pulley belts, 3 ounces—making a grand total of less than 22 pounds. This represents a comparative weight reduction of 478 pounds—a very worthwhile figure!

Physical size or bulk is an equally important factor and must be considered on such a trip and here too we find substantial reductions.

I don't claim that wire recording is the complete answer to the recordist's prayer. When I need high fidelity stuff I use regular fixed studio transcription equipment at my home or, if occasion demands, take along a 13¼" portable disc recorder when high quality transcriptions are required of choirs, orchestras, etc.

But, the wire recorder certainly "rings the bell' for the recording of all of the usable frequencies that are needed for special applications out in the field, in a plane, on a train or, in fact, wherever one does not need to be concerned with mechanical vibration, a maze of accessories, or a case full of spare discs. I, personally, would not resort to the use of rubber pads, spring shock absorbers or cradles, special filters, rubber bands to hold down the cutting head, a pocket full of rags to wipe moisture off of the discs, or a damaged stylus. Instead, I would much prefer to make an hour's recording on wire and then later dub it on to discs if they were to be used for transcription purposes on turntable equipment.

My argument, then, is that we must recognize the basic limitations of any mechanical or electrical device. That is the important point. We must, as

(*Continued on page* 152)

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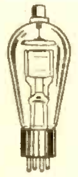

866/866A GOV'T INSPECTED RECTIFIER TUBES. Transmitting tube prices are UP, but you can save money on 866's. We made a good buy on these brand-new tubes and are passing this bargain on to you. Sorry—only four to a customer.

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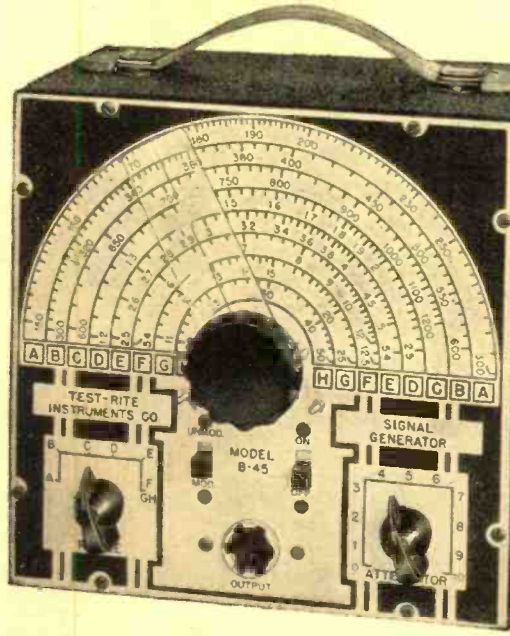

Model B-45 uses a beautiful processed dual-tone front panel. Comes housed in a heavy-gauge crystalline steel cabinet complete with shielded test lead, self-contained batteries and instructions.

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Spot Radio News

★ ***Presenting latest information on the Radio Industry.***

By FRED HAMLIN

Washington Editor, RADIO NEWS

LOOK FOR ONE OF THE BIGGEST Christmas sales seasons in all radio history—but that isn't saying the best. Industrial signposts point toward production at least good enough to meet a high portion of the demand, and the payoff in sales may be considered spectacular reward for the difficulties which are on the horizon and may rise to plague the industry's progress.

CHIEF AMONG THESE IS OPA. Late-summer developments, after OPA was restored, brought a 3.5 percent increase in the trade. The industry was not caught off base by the return of controls—during OPA's 25-day "death," no official reports were made of increases in set prices. Some wildcatters, of course, took advantage of the situation; but the industry as a whole held the line. This is being used as a powerful argument for decontrol as soon as possible, but how soon is a question. After nearly a month of uncertainty as to whether it was going on or going out of business, OPA is one of the busiest offices in Washington. Further grants of price rises seem doubtful under the circumstances.

DECONTROL ISN'T SOMETHING you can get overnight, even if you have it coming to you. Procedure calls for formal petitions and hearings before both OPA Administrator Paul Porter and, in event of appeals, before the new Decontrol Board. RMA and other radio representatives are at work on the problem, and progress was reported as this went to press. One note of minor optimism was sounded by RMA as the work got under way: price increases for certain radio components are an early prospect, and television receivers have been decontrolled.

PRODUCTION IN THE INDUSTRY is breaking records in preparation for the fall and winter market. First break for the better came in June, when receiver production passed the industry's prewar monthly average, although still far short of capacity. Largest production gains continued to be in small table models, and the shortage of gang condensers, tubes, wood cabinets and some component parts continued to dog the industry and hold back console production. Hope at summer's end was that the shortages would dry up as production in other fields smoothed out. Sizable production of television sets, until now only made to take care of show models, was anticipated in the early fall and winter.

RADIO AND TELEVISION TELEMETERING is electronics' latest contribution to the field of science and especially of aviation, and after seeing it demonstrated the other day by the Navy in Washington we are prepared to hail another masterpiece by the radio engineers who helped win the war. Reason for the two systems is that airplanes—and especially fast combat types developed late in the war—have become so swift and so complicated that it was impossible for any one test pilot to keep his eye on everything during initial flights. Of course, he had all the cockpit instruments that the market afforded, so designed that they could be read at a glance. But reading them and flying the plane was enough to keep him working overtime and if something went wrong it was his not to question what—he had little enough time to bail out. Result was that many a test ended in failure, if not test pilot casualties. The problem: to find a pilot with five or six dozen extra eyes.

THE TELEMETERING SYSTEMS solve that problem, giving the pilot some 68 different and almost instantaneous views of his ship while in flight. And if that sounds like black magic, all we can say in rebuttal is that, for our money, it is. Or to put it more practically, the systems record on the ground 68 different kinds of information simultaneously, reducing the costs of tests—a test plane that cracks up without its designers knowing why can mean a loss of as much as a million dollars—and reduces the risks for the test pilot to an all-time low.

TELEMETERING EQUIPMENT is divided into three units—radio-telemetering and television-telemetering flight test equipment, and a mobile receiving station. The radio unit transmits 14 channels of high-speed test data instantaneously to the ground unit and is capable of recording the

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ONE ISSUE FREE IF YOU ENCLOSE PAYMENT slowest change up to those occurring at 12,000 variations per minute. It is invaluable for detecting flutter, strain and pressure upon units in the plane. The radio unit is effective at 25 miles at 20,000 feet, and works at an altitude of as much as 44,000 feet. The television unit is slower, catching variations only up to 400 per minute, but it transmits far more channels of data—54. It televises cockpit instruments, 48 galvanometer light beams representing pressures, strains, positions of control surfaces, voltages, currents, and other variables. It also pictures fifteen breakage indicator lights to signal possible failure of various members of the airplane. A motion picture camera keeps a permanent record of the television screen and reports on trouble spots are radioed to the test-pilot as they appear.

CREDIT FOR THE SYSTEMS goes to the research laboratory of *Curtiss-Wright,* working during the war under a Navy contract. Since the war, work has been transferred in toto to the Cornell Aeronautical Laboratory at Buffalo. It is continuing, with special emphasis on pilotless aircraft and flying missiles. Off the record, we learned that the systems are being installed in industrial plants. *The Thomas A. Edison Company* is leading the way in this field. Tune the equipment into an assembly line of machines and the chief engineer can sit in his office and see how things are going simply by playing with dials. He doesn't even have to sit in his office, for that matter—he can have the central control unit set up in a one-and-one-half ton truck, like the mobile units we saw at the Navy demonstration.

ENEMY RADIO AND OTHER EQUIPMENT also had its day recently in Washington, displayed by the office of technical services of the Department of Commerce. Edwin Y. Webb, Jr., conducted a special tour of the more than three hundred captured German and Japanese items, and then guests stayed to marvel at some of the models. The stuff was assembled by Webb, chief of the Commerce electronics and communications unit, in cooperation with the Army Signal Corps and Navy's Research Laboratories. Most surprising was to find that the Germans were ahead of the Allies in a few fields—infrared (they beat us to the "snooperscope" and "sniperscope"), photophones, which transmit speech over a beam of light which cannot be intercepted (Nazis had one developed as early as 1935), and mine detectors. Their die-castings were also tops, and their walkie-talkies had better range.

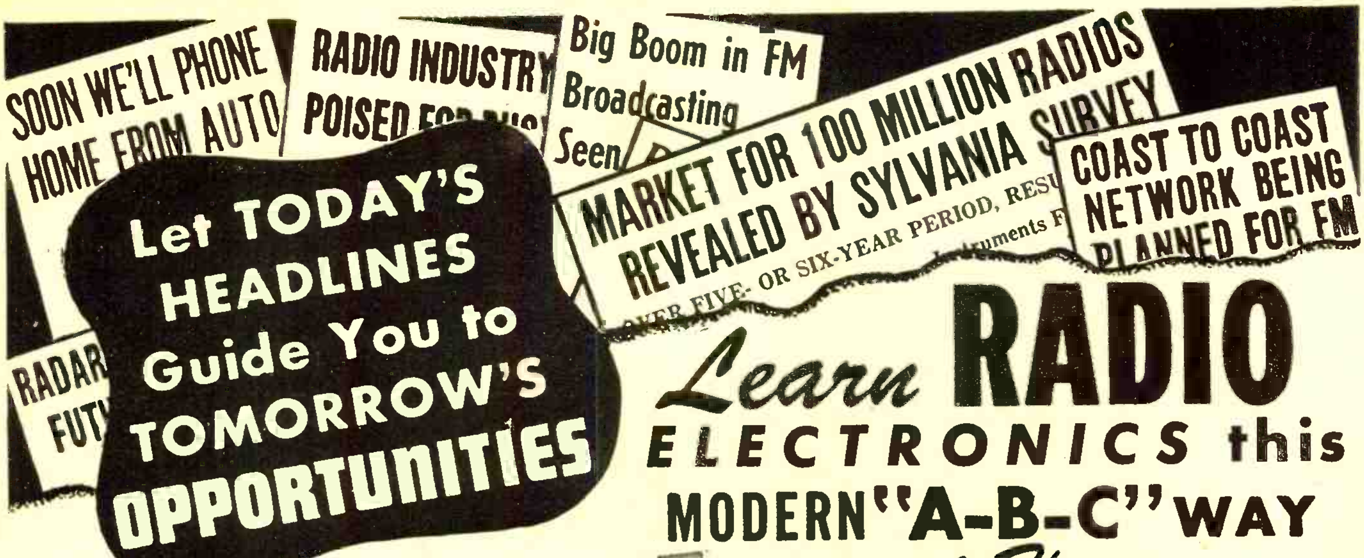
JAP INVENTIVE GENIUS was less brilliant. Most of the stuff was copied from German or Allied models, sometimes with amusing detail. One Jap audio-tone generator was a dead ringer for a U.S. model—built way back in 1929. But they did come up with a few things we didn't have. Their leather was more mold-resistant and most Jap equipment stood up better against fungus growth. A field telephone which had been in water in an Aleutian bay for more than a year worked perfectly after being wiped off with kerosene, and fungus-free equipment in a 30-ft. dugout on the banks of the Irriwaddy had been undamaged despite months of exposure to fungus and weather. Another funny thing—much of the Jap stuff was pretty, especially the elaborate wooden cabinets for some of the radio equipment. Apparently their officers like things fancy, even at the front.

SIMULTANEOUSLY WITH THE OPENING of the Department of Commerce show came an announcement from the State Department that patents on all the German stuff could be used, royalty-free, except for patents lawfully acquired by non-Germans. The announcement followed an accord reached at the recent twelve-nation conference on German-owned patents at London. The number of patents affected by the accord is more than 100,000. It also means that German patents used during the war by U. S. manufacturers under the administration of the Alien Property Custodian will be royalty-free. State Department spokesmen hail the freeing of the patent rights as "an important step in the program for the removal of trade barriers."

PERSONS DIFFER GREATLY in their ability to understand radio or telephone messages in a room full of noise, according to the Office of Technical Services at the Department of Commerce. The statement is based on studies made at the Psycho-Acoustic Laboratory, Harvard University, during the war, which proved conclusively that only certain individuals have the ability to listen in noisy situations. The Harvard savants hastened to add that inability to hear over noise had nothing to do with speaking or memory ability, intelligence, or proficiency in the International Morse Code. The studies were made with the help of phonograph records of single words and meaningful sentences against a noisy background. You can get the tests and instructions on how to take them from the Office of Technical Services, Department of Commerce, Washington, but they cost six dollars.

PUBLIC UTILITIES are the latest industrial group to be given access to radiocommunication services under FCC with its recent authorization of three new classes of stations—power utility, transit utility, and petroleum pipeline. Before the new authorizations, power utilities were restricted in their use of radio to emergencies

(*Continued on page* 143)



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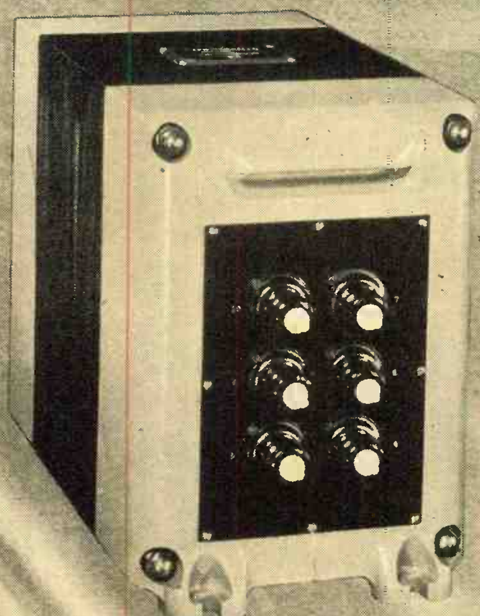

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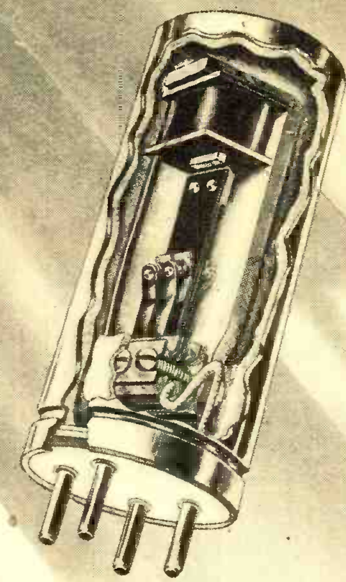

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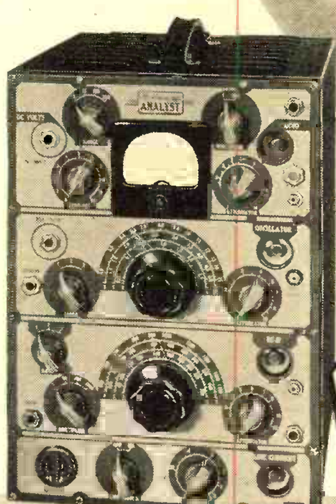

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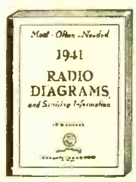

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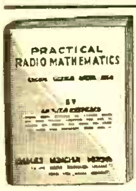

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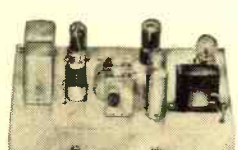

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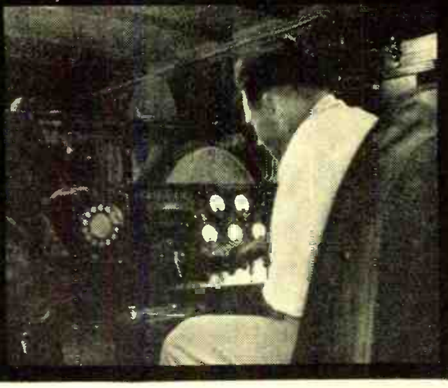

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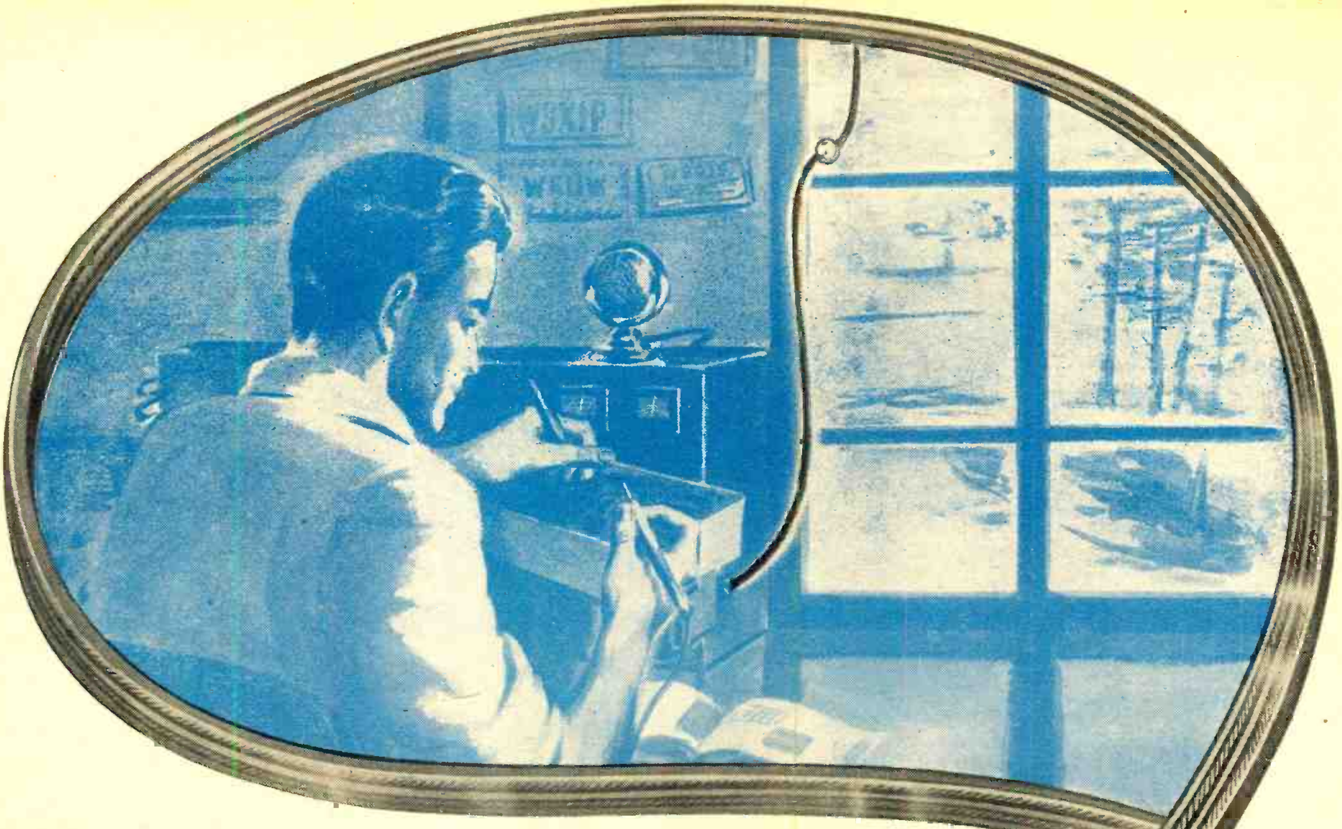

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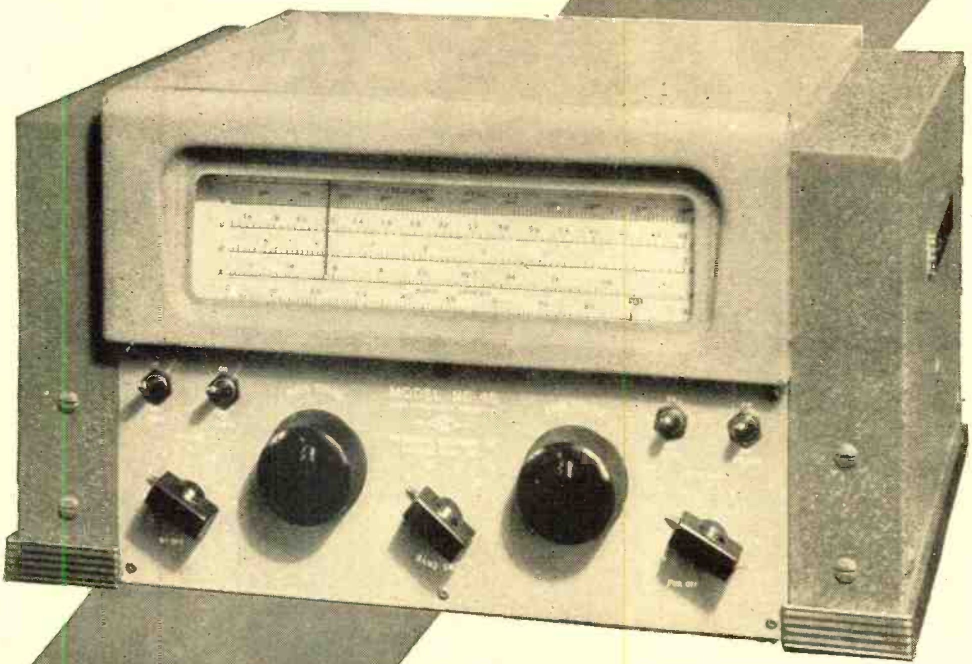

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ARMY E NAVY

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DRONES—Prelude to "Push-Button" WARFARE?

The first "mother" control plane approaches the catapult on the Shangri-La.

Crew connects launching mechanism for F6F Hellcat. Takeoff "control chair" operator (foreground) stands by.

By

OLIVER READ

Editor, RADIO NEWS

Atomic bombs "on the wing," guided swiftly and surely by radio to their target threaten mankind in war.

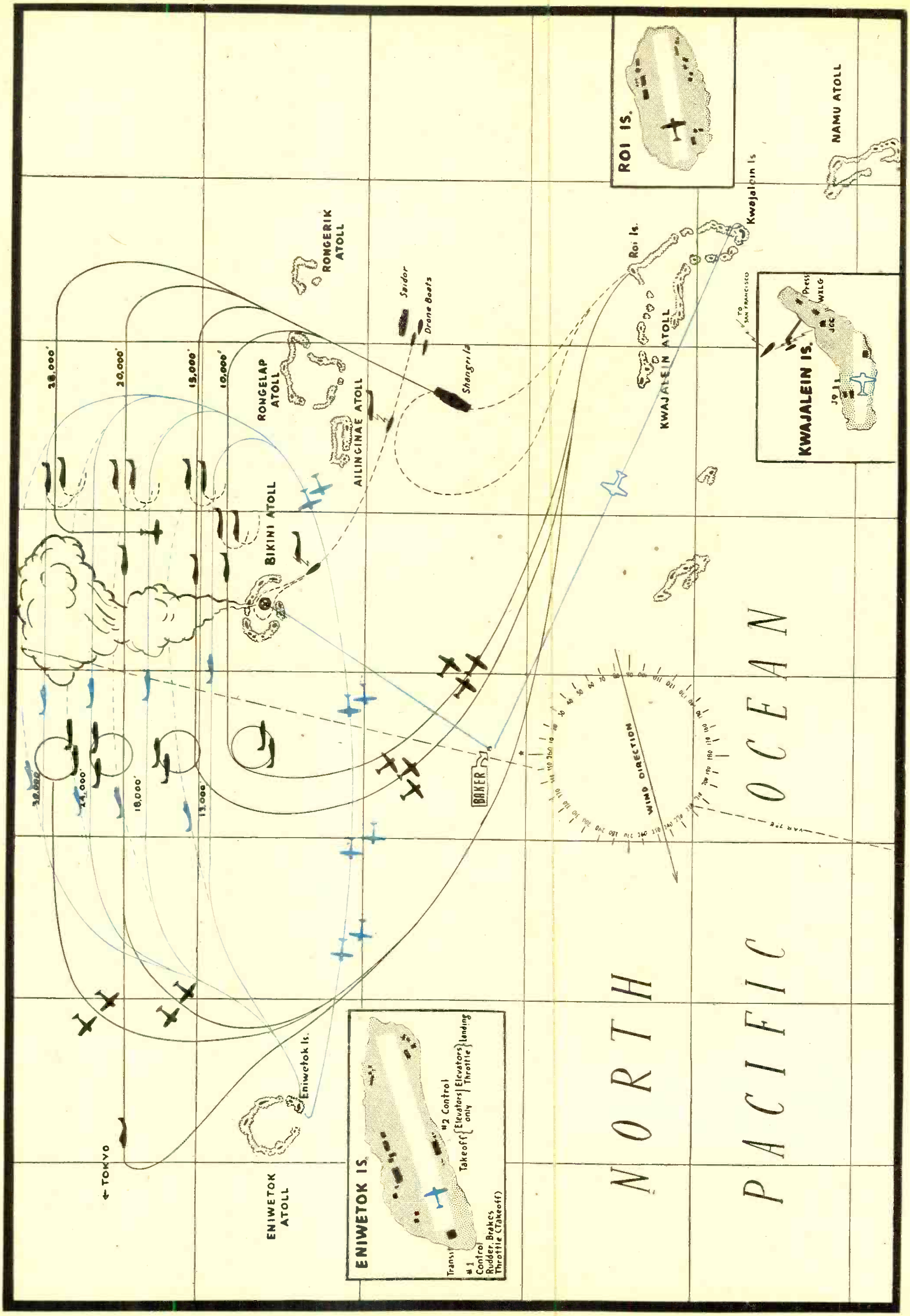
IT TAKES no crystal gazer to foresee wholesale destruction of cities by A-Bombs in future warfare. Those of us who witnessed the detonations at Bikini are quite in agreement that any future war will be fought with "guided missiles."

When a man combines two sciences, such as electronics and nuclear physics and perfects means for controlling their destructive powers he becomes a dangerous guy to have around.

The sterling performance of the radio-controlled planes at Operation Crossroads is very convincing evidence that we have at our fingertips a basically simple media for conducting highly successful airborne A-Bomb attacks on an enemy.

I spent a great deal of time studying both Army and Navy drones while attending the Bikini tests. In fact, I had the thrilling experience of flying

Its 90 foot run completed, the "mother" ship takes to the air at full throttle into the wind. She will stand by to take over control of her drone.


NORTH PACIFIC OCEAN
ENIWETOK ATOLL
ENIWETOK IS.
Eniwetok Is.
← TOKYO
#1 Control
Rudder, Brakes
Throttle (Takeoff)
#2 Control
Takeoff {Elevators only}
{Elevators Throttle} Landing
BIKINI ATOLL
AILINGINAE ATOLL
RONGELAP ATOLL
RONGERIK ATOLL
Shangri-la
Drone Boats
Saidor
BAKER
WIND DIRECTION
KWAJALEIN ATOLL
KWAJALEIN IS.
Kwajalein Is.
Roi Is.
ROI IS.
NAMU ATOLL
TO SAN FRANCISCO
Press
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30,000'
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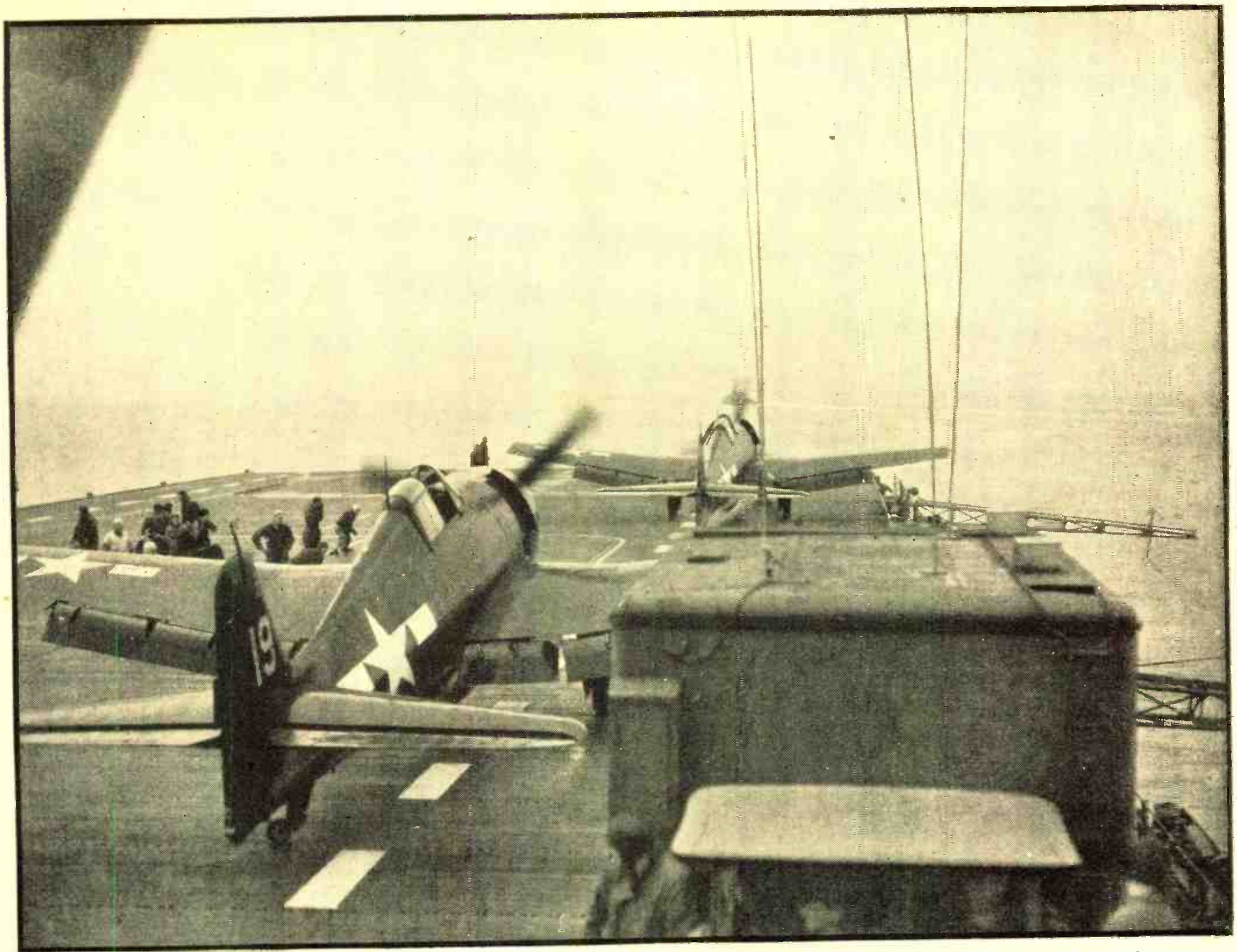


Ready to go—the first drone waits for its "mother" to pass overhead and "take control" after it has left the flight deck.

from Eniwetok to Kwajalein, a distance of over 300 miles, in one of the Army's B-17 drones.

I was stationed aboard the aircraft carrier, U.S.S. Shangri-La on and before A-Day and had a ringside seat to observe and record the operation of the Navy drones (see front cover). As mentioned in my article last month, Navy drones were catapulted from the flight deck of the Shangri-La as we headed into the wind and in the direction of the target. It was part of Admiral Blandy's plan to send these Navy fighters into the cloud at various altitudes in order to obtain samples of the radioactive particles and to record other vital information needed by the scientists.

The Navy employed a total of twenty F6F Hellcats. Sixteen of them were "mother" or control ships and the other four were the participating drones. The Navy system was to have two of the "mother" ships send the drone into the cloud while two more, assigned to each drone, circled on the far side of the cloud to pick up the drone as it came through and to guide it by radio to the island of Roi, located approximately 178 miles distant.

The Hellcat is a single-seater fighter type of aircraft. There is little room available, therefore, for "extra equipment." Hence, the Navy had to utilize the small area directly in back of the pilot's chair. As a matter of fact, there appeared to be more than enough room for the necessary control equipment. The radio system includes a receiver containing separate filters for 10 audio channels. These are highly sensitive in their ability to discriminate between various audio frequencies. A total of ten channels are employed for the control of the aircraft.

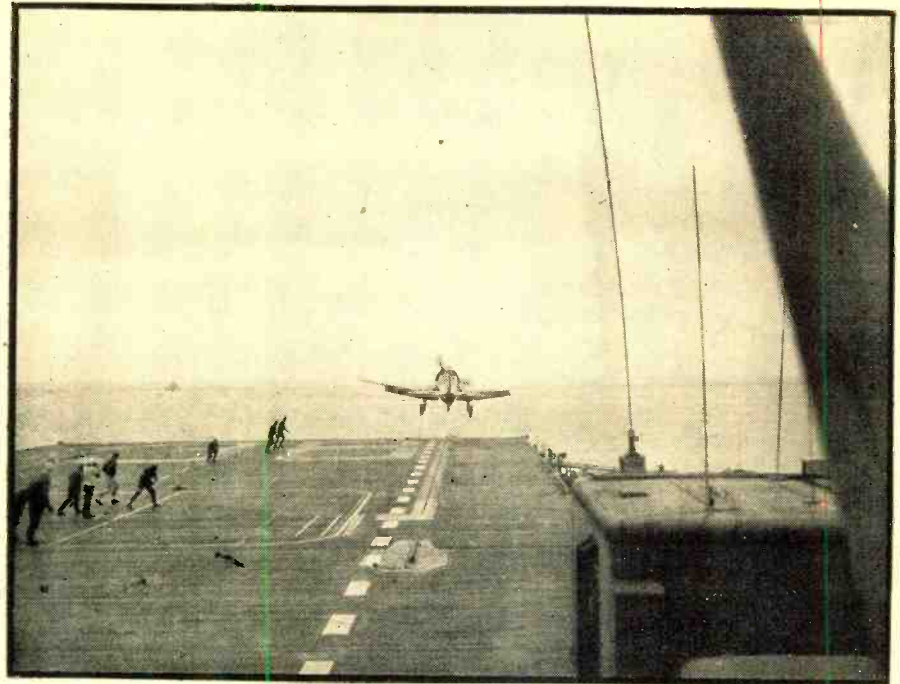
Selsyn motors are connected to the various controls such as the throttle, elevators, etc. by means of relatively simple mechanical gadgets to simulate the efforts of the pilot (if there were one). These planes have been controlled successfully within a radius of better than 150 miles. The entire

←

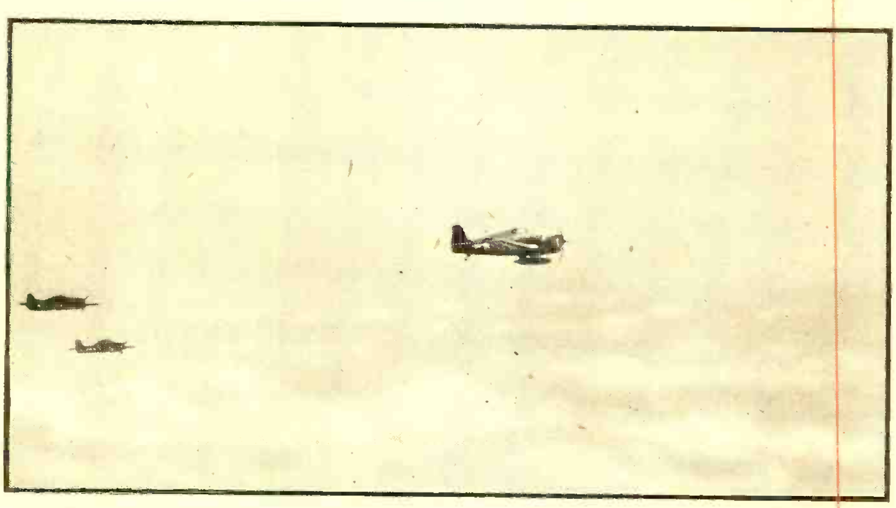
Map indicates route of Army (shown in blue) and Navy planes and ships that were active during the first atomic bomb test. Army drones took off and returned to Eniwetok Island, while Navy drone planes took off from the ship Shangri-La and returned to their land base on Roi Island. Navy F6F Hellcats, catapulted from the Shangri-La, streaked into the cloud first, followed by the Army B-17 drones. All but one of the drones were returned safely to their base after completing their historic atom bomb mission.

☆

Launching cable has been hooked on to this drone and the pilot has "deserted" ship after checking all controls. Until the plane is airborne it will be controlled from the carrier flight deck.



Impulses from the radio truck have the drone under perfect control. Crew rushes forward to "make ready" the next drone plane which will be launched.



Two "mothers" lag behind and send drone into cloud. Two other "mother" planes on the far side of the atom cloud pick up drone and return it to Roi Island.

radio control equipment weighs barely more than the average pilot so the normal maneuverability of the ship is not changed in any way whatsoever.

Each drone carried a special installation consisting of a small air sample bag and Geiger counters. Radioactive cloud material entered this small bag through a radio-controlled port that opened when an impulse was sent to the drone by the "mother" ship. Geiger counters were also carried in each drone and "mother" craft to record the amount of radioactivity present in the area and to warn control pilots. In some cases this information was transmitted by radio to the observers and scientists on various vessels within the Task Force.

On Able-Day minus one we witnessed the final checking of all control and mechanical equipment of the entire drone group. Spare drones were kept in readiness should they be needed.

On the morning of "A" or "Able-Day" I arose bright and early in order that I could have sufficient time to set up my portable wire recorder at a point of vantage where I could see both fore and aft as well as to look directly down on the flight deck. I finally selected a bridge high up on the superstructure, directly under the several radar antennas. I was able to get well over an hour's recording of the historical event. This tiny spool of wire has now become one of my most valued possessions.

While awaiting the takeoff of the first of the "mother" ships I learned that the first Navy drones were used back in 1936. Later several B-24s were controlled by radio. This was in 1944.

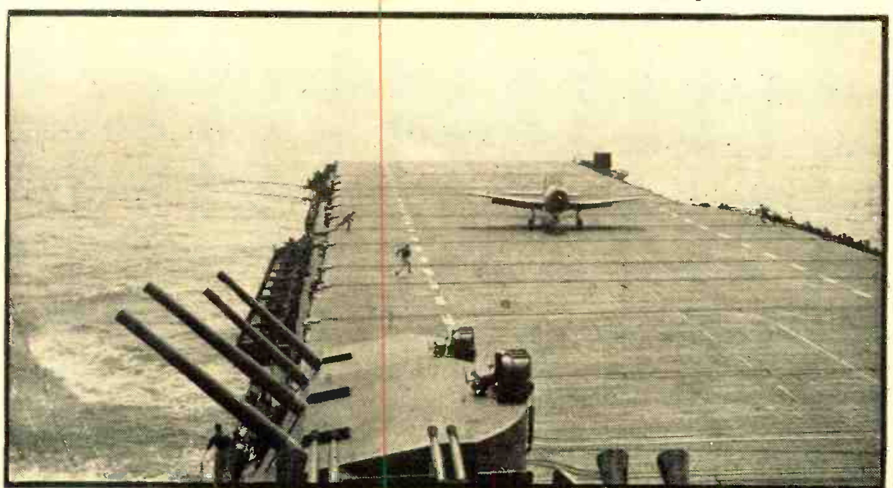
The Hellcats arrived with the Shangri-La and the first rehearsal took place on June 10th, followed by two more on June 24th. The first two tests were conducted under the scrutiny of the pilots who stood by at the controls should it be necessary for them to take over. The June 24th rehearsal however, was carried out minus the pilots and the drones were airborne without personnel.

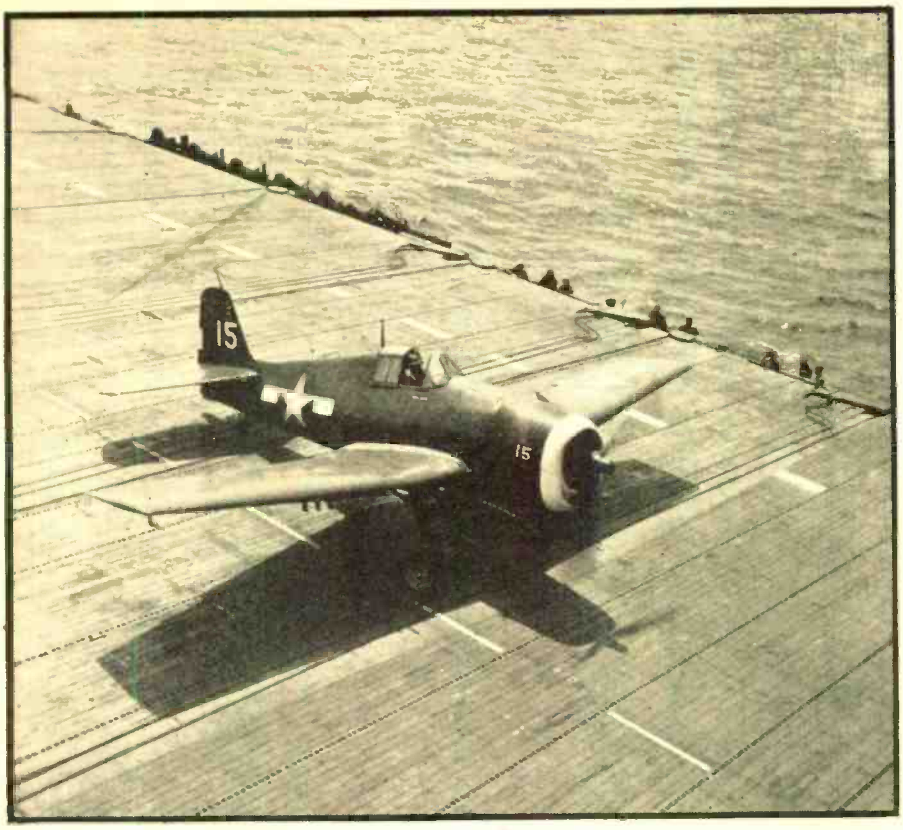
The first to take off on A-Day were the sixteen "mother" ships. They were thoroughly warmed up prior to takeoff and were catapulted at thirty second intervals from the two ninety-foot catapults built into the flight deck.

Shortly thereafter the first of the drones was secured in place on catapult No. 1. The pilot then left the ship which he had taxied to position. After closing the cowling it was ready to go. Two of the "mother" ships which had been circling in the area, came in over the flight deck and, at exactly the right moment, "took over" control of the drone.

The drones are controlled on takeoff from the radio control truck parked and tied securely down to the

Landing at 20 second intervals, the first of ten "mother" planes sets down after completing its mission of guiding the drone planes.





drones were on their way to sections V and S where they were to circle in readiness for the run into the cloud. The four drones had attained altitudes of 10,000, 15,000, 20,000 and 28,000 feet.

We were listening to the communications channels including the direct commentary (140 mc.) from the bomber. I was able to hear and to record many transmissions from the command ship, from Kwajalein, from various aircraft in flight, and from other units engaged in the test.

The drone flying at 20,000 feet got away from its control ships after passing through the cloud and streaked toward Tokyo at approximately 400 m.p.h. It was tracked by radar as its "mother" ships took up the chase and was finally brought under control 53 minutes later and returned to Roi.

The automatic pilot on the 28,000 ft. drone failed before the drone was able to enter the cloud and went down to Davey Jones locker. This was the only drone lost in the operation. The other drones, having passed safely through the cloud, were picked up by their "mother" ships and returned safely to Roi. One of them was so radioactive that it was parked well out in the clear and all personnel were kept away. As a matter of fact,

Mission completed. This pilot taxis his ship forward to park. Another plane will follow in twenty seconds.

→ Ground control positions for the Army B-17 drones. Powerful binoculars on top of the tripod permit the "ground pilot" to view the incoming plane which he is controlling by means of the electronic "joy stick" housed in the small box attached to the tripod. Radio transmitter which controls the plane is in jeep.

Close-up view of control position as plane is landed by radio control from the ground.

flight deck. Long cables extend from the truck to the controlling chair, as shown in the illustrations. The chair operator has a control box at his fingertips which functions in much the same manner as does the control mechanism on the plane. He is able to maneuver the ship during its take-off and while it is airborne as long as he can observe the behavior of the craft while in flight.

The rest of the drones were soon on their way to the target area and things quieted down considerably. We had now reached point Tare and our it was not possible to examine the ship for many days following.

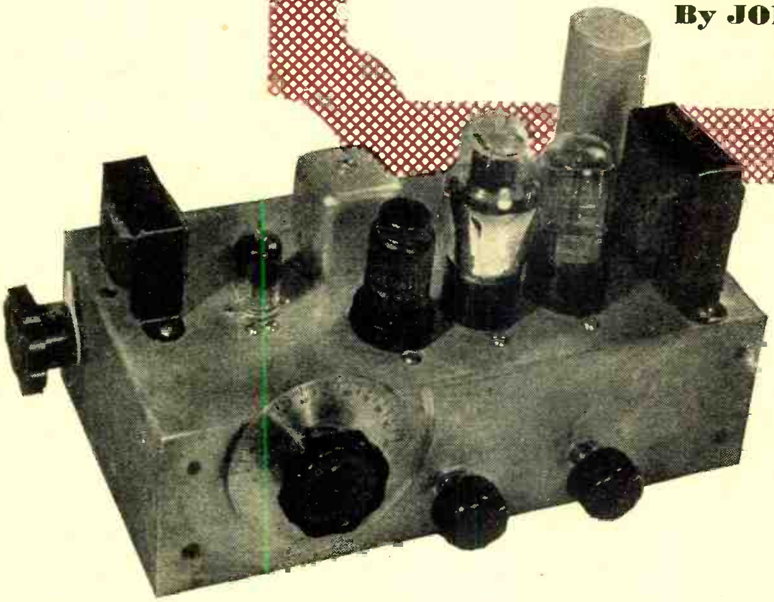
It is interesting to note that the drones could have all been returned to the Shangri-La if there had been no danger of radioactivity. Under the circumstances however, this would have been disastrous to the personnel aboard.

I mentioned earlier that I had flown in one of the Army drones. The B-17s gave an excellent account of themselves during the test. Their job was to gather similar material to that of

(*Continued on page* 100)

SUPER-REGENERATIVE 2 METER RECEIVER

By JOHN A. KIRK, W3CRB



External view of completed receiver. Control on side panel of unit is used to adjust coupling between coils, L_1 and L_2.

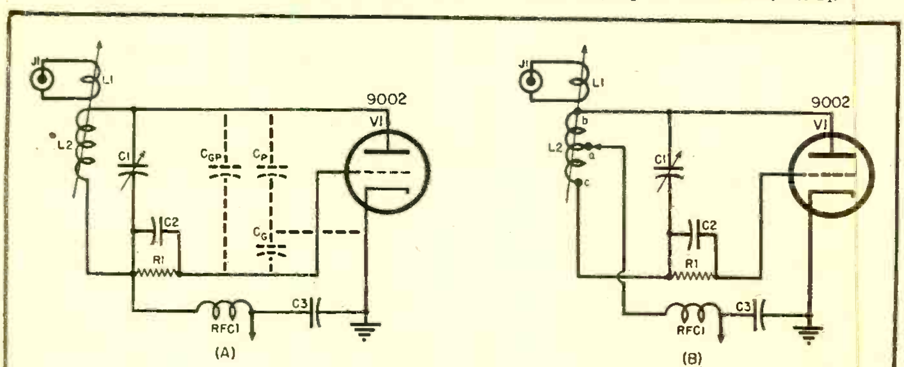
Design characteristics of a highly sensitive receiver that holds a remarkable two-meter reception record of a distance of 850 miles.

ALTHOUGH there have been numerous articles describing super-regenerative receivers and the theory of their operation, there seems to be a great deal about the subject that has been left unsaid.

This article will describe a super-sensitive receiver and tell why and how it came into being. But first it will be necessary to correct some of the misunderstanding and general "haze" that surrounds the subject.

First, super-regenerative receivers are not all alike. We tested a half-dozen local amateur 2-meter receivers. The worst of these could barely receive a 10 microvolt signal while the best receiver could comfortably receive a half microvolt signal.

Fig. 1. (A) Tube and socket capacities as they appear in a conventional Colpitts detector. (B) Circuit used by author to check quality of r.f. choke, RFC_1.



Parts values are the same as those shown in Fig. 2.

Second, a constructor can build two receivers in a row that will perform alike, provided he uses exact duplicate components and scrupulously follows the original layout and wiring placement. Proof of this lies in the fact that thousands of super-regenerative receivers have been built in production and their performance is within a few per-cent of each other.

Third, super-regenerative receivers can be as sensitive as better grade superheterodynes for v.h.f., by any performance standards. The receiver described in this article can "hear" signals as weak as 0.1 microvolt and will develop a 10 db. signal plus noise-to-noise ratio on a 1 microvolt signal (30%, 400 cycle modulation).

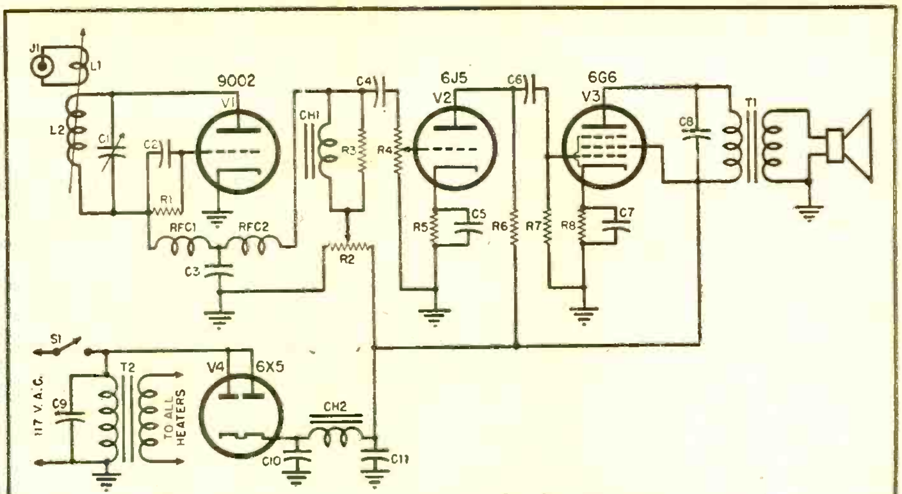
Fourth, an r.f. amplifier will not always make a super-regenerative receiver more sensitive. A less sensitive s.r. detector may develop such a terrific "hiss" output, due to improper component values, bad layout, and poor tuned circuit and/or coupling conditions, that it might take a signal many times above antenna noise to "punch" through. Thus, a less sensitive detector may be improved by an r.f. amplifier which can build up weaker signals (signals which are weak, yet above the noise in the antenna) to a strength sufficient to "punch" through the din created in an inefficient detector circuit. However, a really "hot" s.r. detector can dig down to the first circuit noise level and actually be triggered by noise from the antenna.

Factors influencing super-regenerative receiver performance, not necessarily in the order of their importance, are as follows.

The matter of layout of v.h.f. super-regenerative detectors has seldom been granted sufficient prominence. It might be assumed from a casual consideration of the problem that the important points of a good detector layout would be short leads, low stray capacitance between circuit elements and chassis, and quality r.f. insulation, the usual criteria for a good v.h.f. oscillator. However, it should be remembered that grid-to-ground, plate-to-ground, and grid-to-plate capacities of the detector tube and tube socket are greater than the capacitance of the usual 2-plate, midget variable tuning condenser used in 2-meter super-regenerative detectors. Wiring capacitance and capacity between components may easily become greater in certain layouts. Practically any lead length has significance as an inductance, across which an r.f. potential can develop. In addition is the fact that a good layout which is conducive to "vigorous" r.f. oscillation, is not desirable in a 2-meter detector. Experience has indicated that vigor and sensitivity do not go hand-in-hand in the bi-oscillating, self-quenching, super-regenerative detector. If a reliable, healthy, low frequency (just above audibility) quench oscillation can be maintained while the r.f. oscillation is on the threshold of being extinguished, the happy condition of a super-sensitive, s.r. detector can be realized. The only way the author has found to obtain this characteristic is to try different layouts experimentally while rechecking component values, operating voltage and antenna coil coupling.

The matter of tube type as a factor influencing s.r. detector performance may well be considered here as it is tied up quite closely to the layout factor. Tube type is important in the v.h.f. super-regenerative detector because the tube and socket capacitances make up the capacity voltage divider feedback circuit for the conventional Colpitts detector, as shown in Fig. 1A.

Many technicians have mistaken the heavier audio output of tubes like the 6C4 and 7A4 as increased sensitivity over the 9002. But, while the audio output increased, it was accompanied by an increase in noise, radiation, and "B" current drain. Besides a reminder that audio gain comes easily and is cheap to obtain, the fact should be brought out that detector sensitivity (on a signal-to-noise basis) is usually lost here. The stronger oscillations of the heavier drain tubes makes necessary a stronger input signal in order to cause the same degree of "squelch-out" of the characteristic super-regenerative "hiss." The author was a die-hard on the 955 acorn, believing that the lower capacitances resulting from acorn socket construction would permit more capacity in the tuning circuit, with a consequent improvement in stability and selectivity. However, in several different layouts, trouble was experienced in getting good sensitivity with the 955, and in each case the mere substitution of a 9002 resulted in doubled sensitivity. It is possible that the addition of "gimmick" condensers between tube elements and chassis might make the 955 equivalent to the



R_1—15 megohms, ½ w. res.
R_2—40,000 ohm, w.w. pot. (regeneration control)
R_3, R_6—100,000 ohm, ½ w. res.
R_4—1 megohm pot. (audio gain control)
R_5—5000 ohm, 1 w. res.
R_7—500,000 ohm, ½ w. res.
R_8—500 ohm, 2 w. res.
C_1—Three-plate midget var. cond.
C_2—50 μμfd. mica cond.
C_3—.004 μfd.. mica cond.
C_4, C_6—.02 μfd., 400 v. cond.
C_5, C_7—10 μfd., 25 v. cond.
C_8—.005 μfd., 400 v. cond.
C_9—.1 μfd., 400 v. cond.
C_{10}, C_{11}—40 μfd., 150 v. elec. cond.
T_1—Output trans.
T_2—Fil. trans., 6.3 v., 2 amp.
S_1—S.p.s.t. toggle sw.
L_1—3 turns, #14 wire, ½" diam.
L_2—3 turns, #14 wire, ½" diam.
CH_1, CH_2—20 hy. filter choke
J_1—Coaxial cable fitting (chassis type)
RFC_1—15 turns #28 wire, ¼" diam.
RFC_2—80 mh. r.f. choke
V_1—9002
V_2—6J5 or 6C5
V_3—6G6, 6V6 or 6F6
V_4—6X5

Fig. 2. Using a minimum number of parts and employing conventional type circuits, this super-regenerative type receiver is easy to construct.

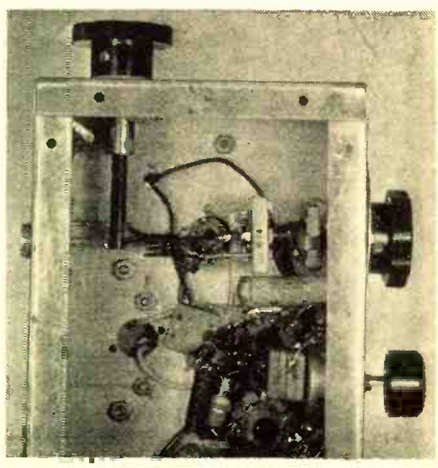
9002 in this application, but it is doubtful whether the time involved in making such experiments would pay off in the long run. Look for the tables to turn with these two tube types, however, on the frequencies above 144 mc..

The matter of grid leak (R_1) and grid condenser (C_2) values for v.h.f. is simple to determine. A good standard grid condenser value is 50 μμfd. and is seldom critical in its effect upon sensitivity. In general, the higher the grid resistor value (in megohms) the more sensitive the detector. Sensitivity usually improves rapidly with increased resistance up to about 10 megohms, but more slowly above this value. A good starting value is 15 megohms. If the quench frequency is within audibility under normal operation and coupled to an antenna, it is wisest to reduce the capacity of the grid condenser to 40 μμfd. or 30 μμfd. in order to raise the audibility. If the quench remains audible after these substitutions, the grid resistor will have to be reduced, one megohm at a time, until the quench is inaudible. However, if it becomes necessary to reduce the grid resistor value below about 7 megohms, the layout should be considered "doubtful" and the detector will probably not perform with the "hottest."

Coupling between the antenna coil and grid coil is a very important factor in the performance of a super-regenerative receiver and should be variable so that it can be adjusted for optimum at any frequency within the tuning range. At different frequencies, antenna loading will be found to vary considerably with the conventional antennas used on 2 meters. Continuity of whatever type feedline used should be maintained right up to the antenna coil. For coaxial cable, the antenna coil should consist of a single turn of wire the same diameter as the grid coil, and short, flexible leads should join the ends of the single turn to a coaxial fitting (chassis type). The addition of an r.f. amplifier stage is said to reduce "antenna effect." This is true insofar as the operator is concerned, as the r.f. stage masks antenna loading performance. An antenna which causes severe sharp dead spots in the band, is in all probability poorly matched at either the antenna end or along the feeder at a splice or relay junction. A temporary cure (and a good test for standing waves on the feeder) is to either shorten or lengthen the feed line 6 inches or so at a time until the dead spots are outside the desired frequency band.

(*Continued on page* 104)

Expanded view of the r.f. section.



An Inexpensive

Midget Phone-C.W. Transmitter

Fig. 1. Panel view of transmitter shows microphone and coaxial antenna line plugged in.

By

RUFUS P. TURNER, W1AY

Consulting Engr., RADIO NEWS

Providing an input of 40 watts, this small transmitter can be built from junk box parts.

THERE is no question that new amateur transmitter building is retarded seriously by the shortage of parts. At this writing, a complete set of *preferred* parts for a particular design just cannot be located, except in rare cases, at any combination of stores in and out of town. Even when certain parts can be located, it is seldom that more than one or two of any specialized item will be available right away. Except for incidental parts like ordinary capacitors, resistors, sockets, etc., they don't appear in threes and fours with any marked regularity. All of this is very annoying to the new ham who wants to get on the air.

The receiver parts situation is somewhat better. While it still is not easy to find specific brands, sizes, and shapes in all of the components for which one shops, some parts meeting specifications more or less can be located in one or more stores.

With all of these things in mind, we decided to build a small, inexpensive, and completely self-contained phone-c.w. transmitter from whatever parts we could find in the single radio store in a small city. We knew we would have to take mostly receiver parts, and we wanted the final amplifier input power to be sufficient to give a newcomer an even break and still not be unattractively low for an old-timer in search of an inexpensive design. So we set 40 watts input as the goal. It was interesting to make concessions here and there and note what we had as a transmitter when it came out of the scuffle.

The final transmitter is described in this article. It is built on an amplifier "foundation chassis" which gives it a rather pleasing appearance —a desirable feature when the transmitter is to be located in living quarters. The r.f. section, modulator, speech amplifier, and power supply all are built upon the same chassis, so there are no loose ends. The parallel 6L6G final amplifier takes an input between 30 and 40 watts and is driven directly by a *lightly-loaded* 7C5 crystal oscillator. The oscillator is capable of plate circuit doubling.

The 6L6G tubes are triode connected (screen tied to plate at the socket) for easier modulation by the single 6L6 cathode modulator. The speech amplifier section is a high-gain 6SJ7-6J5 arrangement with ample gain for a crystal microphone. The power supply is built around broadcast replacement type transformer, filter chokes, and electrolytic capacitors. The total current required by the tube plates and screens is more than could be handled by any of the available replacement type midget filter chokes, so two separate filters will be found in the circuit schematic, Fig. 2. If the reader can find a small-sized 250- or 300-milliampere choke, one of these filters may be eliminated.

The various sections of the transmitter are described separately in the following paragraphs.

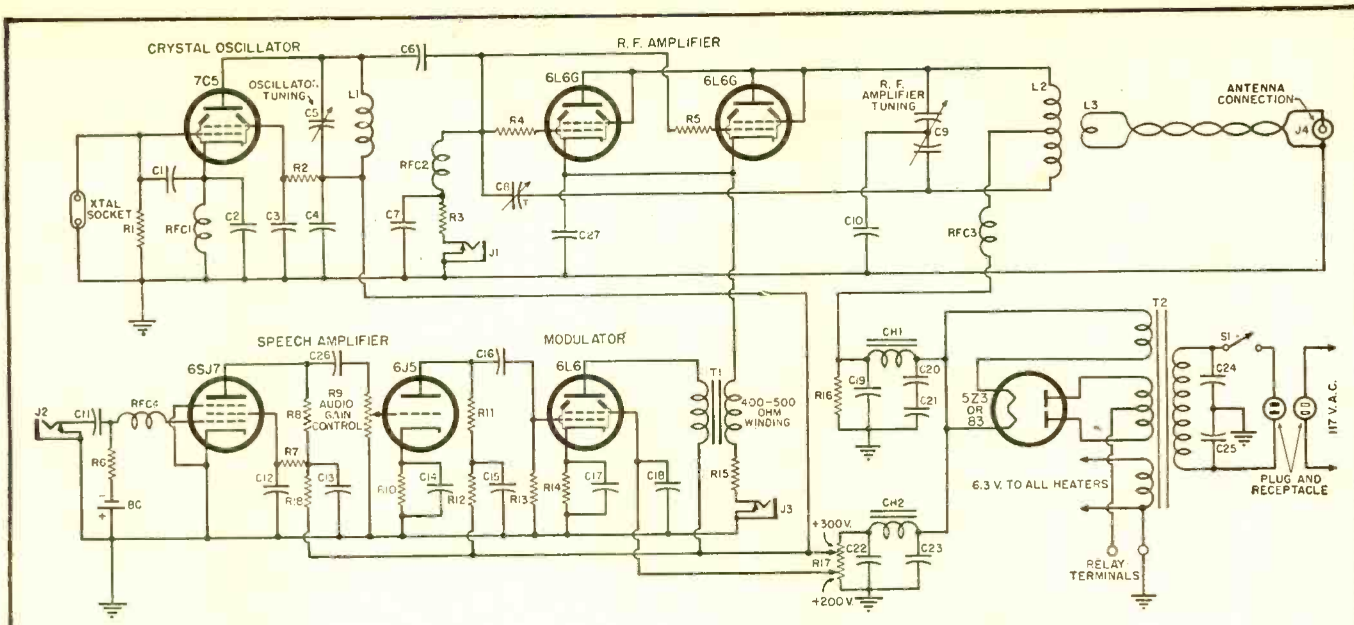
R. F. Section

Fig. 2 shows the complete transmitter circuit. The crystal oscillator employs a type 7C5 loktal tube. Space did not permit a crystal switching arrangement, so crystals must be plugged singly into the one crystal socket when changing frequency. The crystal oscillator tank coil, L_1, is wound on a 4-pin form which plugs into a 4-pin ceramic tube socket. Winding data for this coil is given in the accompanying Table 1. The polystyrene coil form employed by the author may be seen plugged into its socket directly to the right of the 7C5 tube in Fig. 3. The oscillator is tuned by means of a 50 μμfd. single-spaced midget variable capacitor, C_5.

The oscillator is able to double frequency easily in its plate circuit. For example; a 160-meter crystal may be used against an 80-meter L_1 coil for 80-meter output, or a 20-meter L_1 coil may be used with a 40-meter crystal of suitable frequency for 20-meter output. However, harmonic type crystals, such as 10- and 20-meter plates, must be used straight through —that is, in conjunction with a 10-meter coil for 10-meter operation or 20-meter coil for 20-meter operation.

The oscillator is capacitance coupled to the final amplifier by means of a 25 μμfd. mica capacitor, C_6. This small coupling capacitance minimizes interaction between the two r.f. stages and "load modulation" effects. After final adjustments were made on the transmitter, no frequency modulation was detected.

The final amplifier embraces two



R_1—100,000 ohm, ½ w. res.
R_2—10,000 ohm, 1 w. res.
R_3—10,000 ohm, 10 w. res.
R_4, R_5—50 ohm, 1 w. res.
R_6, R_{13}—1 megohm, ½ w. res.
R_7—2 megohm, ½ w. res.
R_8—500,000 ohm, ½ w. res.
R_9—500,000 ohm pot.
R_{10}—1500 ohm, 1 w. res.
R_{11}—250,000 ohm, ½ w. res.
R_{12}, R_{18}—50,000 ohm, ½ w. res.
R_{14}—220 ohm, 10 w. res.
R_{15}—200 ohm, 10 w. res.
R_{16}—100,000 ohm, 10 w. res.
R_{17}—25,000 ohm, 50 w. res. (with two sliders)
C_1—40 μμfd. mica cond.
C_2—.00025 μfd., mica cond.
C_3, C_4, C_{10}, C_{27}—.002 μfd., mica cond.
C_5—50 μμfd. single-spaced midget var. (Millen 21050)
C_6—25 μμfd. mica cond.
C_7—.5 μfd., 600 v. tub. cond.
C_8—3-30 μμfd. leaf-type trimmer (See text)
C_9—100 μμfd. (per section) midget var. (Hammarlund MCD-100M)
C_{11}, C_{16}, C_{26}—.01 μfd. mica cond.
C_{12}, C_{24}, C_{25}—.1 μfd., 600 v. tub. cond.
C_{13}, C_{15}, C_{18}, C_{19}, C_{20}, C_{21}—8 μfd., 450 d.c., w.v. elec. cond.
C_{14}—20 μfd., 25 d.c., w.v. elec. cond.
C_{17}—10 μfd., 50 d.c., w.v. elec. cond.
C_{22}, C_{23}—Sections of a dual 8 μfd., 450 d.c., w.v. elec. cond.
CH_1—15 to 20 hy., 200 to 250 ma. midget filter choke
CH_2—15 to 20 hy., 100 to 125 ma. midget filter choke
RFC_1, RFC_2, RFC_3, RFC_4—2½ mh. r.f. chokes
BC—1¼ volt bias cell
S_1—S.p.s.t. toggle sw.
L_1, L_2, L_3—See text and coil table
J_1, J_3—Midget 2-circuit jack (normally closed)
J_2—Midget single-circuit jack (normally closed)
J_4—Coaxial socket for chassis (Amphenol SO239 CPH49194 with matching plug, Amphenol PL-259 CPH-49190)
T_1—Cathode modulation trans. Plate winding; 4000 to 4500 ohms. Output winding; 400 to 500 ohms at 100 ma. d.c. minimum. (Stancor A3888 or equivalent)
T_2—Power trans. High voltage: 350 to 400 v. each side of c.t. at 200 to 250 ma. Filaments; 5 v., 3 amps; 6.3 v., 5 amps. (Stancor P-5059 or equivalent)

Fig. 2. Schematic diagram for transmitter. For low harmonic output, a 50 μμfd. fixed air condenser should be permanently connected across the 80-meter final tank coil.

6L6-G tubes neutralized by means of capacitor C_8. The latter may be one of the familiar 3-30 μμfd. leaf type ceramic-based mica trimmers or one of the specific 6L6 neutralizing capacitors such as *National* NC600 or *Bud* 890. Neutralization of the amplifier stage is very easy.

The final amplifier has a combination of grid resistor and cathode bias. R_3 is the grid resistor; R_{15}, the cathode resistor. The cathode bias protects the 6L6-G tubes when excitation is removed by detuning or interrupting the crystal oscillator.

A midget split-stator tuning capacitor, C_9, provides amplifier plate circuit tuning. The author shows a *Hammarlund* MCD-100M unit in this position, but any obtainable equivalent, such as *Bud* 911, *National* STHD-100, *Millen* 23100, or *Johnson* 100HD-15 having a maximum capacitance of 100 μμfd. per section may be employed. The plate tank coil, L_2, like the oscillator coil, is of the plug-in variety. It must be center-tapped and provided with a variable-coupling link winding, L_3. The manufactured coil (*Barker & Williamson* Type JVL) employed by the author plugs into a 5-pin ceramic socket and may be seen directly in front of the power transformer in Fig. 3. Any equivalent 50 watt coil of commercial manufacture, with swinging link, might be used—or the reader may wind his own final amplifier coils according to data given in the accompanying coil table.

The link winding, L_3, feeds into a coaxial output jack, J_4. This jack is seen at the right-hand end of the chassis in Fig. 3. A coaxial line from

Fig. 3. Top chassis view shows arrangement of components. Parts may be identified by referring to the chassis layout, Fig. 4. 10-meter coils are shown in position.

BAND	L_1 Oscillator Plate	L_2 Amp. Plate	L_3 Antenna Link
3500-4000 kc.	40 T. No. 24 enamelled wire 1¼" in diam. Space to winding length of 1 inch.	60 T. No. 18 enamelled wire 1¼" in diam. Space diam. of wire. Tap 30th turn.	3 T. No. 18 enamelled wire not less than 1¼" in diam. Space to winding length of ½" and operate at center of L_2.
7000-7300 kc.	21 T. No. 18 enamelled wire 1¼" in diam. Space to winding length of 1 inch.	30 T. No. 18 enamelled wire 1¼" in diam. Space to winding length of 2 inches. Tap 15th turn.	Same as above.
14-14.4 mc.	8 T. No. 18 enamelled wire 1¼" in diam. Space to winding length of 1⅛ inch.	12 T. No. 18 enamelled wire 1¼" in diam. Space to winding length of 2 inches. Tap 6th turn.	Same as above.
28-29.7 mc.	3 T. No. 18 enamelled wire 1¼" in diameter. Spaced to winding length of ¾ inch.	6 T. No. 18 enamelled wire 1¼" in diam. Space to winding length of 1¾ inch. Tap 3rd turn.	Same as above.

Coupling between L_2 and L_3 must be adjustable. This may be accomplished by winding L_2 in two halves between which L_3 may be swung (See Fig. 3). L_3 might also be mounted as a rotating coil inside of L_2.

Table 1. Mechanical and electrical details for coil construction.

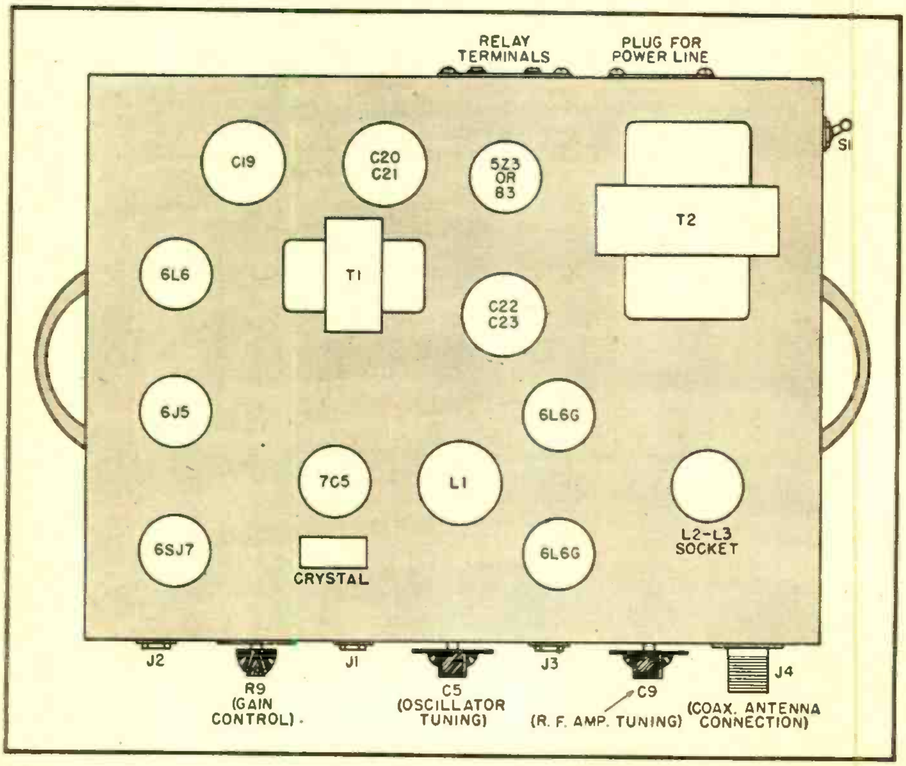
the center of a doublet antenna may be plugged directly into this jack and no antenna coupler will be required. If another type of antenna is employed, the coaxial line may be link-coupled to an antenna coupler located between the transmitter and antenna. A 72 ohm line is shown plugged into the output jack in Fig. 1.

Amplifier grid resistor R_3 is bypassed for audio frequencies by means of a 0.5 μfd. capacitor, C_7. This is a necessary expedient in cathode modulated amplifiers. Small 50 ohm resistors, R_1 and R_5, are connected in the 6L6-G control grid leads to suppress parasitics.

Final amplifier grid current is read on a milliammeter plugged into jack J_1. Final amplifier cathode current is read on a milliammeter plugged into jack J_3. Since the amplifier grid current reaches its peak value when the oscillator is correctly tuned, the grid current deflection will be used as an indicator of crystal stage tuning. The grid current reading is useful also when neutralizing the 6L6-G stage, as will be explained later. The two meter jacks are seen on each side of the center dial in Fig. 3.

The parallel connection of the final amplifier tubes simplifies the grid input circuit and interstage coupling system. It also simplifies, to some extent, the amplifier plate circuit wiring and reduces neutralization to a simple "one-handed" operation. None of the expected bugs appeared. Parallel operation was found entirely satisfactory in this transmitter at frequencies as high as 30 megacycles.

Fig. 4. Chassis layout shows placement of various component parts.



Audio Section

The speech amplifier is comprised of a 6SJ7 high-gain pentode microphone stage followed by a 6J5 triode. This circuit provides ample gain for a communications type crystal microphone. The bias cell and grounded cathode arrangement greatly reduces hum in the input stage. Potentiometer R_9 is the gain control. Resistance-capacitance coupling is employed right up to the modulator grid. The microphone jack, J_2, may be seen on the extreme left-hand end of the chassis front lip in Fig. 3 where it is followed by the gain control.

The modulator tube is a 6L6, preferably metal. Its screen voltage is derived from a tap on voltage divider R_{17}. The primary of the modulation transformer, T_1, is connected in series with the 6L6 modulator plate and the 300 volt tap on R_{17}. T_1 should be a regular cathode modulation transformer with a plate winding of 4000 to 4500 ohms impedance and a secondary winding of 400 to 500 ohms impedance. The plate winding must be capable of carrying at least 60 milliamperes d.c., and the secondary at least 100 milliamperes d.c. Several private builders already have reported to the author that they have been able to use regular 10 watt universal broadcast replacement output transformers with 500 ohm secondary taps in copies of this transmitter with complete success. Such a substitution will appeal to other readers who are unable to obtain standard cathode modulation transformers.

For c.w. operation, a key (with appropriate click filter) may be plugged into jack J_3. When transmitting code, however, the operator must remember to remove the microphone and turn the audio gain control, R_9, to its *"Off"* position.

Power Supply

The power transformer is a replacement-type component. Any available unit supplying 350 to 400 volts each side of center tap at 200 to 250 milliamperes will suffice.

Because the author could not find in local stock a single small-sized filter choke capable of efficiently carrying the total plate-screen current, two separate filters (embracing separate chokes, CH_1 and CH_2) are shown in Fig. 2. However, should the reader find a satisfactory single choke, he may eliminate capacitors C_{22} and C_{23},

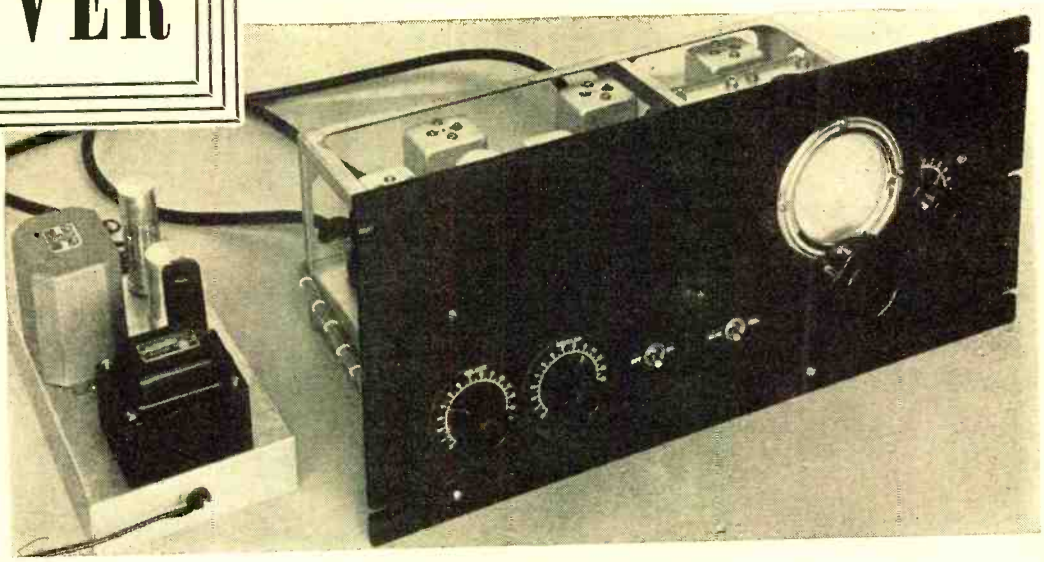
(*Continued on page* 137)

Converting the SCR-522 RECEIVER

By RAY FRANK, W9JU

Amateur Editor, RADIO NEWS

Details for converting the receiver portion of a recently released surplus item which may be used to cover services between 100-156 mc.



The converted receiver with a front panel and dials added, together with its attendant, separate power supply.

ONE of the most interesting pieces of surplus equipment to be offered to the radio-minded public is the SCR-522, consisting of the BC-624 receiver and the BC-625 transmitter.

Originally designed for use in larger military planes of various types, these units offer remote control of any four frequencies in the range of 100 to 156 mc. This portion of the spectrum covers many important services such as facsimile, air navigation aids, airport control, railroad, police, and urban telephone, as well as the amateur band from 144 to 148 mc.

The transmitter, a crystal controlled unit, requires little work with the exception of the adddition of the proper voltages. The receiver, however, presents a different problem if operation over the entire band is desired without a multitude of crystals. The obvious solution, then, is to convert the present crystal controlled oscillator of the receiver to one permitting manual control of the frequency. This conversion is much simpler than might be expected.

The first operation is the removal of the transmitter and receiver units from the case. This is accomplished by loosening the four *Dzus* fasteners located on the sides of the case, and grasping the rack by its recessed handles. The transmitter and receiver may both be removed from the rack by removing the red painted screws. Care should be taken in this operation to see that the frequency shifter slides are disengaged.

Examination of the receiver will reveal that the oscillator is a permeability tuned, crystal controlled type, which drives the harmonic generator and harmonic amplifier. This harmonic generator and amplifier is tuned by the special two-gang condenser, while the r.f. and detector stages are tuned by the three-gang condenser located on the right hand end.

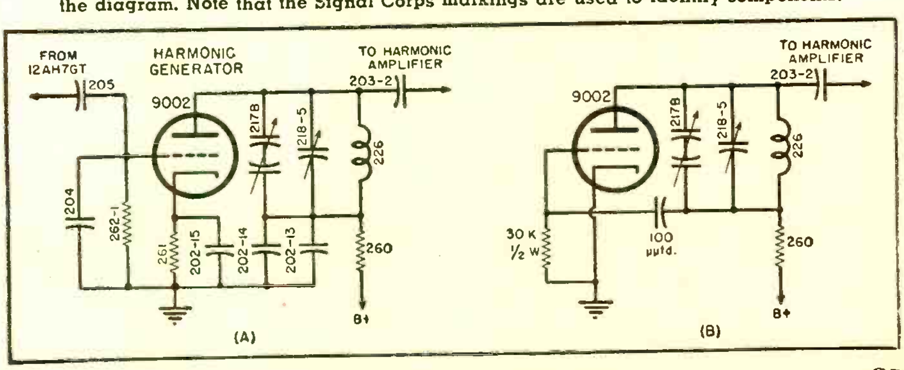
The next step in disassembly is the removal of the frequency shifter slides with their attendant shafts. For this operation it will be necessary to procure a *Bristol* wrench to fit the special set screws used to fasten the couplings. These wrenches are available in the larger hardware stores, or one may be found on the various surplus counters. The proper size is that which will fit a No. 8 screw.

The screws holding the frequency shifter slides are removed, and the set screws at the front of the couplings removed. It is then an easy job to remove the slides and shafts.

With the receiver turned over, the three wires which go to the terminal strip on the oscillator subassembly should be unsoldered. The two nuts and the screw which hold this assembly in place may then be removed, and the entire unit lifted from the re-

(*Continued on page* 74)

Fig. 1. (A) The oscillator circuit as originally furnished in the SCR-522 receiver. (B) The converted oscillator circuit with values for the added parts indicated on the diagram. Note that the Signal Corps markings are used to identify components.



NEW HIGH-GAIN VISUAL-AURAL Signal Tracer

By McMURDO SILVER

Fig. 1. Front view shows placement of various operating controls.

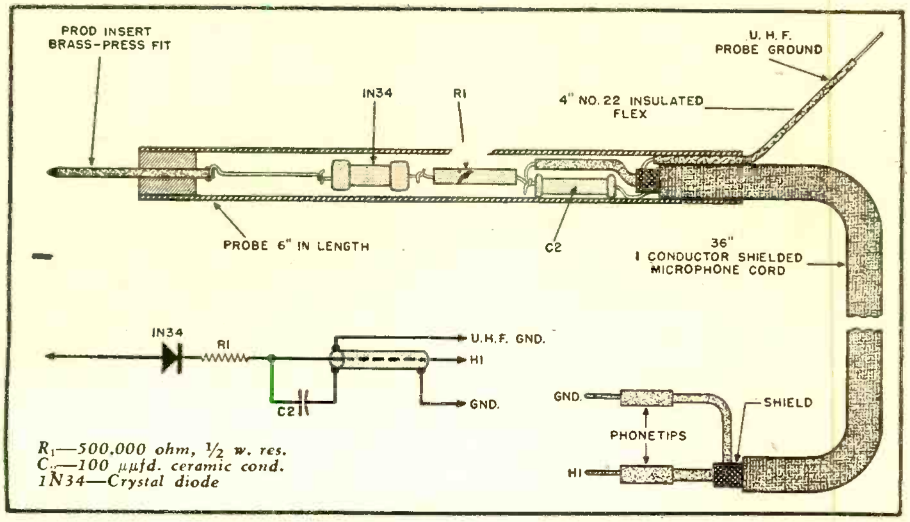
In providing visual and aural indications this signal tracer makes a handy, versatile testbench instrument.

IN THE servicing and maintenance of radio receivers it has been well stated that the signal is the common denominator. In the initial location and subsequent correction of troubles certain fundamental methods are invariably pursued by the trained technician. If immediately after his essential check of, and test for, proper a.c. and d.c. operating voltages he traces the received signal itself from antenna input circuit progressively through every successive signal amplifying circuit right out to the loudspeaker voice coil, it becomes simple indeed to locate faulty r.f., i.f. and a.f. components. Open or shorted resistors, capacitors, coil and transformer windings may be located with truly extraordinary ease—weak tubes found in the proverbial jiffy. If the instrument which makes such circuit tracing possible can also indicate the presence or absence of a.c. and d.c. operating potentials in all circuits and provide an estimate of their magnitude, two successive work operations may often be telescoped into one.

The many functions which the ideal "signal tracer" must perform impose most stringent requirements upon its design if it is to be, in fact rather than only in fancy, the maintenance technician's most valuable tool—something it must be if it is to be worth its salt. The overlooking of certain fundamental requirements by some designers probably accounts for the relatively infrequent use of the aural signal tracing technique. To be useful it must be complete in that every essential test must be capable of being made easily and quickly. Let us consider a few of the things a signal tracer must do:

First and foremost, it must be able to indicate the presence or absence of a received signal in every successive receiver circuit. For location of distortion and hum it should do this aurally through a loudspeaker. For estimating stage gain or loss it should indicate the signal visually as well.[1] It must do this over the frequency range of a.f. to about 200 megacycles for FM, television and communication sets. It must be sensitive enough—and this is where most home-constructed and factory-built signal tracers fall down badly—to give a usefully loud response when contacted directly to the small, inefficient loop of the average table midget used in the country and significantly outside the heavy-signal area of local broadcasting stations. The ideal signal tracer must be able to indicate conclusively the presence, absence and magnitude of superheterodyne oscillator voltage, a.v.c. and a.f.c. voltages. In use it must not "load" the receiver circuit being tested so heavily as to upset performance and so mask the very troubles being sought. It obviously must contain a rectifier to convert r.f. signals into audible a.f. output. It should be capable of omitting the rectifier when critical tests of audio distortion are required—must operate as an audio amplifier and speaker only, when testing p.a. amplifiers, phono-pickups and microphones to avoid introducing the distortion which inclusion of a rectifier in the input circuit would occasion. Most certainly it must not require tuning in operation and must function with the essential simplicity and speed of an ordinary d.c. voltmeter. Its loudspeaker should be accessible in order that it may serve as a test speaker.

Fig. 2. This r.f., i.f., a.f., a.c. probe is simple and easy to construct.



[1] See "Universal Test Instrument," February, 1946, RADIO NEWS.

That these many heretofore unrealized characteristics may be attained by careful design is believed to be most easily demonstrated by an analysis of the new signal tracer illustrated and diagrammed herewith. Its conception and construction are such that it will perform every function outlined above quickly and simply. It additionally indicates presence of all vacuum-tube-electrode and power supply operating voltages. It does all this while retaining the features of small size and light weight so essential to the outside service technician not to mention the modern service shop.

Figures 1, 2, 3, and 4 illustrate this new signal tracer. Basically, this signal tracer consists of a radar-type fixed crystal diode detector 1N34 with capacitor C_2 and anti-loading series input resistor R_1 all housed in a conventional-looking test prod differing from the usual multimeter test prod only in being 6″ long. The a.f.-d.c. load resistor consists of the gain control potentiometer, R_2. With this insulated prod any source-point of r.f., i.f. and—in all except critical audio distortion tests—a.f. signal voltages may be easily reached in an operating receiver or amplifier. The 36″ shielded flexible cable extending from this prod is provided with two phone tips for insertion in the lower left input panel jacks shown in Fig. 1. Inside the cabinet is a ground-isolating, transformer-type power supply to convert usual 115 volt, 50 or 60 cycle a.c. power into low-voltage a.c. filament and high-voltage d.c. plate power for operation of the three-stage audio amplifier built into the cabinet. Contained in the cabinet are a 3-stage a.f. amplifier, panel-mounted input gain control R_2, a 3½″ PM dynamic speaker and the two switching circuits necessary to give the instrument its many operating functions.

The 6E5 electron-ray indicator tube visible at the upper left of Fig. 1 is the visual indicator of the strength of the signal made audible by the loudspeaker. It is more than this, however, since by its switch, S_1, immediately below it, it may be shifted to indicate input voltage to the tracer or output voltage from the tracer amplifier. But more on the subject of employing the instrument as a gain measuring set later. The center position of this indicator switch connects the electron-ray tube directly to the 1N34 crystal diode load resistor R_2 when, the usual d.c.-isolating a.f. coupling condenser C_4 being switched out of circuit, the tracer becomes a low-frequency a.c. voltmeter. Similarly, connection of a d.c. voltage source to the *"Input"* panel jacks turns it into a qualitative d.c. voltmeter.

The right-hand panel switch, S_2, marked *"Output"* adds materially to the instrument's flexibility. When thrown to *"Int."* position the built-in loudspeaker is connected to the a.f. amplifier of the tracer. When this switch is thrown to *"Amp."* the a.f.

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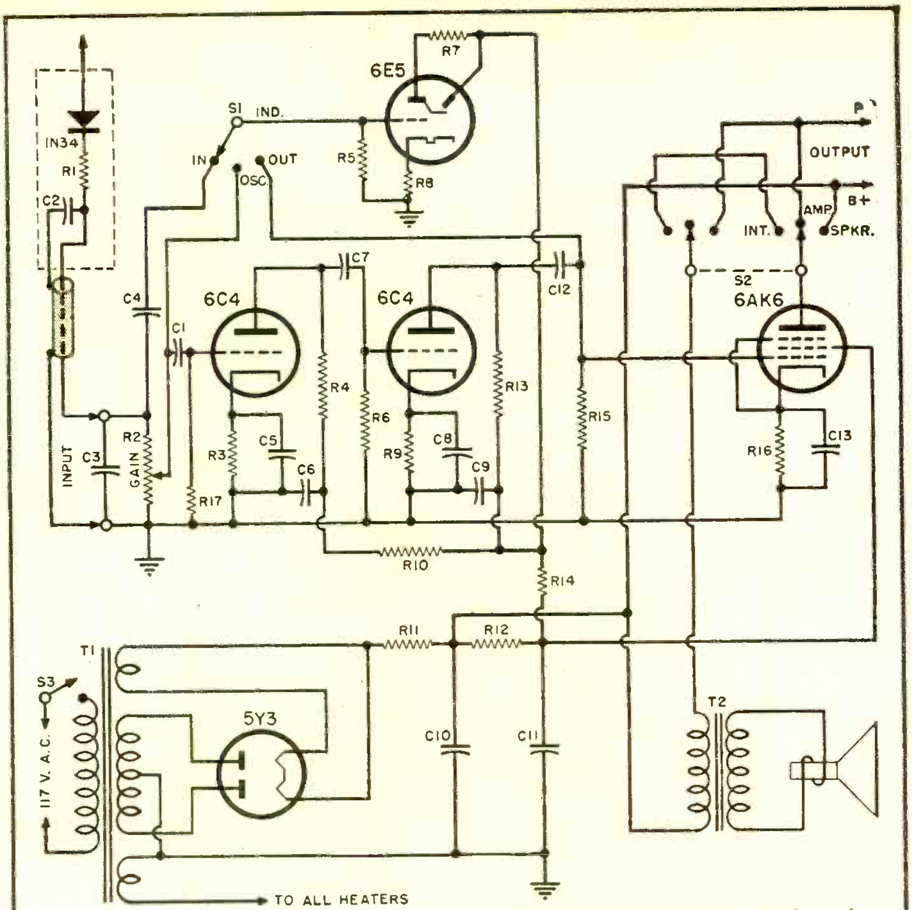

R_1—500,000 ohm. ½ w. res.
R_2—½ meg. linear taper pot.
R_3, R_9—3000 ohm, ½ w. res.
R_4. R_{13}—100,000 ohm, ½ w. res.
R_5. R_{17}—1 megohm, ½ w. res.
R_6, R_{15}—270.00 ohm, ½ w. res.
R_7—2 megohm, ½ w. res.
R_8—1000 ohm, ½ w. res.
R_{10}—40.000 ohm, 1 w. res.
R_{11}—2000 ohm. 2 w. res.
R_{12}—20,000 ohm, 1 w. res.
R_{14}—10.000 ohm. ½ w. res.
R_{16}—510 ohm, 1 w. res.
C_1, C_7, C_{12}—.01 μfd. @ 400 v. cond.
C_2, C_3—100 μμfd. Hi-Q tubular ceramic cond.
C_4—.1 μfd. @ 400 v. cond.
C_5, C_8, C_{13}—8 μfd. @ 25 v. cond.
C_6, C_9, C_{10}, C_{11}—8 μfd. @ 350 v. elec. cond.
T_1—Power trans. (Freed #12901)
T_2—Output trans. 6AK6 to 3 ohm
S_1—Single pole 3 pos. sw.
S_2—2 pole 3 pos. sw.
1—1N34 crystal diode
1—3½″ PM speaker
1—6E5 tube
1—6AK6 tube
2—6C4 tube
1—5Y3GT tube

Fig. 3. Complete schematic diagram of the visual-aural signal tracer.

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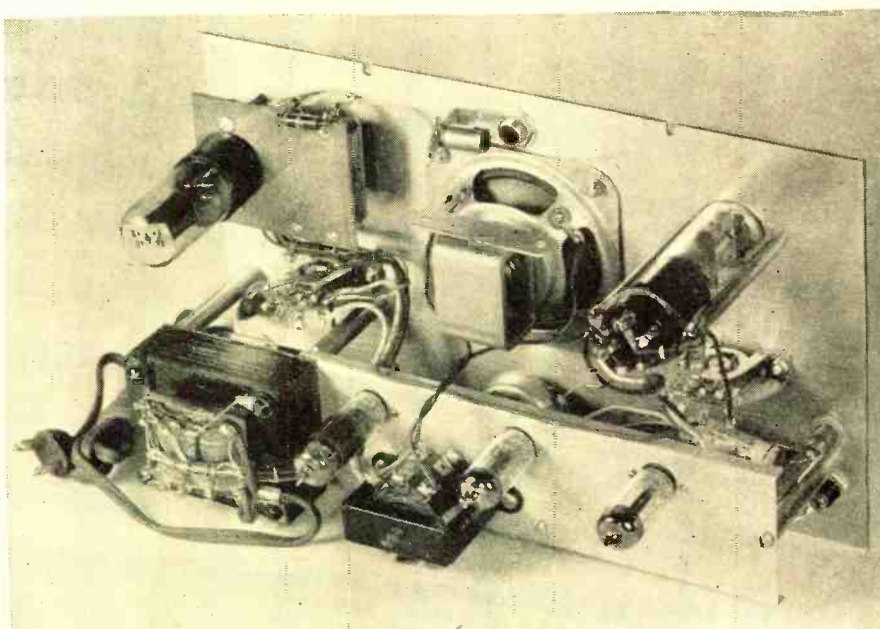
Fig. 4. Rear panel view. Note that all components are mounted to panel.



Alignment of RADIO RECEIVERS

By J. E. CUNNINGHAM

Aligning radio receivers is not a simple process to the uninitiated. All tuned circuits must be in proper alignment to obtain maximum performance.

ONE of the most important and, at the same time, most neglected phases of radio servicing is the proper alignment of receivers. Even though the radio serviceman is aware of the fact that the tuned circuits of a receiver must be properly aligned for best reception, there is an apparent negligence on his part in the matter of aligning sets after repairs have been completed.

There are many reasons for this seeming indifference to alignment. Quite frequently the serviceman is in doubt as to the proper procedure to follow and rather than impair the performance of the set by improperly aligning it, he chooses to omit alignment entirely. Then again, there are many cases where he feels that the customer would be unwilling to pay for the additional time required for alignment. During the war, when a serviceman's time was at a premium, alignment was completely neglected in many shops except for sets that would not work without it.

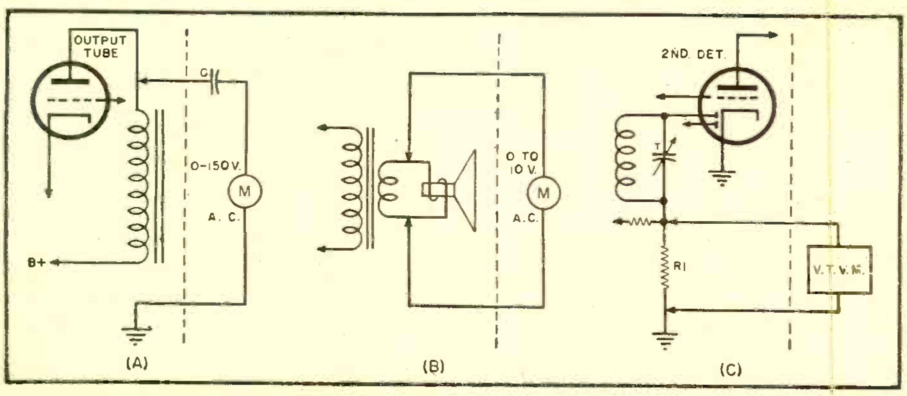
While there are, no doubt, some cases, especially very old or midget sets, where no expense over and above that necessary to make the set work will be tolerated, these cases are in the minority and the performance of the majority of sets encountered on the service bench can be so improved by alignment that the additional cost will not be disputed.

The importance of alignment can be better appreciated when we realize that the three chief criteria of receiver performance, sensitivity, selectivity and fidelity are all affected to a considerable extent by the alignment of the tuned circuits in the receiver.

The obstacles of uncertainty and expenditure of time may be overcome by procuring the essential equipment, becoming familiar with the principles of alignment in general and establishing a routine procedure.

In this treatment of the subject of alignment, rather than attempt to dictate the exact type of equipment and method to be used, we will outline several procedures involving various types of test equipment as well as certain general instructions that apply to all methods, in order that the serviceman may select the procedure best suited to the equipment which he possesses. It will be noticed that the cathode-ray oscilloscope is not mentioned in the discussion of equipment. The reasons for this omission are that the majority of servicemen feel that the use of a scope unnecessarily complicates the alignment of ordinary AM receivers and that a detailed discussion of the use of this instrument in alignment would be quite lengthy and beyond the scope of this article.

Fig. 1. Method of connecting different types of output indicators.



Equipment

The most important instrument in alignment work is the signal generator. In discussing the specifications of a suitable signal generator, we will confine the discussion to the alignment of ordinary household receivers. While great accuracy is desirable, initial cost and simplicity of operation are equally important.

In actual practice, the serviceman seldom, if ever, sets the dial of the instrument any closer to the specified frequency than one per-cent and any very much greater degree of accuracy than this would add unnecessarily to the cost of the instrument.

The signal generator should be capable of covering all radio frequencies commonly found in household receivers. A range of 100 kc. to 20 mc. is generally satisfactory. It is true that some sets in use today have ultra-high frequency bands in the vicinity of 60 mc., but the additional expense of a signal generator covering these frequencies is hardly justified since the output of most instruments available to the serviceman is sufficient to cover this range on harmonics.

If an output indicator is to be used in the audio frequency section of the set, there must be a provision for modulating the carrier. Variable modulation control, while not essential, is desirable in that it provides an excellent means of varying the audio output without raising the carrier level.

A good attenuator that will afford full control of the carrier level is a requisite to prevent overloading and undesired a.v.c. action.

Simplicity of operation is a rather difficult quality to define depending in part on freedom from many complicated controls and in part on the familiarity of the individual serviceman with the instrument itself.

Since the human ear is not a very accurate judge of sound level, it is considered best to use some sort of visual indicator when aligning the receivers.

In Fig. 1, several types of output indicators that may be used are shown. Fig. 1A shows a high range a.c. voltmeter which may be connected between the plate of the audio output tube and ground; condenser, *C*, serving to isolate the meter from the d.c. plate voltage. In Fig. 1B a low range a.c. voltmeter is connected across the voice coil of the speaker. In this circuit the blocking condenser is unnecessary since isolation from the plate voltage is provided by the output transformer in the set.

A vacuum tube or very high resistance d.c. voltmeter may be connected as in Fig. 1C to measure the automatic volume control voltage. This particular type of indicator, connected across the a.v.c. load resistor R_1, is advantageous in that it is not necessary to kill the a.v.c. action. If the set is equipped with an eye tube operating from the a.v.c. voltage, the deflection of the eye may be used as an indication of output. The audio channel of a signal tracer may be used as an audio output meter; however, when signal tracing equipment is available, the procedure to be given later involving the use of the r.f.-i.f. channel is strongly recommended.

When a radio receiver is operating normally with an antenna connected, the antenna appears to contain inductance, capacity and resistance. When the antenna is removed, the tuning of the receiver is slightly altered. For this reason, a dummy antenna representative of the average antenna is recommended for coupling the signal generator to the receiver. Fig. 2 shows a standard dummy antenna, as defined by the Institute of Radio Engineers, which can be easily constructed by the serviceman. While this dummy antenna is more accurate, it is possible to align most receivers quite well by using a 200 μμfd. mica condenser on the broadcast band and a 300 to 400 ohm carbon resistor on the short-wave bands.

When aligning sets employing loop antennas, the dummy antenna just mentioned is, of course, unnecessary. In this case, the signal generator output should be connected to a loop of a few turns of wire about the same diameter as the loop antenna and placed about two feet from it.

Non-metallic screw drivers and wrenches that will not load or detune the stage being adjusted must be considered as essential equipment for alignment.

General Procedure

Regardless of what procedure is used, there are a few general instructions which should be followed in the alignment of all receivers.

First of all, both the signal generator and the receiver should be allowed to warm up for fifteen to thirty minutes. After this period the thermal frequency drift inherent in both receiver and signal generator will have reached its lowest value. All shields and loop antenna, if any, should be in their normal operating position as far as possible. Such features as a.v.c., a.f.c. and a.v.e. (automatic volume expansion) should be rendered inactive during alignment. However, if the a.v.c. voltage is to be measured and used as an indication of resonance, this circuit must be left in operation. When it is necessary to kill a.v.c. action, the simplest way to accomplish this is to reduce the output of the signal generator to such a low level that no a.v.c. voltage will be developed.

If the selectivity of the set is variable, it should be adjusted to its maximum value.

STEP	DUMMY ANTENNA	CONNECT SIGNAL GENERATOR TO	TUNE SIGNAL GENERATOR TO	TUNE RECEIVER TO	ADJUST
1	.05 μfd. cond.	Mixer tube grid	I.F.	Low end of b.c. band	I.F. Trimmers
2	400 ohm res.	Antenna post	18 mc.	18 mc.	Osc. and R.F. Trimmers
3	400 ohm res.	Antenna post	6 mc.	6 mc.	Osc. and R.F. Trimmers
4	200 μμfd. mica cond.	Antenna post	1400 kc.	1400 kc.	Osc. and R.F. Trimmers
5	200 μμfd. mica cond.	Antenna post	600 kc.	600 kc. rock	Low freq. padder
6	Repeat Step No. 4				

Table 1. Step-by-step operation of common alignment procedures.

The last preliminary measure, yet one of the most important, is to determine the location and function of the various trimmers, padders, etc. When the manufacturer's service information, with pictorial diagrams showing these adjustments, is available, this process is comparatively simple, but when this information is not at hand it is necessary to trace the leads from each adjustment to determine its function. When there are many such adjustments in the set, it is often helpful to put identifying marks on the chassis to avoid confusion.

While the methods of alignment given here are typical, there are exceptions in which special alignment procedure must be followed. In such cases the manufacturer's service data should be consulted and the procedure given therein should be followed, as the designer is the one best qualified to deal with problems peculiar to his set.

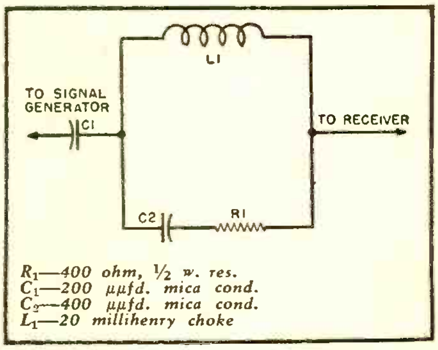


Fig. 2. Standard dummy antenna.

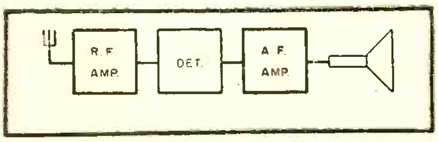


Fig. 3. Block diagram of TRF receiver.

TRF Receivers

The tuned radio frequency receiver consists of one or more stages of r.f. amplification, then a detector, followed by the audio system. A block diagram of this type of set is shown in Fig. 3. All modern TRF receivers employ a ganged tuning condenser with one section in the detector circuit and one in each tuned r.f. amplifier stage preceding it.

In aligning this set, the signal generator is coupled to the antenna post through a suitable dummy antenna and an output indicator is connected to the audio output stage. Both the set and signal generator are tuned to the same frequency at the high frequency end of the dial, usually about 1400 kc. The trimmer condensers are then peaked for maximum output, starting at the detector and working back toward the antenna. The process should then be repeated to compensate for interaction between the various stages.

Usually this one alignment at the high frequency end of the dial is sufficient, but in some cases it may be found necessary to align the set at the low frequency end of the dial as well. There not being adjustments provided for this alignment, the usual procedure is to bend the plates of one or more sections of the tuning condenser until maximum output is obtained. After this has been done the high frequency alignment should be repeated.

In cases where the set is so badly

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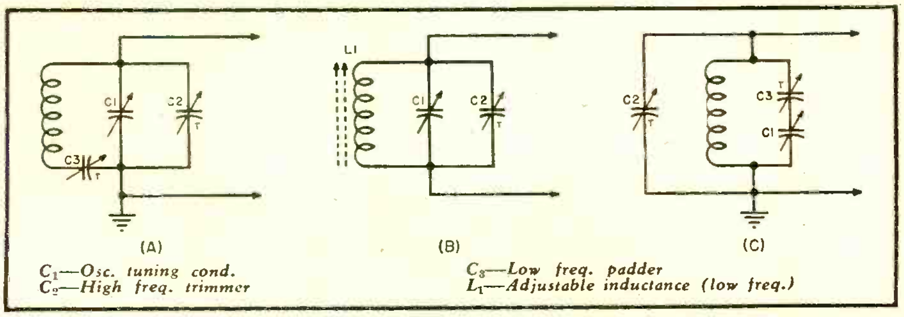
Fig. 4. Circuit diagrams illustrate some of the more common methods of tracking.



Build this 5" CATHODE-RAY OSCILLOSCOPE

By

LYMAN E. GREENLEE

Details for construction of cathode-ray oscilloscope. Government salvage tubes and parts are now available.

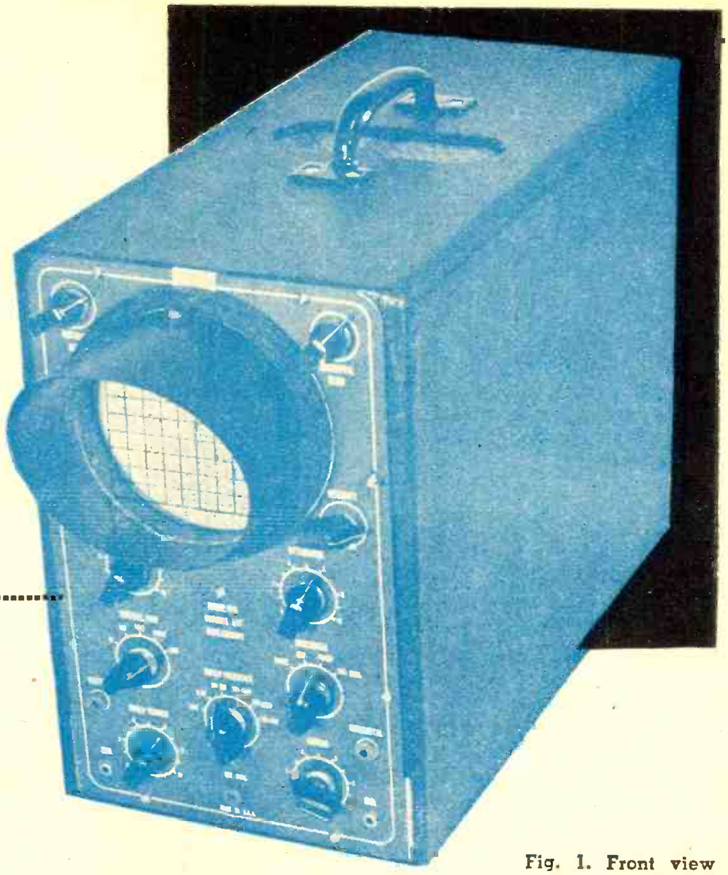


Fig. 1. Front view of home constructed 5 inch oscilloscope.

MOST amateurs and radio servicemen want a serviceable oscilloscope, but do not feel like investing anywhere near the cost of a factory-made job. The oscilloscope described may be built for a fraction of the cost of a comparable factory-built model, and it may be constructed by anyone who has sufficient skill to build a simple 5-tube radio. By using materials salvaged from the home junk-box, combined with surplus parts purchased at a fraction of their original cost, the total outlay for parts may be kept down to as little as $35.00 for the complete instrument.

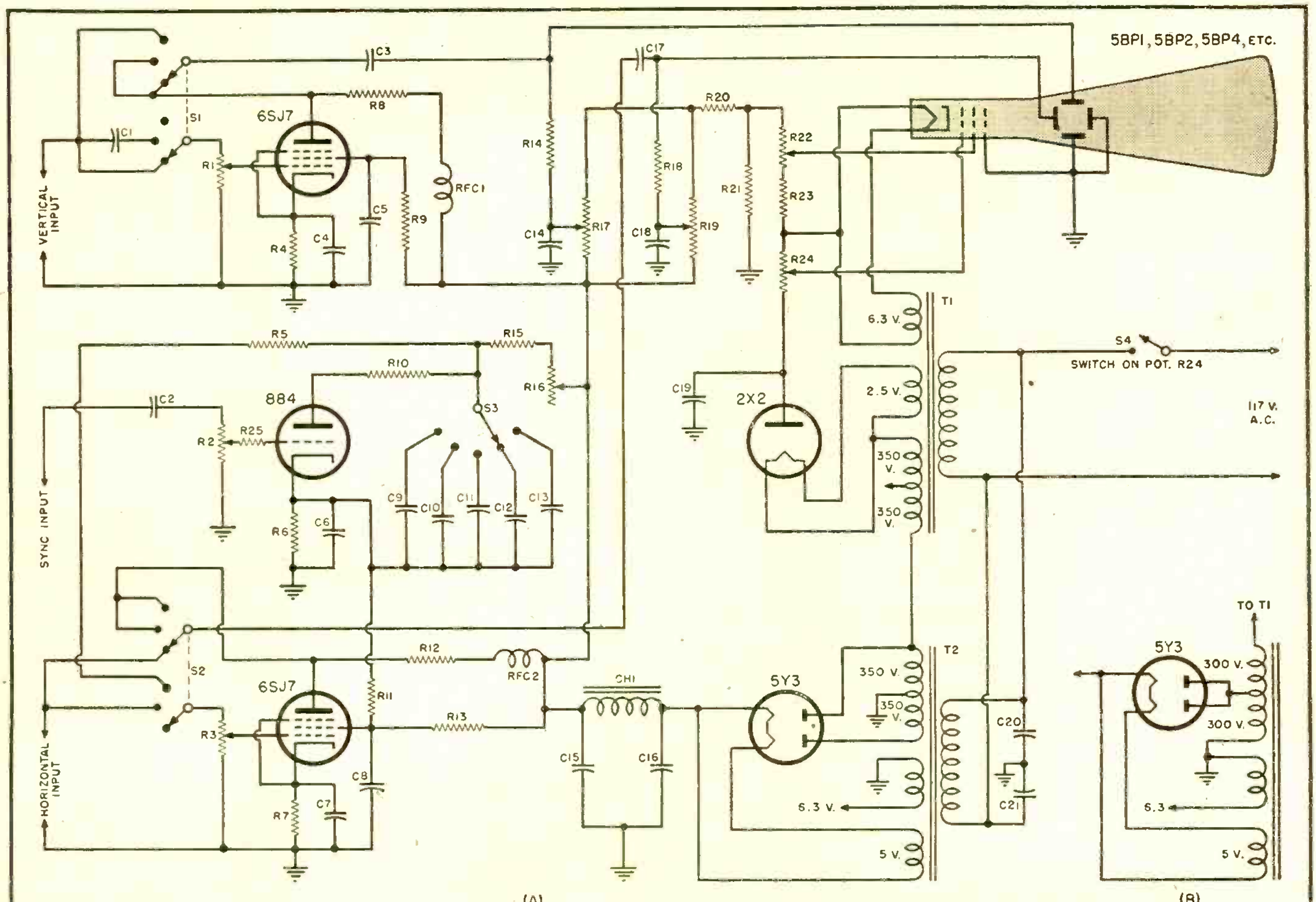
Since sizes of parts will vary with individual constructors, no locations are given for individual components. A general idea of the placement of all parts may be secured from the photographs, Figs. 3 and 4. It is important to follow the same general parts layout. A good plan is to assemble all the components and place them on the chassis. They can then be moved around to the most desirable positions and the exact locations marked with pencil which will serve as a guide for punching and drilling the various mounting holes. There are two important rules to observe in locating parts. Mount all power transformers to the rear of the chassis and as far away from the cathode-ray tube as possible. Keep the horizontal and vertical input circuits separate and shield these leads carefully, being sure to bond shielding to the chassis at a common point to avoid eddy currents and stray pickup through the shielding. A metal front panel salvaged from another oscilloscope was used in building the instrument shown in the photographs. Equally good or better results may be secured with a home constructed panel of bakelite, prestwood, or similar insulating material. For the home constructor, an insulating material is preferable to metal for the front panel. When a metal panel is used, it is necessary to take precautions to prevent shorting of the high voltages present across the intensity, positioning, and focus controls.

A front view of the completed oscilloscope is shown in Fig. 1, while Figs. 3 and 4 show bottom and side views of the instrument removed from its case. Alternate methods of power transformer connection are shown in the diagram in Fig. 2. They give identical results. The circuit selected by the builder will depend on the power transformers available. These two designs have been worked out to allow the home constructor to use readily available radio replacement power transformers since a special oscilloscope transformer is usually difficult or impossible to obtain. Selecting the transformer, T_1, for the 2X2 rectifier may present somewhat of a problem. Insulation must be adequate to withstand the high voltage present since the secondary is to be operated in series with the secondary of T_2. For the 2.5 volt filament winding to the 2X2 tube, half of a center-tapped 5 volt rectifier filament winding may be used, or this 5-volt winding may be utilized for the cathode-ray tube, and the regular 2.5 volt filament winding used for the 2X2. The latter arrangement usually works best because the 2.5 volt winding connects to one side of the secondary (these two windings should be connected together so that the lowest possible internal voltage is built up between the two windings) and therefore a low potential can be maintained between the two windings. While 5 volts is a low value for the CR tube filament, no trouble has been encountered by operating these tubes at that value, except that the warm-up period is increased slightly. The rectifier winding is adequately insulated which is not always true of the 6.3 volt filament winding. Some transformers will have 5 volt, 2.5 volt, and 6.3 volt filament windings. Such a transformer may be used, but it is well to avoid large power transformers because of their large magnetic field which will affect the beam in the CR tube. The best transformers to use are those designed for 5 or 6 tube radios, with a 2½" x 3" mounting area. If larger transformers must be used, mount them on a separate chassis and connect them to the rest of the oscilloscope through a flexible cable. It is a good idea to disassemble the transformer chosen for T_1 and reinsulate the filament windings with pieces of mica. During this process, the filament windings may be rewound to suit, using the old windings as a basis for calculating the number of turns required, i.e. take half the 5 volt rectifier winding for the 2X2, etc. The selection of T_2 presents no special problem, since this transformer is used in the conventional way. Any small power transformer will be suitable for T_2. The choice of the method of connecting the two transformers together will depend on the secondary voltage of the available transformers. Many of the small transformers are rated at total secondary output, and in this case it will be necessary to connect both secondaries in series, as shown in Fig. 2B, to provide sufficient voltage across the 2X2 rectifier. If transformers with 700 or 800 volt secondaries are available, it is desirable to connect them for full-wave rectification with the 5Y3G as shown in Fig. 2A. In actual practice, either connection may be tried, and the one which gives most satisfactory results used. Some cathode-ray tubes will operate at lower voltages than others. If operation is satisfactory at a lower voltage, there is no point in using a higher voltage merely to secure a brighter image at the expense of shorter tube life. In connecting the two power transformer secondaries in series, it will be necessary to try reversing the connections to make sure the two windings do not "buck" each other. If there is any sign of a voltage breakdown when the two secondaries are connected in series experimentally without any load, try reversing connections to both windings as this may overcome the difficulty. The author has built several of these oscilloscopes and so far has had trouble with one transformer, and this was cured by reversing connections to both primary and secondary of the transformer causing the trouble. If no a.c. voltmeter is available for testing the high voltage across both secondaries in series, a small 6 watt bulb with a 50,000 to 100,000-ohm resistor in series may be used to give an indication.

Referring to the wiring diagrams, Fig. 2, R_1 is the vertical input attenuator, and S_1 is the vertical input control switch. Switch S_1 is a 2-circuit, 3-position switch. When contacts are in the upper position, input is directly to the vertical deflection plate of the cathode-ray tube through a .25 μfd. blocking condenser; when in the lower position, the input goes directly to the 6SJ7 vertical amplifier grid through potentiometer R_1; and when in the middle position, input is coupled to R_1 through a .1 μfd. condenser. This blocking condenser is necessary when a d.c. component is present across the input terminals along with an a.c. voltage to be measured.

The 1 meg. potentiometer, R_{17}, is the vertical positioning control. Its purpose is to move the image up and down on the cathode-ray tube screen.

Fig. 2. Schematic diagram of cathode-ray oscilloscope. Alternative power supply (B) may be used as explained in text.



R_1, R_3 R_{17}, R_{19}—1 megohm pot.
R_2—.1 megohm pot.
R_4, R_7—750 ohm, ½ w. res.
R_5—1 megohm, ½ w. res.
R_6—1500 ohm, 2 w. res.
R_8, R_{12}—100,000 ohm, ½ w. res.
R_9—750,000 ohm, ½ w. res.
R_{10}—500 ohm, ½ w. res.
R_{11}—10,000 ohm, 1 w. res.
R_{13}—25,000 ohm, ½ w. res.
R_{14}, R_{18}—7.5 megohm, ½ w. res.
R_{15}—200,000 ohm, ½ w. res.
R_{16}—2 megohm rheostat
R_{20}—250,000 ohm, ½ w. res.
R_{21}—250,000 ohm, 2 w. res.
R_{22}—250,000 ohm pot., 2 w.
R_{23}—100,000 ohm, 1 w. res.
R_{24}—50,000 ohm pot. with sw.
R_{25}—10,000 ohm, ½ w. res.
C_1, C_2, C_{12}—.1 μfd., 600 v. cond.
C_3, C_{13}, C_{17}—.25 μfd., 600 v. cond.
C_4, C_6 C_7—10 μfd., 50 v. elec. cond.
C_5, C_8, C_{11} C_{20}, C_{21}—.05 μfd., 600 v. cond.
C_9—.0005 μfd. mica cond.
C_{10}—.005 μfd. mica cond.
C_{14}, C_{18}—.02 μfd., 1600 v. cond.
C_{15}, C_{16}—8 μfd., 450 v. elec. cond.
C_{19}—2 μfd., 2000 v. oil cond.
S_1, S_2—2 pole, 3 pos. sw.
S_3—S.p. 5 p. sw.
S_4—S.p.s.t. sw. (on R_{24})
T_1—700 v., c.t., 50 ma.; 2.5 v., 2 amp.; 6.3 v., 1 amp.
T_2—700 v., c.t., 50 ma.; 5 v., 3 amp.; 6.3 v., 2 amp.
RFC_1, RFC_2—60 mh. r.f. choke
CH_1—10 hy., 40 ma. filter choke
2—6SJ7 tubes
1—884 tube
1—2X2 tube
1—5BP1, 5BP2, or 5BP4, etc. cathode-ray tube
NOTE: The cathode-ray tube, 2X2 rectifier, high voltage condensers and a few other parts are available from Government surplus. The other parts are standard radio components and may be secured from parts jobbers.

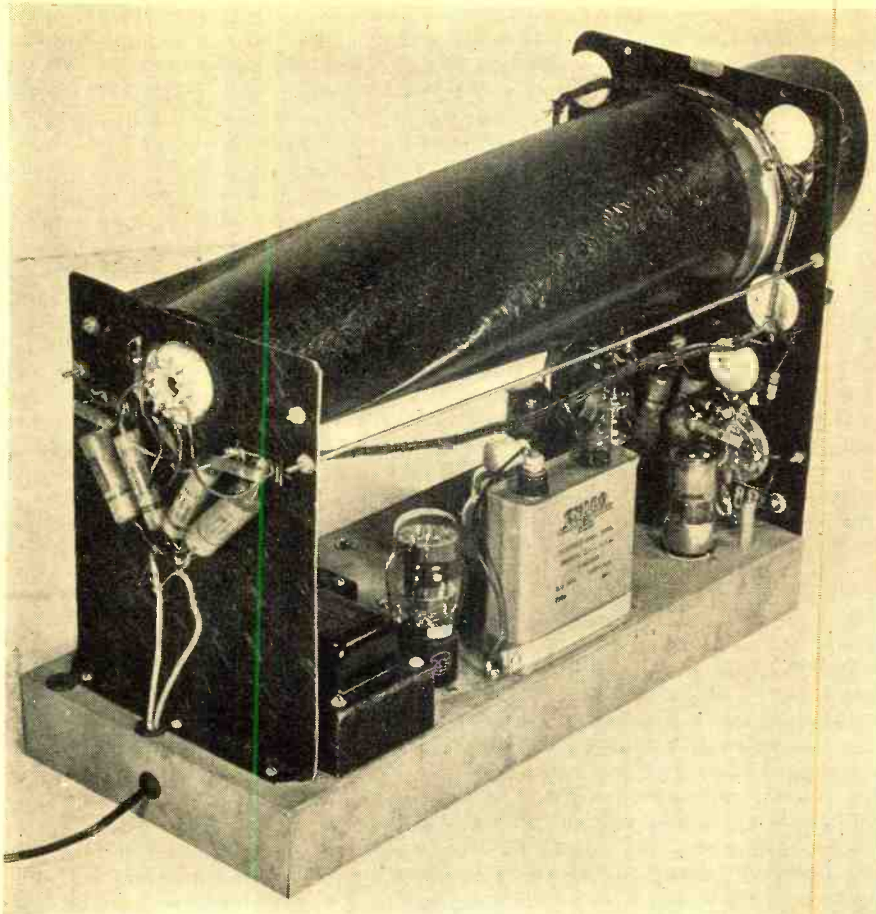
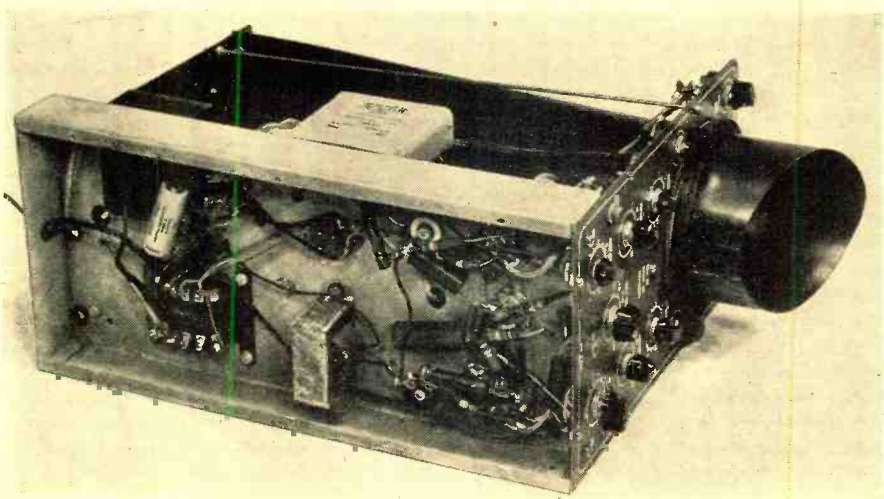


Fig. 3. Side-rear view of 'scope. All power transformers are mounted towards rear of chassis to prevent their magnetic fields from affecting operation of 'scope tube.

R_{19} is the horizontal positioning control, to move the image back and forth. Control is effected by application of a d.c. voltage to the deflection plates through 7½ megohm coupling resistors. These controls are necessary to center the image on the screen of the tube. While they are omitted from some of the cheapest oscilloscopes, they are a necessity which should be included for satisfactory operation of the oscilloscope.

R_{22} is the focusing control, and R_{24} the intensity control. These two controls are to be manipulated in unison to bring the image to a sharp, clear focus on the screen of the tube. Since both of these controls are at high-potential from the chassis, they must be adequately insulated to prevent voltage breakdown. It will be found desirable to dismantle R_{22} and R_{24} and carefully insulate the various parts (especially the 110-volt line switch) with some small pieces of sheet mica. These may be cemented in place with shellac or coil dope. In addition, R_{22} and R_{24} should be insulated from the panel, if a metal panel is used. A standard fiber bushing may be used for this purpose.

Fig. 4. Bottom view shows proper placement of various underchassis components. Chassis is 3 x 7 x 17 inches in size. Bakelite panel is 13 inches high.



R_2 is the external synchronization (locking) control to couple an external signal to the grid of the 884 gas triode for locking and external synchronization of the sweep circuit. For internal sweep control, R_{16} is the fine control or sweep vernier, and S_3 is the coarse or sweep frequency control. Range of frequencies with the constants shown for C_9 to C_{13} is about 5 to 30,000 c.p.s. However, the upper range may fall short in output, or it may cut out before 30,000 c.p.s. is reached. Condensers C_9 to C_{13} should be carefully selected for low leakage and adherence to rated capacity values. It is a good plan to select each one from a lot by checking with a good condenser tester. A change in the cathode resistor of the 884 tube, or substitution of another tube, may be found necessary in case the full range is not covered properly. A value between 1000 ohms and 3000 ohms may be tried for the cathode resistor.

S_2, which is a 2-circuit, 3-position switch, couples the horizontal input directly to the horizontal deflecting plate through a .25 μfd. condenser when in the lower position. In the upper position, S_2 couples the 884 sweep circuit through the 6SJ7 amplifier to the horizontal deflecting plate, and in the middle position an external input is coupled through R_3 to the grid of the 6SJ7 amplifier. R_3 is the horizontal gain control. While some oscilloscopes employ a more complicated input switching arrangement, the one shown in the diagram has proved satisfactory for radio service work and general testing. If necessary, various other external combinations of pulse generating circuits, amplifiers, square wave generators, etc. may be coupled directly to the deflecting plates.

With the constants as shown, the 6SJ7 voltage amplifiers should have a gain of about 100, with an extended frequency range through the use of the 60 mh. plate chokes and large cathode bypass condensers. Push-pull amplification to the horizontal and vertical deflecting plates will give a more uniform pattern with less distortion, but will add a lot of extra complication to the instrument and make its construction difficult for the average amateur or serviceman. The instrument as shown provides all the necessary basic functions of an oscilloscope.

CAUTION: The high voltage developed across the 2X2 rectifier and filter network is definitely DANGEROUS. Use only ONE hand when making tests and adjustments. Keep the other hand in your pocket, but better still, keep BOTH hands away from these circuits when the power is

(*Continued on page* 110)

By CARL COLEMAN

R. A. LEWIS, an old timer "from way back when" arrived aboard his Liberty recently at New York . . . the craft's laying up gave "RA" a few days vacation around the big town. A. E. Azzopardi called in at San Francisco recently aboard the Toloa and still has hopes of a vacation. William S. Sadler also in at the West Coast aboard his cargo craft recently. J. S. Hutson in Philadelphia recently aboard his Liberty. Frank Sergi whose last "Knot" was turned back to WSA was assigned to a Victory and is bound for the Far East on an extended trip. A. A. Vandenberg, former marine radio operator—an old timer from many years ago—was around the town recently to visit some of his old shipmates—Van is now with Colonial Airlines—and looking much heavier than when at sea—no doubt due to his executive position!

SHIPPING circles generally were, to put it mildly, somewhat astounded during late July when the U. S. Maritime Commission cancelled plans to go ahead with the construction of seven modern passenger ships. Shipbuilding generally seems to be on the decline—falling off more rapidly than had been expected after the war program had been concluded. All over the country shipyards are reducing personnel on orders from Washington—it is expected that about 19,000 will be laid off at the naval shipyard in Brooklyn—Philadelphia yards are laying off at the rate of nearly 1000 a week—most of the private shipyards throughout the country have been laying off men for several months. It is expected that shipyards would have only about 200,000 employed by the end of 1946—probably less. During the peak war years shipyards employed nearly a million and three-quarter men. The vessels which the Maritime Commission proposes to cancel were to be 900 foot craft, two for the American President Lines, three Export and two for Moore-McCormack and were to be operated by these lines to compete with the various foreign shipping lines to the Pacific, Mediterranean and on the South American run. At the present time the United States has not a single ship of the "passenger" type of any size—the prewar S. S. America being in the reconversion stage and others still in government service.

RECENTLY released by the Navy—from war time use—was added information on the development of the Electron Telescope and its uses during the war. Beaches in total darkness to enemy watchers were clearly visible to landing parties through the use of infra-red electron telescopes and infra-red floodlights and markers. The small lightweight units enabled landing boats to put men ashore who could not be seen and who could carry out reconnaissance and offensive operations as well as code communication under cover of darkness—being unseen, yet being able themselves to see all that went on. The nerve center of the unit was a small image tube with a photosensitive surface—tubes are designed as small as 1 and five-eighths inches in diameter and 4½ inches long. This is the same type tube as was used by the U. S. Army in the recently announced "Sniperscope" and "Snooperscope." Attached to a rifle the unit can be used as a gunsight as well as a means of seeing any enemy in the darkness.

J. F. WELCH arrived recently aboard his Liberty after having been away from the town for about six months, had a few days around and left for another trip—not of such long duration "JF" hopes. G. E. Ricksham arrived in at the West Coast recently. D. K. Crosby sailed from the East Coast aboard the Cape Avinof after having an extended vacation during which time he was hospitalized for some time. Andre Lacroix was relieved from his tanker berth on arrival recently in order to take a needed rest—well earned after five years aboard the same ship. R. W. McQueen is now aboard a "C4" type craft. Tom Doran and Jerry Coyle both recent additions to the marine service in New York.

BENDIX Aviation Radio Division has developed a new plane-to-land phone, similar to the ship-to-shore phones common on small craft for the use of private planes and has already installed a unit aboard a Lodestar transport owned by the Hercules Powder Co. In addition to having the normal airborne frequencies the unit operates on the additional ship-to-shore bands enabling the ship, while in flight, to contact many shore stations and thereby reach the various connecting telephone offices by means of conventional long distance services.

THE U. S. Maritime Commission recently announced the sale of 190 ships, which had been built during the war, for a total of $133,000,000 which the government has now realized on the sale of vessels. France has purchased 75 Liberty ships. Netherlands 45 ships and Norway 14. Thirty-nine of the ships to be sold will go to American ship operators. They include tankers, fast cargo types, Liberty and Coastal type ships. Over 700 applications for the purchase of ships have been received from 120 foreign governments and individuals. The vessels are being sold by the government under the Merchant Ship Sales Act which was established for the encouragement of an efficient and adequate American-owned merchant fleet — the act gives American citizens the first chance to buy or charter vessels prior to their being made available for purchase by non-citizens. The Chilean Line, which operates between New York and west coast of South America, recently purchased four fast C-2 freighter-passenger ships from

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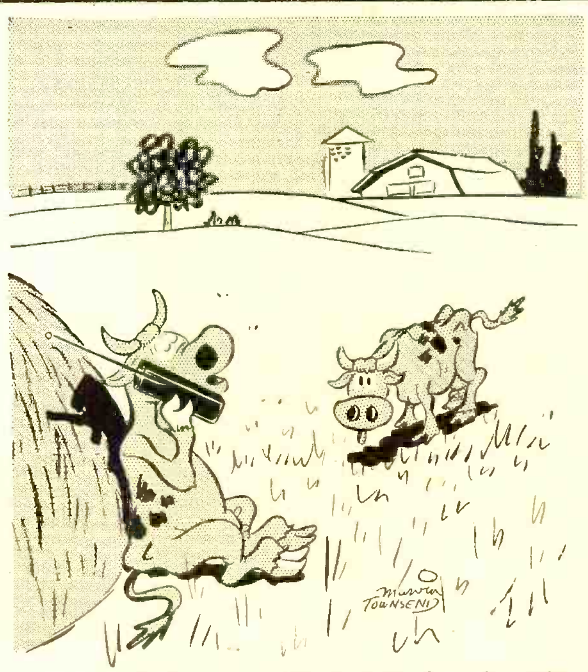


"You want Gertie and myself up to the barn for milking right away? Roger!"

RADIO HEATING in Textile Industry

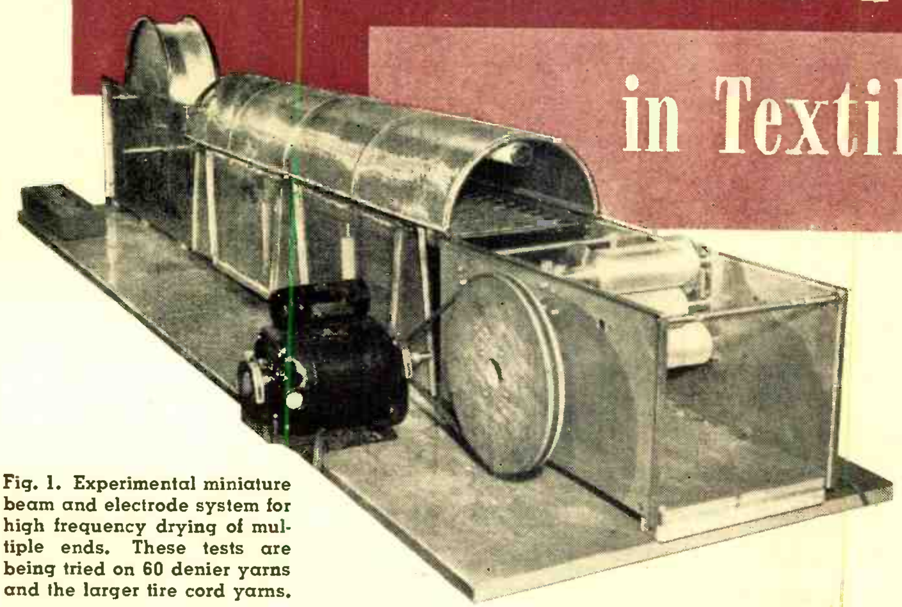


Fig. 1. Experimental miniature beam and electrode system for high frequency drying of multiple ends. These tests are being tried on 60 denier yarns and the larger tire cord yarns.

By C. N. BATSEL

RCA Victor Div.,

Radio Corporation of America

Resumé of experiments conducted on the application of high frequency heating to the processing of textiles.

HIGH-FREQUENCY heating has many advantages when it is desired to heat certain materials quickly, particularly packages which require considerable time for heat from conventional sources to penetrate to the interior. The degree of heating achieved may be anything desired from a small rise in temperature to that required for complete drying of wet materials.

This type of heating, as applied to textiles and other non-metals, is known as dielectric heating. In its simplest form, it is accomplished by placing the material between two metal plates or electrodes, which are in turn connected by means of electrical conductors to a high-frequency generator (Fig. 2). The amount of heat generated in the load is dependent upon its electrical properties, the frequency of the applied voltage, and upon the strength of the electric field between the plates. The strength of this field is, of course, proportional to the voltage between the two plates. In order that the load voltage may be within some practical range, frequencies in the megacycle range are necessary for most dielectric heating applications.

One may reasonably ask, "Why not go to still higher frequencies?" There are several things that limit practical use of the upper frequencies. One is the problem of generating high power at extremely high frequencies. Another is the problem of "tuning" a large load (which represents capacity in an electrical circuit) so that power may be transferred from the generator. Attempts are being made to standardize frequencies for industry. Frequency bands centered at 13.7, 27.4 and 40.8 mc. have already been recommended. Some types of loads require an even lower frequency whereas others require substantially higher frequencies. Standardization on a very limited number of frequencies, therefore, appears to be neither practical or desirable from an industrial viewpoint.

Commercial generators now being built are capable of delivering power from one kilowatt to 125 kilowatts and over, in single units. A 125 kilowatt unit will deliver energy equal to 425,000 b.t.u. per hour. This range of sizes provides generators suitable for many applications.

Various applications to textiles, including cotton, rayon, nylon, and wool, have been the subject of studies in progress for several years in the *RCA Laboratories* at Princeton, N. J., and in *RCA Victor's* applications engineering laboratories in Camden, New Jersey, and *RCA* electronic power generators are in production use in various branches of the textile industry. Such generators are used in the textile business for drying rayon yarn in cake form, and setting twist in rayon tire cord and small denier rayon yarns. They are also useful for various treatments of cotton yarns, and for heating and drying wool.

Especially attractive are the advantages of high-frequency heat for drying nylon on size tubes, and for setting twist in small denier nylon yarns. Other uses include drying tubes of yarn which have been dyed, and drying rayon cakes after the first washing and later when the yarn has been rewet for sizing or other purposes.

Heat Treating Cotton

Drying: An important application, which was one of the first to be made, is the drying of cotton yarns on tube forms after dyeing. This usually is a 16 to 20 hour job when done by hot air. Numerous tests have been made in the drying of dyed yarns on tubes, some of which were centrifuged to partially extract the water, while others were not centrifuged.

Typical test records for forms wound on perforated enameled plastic tubes, and not centrifuged, show that one weighing 1553 grams wet was dried to 811.5 grams in 25 minutes. A second form, having a wet weight of 1885 grams, was dried to 750 grams in 30 minutes. Two other tubes, from which water had been reduced by centrifuging to around 50 per-cent of their dry weight, were dried in 16 minutes.

The quality of the dried yarns in each of these tests was reported to be excellent.

Cloth in roll form has also been successfully dried with high-frequency heat, and rolls of cloth which have been impregnated with certain resins have been successfully cured.

Multiple End Drying: High-frequency drying of multiple ends has also been accomplished experimentally with a miniature beam and electrode system (Fig. 1). These experiments are being made with small yarns of about 60 denier, as well as larger yarns, such as tire cord.

Rayon Applications

Setting Twist: One of the earliest commercial applications of high frequency power to treat rayon yarns was setting twist in tire cords. A typical installation is shown (Fig. 4). This unit will handle from 18,000 to 25,000 pounds of tire cord in 24 hours.

RCA has supplied high-frequency generators for a number of such installations.

As soon as conditions permitted, experimental work was started on the setting of twist in small denier rayon yarns, including crepe yarns. This application has been just as successful as the tire cord application, and several installations are now operating on production work. Precaution against excessive drying of the yarn can be taken by providing for humidity control of the heating chamber or by wrapping or encasing the yarns in boxes while heating. Bobbins with either metal or plastic ends can be successfully heated.

The time required to set twist with high-frequency heat varies with the type of yarn, but it generally requires six to ten minutes at temperatures of around 160 to 180 degrees F.

The efficiency of h.f. installations usually runs around 50 to 55 per-cent of the power input to the generator, i.e. 50 to 55 per-cent of the power drawn from the 60 cycle power line is actually converted into heat within the load material. This high efficiency results because of the absence of much of the thermal loss associated with other methods of heating.

Drying Rayon: The drying of rayon cakes is another application for which h.f. power has definite advantages. A major factor is the necessity of drying the cakes uniformly throughout. Air drying is difficult and slow, and careful control is necessary to maintain a uniform yarn.

Preliminary work on drying cakes with h.f. heat was done several years ago and the encouraging results led to further tests. A laboratory model conveyor system (Fig. 3) was constructed and cakes from several rayon plants were dried. All tests resulted in an improved yarn, but some variations occurred in quality. It is believed that proper control of the process will result in a more uniform and better quality yarn. The present status of this application is in the pilot plant stage.

Most of the rayon cakes we have dried have been one pound dry weight yarns of different denier. These cakes, after the first washing, have contained around 150 per-cent water, based on dry weight, or in other words, 1½ pounds of water per cake. Conveyors are used to carry the cakes between the electrodes and provisions are made to carry off the steam. Drying is accomplished in approximately 30 minutes.

Drying of rewet cakes presents practically the same problem as the original drying, with the exception that less power is needed, since the rewet cakes contain only about 100 per-cent water.

Treating Nylon

Drying: Tests which followed the return of nylon to the hosiery industry have revealed important applications for h.f. power in this field. The most promising of these are the drying of the yarn on sizing tubes and setting twist. The time required to dry a sizing tube, which contains around 800 grams of yarn of single ply, 40 denier, with around 24 grams water content, is 2½ to 3 minutes. The laboratory setup for this process is shown in Fig. 5.

Test samples of yarn dried in this way have been coned and later knitted with excellent results. The h.f. drying of these tubes greatly reduces the number of tubes in use and reduces handling costs proportionately. One conveyor installation is working on production with excellent results, and several more are to be installed immediately.

Twist Setting: This operation has been coincident with the size drying in most cases. However, some tests were run in which the twist was set in small yarns wound on spools and on cones. These tests produced satisfactory running yarns, and if the twist setting of nylon wound in such packages is desirable, the process can undoubtedly be worked out.

Special Applications for Wool

Twist Setting: High-frequency applications to wool have centered around the twist-setting operation. Numerous tests on a number of different types of wool yarns have proved conclusively that twist can be set satisfactorily. High-twist yarns for use in carpet making retained a satisfactory set after heating. Good results were also obtained with wool yarns which were to be woven into cloth.

Tests have been run on wet high-twist yarns in which drying and twist setting were done simultaneously. Some low-twist yarns were set without the addition of moisture. Packages of wet wool yarns weighing 759 grams were dried to 619 grams in 11 minutes. The quality was good and the twist satisfactorily set. Dry low-twist yarns were heated for periods ranging from 4 to 6 minutes, producing a very satisfactory twist set.

Packages of wool, such as cones, bobbins, and skeins, have also been successfully dried. The use of h.f. heating in this field has reached the commercial pilot plant stage and will undoubtedly expand in the future.

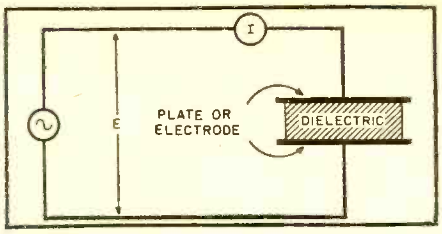


Fig. 2. Fundamental circuit used in all dielectric or electrostatic heating.

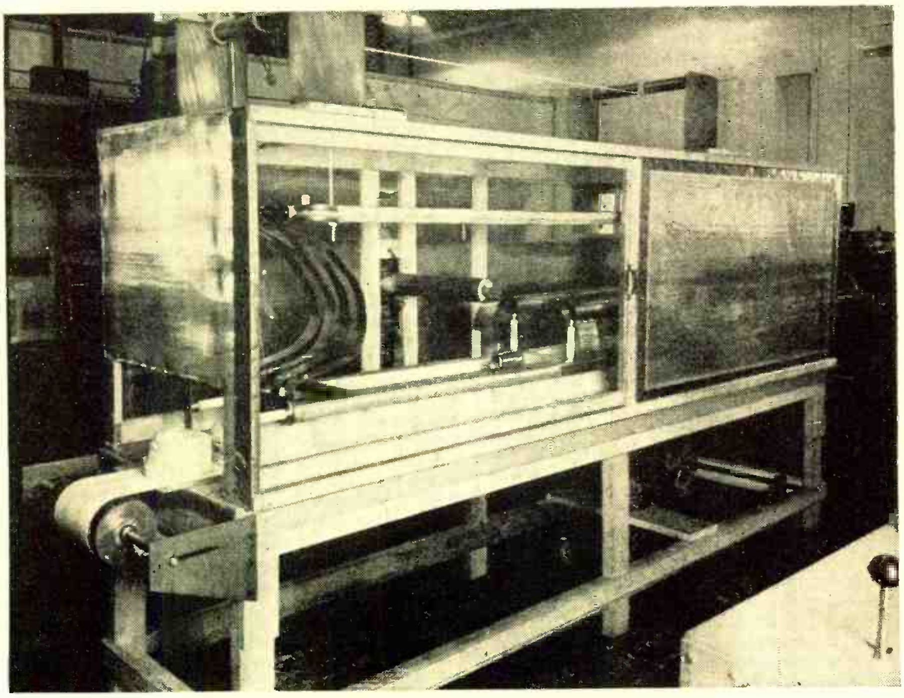
Resin Impregnation

There are numerous applications in the field of resin-impregnated fabrics in which high frequency may prove advantageous, especially for heating rolls of impregnated coth for the purpose of curing the resin. Some laboratory work has been done and the results are promising. It is expected that interest in this application will increase as the use of resins becomes more general.

Most synthetic yarns which improve in quality or have better physical properties after heating may be treated in package form with h.f. power. Exceptional uniform heating

(*Continued on page* 78)

Fig. 3. A laboratory model conveyor system used in drying cakes with high frequency heat. Although this equipment is still in the experimental stage it is believed that proper control of the process will result in a more uniform and better quality yarn.



Developments in SOLID DIELECTRIC R.F. TRANSMISSION LINES

Fig. 1. Testing high-frequency cables at the General Cable Corporation plant.

By R. C. GRAHAM, W8LUQ

Chief Engr., Thermionic Engineering Corp.

Practical graphs and tables of transmission lines for use in conventional amateur rigs.

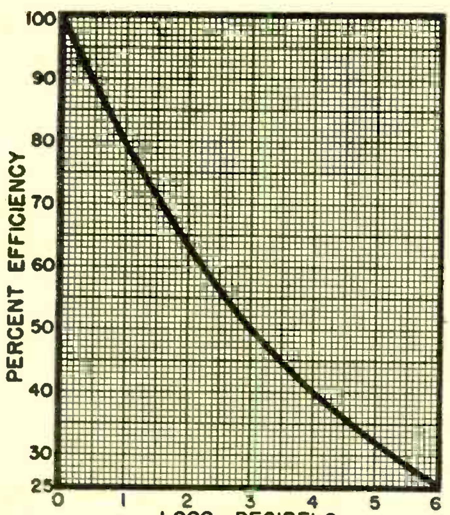


Fig. 2. Line attenuation in decibels.

PREWAR installations of transmission lines or "feeder" systems generally consisted of open wire or air spaced coaxial constructions. It is true that solid insulated lines were making headway due to improvements in dielectrics and designs but the appreciable differences in transmission efficiency favored air spaced lines. Insulated lines (coaxial and especially twisted pair) were used in many instances where compactness, mechanical, or some particular feature was more important than attenuation characteristics—a good example being the small twisted pair designs used for connection to doublet type receiving antennas.

The advantages of a good insulated line are numerous and may be summarized as follows; appearance, compactness, ease of installation, flexibility, reduced line radiation, low impedance, single coupling devices and "matching" networks, and safety. If the transmission efficiency could be made to approach that of air spaced lines and if the effects of weather were eliminated it would appear that solid insulated lines would then be preferred for most installations. It is, therefore, gratifying to describe some important wartime developments that now make it possible to meet these exacting conditions. In this connection, an outstanding contribution was the development of a new and remarkable insulation or dielectric called *Polyethylene.*

Polyethylene*

Polyethylene, an original British discovery, is a synthetic plastic material which may be chemically described as a pure hydrocarbon resin produced by the high pressure polymerization of ethylene gas. The story

* Polyethylene, a chemical name, is used by the Union Carbide and Carbon Corp. to identify its product. Polythene is the trade name used by the E. I. du Pont de Nemours Corp. to identify its product.

of how this difficult process was adapted to large scale wartime production is a subject in itself—another excellent example of American technical achievement.

Polyethylene is an odorless, waxy, flexible material that is now available in a variety of colors. Electrically, it is the best material yet developed for extruded insulation and a similarity to Polystyrene is revealed by the characteristics shown in Table 1 as compared with conventional rubber and steatite insulation.

Physically, the material possesses remarkable toughness and at normal temperatures is resistant to oils, acids, alkalies, and most chemicals. In addition to a high degree of weather resistance, Polyethylene is usable at temperatures from far below zero to as high as 185° Fahrenheit. One of its most useful characteristics is its outstanding resistance to water—being greatly superior to any other nonmetallic wire covering in this respect. For most practical purposes Polyethylene may be accepted as water-repellent. At present, this material may be considered as moderate in cost (as compared to other plastics) but increased demand and production should make Polyethylene one of chemistry's cheapest plastics.

		Polyethylene	Low Loss Rubber	Steatite
Dielectric Constant	10 mc.	2.3	2.8	6.0
	100 mc.	2.2	2.7	5.9
	1000 mc.	2.2	2.6	5.8
Power Factor	10 mc.	.0002	.01	.003
	100 mc.	.0002	.03	.004
	1000 mc.	.0003	.01	.005
Dielectric Strength, volts per mil.		850	425	250

Table 1. Characteristics of polyethylene as compared to low-loss rubber and steatite.

Army-Navy Type No.	Nominal Impedance (ohms)	Inner Conductor	Nominal Diameter Over Dielectric (inches)	Shielding Braid	Protective Covering	Nominal Over-all Diameter (inches)	Weight (pounds per ft.)	Maximum Operating Voltage (Volts)
RG- 8/U	52.0	7/21 AWG copper	.285	single copper	Vinyl jacket	.405	.106	4000
RG-11/U	75.0	7/26 AWG tinned copper	.285	single copper	"	.405	.096	4000
RG-13/U	74.0	7/26 AWG tinned copper	.280	double copper	"	.420	.126	4000
RG-17/U	52.0	0.188 sol. copper	.680	single copper	"	.870	.460	11000
RG-58/U	53.5	20 AWG copper	.116	single tinned copper	"	.195	.025	1900
RG-59/U	73.0	22 AWG copperweld	.146	single copper	"	.242	.032	2300

Table 2. Summary of the characteristics of the more popular polyethylene cables.

Types and Design of Cable

The design of high frequency cables not only involves electrical parameters but must include such physical and mechanical considerations as flexibility, size, handling, weathering, termination, and the most practical aspects of economy and manufacture.

There are several different constructions that are used for solid insulated high frequency transmission cables. These may be described as follows:

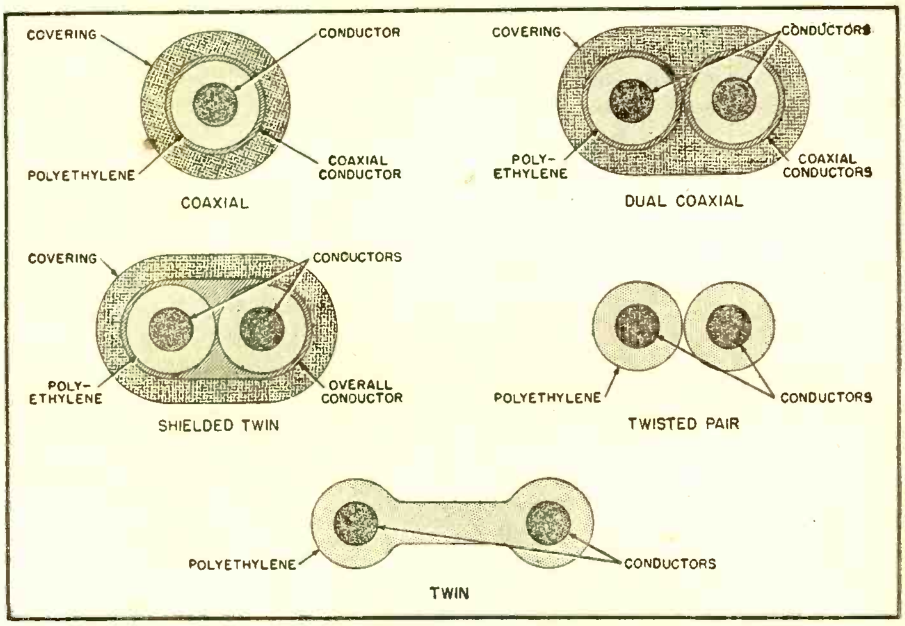
Coaxial—This is becoming the most popular type of insulated line and generally consists of a Polyethylene insulated center wire with an over-all tight fitting concentric metallic covering—such as a flexible copper wire braid. Further mechanical coverings such as jackets or braids may or may not be included for specific service conditions. A single coaxial cable by itself forms an "unbalanced" line and is generally operated as an untuned line. It is not feasible to manufacture such cables except in an impedance range of 12 to 85 ohms. Attenuation or efficiency is largely dependent upon physical size (amount of copper and insulation). For example, some large coaxial cables with losses as low as .2 db. per 100 ft. at 14 megacycles have been manufactured although types recommended for most amateur installations average about .6 db. per 100 ft. Power rating is also dependent upon size and the two cables referred to above may be safely rated (14 mc.) at 30 kw. and 3 kw. respectively. Because of shielding, a coaxial cable has a high degree of operational stability—that is, properties are not affected by weather or installation conditions.

Dual Coaxial—As the name implies this arrangement merely consists of two identical and adjacent single coaxial cables in which the two concentric or coaxial conductors are electrically connected—either within the cable or externally. When operated as a "balanced" line the two conductors are connected in series and the impedance is twice that of the single coaxial circuit. When operated as an "unbalanced" line the center conductors are connected in parallel and one half the impedance of the single coaxial circuit is obtained. In either case the attenuation loss is the same and equal to the loss of the single coaxial circuit. Thus, three different impedance values with equal loss could be obtained from the dual coaxial circuit. For example, two 70 ohm coaxial circuits could be utilized in any one of the following methods:

single circuit 70 ohms
parallel circuit 35 ohms
series circuit 140 ohms

Shielded Twin—This is similar to the dual coaxial arrangement except the two insulated conductors (not coaxial) are covered by a single elec-

Fig. 3. End views of several conventional type high-frequency cables.



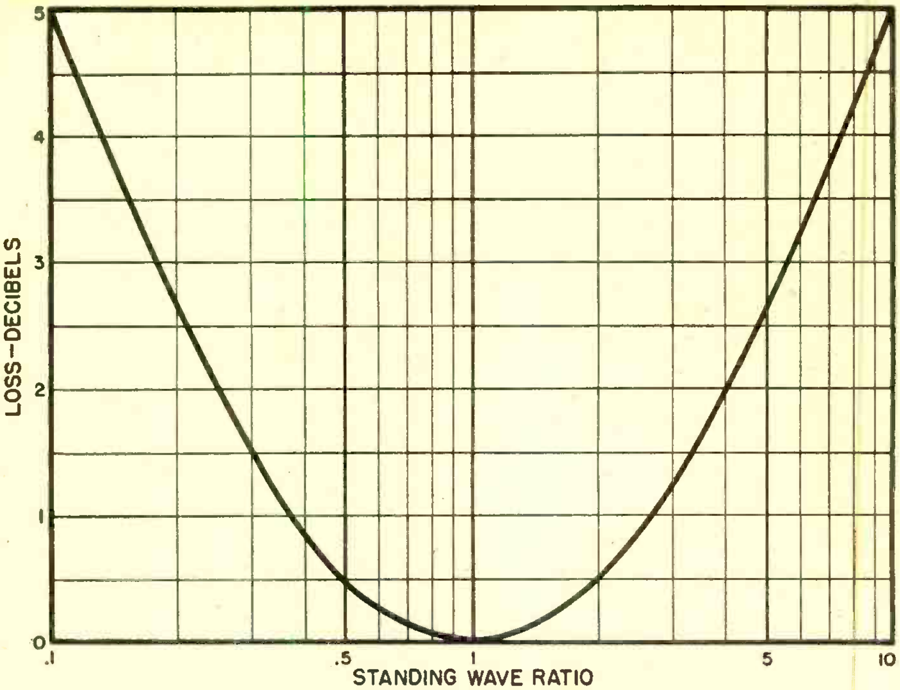


Fig. 4. Graph indicates the db. loss due to different standing wave ratios.

trical metallic shield. It is recommended that this design be used for "balanced" or series connected loads.

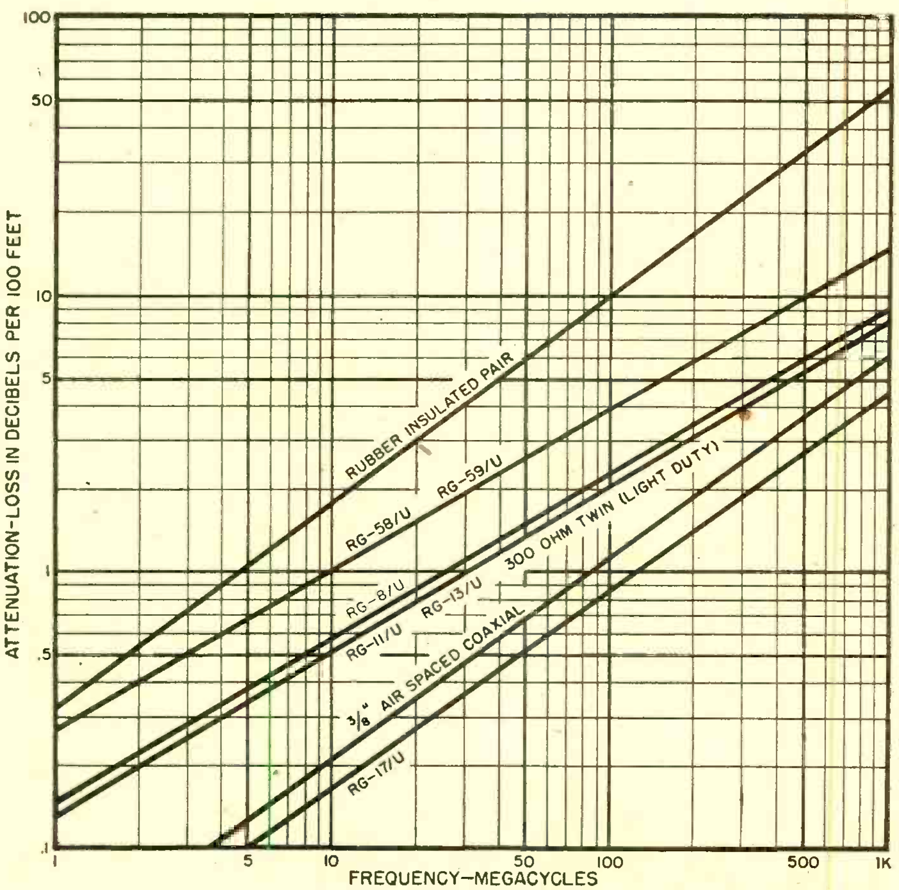
Twisted Pair—This assembly has been well known as an economical feeder for doublet antennas. It consists of two insulated conductors twisted together as a "balanced" untuned line. Since shielding is not used the line impedance and mutual capacitance are subject to variations due to presence of water or external grounds. By proper design, line impedances from 50 to 150 ohms are feasible as well as attenuation values corresponding to equivalent conductor coaxial cables.

Twin—This recent low cost design consists of two parallel insulated conductors with a relatively wide spacing between centers. It is mainly useful as a "balanced" medium to high impedance line with practicable values from 150 to 400 ohms. Because of its low mutual capacitance the attenuation losses are relatively low. Being unshielded this line is subject to slight impedance variations with weather and installation conditions but is not nearly so affected in this respect as the twisted pair. However, the lack of the closer spacing and transportation of the pair may result in a greater magnitude of line radiation or pickup. The twin line may be operated as a tuned line (as well as untuned) whereas the twisted pair should not be.

Mathematical formulas relating to design properties of these cables (impedance, attenuation, velocity of propagation, capacitance, etc.) can be found in the textbooks. Dielectric constant and power factor of the insulation plus the geometry and dimensions of the cable are the main factors involved in the electrical design solutions.

The final test is to judge whether or not these design methods and subsequent manufacture have been correct. Equipment used for this testing is illustrated in Fig. 1.

Fig. 5. Transmission losses for several well-known types of lines.



Line Efficiency

Just what is meant by the expression of line attenuation in decibels? This is merely an accurate mathematical description of the line efficiency—or in other words, the ratio of output in input power. Fig. 2 is a graphical presentation of decibels expressed as per-cent efficiency. For example, a total line loss of 1.0 db. represents 79.4 per-cent efficiency, (from Fig. 2) which means that for every 100 watts put into the line at the transmitter end a value of 79.4 watts is obtained at the antenna end.

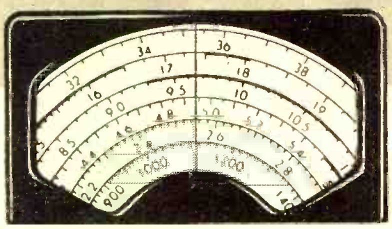
In this same connection there may be other effects contributing to the total loss in addition to that supplied by the untuned transmission line—such as that loss due to the mismatching of impedances. When the line impedance differs from the antenna impedance a standing wave ratio equal to the ratio of these impedances is established. For example, a 35 ohm line connected to a 70 ohm antenna section has a standing wave ratio of 2 (70/35) or 0.5 (35/70). Fig. 4 indicates the db. loss due to different standing wave ratios. It is significant that impedance mismatches up to ratios of 2 to 1 cause almost negligible loss. This means that losses due to use of a 50 ohm cable to a 70 ohm load (and vice versa) are not of any serious consequence. Such mismatch may, of course, have some effect on coupling and cause a slight increase in line radiation.

Available Cable Types

Polyethylene insulated high frequency cables were produced in large

(*Continued on page* 153)

International SHORT-WAVE



***Compiled by* KENNETH R. BOORD**

MANY times daily the laugh of the Kookaburra (popularly known in Australia as "The Laughing Jackass") tells the world that the powerful voice of *"Radio Australia"* is on the air. Reception from "down under" is usually excellent in most parts of the Western Hemisphere, and reports from various parts of the United States and Canada indicate that VLC5, 9.540, used mornings to Eastern North America, sends the most consistent year-around short-wave signal from abroad, normally at "local" level.

Signature sign of "Radio Australia" is the laugh of the Kookaburra bird.

For a brief background about *"Radio Australia,"* these excerpts are quoted from a recent issue of the Australian Army Educational Journal, *"Salt"*:

"*'Radio Australia'* is riding the short-waves to some purpose. Its voice, strong and telling, is penetrating the far corners of the earth, emphasizing the not always recognized fact that as a nation we are now of age . . . *'Radio Australia'* has a vast audience ever on the increase.

"Our short-wave radio service began back in 1939. Then, when only a 10 kw. transmitter was available, someone contemptuously slated our broadcasts as penny-whistles in the Pacific. In the beginning, the Australian short-wave transmission was admittedly weak in point of distance. Today with three transmitters strong as any on earth, *'Radio Australia'* works a wireless pitch which literally extends from pole to pole.

"During the war years, *'Radio Australia'* performed exacting functions. The first was to tell the truth about the war. The second was to let the world know that Australia was really over there, that she was girding herself for all-out effort. War over, we know now that our radio tilts at Jap morale struck home in the place where it hurt most—the uppermost reaches of the Jap High Command. The Nazis early recognized the quality of the Australian short-wave. Even that microphone master, Dr. Goebbels, was careful to answer *'Radio Australia'* because he recognized a direct, incisive note which carried conviction. He wasn't the only one to pay unusual attention to our short-wave blasts. One considered American opinion given wide publicity throughout the U.S.A. was: 'Australian news commentators are the saltiest in the world, and even more pungent than the Germans when they really go to town.' Which was, in its way, saying a mouthful. But it was the Nip who really had his ear to the loud-speaker when *'Radio Australia'* was on the air. We broadcast (and still do) in Japanese, Chinese, Malay, Dutch, Thai, French, and English. Throughout the Pacific War, *'Radio Australia'* hit and hit again. Ultimately, it took the lead in the psychological warfare of the air in this area . . . The Japs, from Tokyo and points south, carefully monitored our short-wave broadcasts. They found it the best way of keeping up with the true trend of the war . . .

"Proof positive of Japanese hostility to *'Radio Australia'* and its effective voice came from the Japs themselves. With horrific bluster, they threatened the lives of leading radio commentators. They gave pride of place to two Australians—Paul McGuire and Geoffrey Sawer. The others on that notable list were William Winter of San Francisco; Wickham Steed of London; and Allington Kennant of New Delhi.

"Critics ask: Is *'Radio Australia'* heard? It's heard, all right. Thousands of letters from the earth's odd spots testify to that.

"Significantly, *'Radio Australia'* has many fans in Northern Europe, particularly Sweden—a neutral country where short-wave listening was entirely free. They tell you why they listen—because *'Radio Australia'* has an accurate news survey, because they're curious about the country, its peoples, and its ways. To many of them it is a prospective home . . .

"If further proof that the world cocks an ear to Australia were needed, it lies in the two world scoops pulled off by *'Radio Australia.'* The first was General MacArthur's speech on his arrival in Australia. The other came on VP day, when the Australian attitude to the Emperor Hirohito was made abundantly clear. Without *'Radio Australia,'* that opinion which so quickly girdled the globe might have

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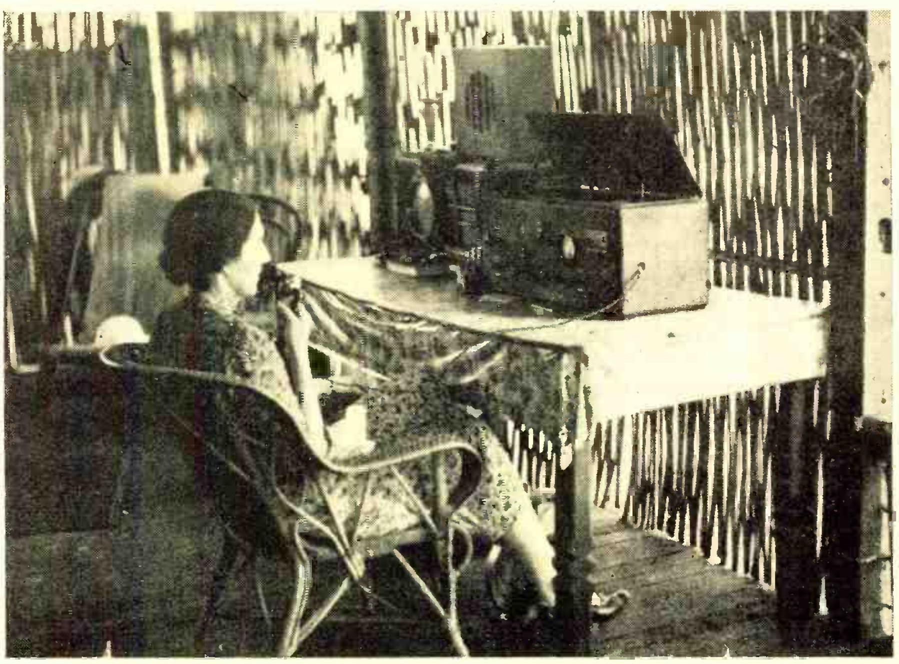
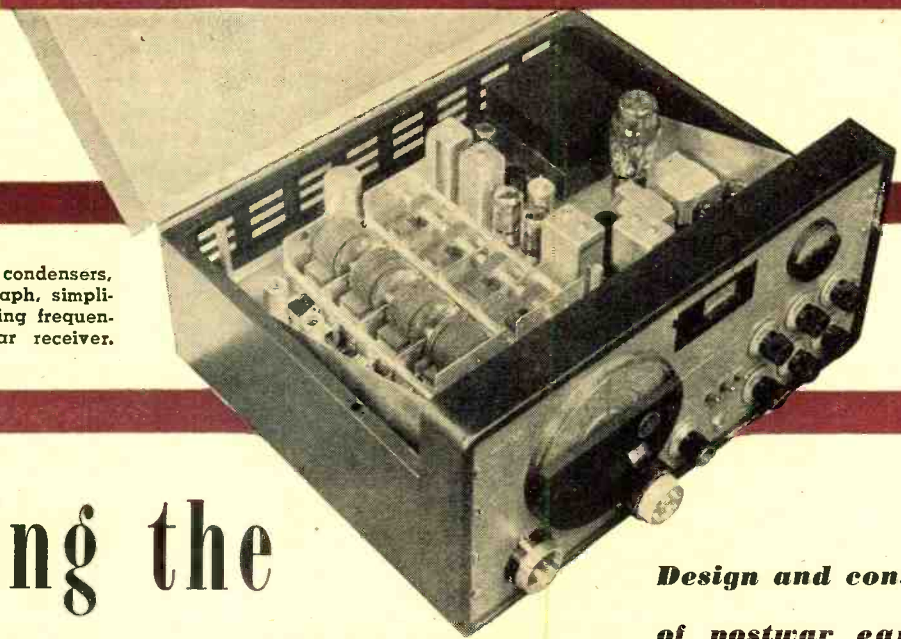


By generating the necessary current with a pedal apparatus, this woman enjoys a morning chat with her neighbors, some of whom are 200 miles away. Two-way radio is an important adjunct to ranch life throughout Australia, and a link with civilization.



The use of split stator condensers, as shown in photograph, simplifies means of extending frequency range of postwar receiver.

Designing the POSTWAR RECEIVER

Design and construction of postwar equipment will present many new, interesting innovations.

By

BILL HALLIGAN, W9WZE and CY READ, W9AA

THE modern communications receiver has a long and varied ancestry. In its evolution it has acquired characteristics from every conceivable source—marine receivers, early regenerative variometer and varicoupler combinations, all-wave sets with plug-in coils, broadcast receivers, etc., etc.,—primarily however, it stems from decades of amateur experimentation and construction. In designing a new type of communications receiver, therefore, the first consideration must be the requirements of amateur operation—in sensitivity, selectivity, adaptability to varying conditions in the amateur bands, operating convenience, and frequency coverage.

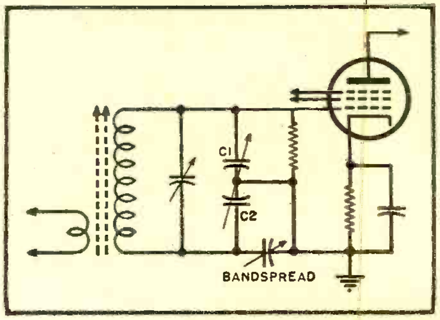
Frequency Limits

In designing the new SX-42 the first radical departure from conventional practice was in the matter of frequency coverage. With the opening of many new v.h.f. and u.h.f. bands to amateur operation anything which makes it possible to cover more amateur frequencies on a single receiver is well worth-while. Then too, the vast majority of amateurs expect to find the broadcast band on any good communications receiver, as in these days of crowded living conditions it must frequently provide radio entertainment for the entire family. The assignment of 88 to 108 megacycles to FM and the obvious fact that frequency modulation is destined to become the dominant broadcast service, makes it highly desirable to provide for the FM band as well. Therefore, this new receiver must—and does—cover all frequencies from 540 kilocycles to 110 megacycles and is capable of c.w. and AM reception throughout that range and FM reception between 27 and 110 megacycles.

The Radio Frequency Section

The principal problem in covering such a tremendous span of frequencies is in securing good r.f. amplification. The gain per stage of a tuned radio frequency amplifier depends directly on the reactance of the coil, among other things, and if normal r.f. circuits are used it is necessary to employ tuning capacitors with exceptionally low minimum capacity in order to keep enough turns on the coils for any gain at all at the higher frequencies. This would not be too difficult except for the necessity of having capacitors large enough to tune the standard broadcast band as well. The solution was the development of a new "split-stator" circuit shown in Fig. 1.

Fig. 1. Fundamental "split stator" circuit.



At the higher frequencies this split-stator circuit has many advantages over the conventional type of tuned circuit. The two halves of the capacitor being in series across the coil, the normal minimum capacity is cut in half. In addition nearly all circulating r.f. current is confined to the coil and capacitor, very little of it flowing through the rotor wiper contacts. In practical circuits employing band switching the coils for the two highest frequency ranges, 27 to 55 to 110 megacycles, are mounted directly on the band switch so that connecting leads are almost non-existent. The switch itself is ruggedly built with positive contacts and is located directly underneath the main tuning gang. The extremely short connection between tuning capacitor and band switch are of silver plated copper strip to hold inductance outside of the coil itself to a minimum. Careful mechanical design has made possible r.f. circuits with band switching in which connecting leads are hardly any longer than would be the case without the band switch. Powdered iron cores are used throughout, even in the inductances for the highest frequencies, and the increased Q thus obtained assists greatly in maintaining high gain throughout the receiver's range. Two tuned r.f. amplifier stages employing miniature type 6AG5 tubes are used.

A single type 7F8 dual triode functions as high frequency oscillator and mixer. While not ordinarily used in receivers for the medium and high frequencies, triode mixers give a much better signal-to-noise ratio on the very-highs than the more conventional multi-element tubes. Temperature compensation is provided for the oscillator section, and plate power comes from a stabilized supply using a type VR-150 voltage regulator tube. This stabilized source is also used to supply the beat frequency oscillator and the direct current amplifier for the FM tuning meter to be described later.

Tuning Controls and Bandspread Arrangement

Wide frequency coverage calls for a high order of precision in the tuning mechanism and several new ideas have been incorporated in the control system. Main and bandspread tuning knobs are mounted coaxially and are placed at the lower right edge of the one-piece lucite main dial housing. A vernier dial in the form of a conic section is an integral part of the main tuning gear drive and rotates under a small window in the lucite housing, separately illuminated. A small locking knob is also mounted coaxially with the two tuning knobs and when rotated half a turn, alternately locks the main or bandspread controls to prevent accidental detuning. When the main tuning is locked its knob can still be turned through a slipping clutch arrangement but the condenser gang itself and the vernier and main dials cannot be moved. When the main tuning capacitor is turned as far as possible in either direction a positive mechanical stop locks the gear drive so that no misalignment can occur through accidentally forcing the knob too far.

Calibrated electrical bandspread in a receiver with such a wide tuning range presents a rather unusual problem because of the fact that some amateur bands occur where the main tuning capacity is nearly at maximum and others at the minimum capacity end of the dial. For example, the bandspread capacity needed to cover 300 kilocycles when the main tuning capacitor is near maximum is far greater than that needed for the same number of kilocycles if the main tuning is near minimum capacity. The problem was solved by designing a "trick" bandspread condenser gang. In this device the stator plates are especially shaped so that when the rotor is turned in to the stator in one direction the rate of change in capacity is comparatively slow whereas when the rotor is turned the opposite direction from minimum capacity a larger plate area is engaged, thus producing a greater change in capacity per degree of rotation. The bandspread condenser is cable driven from the outermost of the two coaxial knobs and the calibrated bandspread dial, located behind an oblong window in the center of the panel, is arranged to turn 180 degrees either way from zero depending on which amateur band is in use.

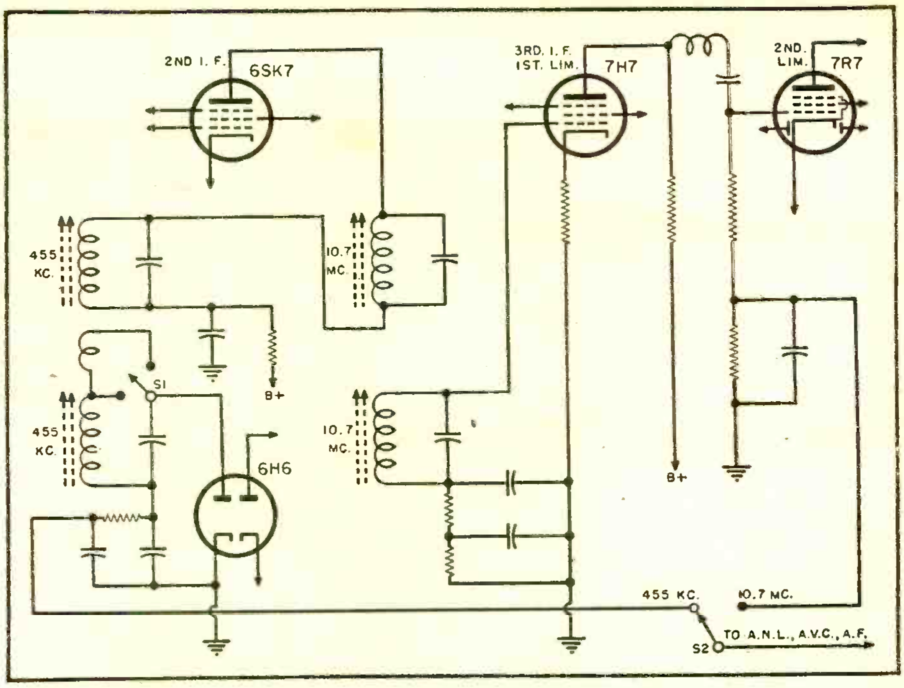


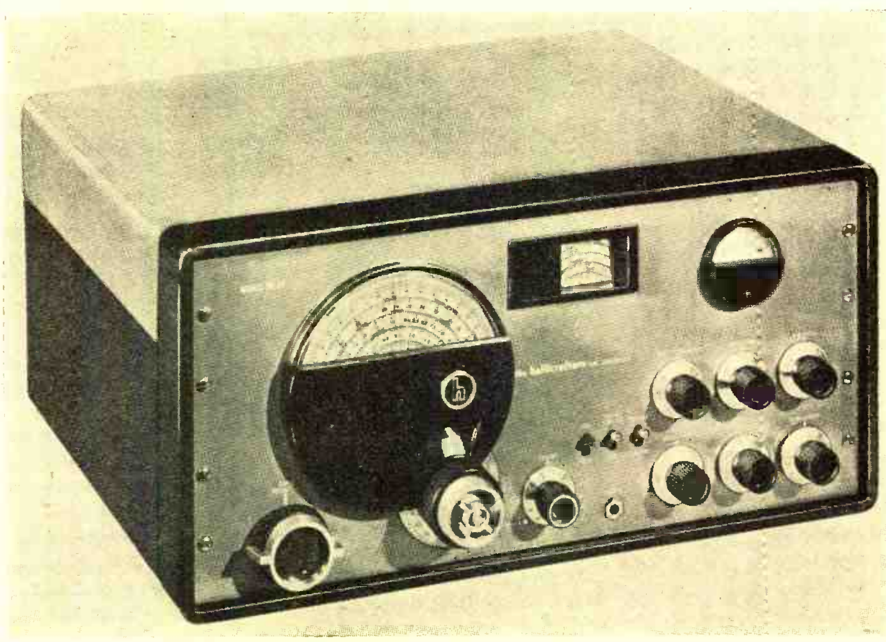
Fig. 2. Simplified diagram of second intermediate frequency amplifier.

This complete tuning assembly is adaptable to the preferences of almost any operator. The positive geared vernier provides absolute accuracy of reset or may be used as a bandspread dial by those who do not wish to use electrical bandspread. Approximately 2100 dial division on the vernier scale are required to turn the main dial from end to end. The combining of all tuning controls in one centralized unit is of great assistance in streamlining the appearance of the whole receiver and in removing the over-complicated look which has handicapped many fine models in the past.

Another radical departure from precedent in this receiver is in the i.f. system. Each i.f. transformer contains primary and secondary windings for both the 455 kilocycles and 10.7 megacycle i.f. channels and in most cases primaries and secondaries for both frequencies are connected in *series*. The change from 455 kc. to 10.7 mc. is automatically accomplished by two contacts on the band switch. In the first i.f. transformer only the secondaries are in series and one switch contact selects either of the two primaries while the other shorts out the 455 secondary and crystal filter components when the 10.7 i.f is in use. Another switching arrangement is used to take the filter out of the circuit for regular reception.

(*Continued on page* 108)

The modern design trend is exemplified in this new receiver panel layout.



Midget handie-talkie, "Tiny Tim," developed by Charles T. Haist, Jr., of the General Electric Electronics Department. Range of this transmitter-receiver is two miles.

Practical RADIO COURSE

By ALFRED A. GHIRARDI

Part 49. Covering commercial types of electron-coupled mixer and converter tubes; pentagrid mixers, pentagrid converter, triode-heptode and triode-hexode converters

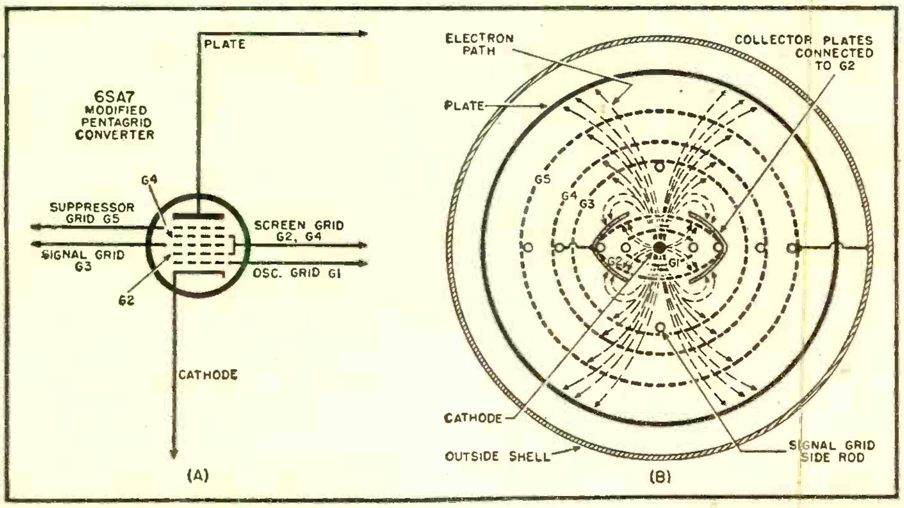
THE simple type of pentagrid converter tube (6A8, 1A7, etc.) described in the previous article of this series,[1] suffers from two inherent limitations at the higher signal frequencies. These are:

1. There is serious reduction in converter gain at frequencies above 10-13 mc. due mainly to the antiphase voltage of oscillator frequency developed in the signal-grid circuit because of the space-charge coupling existing between the signal and oscillator grids.

2. Mainly because of interactions resulting from the fact that the oscillator plate is in the same electron stream with the signal grid, the oscillator plate current is affected by the bias voltage applied to the signal grid, and therefore the application of a.v.c. bias causes variations in oscillator amplitude and frequency (frequency drift).

Both of these undesirable actions were explained in a previous article.[1] They may be reduced by using a separate oscillator tube. The second one alone may be greatly reduced by employing special oscillator-section constructions in the converter tube. Both of these lines of approach have been followed in practice, with the result that several improved forms of mixer and converter tubes have been developed especially for use in receivers operating at the higher frequencies, such as all-wave receivers, those for FM and television services, etc. Each of these improved tube types possesses certain inherent characteristics that differentiate it from the others. The electrode arrangements employed in these tubes, and their operation, will now be explained.

Fig. 1. (A) Usual schematic representation of the electrodes in the 6SA7 and similar types of modified and improved pentagrid converters. (B) Top view of tube elements showing actual structure and the electron beams that result.



6SA7 Type Improved Pentagrid Converter Tube for All-Wave Receiver Applications

A method of improving the oscillator-frequency stability of the pentagrid converter in the range of frequencies encountered in all-wave receivers, by employing a special oscillator-section construction that minimizes the effect of the signal grid on the oscillator plate, is used in the modified and improved design of pentagrid converter tube exemplified by such commercial types as the 6SA7, 1R5, 7Q7, 12SA7, 14Q7, etc. This improved design of pentagrid converter should not be confused with other earlier pentagrids such as the

[1] See Alfred A. Ghirardi, Practical Radio Course, Part 48, Radio News, September 1946.

6A8, etc., since it is of an entirely different construction and the various grids are employed for different purposes. Also, special oscillator circuit arrangements (see Fig. 2) are necessary with it (the Hartley oscillator circuit generally being employed, using a single tapped coil grounded at one end).

Construction and Operation of 6SA7 Modified Pentagrid Converter

The illustration at B in Fig. 1 shows the electrode arrangement employed in this improved design of pentagrid converter tube; the schematic representation is shown at A. Observe the important difference between it and the ordinary 6A8 type tube[1]—in the 6SA7 type there is no electrode which functions only as the *oscillator plate.* The first (inner) grid, *G1,* surrounding the cathode is the oscillator grid, so inner-grid oscillator injection is employed. Next comes the inner screen grid *G2,* which is connected to the outer screen grid *G4* inside the tube. Fastened to the side rods of inner screen grid *G2,* and therefore electrically connected to it, are two curved *collector plates,* as shown in Fig. 1B, whose function will be explained. The signal grid *G3* is located between the inner and outer screen grids *G2* and *G4*. Pentode characteristics are obtained in the mixer section by incorporating the suppressor grid *G5,* between the outer screen grid and the plate. This increases the tube's plate resistance and, therefore, increases the conversion gain obtainable. (This action of the suppressor grid is especially important when the tube is operated with a plate-supply voltage as low as the screen voltage, as is usually the case in an a.c./d.c. receiver.)

An important function of the inner screen grid *G2* and the collector plates connected to it is to minimize the effect of the signal-grid voltage on the space charge near the cathode. As was found to be the case in simple pentagrid converters of the 6A8 type,[1] the 6SA7 and similar modified pentagrid converter tubes have a pulsating virtual cathode formed between the inner screen grid *G2* and the signal grid *G3*. The negative potential of the signal grid repels the electrons travelling toward it on their way to the plate and turns some of these electrons back toward the oscillator grid *G3* and the main cathode. Any of these electrons which reach the region near the main cathode will affect the space-charge conditions in this region, thus affecting the transconductance and input capacitance of the oscillator section, with consequent change in oscillator frequency.

It can be seen from Fig. 1B that the two side rods of signal grid *G3* are located so as to be in the center of the main cathode electron stream. Since each always has a negative potential, it repels the negative electrons in the stream, thereby causing the stream to split into two diverging beams, as shown. As a result of the particular curved paths which these electron beams take, and the geometry and location of the two collector plates, most of the electrons turned back toward the oscillator grid and main cathode by the signal grid *G3* will take paths which cause them to be intercepted by the two collector plates, so they are prevented from reaching the oscillator grid and the region around the main cathode. Consequently, because of this special construction, signal-grid voltage has little effect on the space charge near the main cathode, so changes in a.v.c. bias voltage produce but little change in oscillator transconductance and in the input capacitance of grid *G1*. Therefore, change in a.v.c. bias causes little detuning of the oscillator.

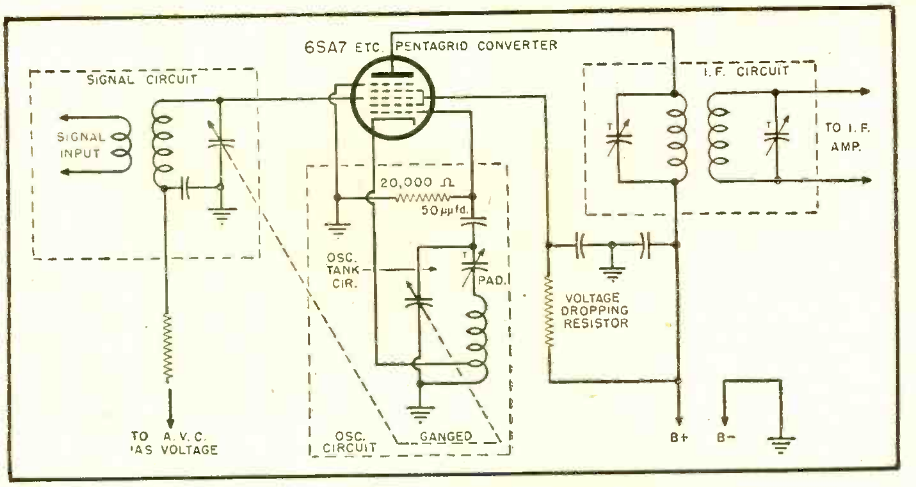


Fig. 2. Typical self-excited converter circuit employing 6SA7 or similar converter tube. The Hartley oscillator uses one tapped coil and is cathode-coupled.

Undesirable Space-Charge Coupling Effects in 6SA7 Tube

With this type of tube, as in other converter or mixer tubes in which the oscillator voltage is injected next to the cathode (inner-grid oscillator injection), a voltage of oscillator frequency may still be set up across the signal-input circuit due to space-charge displacement current set up in the signal grid by space-charge coupling between the oscillator grid and the signal grid,[1] particularly if the percentage difference between the signal and oscillator frequencies is small and the impedance of the signal circuit at oscillator frequencies is appreciable. The effect of this is *degenerative* if the receiver is designed to have f_o always *higher* than f_s by an amount equal to the i.f. employed in the receiver. It results in a reduction of the conversion conductance and gain, particularly at the higher frequencies.

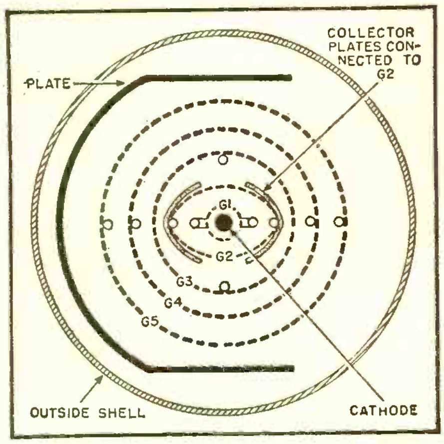
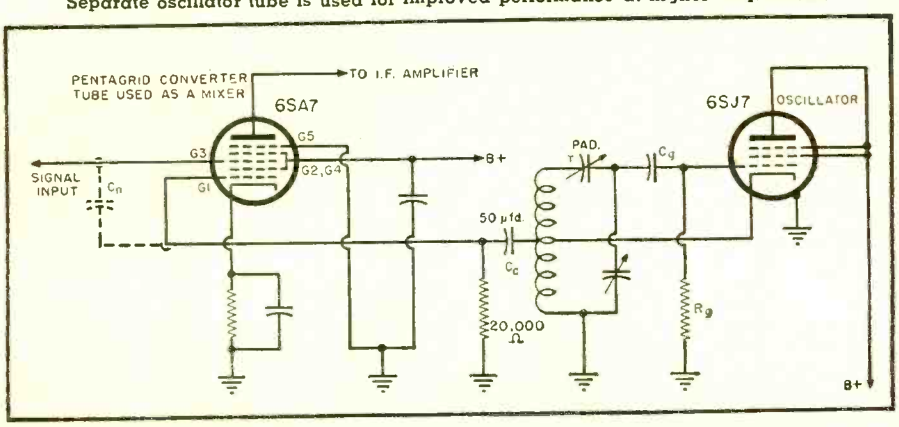


Fig. 3. Arrangement of electrodes in 6SB7Y, improved form of pentagrid converter.

6SA7 Self-Excited Pentagrid Converter Circuit

Fig. 2 illustrates the 6SA7 modified pentagrid converter tube in a popular self-excited converter circuit employ-

Fig. 4. Separately excited converter circuit employing type 6SA7 tube as mixer. Separate oscillator tube is used for improved performance at higher frequencies.



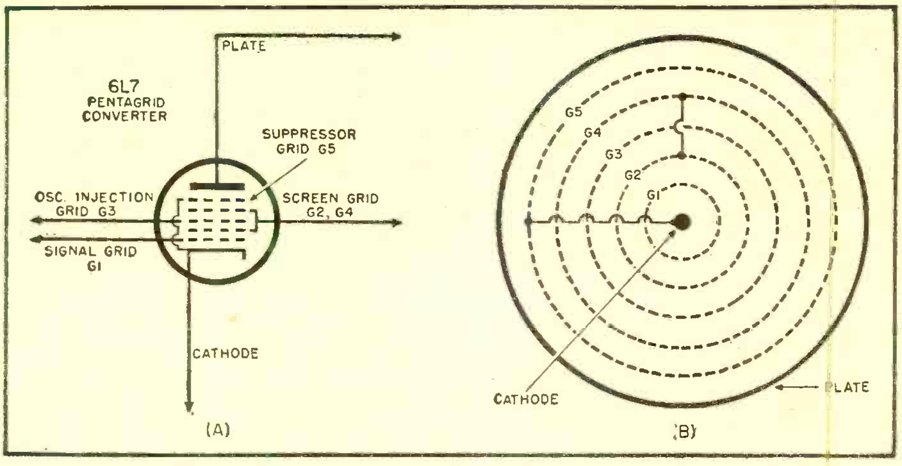
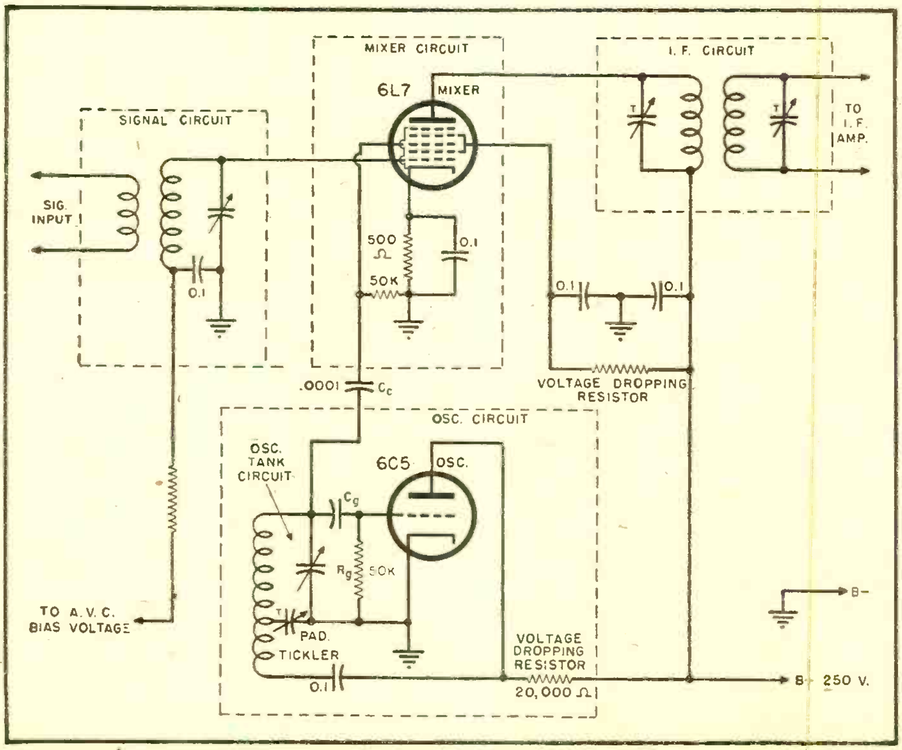


Fig. 5. Schematic representation and actual structural arrangement of electrodes in 6L7 type pentagrid mixer tube.

ing a Hartley type oscillator using cathode-circuit feedback. Notice that one end of the tank coil is grounded, and the cathode is connected to a tap on this coil. This causes the cathode to operate at high r.f. potential. Also, the cathode circuit (and current) returns through a portion of the oscillator tank coil. This circuit arrangement adds to the stability of the 6SA7 circuit. The feedback is obtained with the *total* cathode r.f. current. Because of the shielding effect of the inner screen, the electrostatic field of the signal grid has little effect on the space charge. The collector plates and the inner screen serve to isolate the signal grid from the cathode space charge. The result is that a change in signal-grid voltage produces little change in the main electron stream emitted by the cathode, i.e., in the *cathode current*. Consequently, variations in a.v.c. voltage applied to the signal grid do not change the cathode current appreciably, so the oscillator frequency is almost independent of a.v.c. bias voltage. Variation in screen voltage produces a shift in oscillator frequency in the opposite direction, and the two effects practically cancel. Consequently, excellent frequency stability is obtained.

The position of the cathode tap on the oscillator tank coil is extremely important when operating on the higher frequencies for, if the tap is too far from the grounded end of the coil, the cathode r.f. voltage will be too high, causing an overbiasing effect which reduces the gain. If too low, only weak oscillations are produced, which reduces the gain because of insufficient modulation. Note that the

Fig. 6. Conventional frequency converter circuit employing a 6L7 pentagrid mixer tube and separate 6C5 triode oscillator. This type of circuit (with suitable waveband switching) is widely used in larger all-wave receivers where the necessity for the separate oscillator tube is no disadvantage.



padding condenser cannot be placed at the customary position of the low side of the oscillator coil because a d.c. path must be provided for the cathode return to "B—." It must be placed in series with the oscillator tuning capacitor.

Various other oscillator arrangements are possible, but the use of a Hartley type oscillator has advantages when the receiver is to be designed for multi-band reception, since it simplifies the band switching arrangement.

Advantages of 6SA7 Pentagrid Converter Tube

Because of their improved construction the 6SA7 and similar modified types of pentagrid converter tubes give better performance than do the older pentagrids of the 6A8 type. The gain at AM broadcast band frequencies is higher due to the combination of fairly high conversion conductance (about 450) and high plate resistance (about 1,000,000 ohms), and continues high up to approximately 6 mc. (50 meters). The efficiency falls off at frequencies higher than this owing to the difficulty of maintaining optimum oscillation strength.

At very high frequencies, above approximately 6 mc. it becomes difficult to maintain sufficiently strong and uniform oscillation when the 6SA7 type tube is used as a *converter*. One way of effecting a considerable improvement on frequencies higher than this is to employ a separate oscillator tube, in which case the 6SA7 serves excellently as a mixer. A separate oscillator can generally be built with better operating chacteristics than a *built-in* oscillator. Also, a tube that has to perform mixing only can generally be made to operate better than one that must also incorporate an oscillator function.

With this arrangement, a.v.c. may be applied at all frequencies, and does not result in any serious shift in oscillator frequency. The oscillator frequency is also reasonably stable with variations in supply voltage. However, there is the disadvantage that *two* tubes must be used in order to accomplish the frequency conversion.

A typical circuit for separately-excited operation, using a separate 6SJ7 tube operated as a triode oscillator, is illustrated in Fig. 4. The oscillator is coupled to the oscillator grid of the mixer by means of coupling capacitor C_c. With this separate excitation, there is no oscillating voltage on the cathode of the 6SA7 tube. The amplitude of oscillation, therefore can well be made higher than the amplitude used in self-excitation. As a result, somewhat higher conversion transconductance can be obtained with separate excitation than with self-excitation, and increased gain is obtained.

When separate excitation is used, it may be desirable to neutralize the effects of space-charge coupling by connecting the small neutralizing capacitance C_n between the oscillator

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In announcing forthcoming installation of musical wire reproducers, radio and public address systems on their passenger trains, Fred G. Gurley, president of the Atchison, Topeka, and Santa Fe Railway, yesterday disclosed that individual outlets will be placed in sleeping cars.

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As a forerunner of this innovation, wire reproducing units providing programs of various types of music, will be placed on the Santa Fe dining car 1450 when it goes into transcontinental service on March 10. As soon as equipment and labor are available, the railroad president declared, similar installations will be made on both new and old dining cars, as well as sleeping, chair, and club-lounge cars.

Speakers will be placed in the ceiling of these cars to provide an even distribution of low-level sound throughout the car. The volume will be set at an advantageous point for both the listener and conversationalist, it was stated.

Farnsworth Television and Radio Corporation of Fort Wayne, Indiana, designed the over-all integrated system.

Reprinted from the Chicago Journal of Commerce, March 4, 1946.

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injection grid *G1* and the signal grid *G3* of the 6SA7 tube, as shown.

The 6SB7Y Improved Pentagrid Converter Tube

Improvements on the 6SA7 type of pentagrid converter tube have resulted in the 6SB7Y metal tube, a newer pentagrid converter type designed especially for the higher frequencies. The electrode structure is illustrated in Fig. 3. The relative location and sequence of the various elements are the same as in the 6SA7 (Fig. 1) but their spacing and number of turns are different. Also, the plate is flattened where the electron beams strike it, and it does not form a closed cylinder. This improved construction has made it possible to obtain stable oscillator circuits in the FM broadcast band (88 to 108 mc.). Also, improved signal-to-noise ratio and higher conversion gain are realized in the standard AM broadcast and short-wave bands, and the cut-off is sharper.

The 6L7 Pentagrid Mixer Tube

An entirely different method of attack on the problem of reducing the undesirable interactions between the signal and oscillator-frequency circuits and thereby securing improved high-frequency performance over that obtainable with the early 6A8 type of pentagrid converter tube has been employed in the widely-used type 6L7 *pentagrid mixer* tube (which requires a separate oscillator tube). When used with a well-designed separate oscillator, the 6L7 pentagrid mixer tube (which was especially designed for short-wave reception service) makes possible a frequency-converter arrangement that has negligible frequency drift and negligible degeneration (falling off of gain) even at the ultra-high frequencies encountered in FM and television reception.

The schematic representation of the various elements of this tube is illustrated in Fig. 5A. The electrode structure is shown in Fig. 5B.

The internal construction and connections differ considerably from other pentagrid (5-grid) tubes such as the type 6A8,[1] 6SA7, etc. There are two "control" grids—the inner signal-grid *G1* and the oscillator injection-grid *G3* (outer-grid oscillator injection is thus employed). The signal grid is designed to have a remote cut-off characteristic and is suited for gain control by a.v.c. bias-voltage variation. The oscillator grid has a sharp cut-off characteristic and produces a comparatively large control effect on the electron stream and the plate current for a small amplitude of applied oscillator voltage. This is particularly useful on very high frequencies, where oscillator output voltage usually drops off. Grids *G2* and *G4* are connected together within the tube. They accelerate the electron stream toward the plate, and also serve to shield the oscillator-injection

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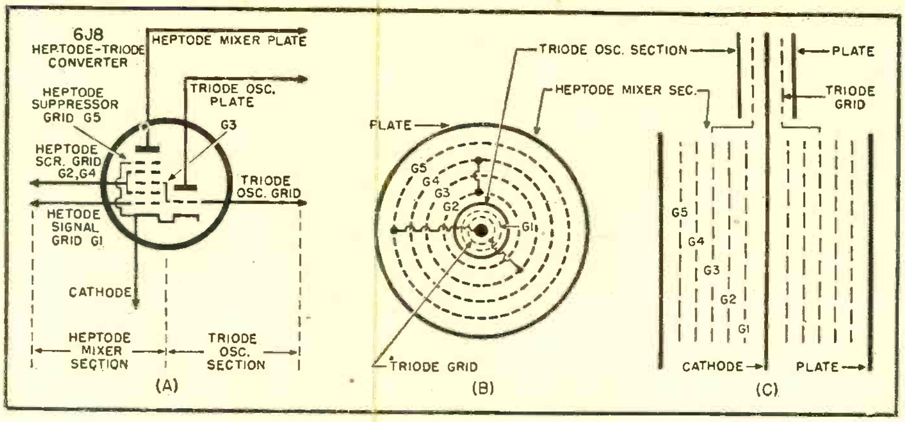


Fig. 7. Schematic representation and actual structural arrangement of electrodes in 6J8 and similar triode-heptode converters.

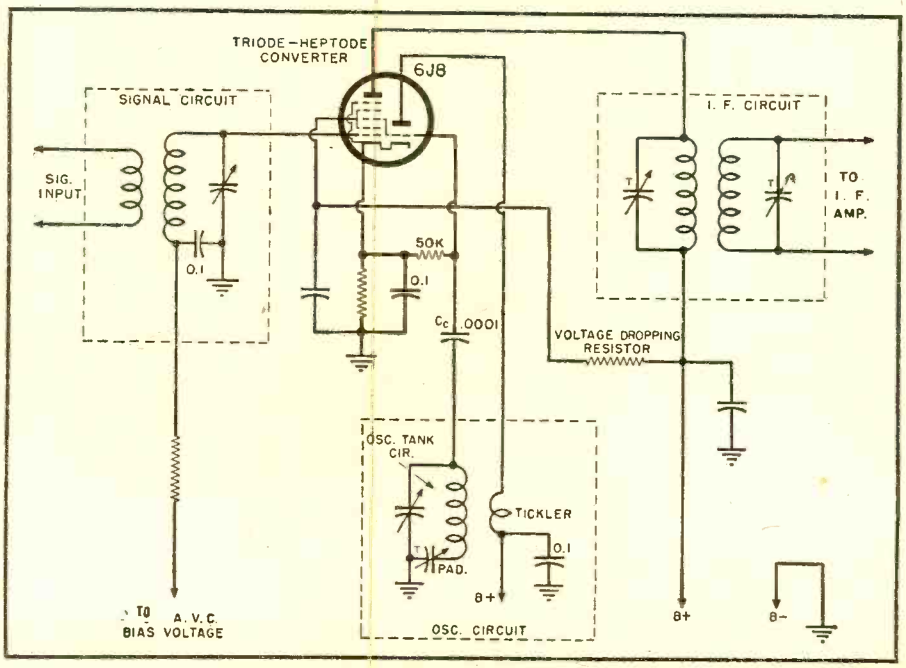
grid *G3* electrostatically from the other electrodes. Grid *G5* acts as a suppressor grid that accelerates the electrons and increases the internal plate resistance, thereby increasing the conversion gain obtainable—similarly to the suppressor grid in a pentode.

The signal impressed on *G1* controls the cathode current, while the oscillator voltage impressed on *G3* alternately increases and decreases the flow of electrons, depending on whether it is positive or negative at the particular instant. Consequently, the variations in plate current are due to the combination of the oscillator and signal frequencies, so the desired (i.f.) sum or difference frequencies are produced.

This arrangement makes this mixer tube superior to other types for several reasons. It has two independent control grids (each electrostatically shielded from the other and from the other elements) that are maintained at a negative potential and that affect the flow of electrons from the cathode to the plate. The plate impedance is considerably higher than that of mixer tubes previously available. True electron-coupling is provided, since the oscillator voltage is applied to injector grid *G3* in the main electron stream. The conversion transconductance is high (from 350 to 375), which compares favorably with the later triode-hexode type in conversion efficiency.

A typical circuit arangement for a frequency converter employing the 6L7 tube as an electron-coupled mixer, and a separate 6C5 tube as a grid-tuned triode oscillator, is illustrated in Fig. 6. Observe that a small fixed capacitor C_c serves to couple the 6C5 oscillator grid to the oscillator injection grid, *G3*, of the mixer. The stability of the oscillator is here dependent only upon the design and construction of the oscillator stage; there can be no feedback of oscillator energy to the signal grid circuit, as is the case when pentagrid *converter* tubes are used. The oscillator design of course, may vary to suit the pref-

Fig. 8. Conventional frequency converter circuit employing a 6J8 triode-heptode converter. This type of circuit (with suitable switching) is widely used in low-priced, compact, all-wave receivers.



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☐ I am entitled to training under the G. I. Bill.

erences of the individual designer. A 6J7 r.f. pentode is frequently used as the oscillator, and is coupled to the oscillator injection grid of the mixer in this same way.

This type of circuit is quite simple and straightforward, and because of its excellent stability at the high frequencies, it is widely used in the larger all-wave receivers (suitable provisions for waveband switching being provided in the tuning circuits of course) where the cost and space requirements of the separate oscillator tube required are not important. Normally, greatest conversion gain is obtained when the peak oscillator voltage is high—about 18 volts.

6J8 Triode-Heptode Converter Tube

The fact that the 6L7 pentagrid mixer makes necessary the use of a separate oscillator tube is an important disadvantage in some all-wave receivers. This is not overly important in the more pretentious, high-priced all-wave superheterodynes where one tube more or less is of little importance insofar as cost and space are concerned, but it is important in the less-expensive, compact midget all-wave superheterodynes where cost must be kept down to an absolute minimum and space is at a premium because of the space taken up by the multiple tuning coil units and waveband switches made necessary by the provisions for all-wave tuning.

In order to eliminate these disadvantages without losing all of the inherent good high-frequency operation characteristics of the 6L7 mixer and separate oscillator tube setup, the familiar single-envelope *triode-heptode* converter tube was developed (6J8, 7J7, 7S7, 14J7, 14S7, etc. types). In this type of tube a pentagrid (heptode) mixer, having characteristics similar to the 6L7 pentagrid mixer just described, is built into the same envelope with an electrically-separate triode oscillator, the triode section sharing a small portion of the common cathode area.

The schematic representation of the various elements in the triode-heptode converter is illustrated in Fig. 7A. The electrode structure is shown at B and C.

Examination of Fig. 7 reveals that the arrangement of the electrodes in the *mixer* section of the triode-heptode converter tube is structurally similar to that in the 6L7 converter tube (Fig. 5), except for the addition of the triode oscillator section within the same envelope and either above, or below, the mixer section. The *triode* oscillator section employs a small portion of the area of the vertical cathode common with that of the mixer section—the upper portion being associated with the small triode oscillator section and the lower portion with the mixer section. The oscillator control grid is connected internally directly to the oscillator injection grid *G3* in the mixer section

SYLVANIA NEWS
RADIO SERVICE EDITION

OCT. *Prepared by* SYLVANIA ELECTRIC PRODUCTS INC., Emporium, Pa. 1946

NEWEST AND FINEST IN TUBE TESTERS NOW READY FOR RADIO SERVICEMEN

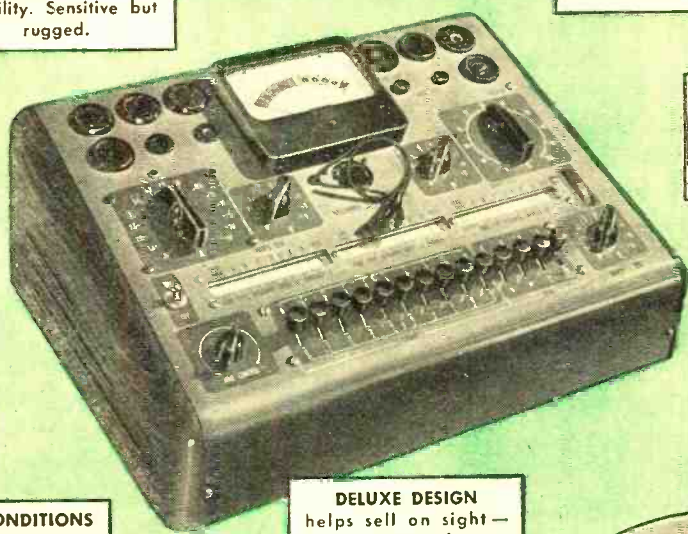
Made by the men who have tested tubes by the million!

LARGE METER
4½ inch size for high legibility. Sensitive but rugged.

PROVISION FOR NOISE TEST

8-FT. LINE CORD—extra long for extra convenience.

LEGIBLE DIAL MARKINGS—lines and numerals in white against green panel.



TESTS STANDARD, LOCK-IN, ACORN TUBES.
Extra sockets and switches allow easy adaptation when new tube types appear.

SHORTS TEST
at voltage low enough to prevent tube damage or faulty indications—high enough for full brilliancy on Shorts Indicator.

FINGERTIP CONTROLS
make settings easy.

DYNAMIC CONDITIONS
All tube elements tested under dynamic conditions.

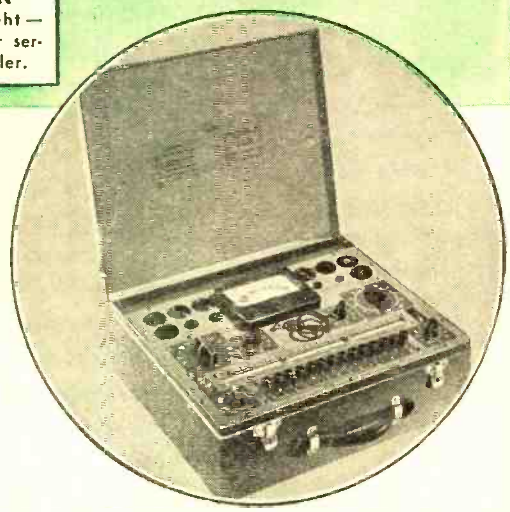
DELUXE DESIGN
helps sell on sight—builds prestige for serviceman or retailer.

Here's the "last word" in tube testers made for discriminating radio servicemen by Sylvania Electric.

Remain up to date easily, economically with this modern tube testing equipment. Now, this advanced type testing unit can be yours—smartly styled, scientifically designed, attractively priced. Besides all the special features, indicated above, the Sylvania tester has been provided with extra sockets and switch contacts to insure quick, inexpensive further modernization as new tube types are developed.

COUNTER TESTER
Type 139 (shown above) 5½" x 12" x 16¼". Net weight 15¾ lbs. Steel cabinet, wooden ends. Two-tone green panel. Power supply: 105-125 volts, 50-60 cycles, 20 watts.

PORTABLE TESTER
Type 140 (shown at right). 5¼" x 13" x 15". Net weight 19¼ lbs. Steel carrying case, sturdy leather handle. Other features same as Counter Type.



SEE YOUR SYLVANIA TUBE DISTRIBUTOR TODAY!

SYLVANIA ELECTRIC
Emporium, Pa.

MAKERS OF RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES; FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS (outer-grid oscillator injection being employed).

A typical circuit arrangement for this type of frequency converter is illustrated in Fig. 8. The tuned circuit for the oscillator may be placed in either the plate or grid circuits. A grid-tuned oscillator is shown here. The mixer operation of this converter circuit is similar to that of the 6L7 pentagrid mixer previously explained. Both the mixer signal grid *G1* and the oscillator injection grid *G3* control the electron stream. This provides true electron-coupled mixing of the oscillator and the signal voltages.

Comparison of Operating Performance of 6J8 Triode-Heptode Converter and 6A8 Pentagrid Converter

The 6J8 tube is considered to be one of the most stable of the electron-coupled converter tubes, and so finds wide use in compact all-wave receivers that provide broad signal-frequency coverage. Varying a.v.c. bias voltage, when applied to the hexode signal grid, does not appreciably alter the triode oscillator plate current, a.c. plate resistance, or oscillation frequency. Reference to Fig. 9A will show that for fairly large values of a.v.c. bias voltage the frequency drift of the 6J8 triode-heptode is less than one-twenty-fifth that of the 6A8 pentagrid converter tube. This data was taken at 18 megacycles, using a conventional tuned-grid shunt-fed oscillator. This difference in frequency drift with a.v.c. bias voltage is really greater than indicated here, due to the more effective attenuation of the signal resulting from the cut-off characteristics of 6J8 tube, as the conversion conductance of the tube drops to a low level without causing the frequency shift to become pronounced. Fig. 9B indicates that, under the same operating conditions as those of Fig. 9A, the 6J8 triode-heptode converter tube will have a frequency drift of less than two kilocycles for a line-voltage variation of as much as fifteen volts in either direction, while the 6A8 pentagrid converter tube may cause a drift of up to ten times this figure.

Although the rated conversion conductance of the 6J8 triode-heptode converter tube is lower than that of the simple 6A8 pentagrid converter tube, it should be remembered that while conversion gain is a function of conversion conductance it is also a function of load impedance of the converter section. The incorporation of a suppressor grid *G5* in the heptode mixer section of the 6J8 gives it a high plate impedance. This factor, and the low input loading of the tube, allows full advantage to be taken of high-quality r.f. signal-tuning transformer and i.f. transformer design for the realization of high gains. Therefore, if such consideration is given to the load impedance, the conversion gain of the triode-heptode converter will not be reduced in the ratio of the

(*Continued on page* 114)

SENSATIONAL RADIO BARGAINS FOR SERVICEMEN, AMATEURS, AND EXPERIMENTERS!

The finest in government surplus radio equipment—immediate delivery!

General Electric 150-Watt Transmitter; Brand New! Only $67.50

EXTRA SPECIAL NOTICE!!!

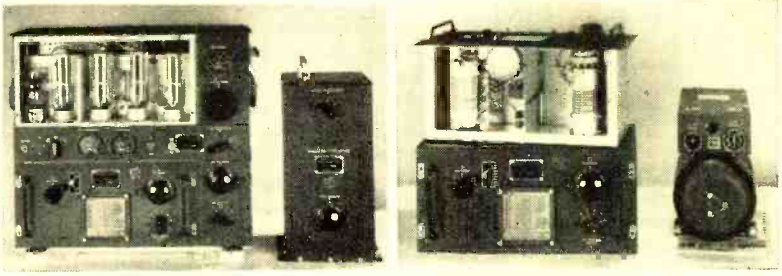
The cost to us of these units has been so drastically reduced by the Government, that we are now able to give you the same equipment at a much lower price than we formerly paid for it ourselves!!!

This is the famous Liason transmitter used in U.S. Army bombers and ground stations during the war. Its design and construction has been proved in service, under all kinds of conditions, all over the world.

The entire frequency range is covered by means of seven plug-in tuning units which are included. Each unit has its own oscillator and power amplifier coils and condensers, and antenna tuning circuits—all designed to operate at top efficiency within its particular frequency range. Transmitter and accessories are finished in black crackle, and the milliammeter, voltmeter, and RF ammeter are mounted on the front panel.

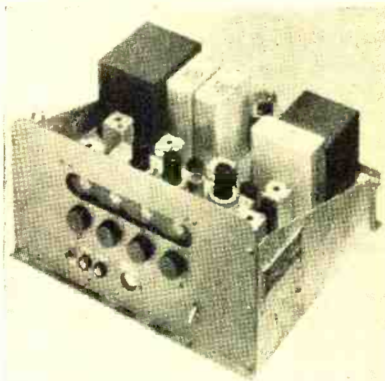
Here are the specifications: FREQUENCY RANGE: 200-500 Kc. and 1500-12,500 Kc. (Will operate on 10 and 20 meter band with slight modification.) OSCILLATOR: Self-excited, thermal compensated, and hand calibrated. POWER AMPLIFIER: Neutralized class "C" stage, using 211 tube, and equipped with antenna coupling circuit which matches practically any length antenna. MODULATOR: Class "B"—uses two 211 tubes. POWER SUPPLY: Supplied complete with dynamotor which furnishes 1000 volts at 350 milliamperes. Complete instructions are furnished to operate set from 110V AC. SIZE: 21½ x 23 x 9½ inches. Total shipping weight, 250 lbs., complete with all tubes, dynamotor power supply, seven tuning units, antenna tuning unit, and two profusely illustrated instruction books, all in the original factory packing case.

These transmitters are priced to move fast; quantities are limited! Order today, and be the proud owner of one of the finest rigs obtainable.

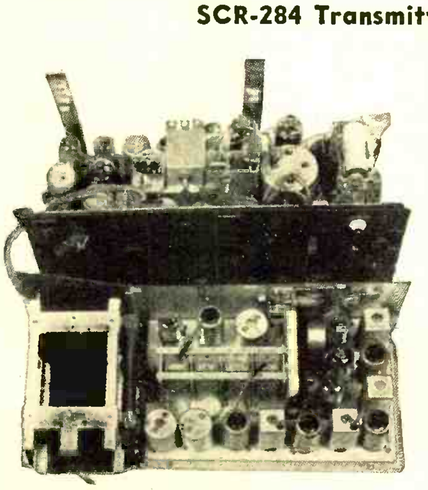


14-Tube UHF Superheterodyne Receiver—$39.95

This beautifully constructed receiver was designed especially for Signal Corps communication service, and is one of the finest and most sensitive sets ever manufactured. Operating from 110V 60 cycles, this set has two tuned RF stages, tuned converter and oscillator, five I.F. stages, using iron-core IF's, a diode detector, tuning eye, and a two stage amplifier that will drive a speaker or phones. The frequency range is 158-210 Mcs. It is a simple matter to operate on other bands by making a slight alteration in the tuning coils. A complete set of tubes is included with each receiver, along with a circuit diagram and parts list. The high-voltage power supply delivers 150 milliamperes, and is well filtered by a heavy-duty choke and three 7 Mfd. oil-filled condensers. This buy of a lifetime cost the government about $700. Amateurs and experimenters will never again be able to purchase fine equipment at such a tremendous saving!



SCR-284 Transmitter-Receiver



Made to be used in Army jeeps and trucks, as well as in the field, or as a headquarters set, the SCR-284 is particularly adaptable for all amateur, experimental, marine, aircraft, police, and mobile applications.

The receiver is a 7-tube superheterodyne, featuring an RF stage, four double-tuned 455 KC iron-core IF transformers, two audio stages, a beat frequency oscillator for CW reception, and is powerful enough to operate a large size speaker. The transmitter employs a calibrated crystal oscillator, a buffer amplifier, and a pair of RK-75 tubes in the final amplifier stage. The speech amplifier and modulator will operate with any ordinary mike, or for $2.75, we can include a Signal Corps mike, complete with "press to talk" switch. A built-in antenna tuning circuit, including an RF ammeter, will match the transmitter to any length of antenna. The transmitter plates are supplied by a 500 volt, 160 MA dynamotor which operates from either a 6 or 12 volt automobile battery. The transmitter output is 25 watts, and operates on both phone and CW. The frequency range is 3760-5825 KC. Operation on other bands may be facilitated by the use of plug-in coils. Circuit diagrams and operating instructions are furnished.

These sets are specially priced at $39.95, complete with set of 13 tubes and crystal. The dynamotor, which must be used, if it is not desired to use 110V AC, is $15 additional. Where a compact and dependable medium power unit is desired, this set is unbeatable!

TUBES—A WAREHOUSE FULL OF THEM!—Order all types needed, not just the critical types, and we'll do our best to fill your order completely!

POWER TRANSFORMERS—Ideal for radio construction or replacement. Primary—110V, 60 Cycle. Filament and high-voltage windings are center-tapped. Specify whether 6.3 or 2.5 V is wanted.
For 5-6 tube sets: 650V, 45MA; 5V fil. and either 6.3 or 2.5V fil. $1.75
For 6-7 tube sets: 675V, 50MA; 5V fil. and either 6.3 or 2.5V fil. 1.95
For 7-8 tube sets: 700V, 70MA; 5V fil. and either 6.3 or two 2.5V fils. 2.35
For 9-15 tube sets: 600V, 150MA; 5V fil. and a 6.3V fil. only 3.10
Transmitting type filament transformers—5000V insulation—2.5V, 20Amps. 1.49
5V, 10Amps—$1.98; 6.3V, 8Amps—$1.98; 2.5V, 20Amps and 6.3V, 3Amps. 2.25

AUTO-TRANSFORMERS—May be used on 90 to 250 volts for step-up or step-down applications. Up to 300 Watt capacity 1.95

FILTER CHOKES—200, 300, 400, or 500 ohms—Heavy duty—89c; Midget type—49c; 250MA, 35 ohms DC—Fully shielded in black crackle case, only—$1.95. **AUDIO TRANSFORMERS:** Single plate to single grid 3:1—69c; Single plate to P.P. grids—69c; Heavy-duty, class "AB" or "B" P.P. inputs—$1.29; Midget output, for AC-DC sets—59c. **UNIVERSAL OUTPUT TRANSFORMER**—tapped for various impedances—79c; **MIKE TRANSFORMER**—Single or double button—69c. High fidelity MIDGET MIKE to grid transformer, similar to UTC ouncer units $3.00

RELAYS—Sigma No. 4RJ—2000 ohm, SPDT—May be adjusted to operate on less than one milliampere! Ideal for photo-electric and electronic control circuits. Regular price $8.50, now only $2.50; **GUARDIAN SPST RELAY**—12 to 24 volts. Has 400 ohm, center-tapped coil for operation in balanced current circuits if desired—$1.25; **GUARDIAN** 3-make, 1-break, 12 to 24 volts—$1.00 each, or 5 for $3.75; **SPST**, normally open, works on AC or DC, only—65c; 4-pole (3-make, 1-break), 400 ohm, AC or DC, excellent for plate circuit of tube, photo-cell amplifiers, etc. $1.75

SELENIUM RECTIFIERS—Dry disc type, 1½" by 1", 1.2 Amp. maximum, suitable for converting DC relays to AC, for supplying filament source in portable radios, converting DC meters to AC applications, and also may be used in low current chargers 99c

TRIPLETT METER RECTIFIERS—Full wave, may be used for replacement, or in construction of all types of test equipment $1.25

E-Z WIRE STRIPPERS—Cleans insulation from solid or stranded wire swiftly, neatly, and without damaging wire. A real time saver. Standard model—$3.95; Automatic model—Stays open after grip is relaxed until wire is removed $4.95

SILVERTONE CABINETS—Walnut finish—excellent replacement cabinets—Model 1923, 11x18x20; Model 4465, 15x10x8; and Model 4619, 9x10x16½. Each $1.50

FIRESTONE PORTABLE CABINETS—Two tone, leatherette covered, carrying cases, sloping dial—Ideal for rejuvenating banged-up portables $3.95

PHONO CABINETS—With speaker grille—$7.75; Without—$8.50. Both types leatherette covered with well designed grips and hardware.

PORTABLE AIR COMPRESSOR—Attaches to ¼ H.P. motor. Just the thing for refinishing radios, painting cars, blowing out chassis, etc. 100 lb. gauge and syphon type gun with 12 feet of rubber hose included. Pressure adjustable to stay constant at any pressure up to 100 lbs. .... Net Price, $21.60

RECORD CHANGERS—These are beauties—two post, with featherweight plastic and chrome pick-up, plays 10" and 12" records **intermixed!** Complete with blue leatherette, mahogany or walnut stained cabinet, your choice. Ready for attachment to any radio at the give-away price of only $24.95

CRYSTAL PHONO PICK-UP—Latest design. Features needle pressure compensation to reduce record wear. Excellent replacement for any record player $2.75

AUTO ANTENNAS—Cowl Type 3-section type with triple plated chrome, complete with shielded leads—66"—$1.50; 96" (4-section)—$2.75; "Rocker" antenna, adjustable to any angle for rocket and torpedo bodies, 72"—$2.75; Fender and Cowl types—adjusts from 20" to 50"—$3.00; Underhood type—mounts on either side of regular and alligator hood—no holes to drill on body of car, 72"—$2.50; Disappearing 50" fender type $3.75

RADIO HANDBOOK—Published by Editors and Engineers—Tenth Edition $1.95
All Rider's Manuals and publications at current prices.

VALPEY CRYSTALS—Amateurs—All 40 and 80 meter frequency crystals in stock. Mounted in hermetically sealed, low loss plug-in holders. Specify frequency when ordering—each $2.80; Polystyrene crystal adapters from small socket to large crystal spacing, and vice-versa .... 35c each

CONDENSERS—Guaranteed one year! Priced in lots of ten or more, either one type or assorted. 50mfd. 150v—53c; 25mfd. 35v—23c; 20-30mfd. 150v—46c; 20-20mfd. 150v—35c; 20mfd. 150v—23c; 10mfd. 450v—32c; 10mfd. 35v—23c; 8-8mfd. 475v—65c; 8mfd. 450v—45c; 8mfd. 200v—20c. **PAPER CONDENSERS**—600 W.V., 25mfd.—23c; 1mfd.—11c; .05mfd.—11c; .02mfd.—9c; .01mfd.—9c; .006mfd.—8c; .5mfd.—36c; 1.0mfd.—45c; Screwneck aluminum can type—16mfd.—600P.V.—85c; 16mfd.—550 P.V.—65c; Mica condensers—any size—15c or 100 Micamold assorted for 59c

MICROPHONES—Bullet crystal mike—Only $5.45; Bullet dynamic mike—$7.45; Both are nationally advertised brands and sold elsewhere at much higher prices. **SURE T-17** single button mike, made for Signal Corps., has press-to-talk switch in handle, and is complete with cord and plug—Only $2.75! Midget Mike—Made for Signal Corps. Single button type, with stretched duraluminum diaphragm. Gold plated finish. This unit makes an excellent lapel mike, or concealed pick-up. Specially priced at 95c

TOGGLE SWITCHES—

All types	SPST	SPDT	DPST	DPDT	DPDT center off
1" Shanks	$0.30	$0.39	$0.54	$0.60	$1.60
½" Shanks	.27	.36	.51	.57	.80

General Electric microswitches — SPDT — 50c; Spring Action Cube Taps 10c

RADIO CHEMICAL KIT—In leather case. Contains one bottle each of cabinet stain, dial-drive "no-slip," contact cleaner, lubricating oil, service cement, and polish .... $1.34 per kit

Minimum order accepted $3.00

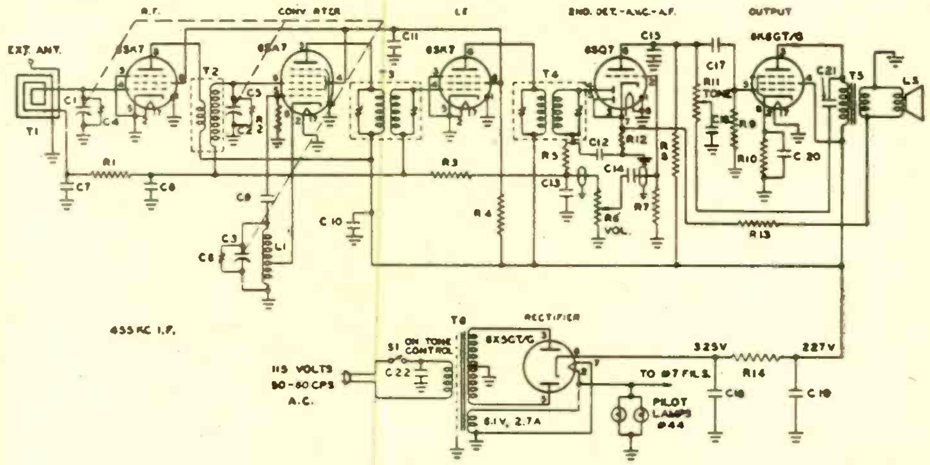
Please enclose at least 10% deposit with COD orders. Send for our free parts catalog!

BUFFALO RADIO SUPPLY, 219-221 Genesee St., Dept. 10N, BUFFALO 3, N.Y.

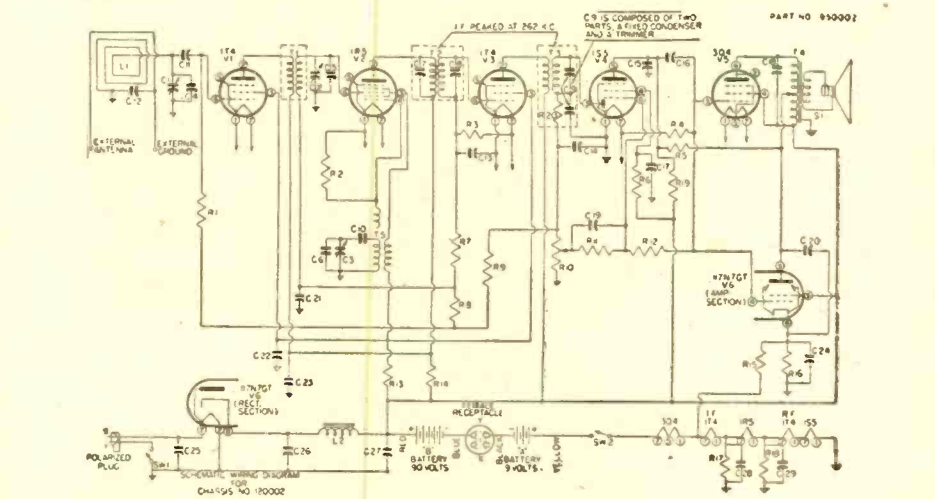
the RN CIRCUIT PAGE

(FOR PARTS LISTS SEE PAGE 72)

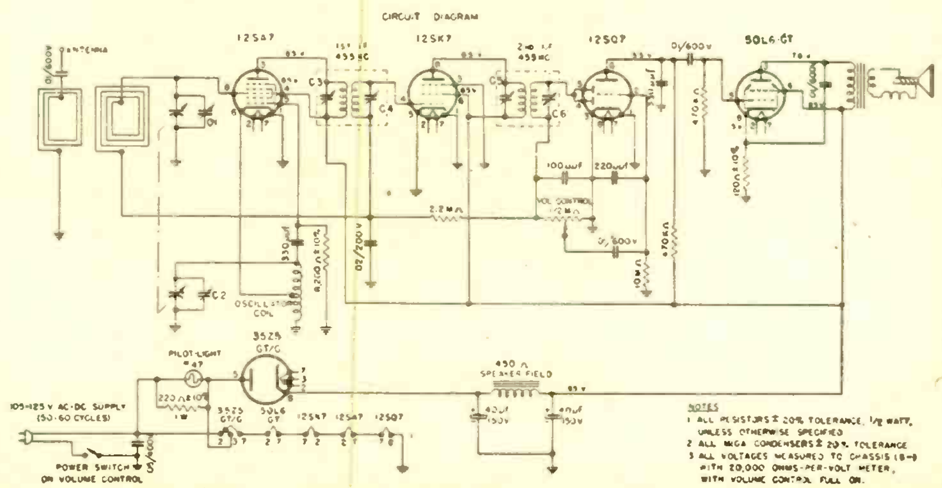
RADIO NEWS, OCTOBER, 1946 — HOFFMAN MODEL A300



RADIO NEWS, OCTOBER, 1946 — EMERSON MODEL 505

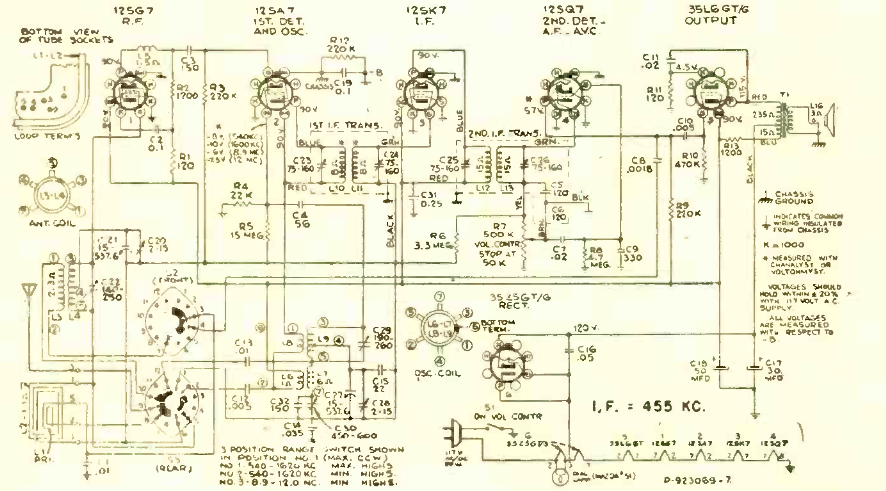


RADIO NEWS, OCTOBER, 1946 — OLYMPIC MODELS 6-501, 6-502, 6-503

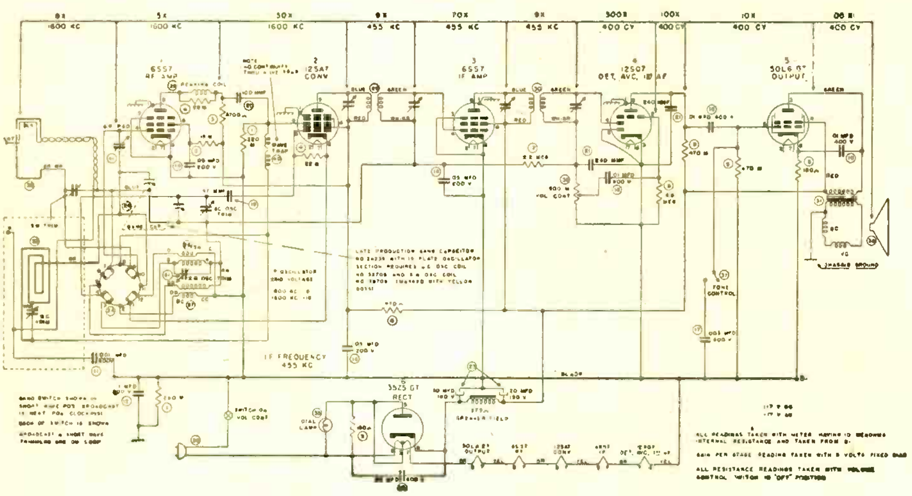


Here, and on following pages, are circuit diagrams and parts lists of many new postwar radio receivers. Radio News will bring to you other circuits as quickly as possible after we receive them from manufacturers.

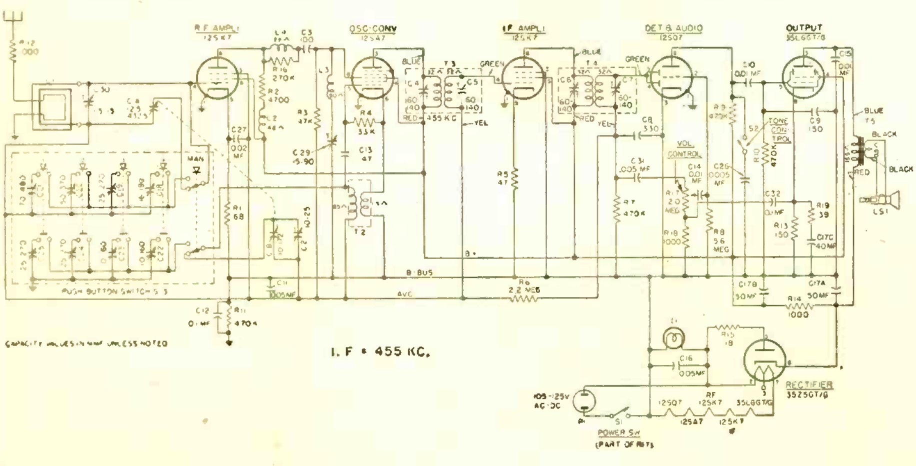
RADIO NEWS, OCTOBER, 1946 **RADIOLA MODELS 61-5, 61-10**



RADIO NEWS, OCTOBER, 1946 **FARNSWORTH MODELS ET-060, ET-061, ET-063**



RADIO NEWS, OCTOBER, 1946 **GENERAL ELECTRIC MODEL 321**

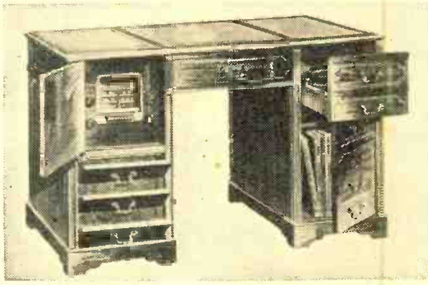


What's New in Radio

DESK-RADIO COMBINATION

One of the features of the *Lear* radio exhibit at the recent Chicago show was a desk and radio-phonograph combination.

One side of the desk is fully equipped



with drawers while the other side of the desk contains a radio and record changer with ample record storage. Opening one drawer-louvre below the built-in radio automatically opens all three louvres for radio or record playing.

The desk is in 18th Century styling of hand-rubbed Honduras mahogany veneer. The top of the desk is covered with genuine top-grain leather. This desk-radio combination is a decorator piece which will be suitable for living rooms, dens, etc.

This receiver is currently in production at *Lear, Inc.,* Grand Rapids, Michigan.

VIBRATOR INVERTER

A new vibrator inverter, designed to permit operation of a.c. phonographs with direct current is now in production at *Electronic Laboratories, Inc.,* of Indianapolis.

Compactly designed, this unit which measures 4½" x 4" x 2¼" and weighs 14 ounces, can be installed under the turntable or in the corner of the phonograph cabinet. With an input of 115 volts d.c., the inverter's output is 110 volts, 60-cycle a.c., providing a maximum load capacity of 25 watts.

Although intended for use with a phonograph, this vibrator inverter may also be used with timing devices, a.c. electric razors and similar equipment using small synchronous motors with low wattage requirements.

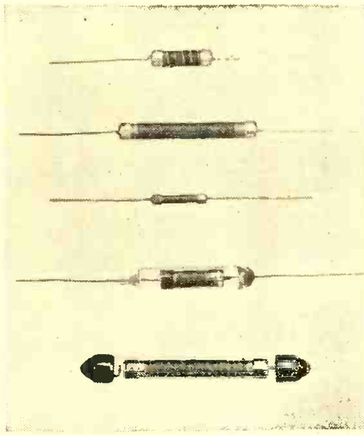
Electronic Laboratores, Inc., Indianapolis, Indiana, will furnish additional information upon request.

FILM TYPE RESISTORS

Of interest to manufacturers of instruments, radar and television equipment is a new line of film type resistors which are currently being offered by *Wilkor Products, Inc.,* of Cleveland.

For the present the new resistors will be available in two sizes; a one-watt unit with a resistance range of 10 ohms to 35 megohms at 1% accuracy and dimensions of ¼" x ⅞"; a two-watt unit with a resistance range of 10 ohms to 100 megohms at 1% accuracy and dimensions of ¼" x 2". Both of these resistors have axial leads.

These resistors are being manufactured by *Wilkor Products, Inc.,* at their plant, 3835 West 150th Street, Cleveland 11, Ohio, under license arrangement with *Western Electric*



Company. Additional information on these and other units to be in production soon will be furnished by the company.

CRYSTAL UNIT

Bliley Electric Company has just announced the release of a new crystal unit, the type VX2.

This unit which is designed for specific applications where space is at a premium features a compact, gasket sealed assembly and solder lugs, replacing the usual pin contacts.

The crystal unit is supplied at 3105 kc. for use in private aircraft transmitters and is available at any specified frequency between 3000 kc. and 11,000 kc.

Additional information will be furnished by *Bliley Electric Company,* Erie, Pennsylvania, upon request.

SIGNAL TRACING ANALYZER

A new service test instrument, the TS-2 Signal Tracing Analyzer, is currently being offered by *Feiler Engineering Company* of Chicago.

This instrument is capable of trac-

ing trouble at first grid, r.f., i.f. and audio stages, locates parts failures, mistracking, causes of intermittent operation, distorted tone, noise, low

sensitivity, etc. The analyzer has a built-in high impedance isolation network which permits connection directly across high impedance circuits with minimum effect.

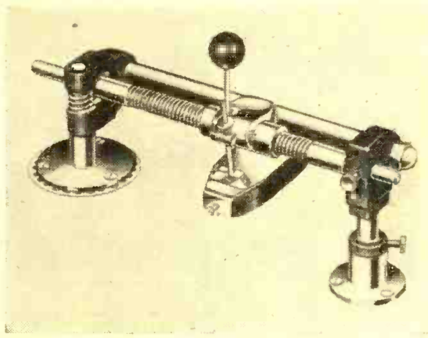
The TS-2 Analyzer is completely portable and features low-drain tubes and an economical battery supply. The unit weighs 10½ pounds.

Full particulars of this analyzer will be sent upon request to *Feiler Engineering Company,* 803 Milwaukee Avenue, Chicago, Illinois.

RECORDING MECHANISM

The first item to be manufactured in a new recording mechanism line recently introduced by *Techno-Craft Products,* is the low cost instantaneous recording mechanism of the overhead type.

This recorder is entirely new in design and incorporates such features as lightweight construction and simplified operational features. Also included are cutting needle angle adjustment, single lever for engaging feed screw and lowering the cutting



head, and positive drive and gear which cannot become clogged by chips.

This particular unit is adaptable to any height recording turntable. A thumbscrew allows for accurate adjustment of cutting depth. Cutting pitch is 110 lines per inch, outside in.

Two models of this recording mechanism are currently available, permitting recordings up to 16" diameter. Four types of *Astatic* cutting heads are furnished at present, X-26, X-29A, M-41-8 and M-41-500.

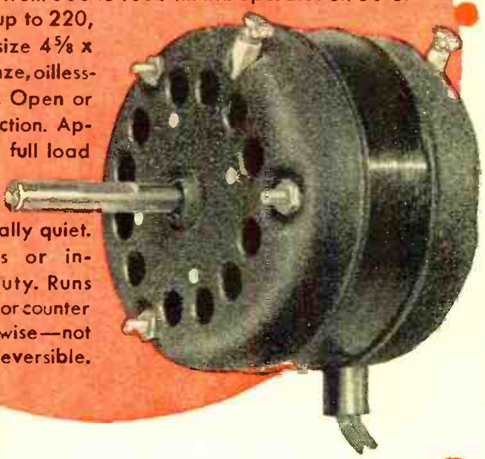
Complete information on this unit of the line will be supplied upon re-

(*Continued on page* 142)

DRIVE YOUR PRODUCTS to market with alliance MOTORS

ALLIANCE PHONOMOTORS —POWR-PAKT MOTORS in shaded pole induction and split-phase reversible resistor types rated from less than 1/400th h. p. on up to 1/20th h. p. for powering valves, switches, controls, driving turntables, fans, record changers and automatic devices.

THE NEW MODEL A shaded pole, induction-type Alliance Fan Motor for speeds from 500 to 1050 R.P.M. operates on 50 or 60 cycles at voltages up to 220, 1/30th horse power, size 4⅝ x 2¾ inches. Porous bronze, oilless-type sleeve bearings. Open or fully enclosed construction. Approx. 8 to 40 oz. in. full load running torque, depending on stock length. Exceptionally quiet. For continuous or intermittent duty. Runs clockwise or counter clockwise—not reversible.



SLOWER SPEEDS • LOWER CURRENT COSTS
QUIETER OPERATION • SMALLER SIZE

Here are four *big* advantages built into the new *Alliance Powr-Pakt* fan motors. Results are longer life — less repair — smoother performance. This new Alliance shaded pole fan motor reflects advanced engineering! Mass-produced at low cost. Write!

WHEN YOU DESIGN—KEEP alliance MOTORS IN MIND

ALLIANCE MANUFACTURING COMPANY • ALLIANCE, OHIO

Parts Lists

(FOR CIRCUIT DIAGRAMS APPEARING ON PAGES 66 AND 67)

HOFFMAN—MODEL A 300

Part No.	Code and Description
4500	R_1, R_8—.22 megohm, ½ w. res.
4501	R_2—22,000 ohm, ½ w. res.
4502	R_3—2.2 megohm, ½ w. res.
4503	R_4—10,000 ohm, 2 w. res.
4504	R_5—47,000 ohm, ½ w. res.
4800	R_6—.5 megohm pot.
4505	R_7—10 megohm, ½ w. res.
4506	R_9—.47 megohm, ½ w. res.
4507	R_{10}—560 ohm, ½ w. res.
4801	R_{11}—.25 megohm pot. with sw.
4508	R_{12}—47 ohm, ½ w. res.
4509	R_{13}—330 ohm, ½ w. res.
4702	R_{14}—1500 ohm, 10 w. wire-wound res.
4400	C_1, C_2, C_3—Three-section var. (388-388-180 µµfd.)
	C_4, C_5, C_6—Trimmer cond. (part of var. cond.)
4100	C_7, C_8—.05 µfd., 200 v. tub. cond.
4000	C_9, C_{12}, C_{13}, C_{15}—100 µµfd. mica cond.
4101	C_{10}, C_{11}—.05 µfd., 400 v. tub. cond.
4102	C_{14}, C_{16}—.005 µfd., 600 v. tub. cond.
4103	C_{17}—.01 µfd., 600 v. tub. cond.
4200	C_{18}, C_{19}, C_{20}—20/20/20 µfd., 450/450/25 v. elec. cond.
4104	C_{21}—.001 µfd., 600 v. tub. cond.
4105	C_{22}—.01 µfd., 600 v. tub. cond.
5200	L_1—Osc. coil
9003	LS—5" PM loudspeaker
	S_1—On-off sw. on tone control
5201	T_1—Antenna loop
5202	T_2—R.f. coil
5203	T_3—Input i.f. trans. (455 kc.)
5204	T_4—Output i.f. trans. (455 kc.)
5100	T_5—Audio output trans.
5000	T_6—Power trans.

OLYMPIC—MODELS 6-501, 6-502, 6-503

Part No.	Code and Description
REB106M	10 megohm, ½ w. res.
REB121K	120 ohm, ½ w. res.
REB225M	2.2 megohm, ½ w. res.
REB474M	470,000 ohm, ½ w. res.
REB822K	8200 ohm, ½ w. res.
REC221K	220 ohm, 1 w. res.
CO-107	40/40, 150 w.v. elec. cond.
CV-501	2-gang var. tuning cond.
RCM20A101M	100 µµfd. mica cond.
RCM20A221M	220 µµfd. mica cond.
RCM20A331M	330 µµfd. mica cond.
RCP10W2203A	.02 µfd., 200 v. tub. cond.
RCP10W4503A	.05 µfd., 400 v. tub. cond.
RCP10W6103A	.01 µfd., 600 v. tub. cond.
C1-159	Osc. coil
PT-102	Vol. control and power sw.
TR-186	First or second i.f. trans.
SK-110	5" dynamic speaker with output trans.

EMERSON—MODEL 505

Part No.	Code and Description
311330	R_1, R_3, R_5, R_6, R_7, R_8—3.3 megohm, ¼ w. res.
310970	R_2—100,000 ohms, ¼ w. res.
321130	R_4, R_{19}—470,000 ohm, ¼ w. res.
321290	R_9—2.2 meg., ¼ w. res.
390020	R_{10}—500,000 ohm vol. control
311390	R_{11}—5.6 megohm, ¼ w. res.
321450	R_{12}—10 meg., ¼ w. res.
340770	R_{13}—15,000 ohm, ½ w. res.
340630	R_{14}—3900 ohm, ½ w. res.
310130	R_{15}—33 ohm, ¼ w. res.
310610	R_{16}—3300 ohm, ¼ w. res.
310570	R_{17}—2200 ohm, ¼ w. res.
310450	R_{18}—680 ohm, ¼ w. res.
	R_{20}—47,000 ohm, ¼ w. res. (Part of T_2)
900080	C_1, C_2, C_3—3-gang var. cond.
	C_4—Trimmer (Part of C_1)
	C_5—Trimmer (Part of C_2)
	C_6—Trimmer (Part of C_3)
	C_7, C_8—Trimmers (Part of T_2)
	C_9—Trimmer and fixed cond. (Part of T_3)
900110	C_{10}—Padding cond.
920060	C_{11}, C_{13}—.05 µfd., 200 v. cond.
920010	C_{12}, C_{18}—.002 µfd., 600 v. cond.
910010	C_{14}—110 µµfd., mica cond.
910050	C_{15}—400 µµfd., mica cond.
92100	C_{16}, C_{19}, C_{21}, C_{22}, C_{29}—.02 µfd., 200 v. cond.
920090	C_{17}, C_{20}—.01 µfd., 400 v. cond.
920020	C_{23}—.02 µfd., 400 v. cond.
925090	C_{24}—100 µfd., 25 v. elec. cond.
920030	C_{25}—.05 µfd., 400 v. cond.
925050	C_{26}, C_{27}—20/40 µfd., 135 v. dual elec. cond.
920110	C_{28}—.25 µfd., 100 v. cond.
700090	L_1—Loop antenna
737010	L_2—Filter choke
713000	T_1—R.f. coil
720170	T_2—First i.f. trans.
720190	T_3—Second i.f. trans.
734040	T_4—Output trans.
716030	T_5—Osc. coil

GENERAL ELECTRIC—MODEL 321

Part No.	Code and Description
URD-021	R_1—68 ohm, ½ w. res.
URD-065	R_2—4700 ohm, ½ w. res.
URD-089	R_3—47,000 ohm, ½ w. res.
URD-085	R_4—33,000 ohm, ½ w. res.
URD-017	R_5—47 ohm, ½ w. res.
URD-129	R_6—2.2 megohm, ½ w. res.
URD-113	R_7, R_9, R_{10}, R_{11}—470,000 ohm, ½ w. res.
URD-139	R_8—5.6 megohm, ½ w. res.
URD-049	R_{12}, R_{18}—1000 ohm, ½ w. res.
URD-029	R_{13}—150 ohm, ½ w. res.
URF-049	R_{14}—1000 ohm, 2 w. res.
URE-007	R_{15}—18 ohm, 1 w. res.
RLP-002	R_{16}, L_4—Series peaking coil and resistor assembly
RRC-003	R_{17}—2 megohm potentiometer, vol. control
URD-015	R_{19}—39 ohm, ½ w. res.
RCT-003	C_{1a}, C_{1b}, C_2—Tuning capacitor assembly
RCU-112	C_7—100 µµfd., 500 v. mica cond.
RCU-115	C_8—330 µµfd., 500 v. mica cond.
RCU-113	C_9—150 µµfd., 500 v. mica cond.
UCC-025	C_{10}, C_{14}—.01 µfd., 400 v. cond.
UCC-045	C_{11}, C_{16}—.05 µfd., 600 v. cond.
UCC-030	C_{12}—.1 µfd., 400 v. cond.
RCU-110	C_{13}—47 µµfd., 500 v. mica cond.
UCC-040	C_{15}—.01 µfd., 600 v. cond.
RCE-001	C_{17a}, C_{17b}, C_{17c}—50/50/40 µfd. 150 v./150 v./25 v. elec. cond.
RCX-001	C_{18}, C_{19}, C_{20}, C_{21}—R.f. trimmer strip
RCX-002	C_{22}, C_{23}, C_{24}, C_{25}—Osc. trimmer strip
UCC-039	C_{28}, C_{31}—.005 µfd., 600 v. cond.
UCC-009	C_{27}—.02 µfd., 200 v. cond.
RCY-001	C_{29}—Wave trap trimmer
RCY-002	C_{30}—1.5-15 µµfd. antenna trimmer
UCC-013	C_{32}—.1 µfd., 200 v. cond.
RLL-004	L_1—Antenna assembly
RLP-001	L_2—Plate choke
RLW-001	L_3—Wavetrap coil
RLC-002	T_2—Osc. coil
RTL-003	T_3—First i.f. trans.
RTL-004	T_4—Second i.f. trans.
RTO-002	T_5—Output trans.

RADIOLA—MODELS 61-5 AND 61-10

Part No.	Code and Description
30189	R_1, R_{11}—120 ohm, ¼ w. res.
30731	R_2—1200 ohm, ¼ w. res.
14583	R_3, R_9, R_{12}—220,000 ohm, ¼ w. res.
30492	R_4—22,000 ohm, ¼ w. res.
38785	R_5—15 megohm, ¼ w. res.
12928	R_6—3.3 megohm, ¼ w. res.
36242	R_7, S_1—Vol. control and power sw.
30931	R_8—4.7 megohm, ¼ w. res.
30648	R_{10}—470,000 ohm, ¼ w. res.
6134	R_{13}—1200 ohm, 1 w. res.
70652	C_1, C_{13}—.01 µfd., 1000 v. tub. cond.
70617	C_2, C_{10}—.1 µfd., 400 v. tub. cond.
39632	C_3, C_{32}—150 µµfd. mica cond.
39622	C_4—56 µµfd. mica cond.
70412	C_5, C_6, C_{25}, C_{26}, L_{12}, L_{13}—Second i.f. trans.
70711	C_7, C_{11}—.02 µfd., 700 v. tub. cond.
70712	C_8—.0018 µfd., 600 v. tub. cond.
39640	C_9—330 µµfd., mica cond.

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70627	C_{10}, C_{12}—.005 μfd., 800 v. tub. cond.
70635	C_{14}—.035 μfd., 600 v. tub. cond.
39612	C_{15}—22 μμfd. mica cond.
70615	C_{16}—.05 μfd., 400 v. tub. cond.
39152	C_{17}, C_{18}—30/50 μfd., 150/50 v. elec. cond.
70700	C_{20}, C_{21}, C_{27}, C_{28}—Var. tuning cond.
70417	C_{22}—140-250 μμfd. mica trimmer mounted on antenna coil
70411	C_{23}, C_{24}, L_{10}, L_{11}—First i.f. trans.
39839	C_{29}, C_{30}—190-260/450-600 μμfd. adj. mica cond.
70618	C_{31}—.25 μfd., 400 v. tub. cond.
39841	L_1, L_2—Antenna loop
70416	L_3, L_4—Antenna coil
70418	L_5—Peaking coil
39892	L_6, L_7, L_8, L_9—Osc. coil
39837	S_2, S_3—Range sw.
36800	T_1—Output trans.

FARNSWORTH—MODELS ET-060, ET-061, ET-063

Part No.	Code and Description
77216	1—220,000 ohm res.
77265	2—15,000 ohm res.
77211	3—4700 ohm res.
77266	4—22,000 ohm res.
77259	5—150 ohm res.
77261	6—470 ohm res.
77270	7—2.2 meg. res.
77273	8—6.8 meg. res.
77217	9—470,000 ohm res.
25197	11—.001 μfd., 600 v. cond.
25215	12—.1 μfd., 600 v. cond.
25196	14—.05 μfd., 600 v. cond.
25195	15—.02 μfd., 600 v. cond.
25194	16—.01 μfd.. 600 v. cond.
25184	17—.003 μfd., 600 v. cond.
25193	19—47 μμfd. mica cond.
25188	20—100 μμfd. mica cond.
25187	21—240 μμfd. mica cond.
25022	23—20/30 μfd. elec. cond.
26154	24—Gang cond.
26239	24—Gand cond.
38549	26—S.W. osc. coil for 26154
38709	26—S.W. osc. coil for 26239
38483	27—B.C. osc. coil for 26154
38707	27—B.C. osc. coil for 26239
38550	28—Peaking coil
38536	29—First i.f. trans.
38537	30—Second i.f. trans.
94091	31—Output trans.
38535	32—S.W. loop assembly
81091	38—Speaker

—30—

Converting the SCR-522
(*Continued from page 35*)

ceiver. Care should be taken in this operation not to damage the loop of tinned wire which projects from this unit.

The leads from the stator section of the front condenser 217B to the by-pass condensers 202-14 and 202-13 may be broken by reaching in with a pair of long nose pliers from the side away from the loop. These condensers are the ones soldered directly to the stator. The ground end of the condensers need not be disconnected and the condensers may be left in place.

The insulated terminal at the front end of the terminal strip should now be disconnected. Condenser 205, a 220 μμfd. unit, which runs from this terminal to pin number 6, the grid of the 9002, should be removed. Also remove condenser 204, the 15 μμfd. unit and resistor 262-1, a 560,000 ohm resistor that connects between the grid of the 9002 and ground. The cathode of the 9002 pin No. 7 should be grounded directly to the condenser frame and to the center of the socket. Resistor 261 and condenser 202-15, which run from the No. 7 pin of the 9002 to ground, may either be removed completely or left in place.

A 100 μμfd. postage stamp mica condenser should be run from the grid of the 9002 to the "B+" side of the stator

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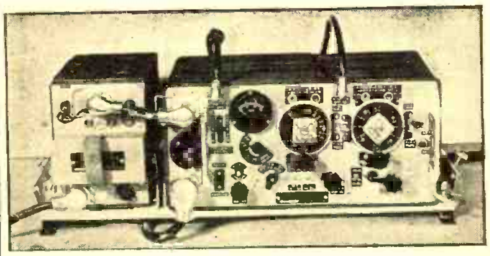

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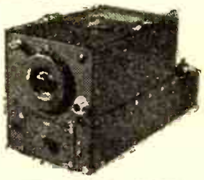

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3BP1	15.00	3.95
3FP7	27.00	5.95
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1—3200 volt. 150 MA power transformer.
1—Variac 5 amps. General Radio type CU 200.
1—5 volt. 26 Amp. fil. transformer (for 304 TL).
1—2.5 volt. 10 Amp. fil. transformer (5000 volt. insulation).
1—1 mfd. 1,000 volt. GE Pyranol.
1—2 mfd. 1,000 volt. GE Pyranol.

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Modulation XFMR: 807 to pair of 807's....	$ 1.65
Modulation XFMR; For 211's cl. A. 50 Watts	1.10
Modulation XFMR: 811's to 813..........	5.00
Driver: 6V6 to pair 811's..........	3.00
CHI Trans. P.P. Mod. & Driver, 6L6's—per pair..........	3.30
PWR: 115 v. 60c/330-0-330, 85 ma/6.3 v., 7.5a/5v-2a/6.3v-.3a..........	3.95
PWR: 115 v. 60c/750v-110 ma/c.t./6.3v-5a/5v-3a..........	5.95
H.V. Plate: 115v60c/2750v.-750 ma oil, Navy Specs..........	35.00
Swinging Choke: 2.5 hy @ 375 ma.; 10 hy @ 75 ma..........	3.95

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Mica. Sangamo F3L .0005-8000 VDC (list $29)..........	5.25

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KIT 3: 50 mica condensers, asstd......	2.65
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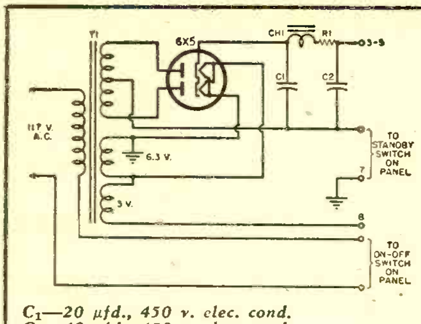


C_1—20 μfd., 450 v. elec. cond.
C_2—40 μfd., 450 v. elec. cond.
R_1—1000 ohm, 10 w. res.
T_1—350-0-350 v., 70 ma. trans.; 5.0 v., 3.0 amp.; 6.3 v., 2.5 amp.
CH_1—70 ma. filter choke

Fig. 2. Suggested power supply for the SCR-522 converted receiver.

of the oscillator condenser 217B. A 30,000 ohm, ½ watt resistor should be connected from the grid of the 9002 to ground. This completes the conversion of the oscillator section of the receiver and the unit may now be re-installed and the terminal strip reconnected.

While a description of the conversion sounds complicated, the simplicity of the work may be seen by examining the "before" and "after" diagrams shown in Fig. 1.

As both sets of tuning condensers in this receiver are of a ball bearing type and rotate freely, some sort of friction arrangement is necessary to prevent shifting of frequency with vibration. As may be seen from the photos, a Masonite front panel, measuring 8¾" by 19", has been added to the receiver for convenience in operating.

As the holes in the couplings on the condenser shafts are slightly under ⅜" in diameter, either a piece of rod will have to be turned to fit or the threaded portion of a panel bushing may be sawed off and used to couple the oscillator condenser to the dial. Most dials are made for a ⅜" diameter shaft. If a dial with a ¼" hole is used, the same method described in the next paragraph may be used.

For the r.f. and mixer condensers, a piece of ¼" brass rod is soldered into a standard panel bushing. The threaded portion of the bushing is then placed in the coupling from the r.f. mixer condensers. The front panel is mounted to the receiver chassis by means of 1¼" 10-32 screws and spacers made from ¼" o.d. copper tubing, ¾" in length. For sake of symmetry, the gain and squelch controls are removed from their present holes and replaced by units having standard shafts in the holes located just below the center line of the chassis.

Terminals No. 5 and No. 3 on the power plug should be connected together and a lead run from these terminals, as well as terminals No. 4 and No. 8, to a six-prong male plug mounted on the rear of the chassis.

As the antenna input terminals are now located on the front of the receiver in an inaccessible place, a short length of 50 ohm coaxial line is run from these terminals to a standard coaxial connector mounted on the rear of the chassis.

An on-off switch and a standby switch are also mounted on the front panel. The on-off switch controls the a.c. power to the receiver, while the standby switch is a single-pole, double-throw type which grounds the center tap of the power supply. The terminal from the unused side of this switch is brought to a terminal strip in the rear of the receiver, to permit controlling the associated transmitter from the same switch. Audio output is brought to this same terminal strip from pin No. 4 and ground of the power plug.

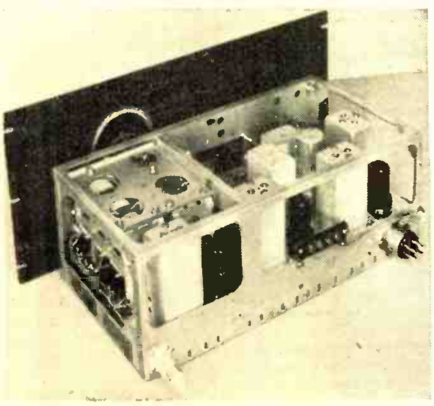
The power requirements of the receiver are 300 volts at 60 ma. and 12.6 volts at 1.5 amps. As power transformers with a 12.6 v. heater winding are not common, the normal 5 volt rectifier winding is connected in series with the 6.3 volt winding of a standard replacement type unit as shown in Fig. 2. Care must be taken in this operation to see that the voltages of these two windings "add." A small a.c. voltmeter will serve to determine the correct polarity. Due to the light load on these windings, the voltage under load is approximately 12.5 volts. A suitable power supply is shown in Fig. 2.

The vernier dial used to drive the oscillator tuning condenser is of approximately 14 to 1 ratio. For ease in tuning it would be preferable to replace this by one having a reduction ratio of 40 or 50 to 1. If desired, the vernier dial may also be used on the r.f.-mixer condenser. If the shaft on this condenser tends to turn too freely, a felt washer should be placed between the knob and the front panel to give a nominal degree of friction.

When conversion of the receiver has been completed, the connections to the output transformer should be examined to see that the output terminal is connected to terminal No. 7 on the transformer. This terminal gives an output impedance of 4000 ohms and a speaker output transformer to match this value should be selected. The receiver is now ready for test.

When the receiver has reached operating temperature, the frequency range may be checked by means of a signal generator or a calibrated oscil-

Top view of the converted receiver showing the terminal strip and power plug.



lator. The r.f.-mixer condenser will have to be resonated each time the oscillator condenser is varied, although for small frequency coverages it may be left fixed and simply used to "trim" after the signal has been located.

The tuning condensers, being of a special type, afford only 90 degree rotation. It will be found that the tracking of the circuits is better when the condensers are so set that the capacity decreases as they are rotated in a clockwise direction, as they were originally aligned for this direction of rotation.

Input impedance of the antenna circuit in this receiver is designed to match standard 50 ohm coaxial cable, and for best results this type of feeder should be used, with an antenna cut to resonance at the most used frequency.

—30—

Radio Heating

(*Continued from page* 45)

can be obtained, with resulting uniformity in quality.

Conclusions

The use of h.f. heating by the textile industry will undoubtedly increase rapidly as its advantages and applications become better known. The large number of units now in use at various plants will greatly facilitate future installations by providing a better working knowledge of the technique.

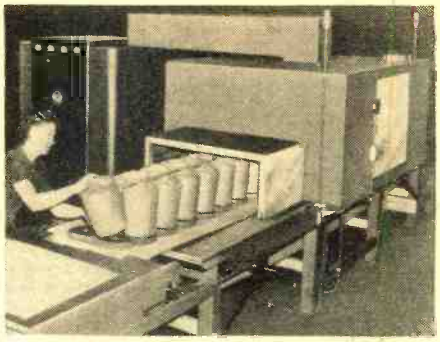


Fig. 4. One of the earliest commercial applications of high frequency power to treat rayon yarns was setting twist in tire cords. Unit shown will handle from 18,000 to 25,000 pounds of tire cord in 24 hours.

Primarily, h.f. power offers its greatest advantages when used to heat material in packages. Its ability to heat or dry uniformly, regardless of the size of the package, permits the use of packages above the size limits sometimes imposed by other heating methods.

Costs of operation follow power costs; however, they are not always in direct proportion. Savings effected by reduced handling, more uniform quality, and reduction in maintenance and overhead, sometimes far offset power costs.

In general, the high-frequency power requirements can be figured simply by calculating the hourly b.t.u. requirements and dividing by 3414 (which is the b.t.u.'s produced by one kilowatt working for one hour). This figure, multiplied by the cost per kilowatt hour for electrical energy, and then multiplied again by two (the average factor for converting 60-cycle line power into high-frequency power delivered into a load) will give total power costs.

As an example, suppose the problem is to calculate the power requirements to dry 1,000 pounds of cotton yarn, dry weight, per hour. Assuming an ambient temperature of 75 degrees, a water content of 50 per-cent, and a specific heat for the cotton of 0.5:

BTU required to raise the cotton from 75° *F. to* 212° *F.* =
$1000 \times (212 - 75) \times 0.5 = 68{,}500$

BTU required to raise 500 *pounds water from* 75° *F. to* 212° *F.* =
$500 \times 137 \times 1 = 68{,}500$

BTU required to convert 500 *pounds water to steam*
$500 \times 971 = 485{,}500$

Total heat = 622,500 *b.t.u. per hour.*
High frequency in kw. =
$$\frac{622{,}500}{3414} = 184.9 \text{ kw.}$$

For a job like this, a unit rated at 200 kilowatts output would be quite satisfactory. If we assume that the power drawn from the mains is approximately twice that of the genera-

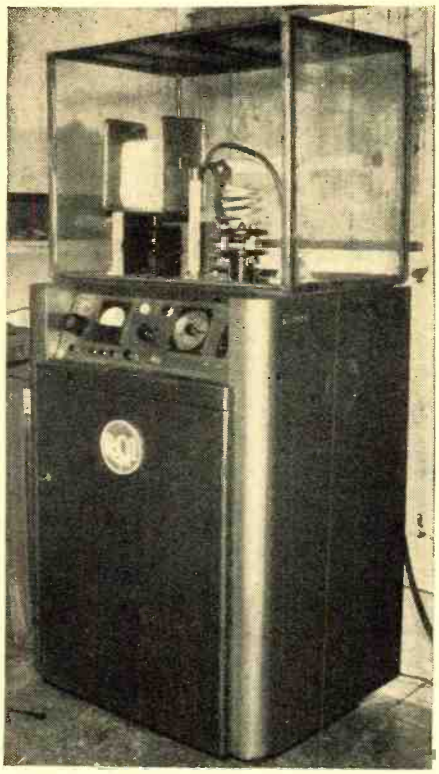


Fig. 5. Experimental equipment that is used to dry nylon yarn on sizing tubes. This process is also used to set the twist of yarns. The time required to dry a sizing tube, containing 800 grams of single-ply, 40-denier yarn with 24 grams water content, is approximately three minutes.

tor output, a total of 400 kilowatts will be required. At an assumed cost of one cent per kilowatt hour, this amounts to $4.00 per hour.

The costs of the electron tubes are comparatively small when spread over the tube life. For instance, a power tube costing $345 may be expected to last 5000 hours or more. Its cost will, therefore, be approximately seven cents per hour. Since such a tube has an output of 26,000 b.t.u. per hour, 24 of them would be required for the job described above. At seven cents per hour per tube, the total cost would be $1.68 per hour.

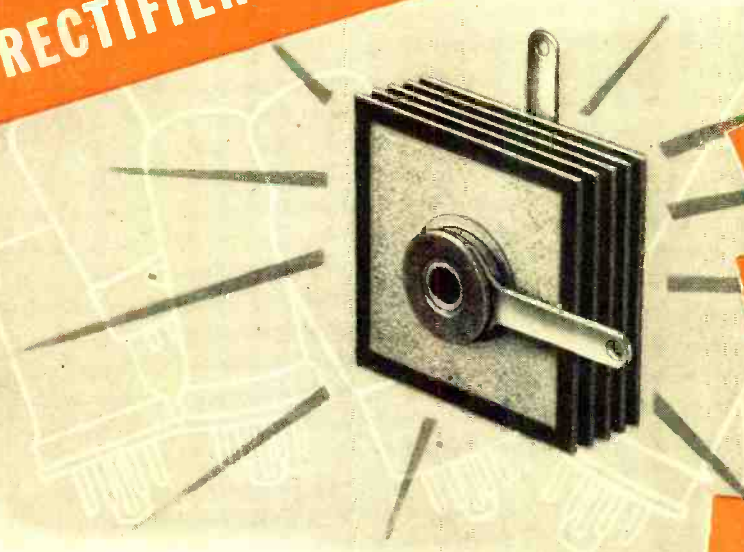
Larger tubes cost much less per kilowatt hour. One large tube commonly used in industrial h.f. heating equipment, for example, costs $725 (not quite double the initial cost of the smaller tube) and will deliver approximately 215,000 b.t.u.s per hour, which is approximately eight times the output of the smaller tube. Using this type of tube, of which only three would be required for the job illustrated above, the tube costs at about 15 cents per tube per hour would be only 45 cents.

Application problems at present require a considerable amount of individual engineering, but as the use increases and more allied problems are solved, this difficulty will be reduced. In fact, some applications have been worked out to a point where generators approaching a package line of equipment are available. Such a situation already exists in the plastics industry.

29 DIFFERENT RECTIFIER TUBES *Now Replaceable*—

WITH THE FEDERAL SELENIUM RECTIFIER

(No. 403D2625)



IT'S SMALLER . . .

COSTS LESS . . .

LASTS LONGER . . .

RUNS COOLER . . .

READILY INSTALLED!

–FIRST OF ITS KIND IN THE INDUSTRY!

NO less than *twenty-nine* different types of rectifier tubes are now replaceable with Federal's new, miniature, 5-plate rectifier. Available now, this replacement is also an *improvement!* For not only does it subtract from your own manufacturing costs, it adds to product quality as well . . . and to consumer satisfaction. Here's how:

- **Saves space — only 1¼ x 1¼ x ¹¹/₁₆ inches — fits where tube won't**
- **Costs less than tube and socket it eliminates**
- **Long life — built to last the life of the set**
- **No warm-up period — starts instantly, runs cooler**
- **Installed in less time than tube — only two soldering jobs**
- **Sturdy, all-metal construction — not easily damaged**
- **Withstands overloads — even when charging deformed electrolytic condensers**

Every one of Federal's line of "Center Contact" Selenium rectifiers is designed to give the full measure of performance that have made them the standard of the industry. A Federal engineer will show you how to put this latest model into your circuits. Write for details to Department F459

Replacement for these Tubes:

5T4	5Y3	6Y5	25Z6	50Y6
5U4	5Y4	6Z5	35W4	50Z7
5V4	5Z4	12Z5	35Z3	117Z3
5Z3	6X5	7Y4	35Z4	117Z6
5W4	0Z4	12Z3	35Z5	0Y4
5X4	80	25Z5	35Z6	

Electrical Characteristics:

Maximum RMS Voltage	130 Volts
Maximum Inverse Voltage	380 Volts
Maximum Peak Current	1200 ma.
Maximum RMS Current	325 ma.
Maximum DC Output	100 ma.
Approximate Rectifier Drop	5 Volts

Two Federal Miniature Rectifiers in a voltage doubler circuit give *250 volts and 80 milliampere output* from 117 volt AC power source.

Federal Telephone and Radio Corporation

In Canada:—Federal Electric Manufacturing Company, Ltd., Montreal

Export Distributor:—International Standard Electric Corporation, 67 Broad St., N. Y. C.

An IT&T Associate — FTR Federal Telephone & Radio

Newark 1, New Jersey

The larger installations will always require more or less engineering, the same as large steam and electrical installations. These problems, however, are as possible of solution in h.f. heating as they were in steam and electrification. Their solution will pave the way for the use of h.f. power for all heating and drying jobs where its advantages make it desirable.

—30—

International Short-Wave
(*Continued from page* 49)

lost its thought-provoking value.

"In the past, Australia was actually days away as a spot news locale for the world press. All that is changed by short-wave transmission.

"Potentially, the world is *'Radio Australia's'* audience. In peace as in war the radio is easily the best and quickest medium to catch the world ear. There are no barriers—not even language. Australian linguists, assisted by a few overseas experts gathered together during the war, have overcome this problem . . .

"Wide wireless vistas for our short-wave radio may be already seen. *'Radio Australia'* is the perfect medium to make this country better known to millions of would-be immigrants seeking new lands of opportunity. Radio, with its intimacy, helps to reduce the fear of distance which hitherto prevented people from seeking a home with us. Properly handled, mobile units could reveal the Australian way of life to millions, who, despite our war story, have a lingering feeling that we are still in the skin and boomerang era.

"When it comes to advertisement of the goods we can and will produce, *'Radio Australia'* will be a big trade-booster. What the commercial stations do for the local market can be done by *'Radio Australia'* for the world market.

"Culturally, too, short-wave can do much to put us on the map. From now on, the accent will be on entertainment, although news will still highlight the programs. Here is a chance for Australian musicianship to prove its creative quality. Our entertainment programs should be peculiarly Australian in content, suited, of course, to a huge diversity of listeners. Australian thinkers, too, through the medium of *'Radio Australia,'* should have an opportunity to influence world thought and opinion.

"Children the world over find distance fascinating. They will thrill at the chance to listen to programs from a far-off land. They would comprise our most eager audiences if we only provide some of the kind of fare that the child mind enjoys. To Europe, to America, Australia is the frontier land. We have the stuff that makes great radio copy for kids—if only we use it.

"Technically, there is nothing to stop *'Radio Australia'* telling its story anywhere. Our short-wave comes through as strongly in a London drawing room as 2FC does in a Bondi flat.

"Every nation has taken to the short-waves. It's a comforting thought that we have also—so far, with very good results."

"Radio Australia" is operated by the Short-wave Division of the Commonwealth Department of Information. The official address is Box 780H, G.P.O., Melbourne, Victoria, although mail addressed simply, *"Radio Australia,"* Melbourne, will reach its proper destination.

All *external* short-wave transmissions from Australia are conducted by *"Radio Australia."* The Australian Broadcasting Commission controls a number of *internal* short-wave transmissions. These are directed to listeners not serviced by the Commission's medium-wave national programs. The short-wave transmitters in Perth and Brisbane are heard well in most parts of the world, particularly in America.

The VLA series of transmitters uses 100 kw.; VLC, 50 kw., and VLG, 10 kw. From these stations programs are beamed *daily* to North Pacific, Asia, *North America*, Tahiti, New Caledonia, South Pacific, and the British Isles. While Commonwealth short-wave services are expanding constantly, *"Radio Australia"* already truly blankets the entire world.

Attractive QSL cards are now being

sent out by *all* Australian stations. *"Radio Australia"* welcomes reports and comments. "It is only by the comments of our listeners on programs and reception conditions that we are able to maintain the technical quality of our transmissions and keep in touch with the feeling of our audience," T. P. Hoey, director of *"Radio Australia,"* informs me. "We place great value on letters from our listeners . . . and we look forward with the expectation of transmitting longer and more entertaining programs."

Australia is one of the most radio-conscious nations in the world. At the last count, 1,419,793 persons had broadcast listeners' licenses, or 19.7 licenses for each hundred of population. The license fee is 1 pound, Australian, or about $3.21), less than a penny a day.

Careful control since inauguration of broadcasting has provided a unique service for Australia. A Commonwealth-wide network of national (or A class) stations gives a service from the Australian Broadcasting Commission on behalf of the Government. This contains no advertising, and in capital cities gives alternative programs for different groups of listeners. There are also in the Commonwealth more than 100 commercial (or B class) stations, which pay a license fee of 125 pounds per annum, and derive their revenue from the advertisements which are broadcast during programs. There is a strict official check on wave bands and interference.

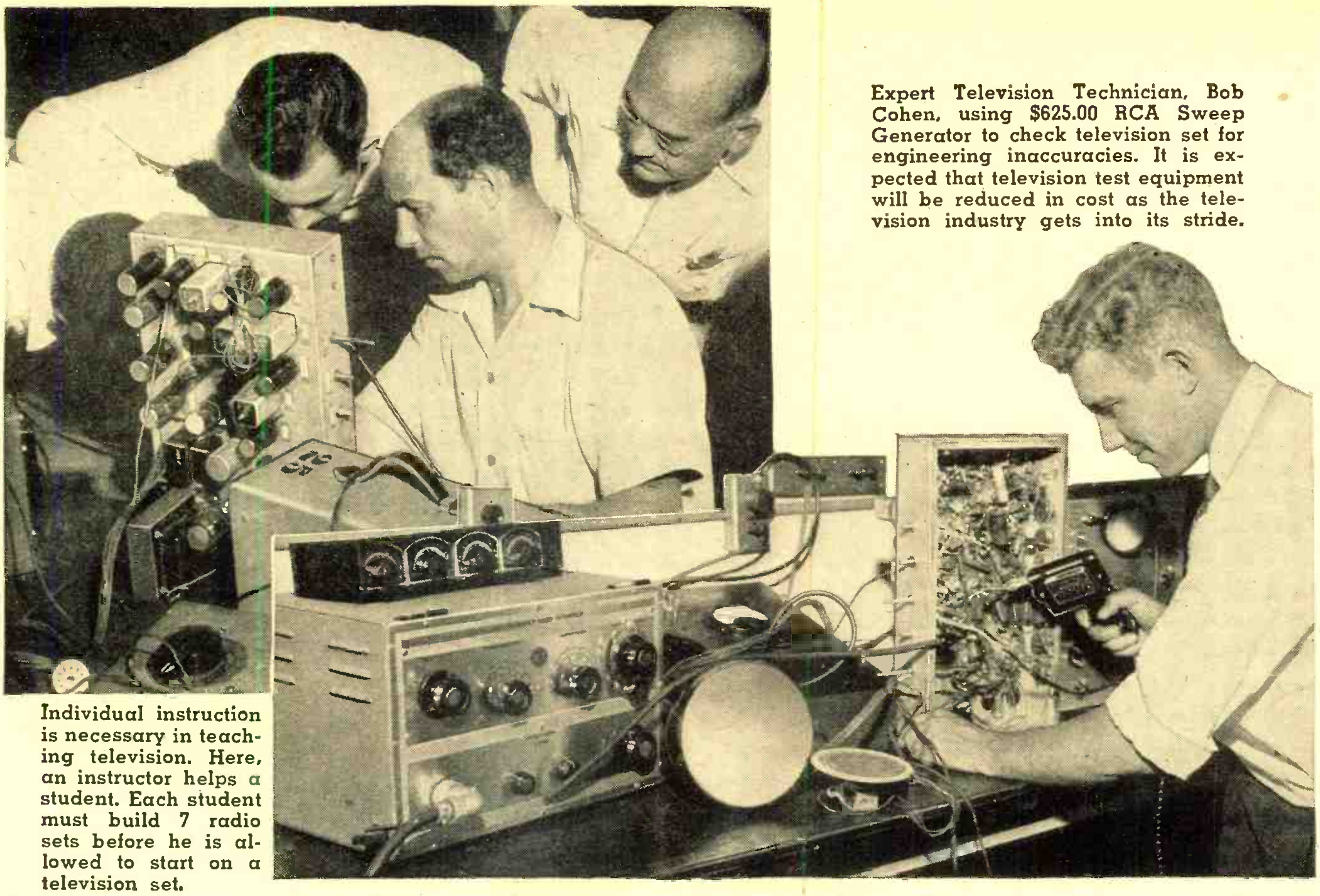
General standards of programs in Australia are high, and improvements are being made continuously through the many phases of both domestic and international short-wave radio.

(Incidentally, during the winter months here in America, some of the Australian b.c. stations are audible and are much sought-for by U. S. and Canadian b.c. DXers. The stations verify.)

Radio listeners in Australia are served by many first-class radio publications such as *"The A.B.C. Weekly," "Listener In," "Radio Call," "Radio and Hobbies in Australia,"* and similar journals. Australians are avid DXers both on the broadcast band and on short-wave. There are several active radio clubs throughout the Commonwealth (including the *"Australian Radio DX Club,"* the *"Wireless Institute of Australia," "All-World All-Wave DX Club," "Short-Wave League of Western Australia," "Dandenong Range Radio Club"*), and many Australian DXers also belong to radio clubs in various other countries.

Many old-time short-wave DXers will remember the great thrill of many years ago when they first picked up Australia over the pioneer short-wave transmitters, VK2ME, VK3ME, or VK6ME, and the still bigger joy of receiving that attractive verification card from "down under." Direct beam wireless service with London was established April 8, 1927, and with North America on June 16, 1928.

Radio has played a great part in the *"Flying Doctor* stations" in Aus-



Expert Television Technician, Bob Cohen, using $625.00 RCA Sweep Generator to check television set for engineering inaccuracies. It is expected that television test equipment will be reduced in cost as the television industry gets into its stride.

Individual instruction is necessary in teaching television. Here, an instructor helps a student. Each student must build 7 radio sets before he is allowed to start on a television set.

THEY BUILT THEIR OWN

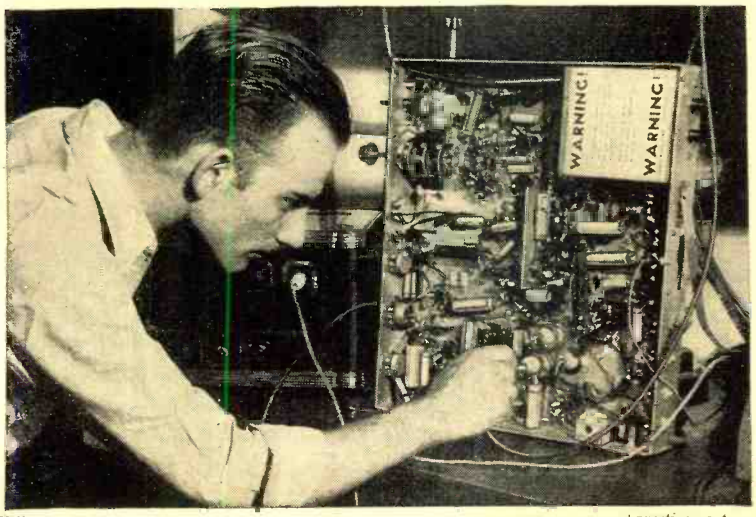
MANY veteran students are now attending N.Y.T.I. of N.J. under the generous provisions of the G.I. Bill of Rights, which allows any approved school of the veteran's choice to charge the Veterans Administration up to $500 a school year against the educational expenses of qualified veteran students. Full-time students, with dependents, are also paid a subsistence allowance of $90 monthly by the VA, and those without dependents, $65. Many students hold part-time jobs, thus augmenting their monthly subsistence payments. However, you do not have to be a veteran to be accepted as a student.

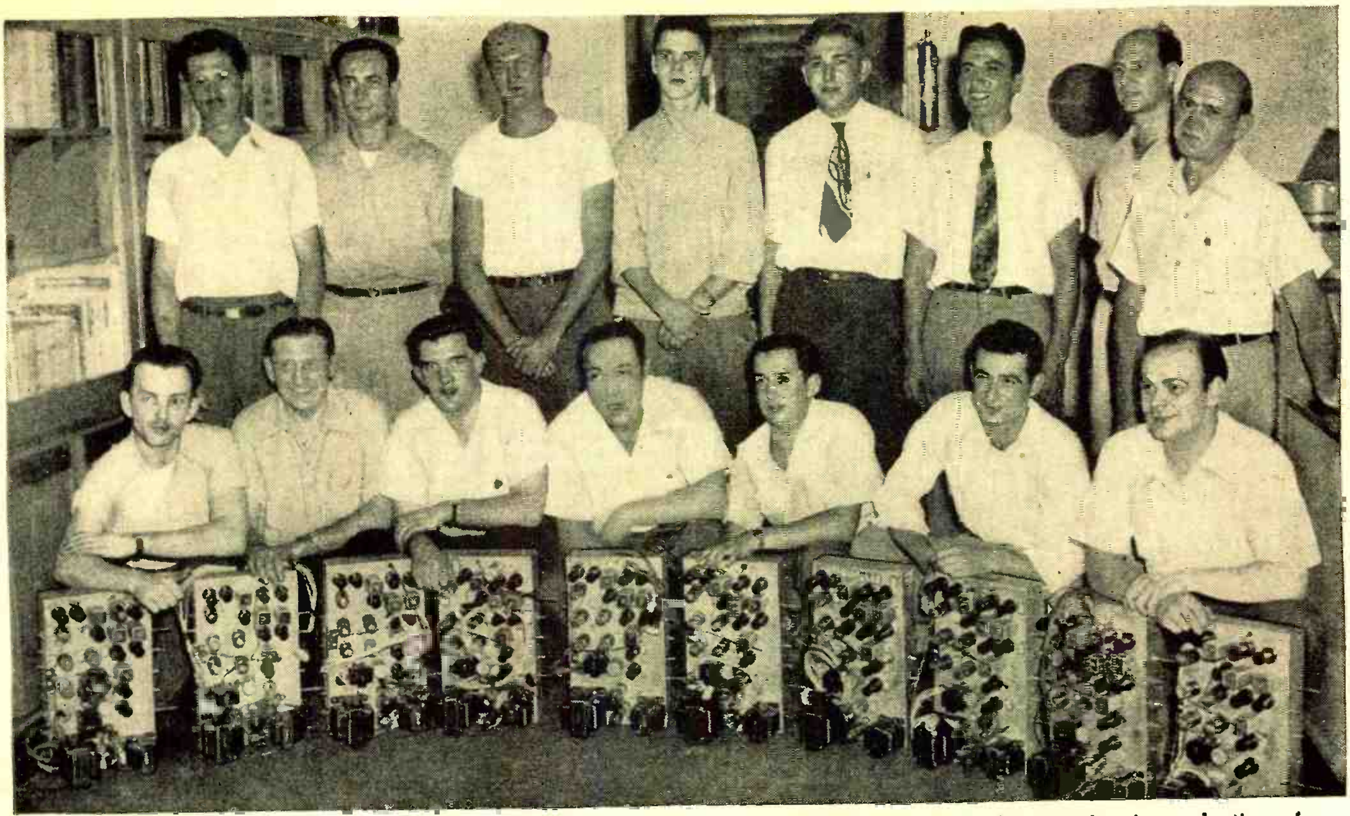
A considerable number of out-of-state students attend the school because of its excellent, practical type of radio and television courses, so difficult to get anywhere else in the world today. Living quarters are obtainable by single students, but married students report considerable difficulty in finding quarters for their families.

Students at N.Y.T.I. of N.J. particularly like the way the school puts into practice what it teaches. You actually build a television receiver. You also build as many as 7 radio receivers of different types. Class study and laboratory study, in the proper combination, increase interest—and your hands get as smart as your head. With only average ability you can learn radio servicing in 8 months. In only 4 more months, you can know television receiver servicing. You can take even more advanced engineering-type courses if you wish. And throughout all your laboratory work you are using the finest and latest laboratory equipment available.

No high-school diplomas are required. Every

Student Walter E. Stevens, making engineering checks with $395.00 United States Television Sweep Generator. The school is lavishly equipped with the most advanced types of test equipment.





An Advanced Class in Television at N.Y.T.I. of N.J., famous television school, and the 17-tube television sets they built. Students at this school have been building television sets as part of their courses since 1939, when television programs were first broadcast regularly. School officials found that this practical method of instruction is productive of very satisfactory results. Each student may build a set and keep it to use in his own home laboratory, if he chooses to. The school is located in the heart of the radio, television, electronics industry.

TELEVISION RECEIVERS!

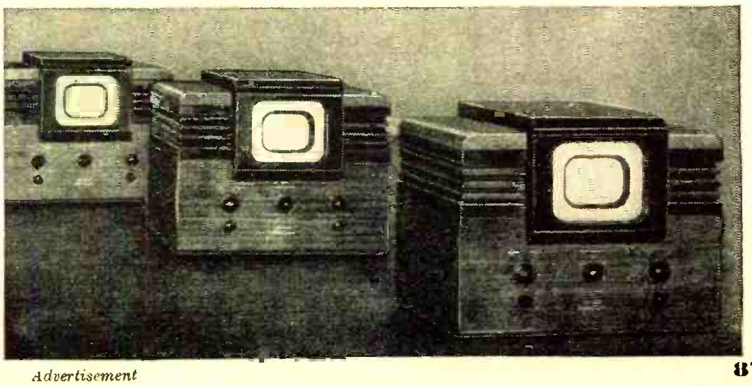
student must have at least a grammar-school education, however. And the school requires that a student be earnest, sincere and technically inclined. Students without proper mathematical backgrounds are taught the radio and television mathematics they need.

You probably have been wondering what N.Y.T.I. of N.J. means. It stands for the New York Technical Institute of New Jersey, a resident school located in Newark, N. J., just across the river from New York City (Only 20 minutes from Broadway by subway or train). The school is located in the heart of America's great radio and electronics industry. Such leading television, radio and electronics manufacturers as Western Electric, Du Mont, Federal and Edison are nearby. Newark also is near Radio Stations WJZ, WEAF, WABC and WOR; each a leader in broadcasts going on networks all over the country. This means that the school offers numerous advantages, as it is in touch with the most recent developments in radio and television. This also means that qualified radio and television engineers are available to the school for teaching purposes.

During the war N.Y.T.I. of N.J. was approved for the training of enlisted Signal Corps personnel by the U. S. Army. When the war ended the enrollment increased even more, because of the influx of veterans desirous of getting practical television training. At the present time, there are 120 openings for new students for the classes beginning in October and November 1946.

The school issues a special Bulletin, Numbered 110, which illustrates and describes its facilities and equipment and shows students using its varied laboratory equipment. Bulletin 110 also describes classes that may be attended, housing conditions, costs, hours, etc. To get complete information write for Bulletin 110 (for which no charge is made) to the New York Technical Institute of New Jersey, 158 Market St., Newark, N. J.

A line of RCA television receivers used for comparative test purposes at N.Y.T.I. of N.J.



BEST BETS FROM RADIO AUSTRALIA

To North America (English)

Trans. I—(East)—7-8:15 a.m., VLC5, 9.54; news, 7, 8 a.m.
Trans. II—(West)—11-11:45 a.m., VLC6, 9.615, and VLG, 9.58; uses VLC5, 9.54, irreg., instead of VLC6; news, 11 a.m.
Trans. III—(East)—7:30-8:45 p.m., VLC9, 17.84; news, 8 p.m.
Trans. IV—(West)—12-12:45 a.m., VLC4, 15.32, VLG4, 11.84, and VLA4, 11.77 (100 kw.); news, 12:15 a.m.

To British Isles (English)

Trans. I—2-3:15 a.m., VLC10, 21.68, and VLA4, 11.77; news, 2:30 a.m.
Trans. II—10-10:58 a.m., VLG9, 11.90, VLA3, 9.68, and VLC6, 9.615.

To Switzerland (Swiss and English)

Thursday *only*—1-1:40 a.m., VLA4, 11.77.

tralia, first service of its kind in the world. The service is equipped with a fleet of light planes which fly out to the stations in isolated parts of the country, known as the *"outback."* Most of these stations have a transmitter-receiver, operated, in some cases, by a pedal generator. Some use phone while others use c.w. sent from a special *"typewriter-sender."* These stations are located at the *"Flying Doctor"* bases at Wyndham (8SI, 1600 kcs., 5.300, 8.830); Port Hedland (8SC, 1600 kcs., 4.030, 6.960); Kalgoorlie (8UB, 1600 kcs., 5.360, 8.750); Alice Springs (8US, 1600 kcs., 5.410, 8.690); Cloncurry (VJI, 2020 kcs., 5.110, 8.630); and Broken Hill (8SK, 2020 kcs., 4.130, 6.690). *They verify.*

This Land "Down Under"

Our story of radio in Australia would be incomplete without citing some pertinent facts about *"the only nation that holds an entire continent."* The Commonwealth of Australia is an independent and democratic nation. It is one of the United Nations, and before the war sent its own representative to the League of Nations. It sends its own Ministers to foreign capitals. Its Executive can declare war. Australia is extending its voice in the making and keeping of the peace—it will play its part in guarding the security and prosperity of the Pacific as its share of the world's peace planning. Its particular interest will be an extended Australian zone, including the islands close to its shores, which have a community of interest in defense, in trade, and in transport. Australia in the post-war era is welcoming migrants. Employment in Australian factories increased greatly during the war and still further expansion of manufacturing industries is going on. For Australia, a young, virile and growing nation, the problems of governing and developing a continent, and of sharing the responsibility for the oceans which surround it, offer a challenge and a promise in the prosperous and peaceful world of the future!

The Commonwealth of Australia was proclaimed on January 1, 1901, and the first Federal Parliament was opened that year in Melbourne by the late King George V, who was then Duke of York. Parliament was moved to the new capital, Canberra, in 1927, first session there being opened in May of that year by the then Duke of York, now King George VI. Parliament now meets at regular intervals, members of both Houses coming to Canberra from all parts of Australia. H.R.H. the Duke of Gloucester is Governor-General of Australia, with Mr. Joseph B. (Ben) Chifley as the present Prime Minister.

Roughly, Australia comprises three million square miles, this land "down under" being the smallest continent and the largest island in the world. Including Tasmania, Australia has a coastline of 12,210 miles, about twice that of the seaboard of the United States. In June, 1944, the population was estimated at 7,306,637. More than 4,600,000 of the populace live in cities and big towns, about 3,500,000 of this number in the six state capitals.

As in all newly-settled countries, the natives suffered at first from their contact with the white race. It has been estimated that at the time of the first settlement in 1788 there were about 300,000 natives in Australia. Many were badly treated in the early years, but it is believed that there are still 52,000 full-blooded aborigines in the country, mostly in reservations which white men are not permitted to enter, and where the native tribesmen, living in their natural state, are increasing in numbers. In other parts of the Commonwealth they are also strictly protected. They cannot be given liquor and are encouraged to live an active communal life. Many of the young men enlisted in the armed forces.

States and territories, capitals (with population) are, according to 1944 figures:

New South Wales, 2,870,956 (Sydney, 1,337,000); Victoria, 1,997,804 (Melbourne, 1,107,000); Queensland, 1,065,414 (Brisbane, 344,200); South Australia, 621,998 (Adelaide, 350,000); Western Australia, 485,407 (Perth, 230,000); Tasmania, 245,434 (Hobart, 67,900); Northern Territory (including Darwin), 5179; Australian Capital Territory (Canberra), 14,445.

Scientists have estimated that 20,000,000 people could live with comfort in Australia, discounting the mountainous and inaccessible land.

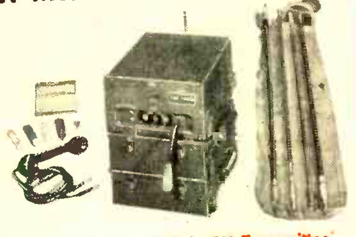
In a country the size of Australia it is possible to experience every kind of climate. The west coast of Tasmania has been compared to the west coast of Ireland, with its rain and moist mists. Much of the southern part of Australia has been compared to the Mediterranean basin with its warm summer and long hours of sunshine. But in the Australian Alps, snow

SCARCE RADIO PARTS
TRANSMITTERS, ELECTRICAL EQUIPMENT AT MONEY-SAVING PRICES!

**DEALERS
JOBBERS
QUANTITY BUYERS**

Dealers, Jobbers, Industrials, Schools, and other quantity buyers—write for special trade discounts on items illustrated as well as condensers, resistors, tubes, transformers, sockets, jacks, wire and hundreds of other items.

A MID-AMERICA SCOOP!

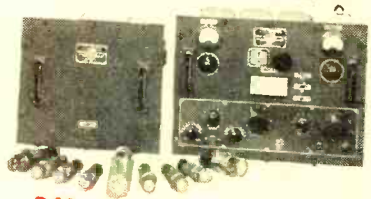


Portable and Mobile FM Transmitter and Receiver, SCR-510

FM transmitter and receiver for short range communication. Lightweight. Operate from 6 or 12 volt DC source. Freq. range 20 to 27.9 mc, crystal controlled for operation on any two of 80 channels. Either of two pre-set frequencies can be chosen by the channel switch. Change from receive to transmit by switch-on telephone hand set. Tubes: one 1LH4, one 1LC6, four 1LN5, two 1291, one 1294, four 1299. Complete with 80 crystals, tubes, telephone hand set, instructions, accessories, ready to operate, less batteries.

SPECIAL, **$79.50 ea.**
$59.50 in lots of 50

SPECIAL!



RAK-7 Long Wave Receiver

A real commercial receiver for experimenters, marine, aviation, hams, etc. 110 volt AC operated, regulated power supply. Frequency range, 15-600 kc. Two tuned RF stages. Panel has band switching, DB meter, AVC level control, Antenna, and RF controls, audio tuning control, sensitivity controls, including an AC-DC Filament Voltmeter with a range of 10 volts. Tubes: four 6D6, two 41, one 5Z3, one 874, one 876. Comes complete with *extra* set of tubes and parts. MA #RAK-7.

SPECIAL, **$64.50 ea.**
$55.00 in lots of 50

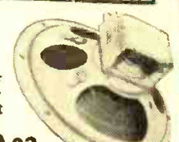
INTERPHONE SET

Sensational buy! Look at these parts:
125 feet—3 conductor cable
75 feet—#72 Seine Twine
1 roll—6 ft. red acetate tape
1 roll—6 ft. white acetate tape
2 —Cable clamps
1 —4 prong Jones plug in aluminum jacket
1 —4 contact Jones socket in aluminum jacket
2 —Pull chain assemblies

MA #Tow-3
SPECIAL, **98c per kit**
75c per kit in lots of 50

WHILE THEY LAST!

ALNICO 5" SPEAKERS



5" Alnico PM Speaker with 4 ohm voice coil, less output transformer. Limited supply—order at once! MA #7580.

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Telephone Handset TS-13

With listen and talk switch. Incorporates 200 ohm carbon mike and 2000 ohm ear 'phone. Supplied with 6 ft. cord and one each PL-55 and PL-68 plugs.

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T-17-B 200 Ohm Carbon Mike

Lightweight, with press-to-talk button. Built-in filter to suppress carbon hiss. 5 ft. rubber covered cable and PL-68 three-circuit plug supplied.
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UNIVERSAL OUTPUT TRANSFORMER

Will match voice coil to any tube, single or push-pull. Strap mounting, on 2⅞" centers. Size 2¼" high, 2" wide, 2" deep. MA #UOT-15.
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80 meter transmitter, phone, CW, or ICW, 25 watt output. Use as regular transmitter or as exciter: 2000 kc to 5250 kc. Requires external power supply (not supplied) that can deliver 500 plate voltage. Tubes: 801 osc, 801 PA, 46 speech amp, and two 46 class B modulation. Panel switch selects M.O.P.A. or any of four crystal frequencies. Unit supplied less tubes.
MA #3233-A. SPECIAL, **$22.50 ea.**
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UNBEATABLE PRICES ON ANTENNAS

(A) TEN METER COLLAPSIBLE, SPRING-ACTION VERTICAL ANTENNA—8 sections totaling 120 inches. ⅜" threaded base shank.

(B) VERTICAL ANTENNA, 32½ in. long. Flexible spring base with threaded stud. Top section pulls out for storage. ⅜" threaded base shank.

(C) ANTENNA ELEMENTS—set of six. Screw in antenna section approximately 38" long, totaling 18', tapering from 9/16" base to 3/16" tip.

(D) 12½ FOOT TELESCOPIC ANTENNA—pulls out to 12½ feet and telescopes down to 12 inches. Base is ⅞" diameter with ⅜" threaded base shank.

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C—MA No. AE-6	3.45	2.90
D—MA No. TE-12	1.95	1.40

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POTENTIOMETERS:

50000 ohm W.W. with switch 3" shaft	34¢
400 ohm W.W. 3" shaft	24¢
750 ohm W.W. 2" shaft	24¢
50000 ohm carbon 3" shaft	24¢
Dual carbon 20000 ohm frt 40000 ohm rear	32¢
Socket std acorn for 954,955 tubes, etc.	$9.50/C
Socket octal ceramic 1½" mtg ctrs	4.50/C

MILLIAMMETERS:

	EACH
GE, West'hs 0-20 DC, 2⅝" dia. flange	$2.49
GE, 0-300 DC 2⅝" dia. flange	2.49
Simpson 127, 0-5 DC	2.49

POWER RHEOSTATS:

H.H.F.—500 watt, 10 ohms, 7 amps	$3.95
Ward Leon. 500 watt, 12.5 ohms, 10 amps	3.95
West'hs 800 watt, 175 ohms, 3.7 amps	4.95

ELECTROLYTIC CONDENSERS:

30 mfd, 15 mfd, 10 mfd, at 250 VDCW	75¢
80 mfd, 40 mfd, 40 mfd, at 250 VDCW	75¢
1 mfd, 500 vdcw, GE #26F466 pyranol	39¢
1 mfd, 600 vdcw, GE #22F281 pyranol	49¢
.25 mfd, 1000 vdcw, GE #26F467 pyranol	39¢
10 mfd, 1000 vdcw, GE#23F17G2 pyranol	$2.95
3 mfd, 4000 vdcw, pop. makes, oil filled	4.50

MISCELLANEOUS PARTS:

Headphone 8000 ohm HS23	$1.50
Bliley crystal holder FT-171-B	30¢
DPDT high volt. antenna knife switch	39¢
Circuit breaker .5 amps at 1000 volts	4.50
Circuit breaker 220 milliamps at 115 v.	2.40

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TRANSMITTING TUBES: 2X2/879 2C26A 211 3D21A HY114B HY615 RK34 801A 803 803B 954 955 957 958A 9002 9003 9004 1201 1203A 1613 1624 1625 1632 1633 1634 1635 1644 3BP1 5CP1

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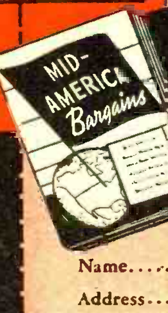

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sports can be enjoyed for several winter months. Inland there is a large area of desert country resembling the Sahara, surrounded by a semi-fertile belt with low rainfall, not suitable for close settlement. The wheat plains and sheep country of the south-east river basin have been compared to the Caspian steppes of Russia, the tropical north of Australia with the monsoon area of central India, and the heavy rainfall area of the north Queensland coast with the Madras coast of India.

At last estimate, railways totaled 27,972 miles (of three different gauges which will likely be unified soon). Peacetime air routes totaled around 29,000 miles, which figure will be increased immensely by post-war projects. There are about half a million miles of roads, including valuable strategic highways built during the war.

The longest river is the Murray, 1520 miles long, which with its tributaries drains an area of 414,253 square miles.

It's true and pleasant to say that Australia is the continent of sunshine for every part, even the cooler areas in the south, enjoys long hours of sunshine. But there are three main mountain ranges in Australia on which snow falls regularly—the Australian Alps in New South Wales, the Alps in Victoria, and Mt. Wellington in Tasmania. Mt. Kosciusko, in the Australian Alps, is the highest mountain, 7328 feet. In spite of the sunshine, the temperate regions have a good but not excessive rainfall.

In peacetime the living standard is one of the highest in the world. More than half the dwellings in Australia are occupied by owners or persons buying them by installments. Before the war there were more than 560,000 motor cars in Australia, or about 80 for every 1,000 of the population. The average income in Australia in 1938-39 was 259 pounds a year, but in 1943 it had risen to 327 pounds. (Incidentally, the Australian pound of about $3.21 will buy considerably more in Australia than its dollar exchange equivalent will buy in the United States—as many American servicemen in Australia found to their pleasure and profit.) Professional fees are similar to those in other parts of the world, and competent professional men and women earn large incomes.

Education between 6 and 14 or 15 years, varying according to states, is compulsory. Free education is provided in state primary, secondary, and technical schools, and, in addition, there are hundreds of private schools of high standard. Scholarships are obtainable to universities, and there is now a system of subsidies for university and technical students whose parents might otherwise be unable to give them university training. There are 6 universities, plus 2 university colleges.

Australia is a young country, which in many ways has been isolated from the main current of world thought, but


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there have always been standard bearers in the arts and sciences. Australian literature has developed unevenly in the past 50 years, although there have been and are many writers of distinction. Singers have included Dame Nellie Melba, Florence Austral, Marjorie Lawrence, and Peter Dawson, and there have been many other vocal and instrumental musicians of high caliber. Appreciation of music and drama in Australia is being stimulated by good broadcast programs. Australian paintings are favorably known in England and America—and Australia can justly claim a host of able and distinguished painters. But Australia is perhaps more widely known for her black and white art than for her paintings. Every state capital has its national art gallery and also a state art school.

Vocational training and, in certain cases, financial assistance is being made available to members of the services after discharge. Old age, invalid, and widows' pensions are provided. There are maternity allowances before and after every birth. Child endowment of 5s. a week is paid for all children after the first, whatever the income of the parents. Wage-earners' benefits are also in effect for temporary sickness or unemployment. Public hospitals throughout the Commonwealth operate under a system whereby a nominal fee is charged in public wards to patients able to pay. Apart from Government subsidies public hospitals derive income from charities. There are about 570 public hospitals in Australia.

In spite of its small population, Australia is one of the leading agricultural countries of the world, and its products contribute a great deal to the food supplies of many overseas countries. Wool production easily surpasses that of any other country. Cattle raising provide the beef, dairy products, and leather which are all outstanding products of Australia. Other livestock raised in vast numbers include pigs, horses, and poultry. Australia is one of the leading wheat producers of the globe. Fruit of all varieties is grown in every state, and the production of vegetables is being accelerated.

According to a late short-wave broadcast from *"Radio Australia,"* all indications point to a healthy business year there, with even better prospects ahead for Australia. Only the fringe of banked-up consumer demand has been touched so far. Millions of dollars worth of business is waiting fulfillment in housing, cars, food supplies, retail trade, and the products of new secondary industries. Attracted by possibilities of profitable and strategic investment, American and British capital has already taken steps to establish new industries in Australia. During the war, Australia became one of the highest-taxed countries in the world, but now taxes have been reduced considerably and there are general expectations of further reductions. Australian company structures

are reported as sound and are paying good dividends in all fields. Efforts are being made to make Australia as self-supporting as possible, thereby relieving the strain on Britain. Latest statistics show that 85 per-cent of Australia's men are working. Most of the remaining 15 per-cent are in the old age and pensions groups or are otherwise unemployable. Australia's export trade is rising rapidly.

In April, 1944, Australia had 891,000 men and 49,126 women in the armed forces. Seven of every ten men between the ages of 18 and 35 years served in the armed forces, more than half a million as volunteers liable for service in any war theater. Australia's interim army now numbers 26,400 (May, 1946). This figure includes 8900 members of the forces who have volunteered to serve a further two years, 7500 new enlistments, and the 10,000 Australians in the British Commonwealth Occupation Force in Japan.

The Commonwealth maintains The Australian News and Information Bureau in the United States at 610 Fifth Avenue, New York City. Much of the material sent out *daily* from this news bureau is taken from short-wave broadcasts of *"Radio Australia."*

There are about 400 kinds af animals and 700 kinds of birds in Australia. Apart from the kangaroo family, the more unusual creatures include:

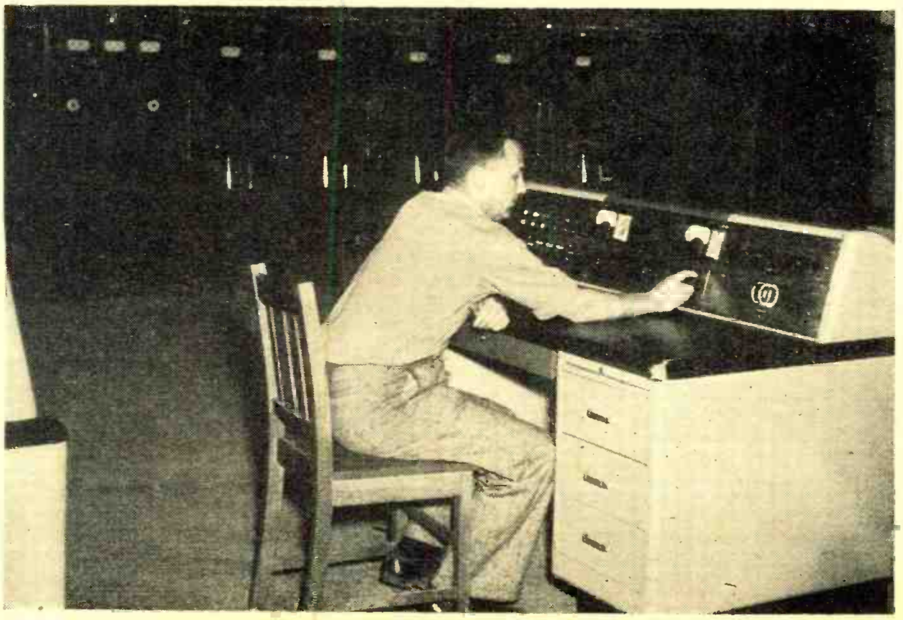
The koala (or "Teddy Bear"), which may be seen in parks near the cities and in the "bush," is a soft bundle of fur of up to 26 inches in length when fully grown, which never drinks, but obtains sufficient moisture from the young eucalyptus leaves on which it lives; the dingo (or wild dog) and the spotted native cat; the platypus, a combination of fish, bird, and animal which is equally at home in the water or on land, and which is one of the two creatures known to science which lays eggs and nourish its young with milk, the other being the Australian echidna, or ant-eating porcupine; the mole that is blind, deaf, and dumb; barking and cycling lizards; house-building rodents; fish that breathe, having a lung as well as gills; and the wombat, which burrows deeply. The birds include the emu, the lyre bird, the bell bird, the rosella, varieties of eagles, parrots, and cockatoos of brilliant plumage, and, of course, our old friend, the Kookaburra.

The Kookaburra

So the next time you tune in *"Radio Australia"* and listen to its signature call, the laugh of the Kookaburra, you may recall some of this little story (from the *Australian Handbook*) about the "Laughing Jackass," as the Kookaburra is familiarly known "down under":

"He is found chiefly in open forest country. He belongs to a family which includes many beautiful birds, but is the 'poor relation' so far as color goes, with brown and brownish-gray plumage, flecked with pale blue feathers in the wing. His tail is barred, black and brown. His powerful bill suggests a utilitarian purpose and his keen eyes are particularly alert. Yet he has a friendly look, as though he were ready to share your lunch and be your friend. It is his voice that makes him famous—a medley of raucous notes resembling laughter, interspersed with rich, throaty chuckles; it is heard at its best in the early morning or around dusk, when the laughing of one bird will frequently be the keynote for a chorus in which a large number will join. Mice, rats, small birds, lizards, and even snakes have a place in the diet of the kookaburra. His strong bill is an efficient weapon. It is claimed that, in snake-killing, the bird swoops down and grasps the snake in its bill, flies to a height and then drops

Control desk for one of the 50 kw. transmitters operated by "Radio Australia."



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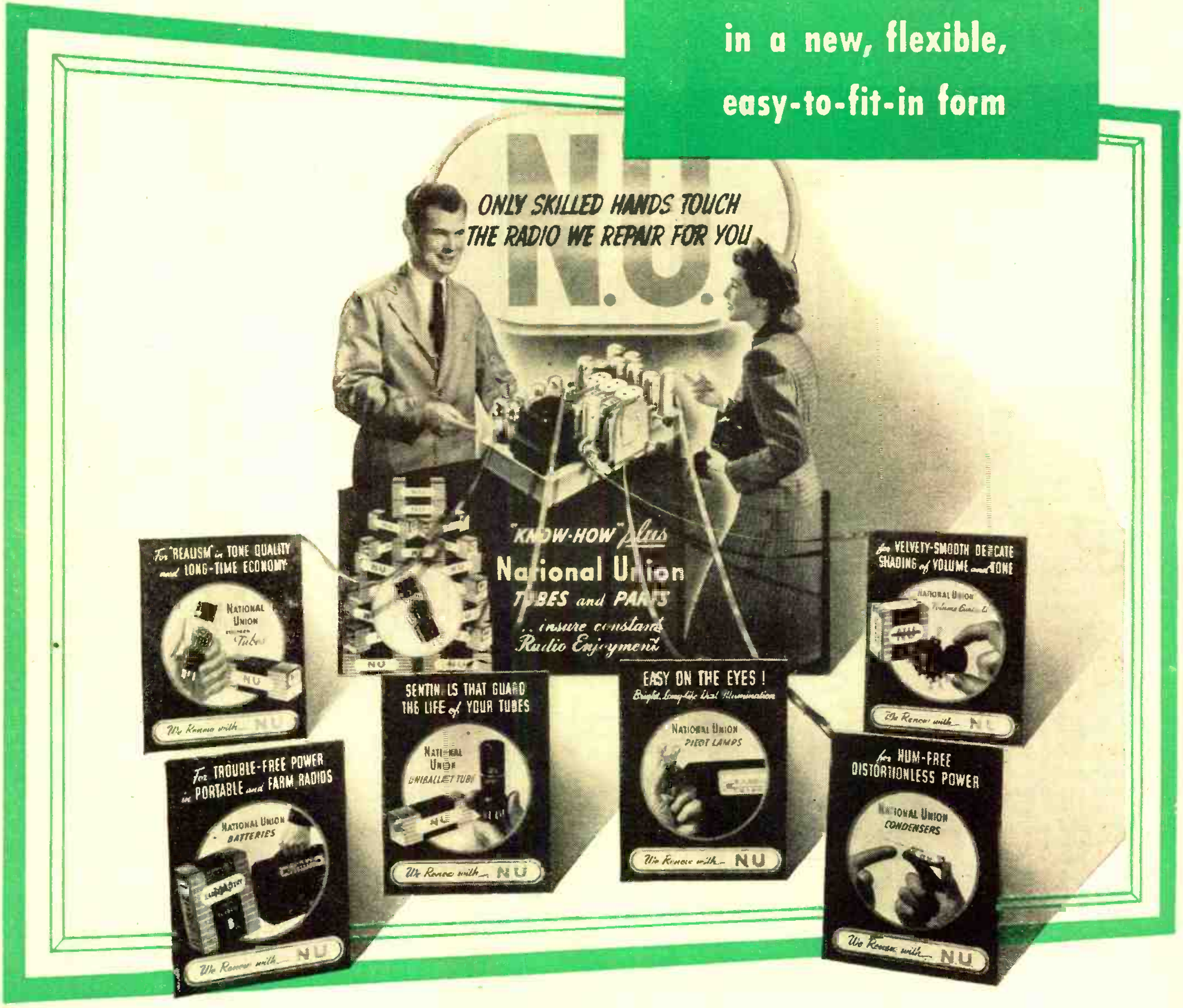

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Be one of the first to show this brand new display idea—that sells your service skill and tells customers how and why you can insure their radio enjoyment. Full of life, action and interest—printed in 10 colors on heavy cardboard—each unit is a complete display with easel and ribbon streamer. Display them as a group or as individual window, counter or shelf cards. Order from your N.U. Distributor now for immediate shipment.

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NATIONAL UNION RADIO TUBES AND PARTS

Transmitting, Cathode Ray, Receiving, Special Purpose Tubes • Condensers • Volume Controls • Photo Electric Cells • Panel Lamps • Flashlight Bulbs the snake. These tactics are continued until the snake has been killed by the repeated falls.

"The kookaburra is a friendly bird that can readily be induced to accept meat scraps from the kitchen. He will come regularly to be fed, and will even take the food from the hand of the person who feeds him. To see such a 'tame' kookaburra slapping a piece of meat against a post with its bill is an object lesson in the workmanlike way in which living prey is dealt with. Because of their laughter, these birds are popular and they are strictly protected."

* * *

Best Bets for Beginners

Arnold deBrier, Atlantic City, New Jersey, lists these best bets: VLC5, 9.54, *Radio Australia,* 7-8:15 a.m.; VLC4, 15.320, 12 midnight-12:45 a.m.; *Radio Brazzaville,* best on 11.97, late afternoons; Leopoldville, 9.738 (varying), Belgian Congo, with *English* news at 8:10 p.m.; Bern, 9.539, Switzerland, 8:30-10 p.m., *except Saturday,* also good on 6.165 in dual; Paris is best on 9.55, *English* news at 9 and 10:30 p.m.; HCJB, Quito, Ecuador, best on 12.455, 8-10 p.m.; ZFY, 6.000, Georgetown, British Guiana, signs off at 7:45 p.m.

These best bets for the New York area are listed by Carl Beck, Jamaica, Long Island:

GSP, 15.31, London, 4:15, 7:45 p.m., GWH, 11.80, 4:15-9:45 p.m., GRH, 9.825, 5-11 p.m., GSU, 7.26, 7-11 p.m., news at 4:45, 5:45, 6:45, 8, and 9:30 p.m., North American Service concludes at 9:45 p.m., after which General Overseas Service is relayed; GVW, 11.70, London, GWO, 9.625, GWN, 7.28, 6-10:45 p.m., directed to Latin America *(Spanish);* VLC9, 17.84, Melbourne, 7:30-8:45 p.m., news at 8 p.m.; VLC5, 9.54, Melbourne, 7-8:15 a.m., news at 7, 8 a.m.; VLC4, 15.32, VLG4, 11.84, VLA, 11.77, Melbourne, 12 midnight-12:45 a.m., news at 12:15 a.m., best on VLA4 and VLC4; HJCT, 6.198, HJCD, 6.16, Colombia, good nightly in *Spanish;* HCJB, 15.095, 12.455, 9.958, mornings and evenings, *English* news at 5 p.m. (relayed from United Network, San Francisco); Paris, 11.845 and 9.55, 9-10:45 p.m., news in *English,* 9, 10:30 p.m.; PCJ, 9.59, Hilversum, Holland, "Happy Station Program," Wednesday and Sunday *only,* 10-11:35 p.m., the 11.73 and 6.025 frequencies in parallel are poor with heavy QRM; HRN, 5.875, Honduras, nightly to 11 p.m. sign-off, has occasional station-break in *English,* otherwise uses Spanish; ZFY, 6.000, Georgetown, British Guiana, 2:45-7:45 p.m., BBC news relay at 4:45 p.m., Caribbean news at 7:30 p.m.; PZH5, 5.845, Paramaribo, Surinam, 6-8:30 p.m., Dutch *only;* OAX4Z, 5.895, Lima, Peru, off at 11:30 p.m., Spanish *only;* HH2S, 5.945, Port-au-Prince, Haiti, off about 10 p.m., Sundays at 8 p.m., also HHBM, 6.165, same location, off at 10 p.m.; ZYC8, 9.61, PRL7, 9.72, both Rio de Janeiro, and ZYB7, 6.095, Sao Paulo, all in

Brazil, off around 10 p.m.; *Radio Brazzaville's* FZI is best on 11.97 and 9.44, 5:05-8:15 p.m. to America, *English* news, 5:15, 6:30 p.m.

* * *

Special Broadcast From Sweden

Radiotjanst, the Swedish Radio, will dedicate a 30-minute broadcast to readers of RADIO NEWS on Sunday, November 24, 1946, between 11-11:30 a.m. EST (1600-1630 GMT). Reports are requested. Full details will be given in this department next month.

* * *

Schedules

Alaska—DXers in British Columbia report WXFG, 12.235, Adak, Aleutians, is still in use, heard at 6 p.m. to RCA.

Albania—Latest schedule of ZAA, 7.850, Tirana, is 2-6 p.m., with *English* news at 4:15 p.m. *only*.

Algeria—A new relay of *Radio Algerie* is heard daily at 12:35-3:00 a.m. and 12 noon-6 p.m. with generally good signal in the East, weak to fair in the West; the frequency is 11.836 and it usually parallels 12.116; this station formerly was known as *Radio France*.

Just in via airmail from Miss Eileen Reis, Program Director, "The Voice of America in North Africa," Algiers, is this information:

"The three 50,000-watt transmitters located in the vicinity of Algiers and known as 'The Voice of America in North Africa' are owned and operated by the U.S. Government. Their principal function is to relay news and entertainment programs which originate in the New York studios of 'The Voice of America.'

"A receiving location, situated in a small town outside of Algiers, picks up programs which are broadcast from the United States over a number of high powered short-wave transmitters. The programs are fed via telephone lines to the transmitters. The transmitters which relay these programs use directional rhombic antennas beamed on Europe.

"At present, we operate on 25.25 meters (11.88) from 6 a.m. to 12 noon; 31.4 meters (9.54) from 12:30 to 5:15 p.m.; 25.5 meters (11.765) from 6 a.m. to 2:15 p.m.; and 31.2 meters (9.610) from 2:30 to 5:15 p.m. In addition, we have one medium-wave station operating on 255 meters (1,176 kcs.) from 11 a.m. to 5:15 p.m."

(For details of how to send for verification, see item on "Verifications.")

Andorra—*Radio Andorra* has shifted from 5.997 to 5.960; the widely reported 11.995 frequency was a harmonic, not a fundamental radiation.

Anglo-Egyptian Sudan—Direct, via airmail, from Khartoum comes word that the 9.220 transmitter is no longer in use; present frequencies of 13.320 and 9.650 (paralleling 572.5 kilocycles) are in use in Arabic, all days of the week *except* Thursday, 11:30 a.m.-1 p.m. and 2-2:30 p.m.; Thursday, 11:30 a.m.-12:30 p.m. and 2-2:30 p.m.; Fridays, 3-4:30 a.m.; Sundays, 3-4 a.m.; English program is broadcast Thurs-

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There's no use reminding you that strikes and shortages of material have resulted in a scarcity of steel and copper wire and all of the parts needed for making loud speakers. Nor can we console ourselves with the thought that other manufacturers are in the same boat. We know our customers need merchandise and we're truly sorry that our production is a trickle instead of a flood; that our deliveries are slow; that our new products are not yet in full production. Some day soon materials will become more plentiful and our production will catch up with our backlog.

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President

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days *only*, 12:30-1 p.m. I have just received a form letter verification. Address, Sudan Broadcasting Service, Khartoum, Anglo-Egyptian Sudan (Africa).

Australia—VLA4, 11.770, Melbourne, is being heard well around 6-8 a.m. beamed to the Pacific, replacing VLA6, 15.200, and is also used in the 2-3:15 a.m. radiation to Britain. VLG5, 11.880, Melbourne, is heard around 6-8 a.m. to Asia, replacing VLG10, 11.760. VLC11, 15.210, Melbourne, heard well 2-3:15 a.m., with the broadcast to Britain. (Legge, VRC)

Austria—Reception of *Radio Wien*, Vienna, has been poor lately in the Eastern United States, and there is confusion as to present schedules and frequencies. Those best heard are reported as 9.833, 12 midnight-5 a.m.; and 12.212, at 5 a.m.

Azores—Ponta Delgada has replaced 7.018 with 11.090, heard well now on schedule of 2-3 p.m.

Belgian Congo—OTC2, 9.738 (varying), Leopoldville, complete schedule now is 5-9:45 p.m., news at 7:15 and 8:10 p.m., relays BBC's North American Service after 8:15 p.m., including *English* news at 9:30 p.m.

British Somaliland—*Radio Somali*, 7.126, Hargeisa, heard 8-10:30 a.m. sign-off; uses 1 kw. transmitter, RCA-built; all reports verified. Transmitter uses two 833A's in PA driven by 4

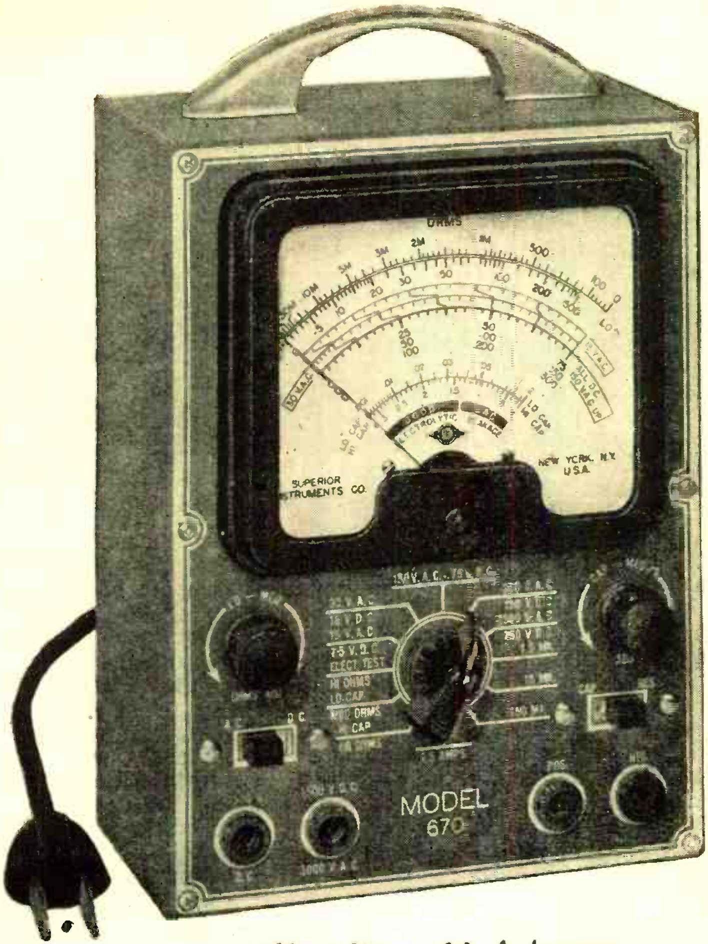
(*Continued on page* 122)

Drone Planes

(*Continued from page* 29)

the Navy drone only on a larger scale. Having more space, heavier equipment and larger air sample bags could be installed. The latter was built into the right bomb bay while the air port was built into the belly of the ship and operated in a manner similar to that on the Hellcats. The

Major D. H. Whittaker and Col. Harvey T. Alness examine the control box which is used to guide B-17 drones in landing.



The New Model 670

...our advertising copywriter is on vacation : : : : : :

The guy that usually writes this stuff is on vacation so here goes with a description of our new Model 670—fancy adjectives omitted.

This new model is not a radically new post-war whizz-bang sensation. It's just a good solid Volt-Ohm Milliammeter made as best we know how. (We've been making radio testers since 1930. During the war we made more than we ever thought possible.) In addition to the usual Volt-Ohm Milliammeter services the Model 670 measures Capacity, Reactance and Decibels—it also has a Good-Bad Scale for checking the quality of electrolytic condensers at a test potential of 150 Volts. Most important at $28.40 it represents *very good value*. We guarantee it for one year.

If you need an accurate dependable all purpose meter quit looking around and order a Model 670 from your regular radio parts jobber. If he doesn't handle our line write for a list of jobbers in your state who do distribute our products or send your order directly to us.

Specifications:

D.C. VOLTS: 0 to 7.5/15/75/150/750/1,500/7,500 Volts
A.C. VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
OUTPUT VOLTS: 0 to 15/30/150/300/1,500/3,000 Volts
D.C. CURRENT: 0 to 1.5/15/150 Ma. 0 to 1.5 Amperes

RESISTANCE: 0 to 500/100,000 ohms 0 to 10 Megohms
CAPACITY: .001 to .2 Mfd. .1 to 4 Mfd. (Quality test for electrolytics)
REACTANCE: 700 to 27,000 Ohms 13,000 Ohms to 3 Megohms
INDUCTANCE: 1.75 to 70 Henries 35 to 8,000 Henries
DECIBELS: —10 to 18+ +10 to +38 +30 to +58

***Added Feature:* The Model 670 includes a special GOOD-BAD scale for checking the quality of electrolytic condensers at a test potential of 150 Volts.**

The Model 670 comes housed in a rugged, crackle-finished steel cabinet complete with test leads and operating instructions. Size 5½" x 7½" x 3".

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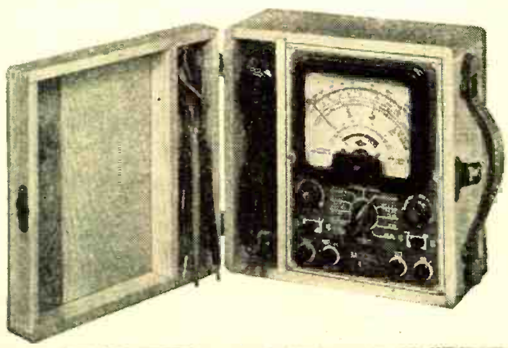
Please place your order with your regular radio parts jobber. If your local jobber cannot supply you, kindly write for a list of jobbers in your State who do distribute our instruments or send your order directly to us.

Model 670P

The Model 670P is identical to the Model 670 described above except that it is housed in a hand-rubbed, portable oak cabinet complete with cover.

The Model 670P comes complete with test leads and all operating instructions.

$35.75 NET



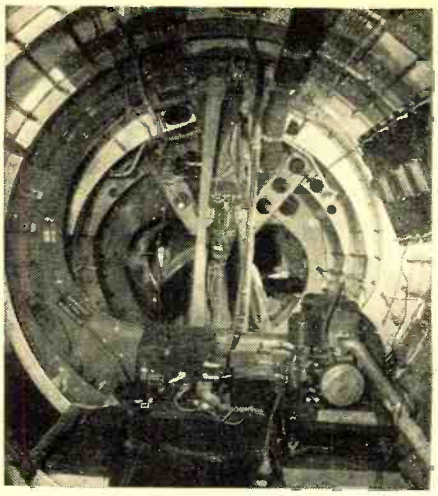
SUPERIOR INSTRUMENTS CO. DEPT. RN10—227 FULTON STREET NEW YORK 7, N. Y.

Army too, uses a 10 channel system.

The Army Drone Unit was organized on March 15, 1946 at Clovis, New Mexico, and consisted of ten drones and six "mothers." The drone unit arrived at Eniwetok April 29th and immediately began its rehearsals for the Bikini operations. There were a total of four drones and four "mothers." Operation is as follows: A "mother" ship takes off with manual control and circles the airstrip while its drone is taxied to position. The No. 1 control operator is positioned on a platform on the leeward end of the strip. The radio control equipment is installed in a small Army truck parked on the platform. The operator looks directly down the runway through a transit similar to a surveyor's instrument. His job is to control the rudder, brakes and throttle during take-off.

A second control position, known as No. 2, is situated on the side of the strip approximately 200 yards ahead of the No. 1 position. The ground radio equipment is installed in two vehicles. The No. 2 operator controls the elevators of the drone during take-off as he is in a better position to observe the climb of the ship. (When landing, the No. 2 operator controls both elevators and throttle.)

Two television cameras are installed in each B-17 drone plane. One of them is mounted in the nose of the ship and the other is located in a wood box enclosing the instruments of the ship. Within this box are several automotive type headlamp bulbs used for illumination of the instruments. Operators at the No. 2 control have at their disposal two television receivers. They are able to observe the airspeed, pressure, altitude, manifold pressure, oil pressure, and the flux gate compass of the drone while it is airborne. The other televiser gives "eyes" to the drone. The operators on the ground can observe the target or whatever is ahead of the plane.



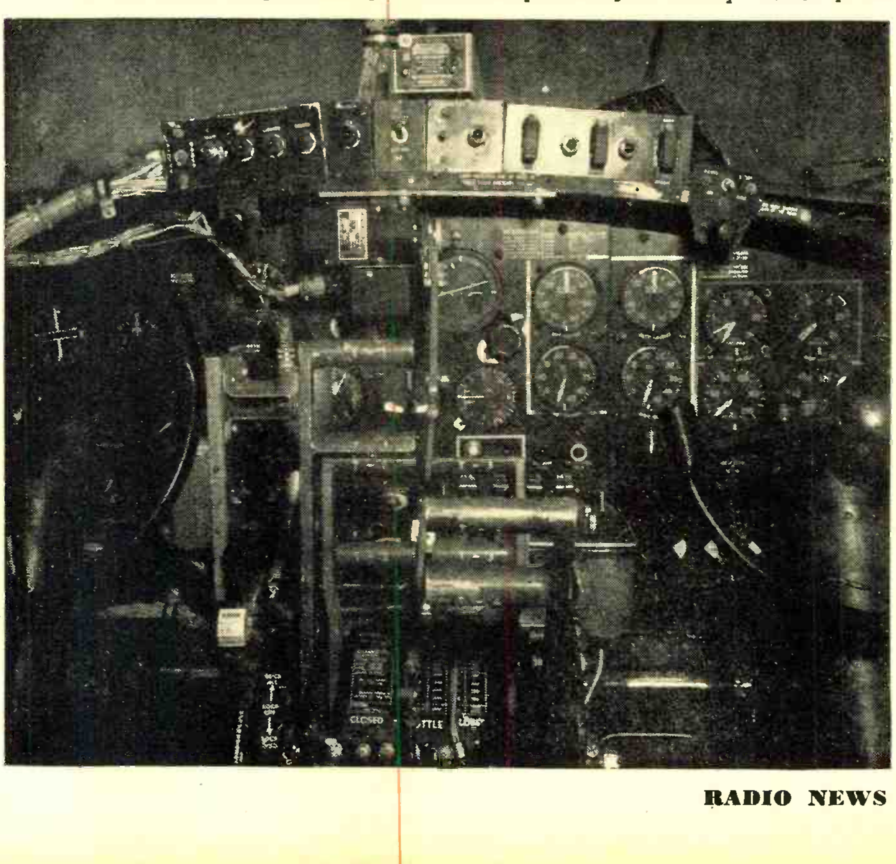
Tail section of B-17 showing some of the radio control equipment in place.

The television system worked extremely well. In fact, I was able to see myself looking into the nose television receiver on the ground, while one of the drones which was televising the area, came in for its landing.

The B-17 "mother" ships were also equipped with radar.

After witnessing the sensational performance of both the Army and Navy drones, it becomes quite obvious that the perfected A-Bomb of the future would be carried and directed to its target entirely by radio controlled

Cockpit of a B-17 drone. Selsyn motors operate controls by radio signals sent by "mother" plane.



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drones. Yes, a "push-button" war is possible. The most important job now is to develop counter-control equipment.

—30—

Super-regenerative Receiver

(*Continued from page* 31)

The r.f. choke, RFC_1, through which the "B" voltage is applied to the detector circuit is critical for good performance. For 2-meters it should have about 15 turns of No. 28 enameled wire on a ¼" form. If this choke has insufficient inductance, excessive inductance, or a high distributed capacity, it can cause the strength of the detector oscillations to vary over the tuning range. Most 2½ meter chokes cause a severe "dead spot" right in the 2-meter band. A good test of an r.f. choke in this application can be made using the following procedure. Connect the choke to point (a) of Fig. 1B and adjust the regeneration control and antenna coupling so that the detector is barely oscillating and producing the characteristic "hiss." Then move the choke to point (b) and next point (c). It should only be necessary to advance the regeneration control slightly to maintain oscillation and it should only be necessary to retune C_1 slightly (less than 1% in frequency) to maintain resonance with a test signal. Once the quality of the r.f. choke is assured it should be tried at each point, in turn, for best sensitivity. Generally, it will be found that feeding the grid end of the tuning coil gives slightly better results on 2-meters with the 9002 in the Colpitts self-quenching detector.

The *LC* ratio of the tuning circuit requires attention in design if good performance is to be obtained. A desire for bandspread frequently results in very low *C* with its attendant evils; poor selectivity due to low circuit *Q*, strength of oscillations varying from one end of the tunning range to the other, calibration shift with antenna changes, and reduced stability (coupling and regeneration controls cause greater detuning from resonance with incoming signal). For 2-meters, a 3-plate midget variable tuning condenser is recommended, with a vernier dial supplying any additional bandspread the operator desires. In most cases the improved selectivity observed after the addition of an r.f. stage results from either intentional (trimmer) or stray capacity that was added to the detector circuit incidental to the r.f. stage installation. However, it is probable that an r.f. stage, which is regenerative to the point of near-oscillation, will add selectivity.

The bypass condenser, C_3, used at the cold side of RFC_1 is important to detector sensitivity, and various values should be tried when the conventional audio transformer (or resistance coupling) is employed to couple the detector to the first audio. A .003

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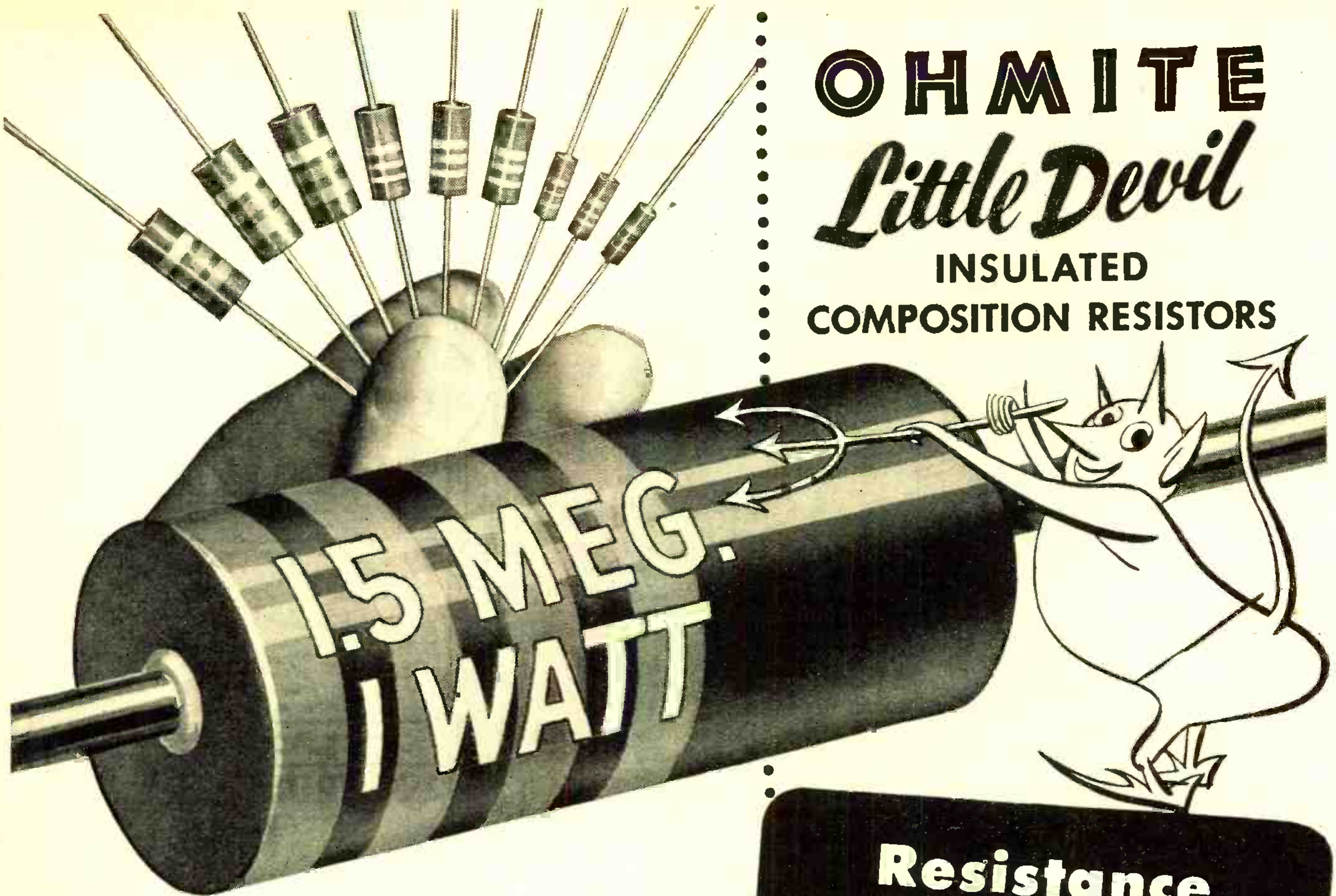

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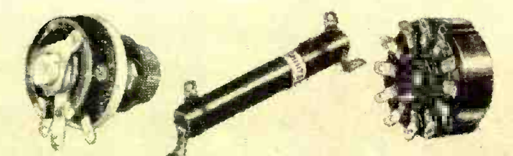

RHEOSTATS RESISTORS TAP SWITCHES

μfd. condenser is commonly used in this application.

Up to this point, the design of the super-sensitive, super-regenerative receiver diagrammed in Fig. 2 has followed conventional s.w. receiver design, but with special emphasis being laid on optimum circuit constants. Now a novelty is introduced. Capacitor, C_3, and inductance, CH_1, were selected so that their constants form a parallel resonant circuit at 400 cycles. The Q of this circuit is relatively high with the result that the audio signal is built up and the "hiss" level attenuated to a great extent. RFC_2 is an 80 millihenry r.f. choke which aids in keeping quench voltage out of the audio system, but does not enter into the calculations of the tuned filter system. R_3 was necessary in this receiver to eliminate "fringe howl" when the detector was on the threshold of oscillation. If it becomes necessary to use less than 50,000 ohms to eliminate undesirable fringe howl, change CH_1 to 10 henries and C_3 to .01 μfd.

It has been brought out here that the sensitivity of a receiver does not alone depend upon the detector, as a good audio system may increase receiver sensitivity (on a signal-to-noise basis) several times. At a number of spots in the receiver diagrammed in Fig. 2, signal output was sacrificed, but in each case, noise suffered greater attenuation. It is necessary to provide sufficient audio gain to bring the weakest perceptible signal up to loudspeaker volume and for this reason V_2 has been included.

The output pentode, V_3, used in this receiver was the 6G6 which has ample power output, the same power sensitivity as the 6V6, and very low "B" current drain.

Filament transformer, T_2, was incorporated to reduce hum (at the detector) and to permit flexibility for experimenting with various tube types. For these reasons, a.c.-d.c. series filament operation is not recommended in a receiver of this type.

In operation, the tuning condenser, C_1, and audio gain control, R_4, are used as in any other super-regenerative receiver. The regeneration control, R_2, is first adjusted to a value sufficient to produce the characteristic "hiss," and the coupling between L_1 and L_2 is tightened up to the point where the detector is "pulled out" of oscillation. Then the coupling should be reduced just below this critical point so that the characteristic "hiss" is maintained. When a weak signal is tuned in by C_1, various settings of regeneration control R_2 should be tried with coupling between L_1 and L_2 always maintained near the critical point. A certain setting of R_2 will be found to result in a "best" signal-to-noise ratio on all weak signals tuned in, if coupling is always adjusted to optimum. After this setting has been determined, operation will be reduced to tuning C_1 and adjusting coupling between L_1 and L_2. On the receiver described this particular set-

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1249 MAIN STREET • HARTFORD 3 • CONNECTICUT ting occurs with R_2 at about three-quarters of full setting where the detector is receiving approximately 65 "B" volts.

—30—

Postwar Receiver

(*Continued from page* 51)

The changeover from 455 kc. to 10.7 mc. takes place between bands 4 and 5. As band 4 runs up to 30 megacycles and band 5 starts at 27 megacycles this arrangement permits the use of narrow-band standard communications receiver performance or wide-band v.h.f. performance on the amateur frequencies between 28 and 29.7 megacycles. The same flexibility is also available in the "QRM" band, 27,165 to 27,455 kilocycles, which is shared with industrial electronics, diathermy, etc.

The second i.f. transformer requires no switching except for a contact on the selectivity switch which connects the small auxiliary winding used in "expanding" the i.f. These extra windings are found in the 455 kc. section of the second and third i.f. transformers and the selectivity switch on the panel cuts in both, one, or none of these windings to give broad, medium, or sharp i.f. Three more positions on the same switch connect trimmer capacitors in the crystal filter circuit to provide broad, medium or sharp crystal, a total of six variations in selectivity available on frequencies between 540 kc. and 30 mc.

Fig. 2 is a simplified diagram of the second i.f. stage and parts of the third i.f. or first limiter and second limiter stages. Switch S_1 cuts in the auxiliary winding for expanding the i.f. referred to above. Switch S_2 is a part of the band switch. One diode section of a type 6H6 tube is used as an AM detector on the first four bands. On bands 5 and 6 when using AM or c.w. the first limiter becomes a third i.f. stage and grid rectification in the second limiter provides AM detection. As can be seen from the diagram, the two primaries in the third i.f. transformer are in series but the secondaries are not connected nor do they require switching as they feed into separate tubes.

B.F.O. and Additional Switching Circuits

A panel switch labeled *"Reception"* accomplishes most of the remaining switching operations. Its four positions serve: To connect the audio frequency amplifier to a phonograph input jack on the rear of the chassis; to connect the a.f. amplifier to the output of the FM discriminator which follows the second limiter stage; to connect the a.f. to S_2 (Fig. 2) for AM reception on any of the receiver's frequency bands; or to turn on the beat frequency oscillator for c.w. operation. In the FM position this switch performs another unique operation, it converts the type 7A4 b.f.o. tube to a direct current amplifier,

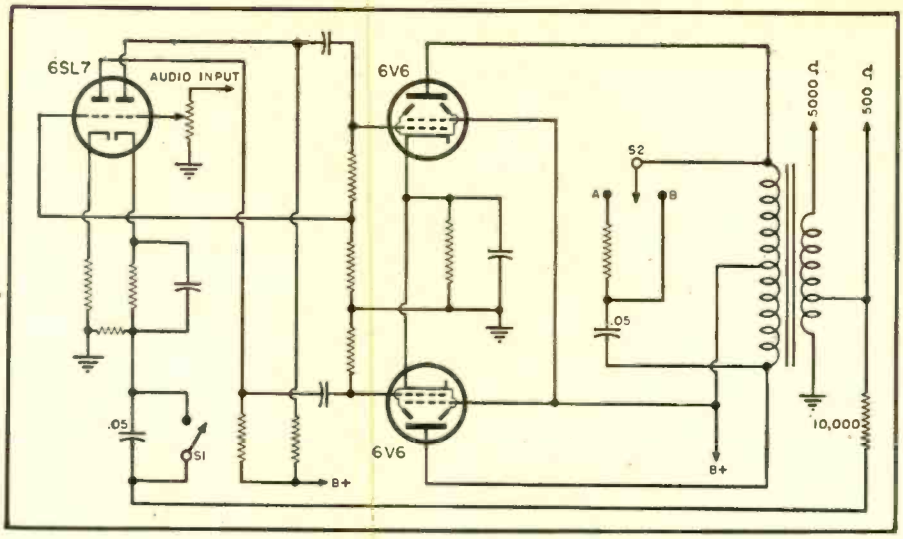

Fig. 3. Basic audio frequency circuit showing operation of tone control.

disconnects the S-meter from its normal position in the i.f. circuit, and connects both units to function as a sensitive FM tuning indicator.

The b.f.o. transformer contains two windings in series the same as the i.f. transformers. The b.f.o. circuit is a modified Colpitts with a small tickler added to assist oscillation on 10.7 mc. When operating on the lower bands using 455 kc. i.f., part of the band switch is open. On bands 5 and 6 this switch closes thus permitting oscillation at 10.7 mc. The lead to the b.f.o. trimmer on the panel is tapped down on the 10.7 mc. coil. This was necessary as a capacitor large enough to provide good b.f.o. adjustment on 455 kc. is so big that it would be almost impossible to tune if connected across the entire 10.7 mc. coil. As it is, the b.f.o. tuning is practically the same throughout the range of the receiver. Both b.f.o. windings are provided with adjustable iron cores.

Audio Frequency Amplifier

In order to take full advantage of the versatile performance of this receiver an exceptionally good audio system is incorporated. A type 6SL7 dual triode functions as an audio inverter and drives two 6V6s in push-pull as a final amplifier. A simplified diagram of the four-position tone control is shown in Fig. 3. For high fidelity operation switch S_1 is closed and S_2 is open. With this setting a small amount of the audio output is fed back to the cathode of the inverter tube thus producing inverse feedback at all frequencies. For bass boost S_1 is opened thus placing an .05 μfd. capacitor in series with the inverse feedback lead. This allows the higher frequencies to pass as before but effectively blocks the lower frequencies thus preventing degeneration of the bass. With the circuit constants shown here the bass response is increased approximately 12 db. with maximum gain in the vicinity of 100 cycles. For medium or low tone switch S_1 is opened and S_2 goes to position A or B thus attenuating the higher frequencies partially or almost altogether. In the high fidelity position the audio response curve of the amplifier is essentially flat from 60 to 15,000 cycles and an output of 5 watts with less than 5% harmonic distortion is easily attainable.

Actual performance in amateur operation has been very satisfactory as the combination of high signal-to-noise ratio, real stability, and high sensitivity leaves nothing to be desired. Over-all sensitivity of the receiver, measured with a 300 ohm dummy load across the antenna terminals, is less than 2 microvolts input for *500 milliwatts* output in any of the amateur bands below 30 mc. Performance at all other comunications frequencies is comparable.

—30—

5" Oscilloscope

(*Continued from page* 42)

turned on. ALWAYS pull the line plug before making any changes or adjustments.

Operation

With the instrument completed and plugged into a light socket, test first for voltage breakdowns with only the rectifier tubes in place. If there is no indication of a short anywhere in the circuit, after about 5 minutes of operation, pull the line plug and insert the rest of the tubes. Set the controls as follows: R_{17} and R_{19} should be in their middle position or at about half scale at first; later they may be adjusted to center the image on the screen. Set S_2 at the upper position, and R_3 at about half scale, and it should be possible to get a linear sweep on the screen, which should make a straight line across the face of the tube when properly focused by manipulating R_{22} and R_{24}. The linear sweep should be formed for all positions of S_3 and R_{16} and at the higher frequencies, an audible whistle which seems to come from the internal structure of the 884 tube will prob-

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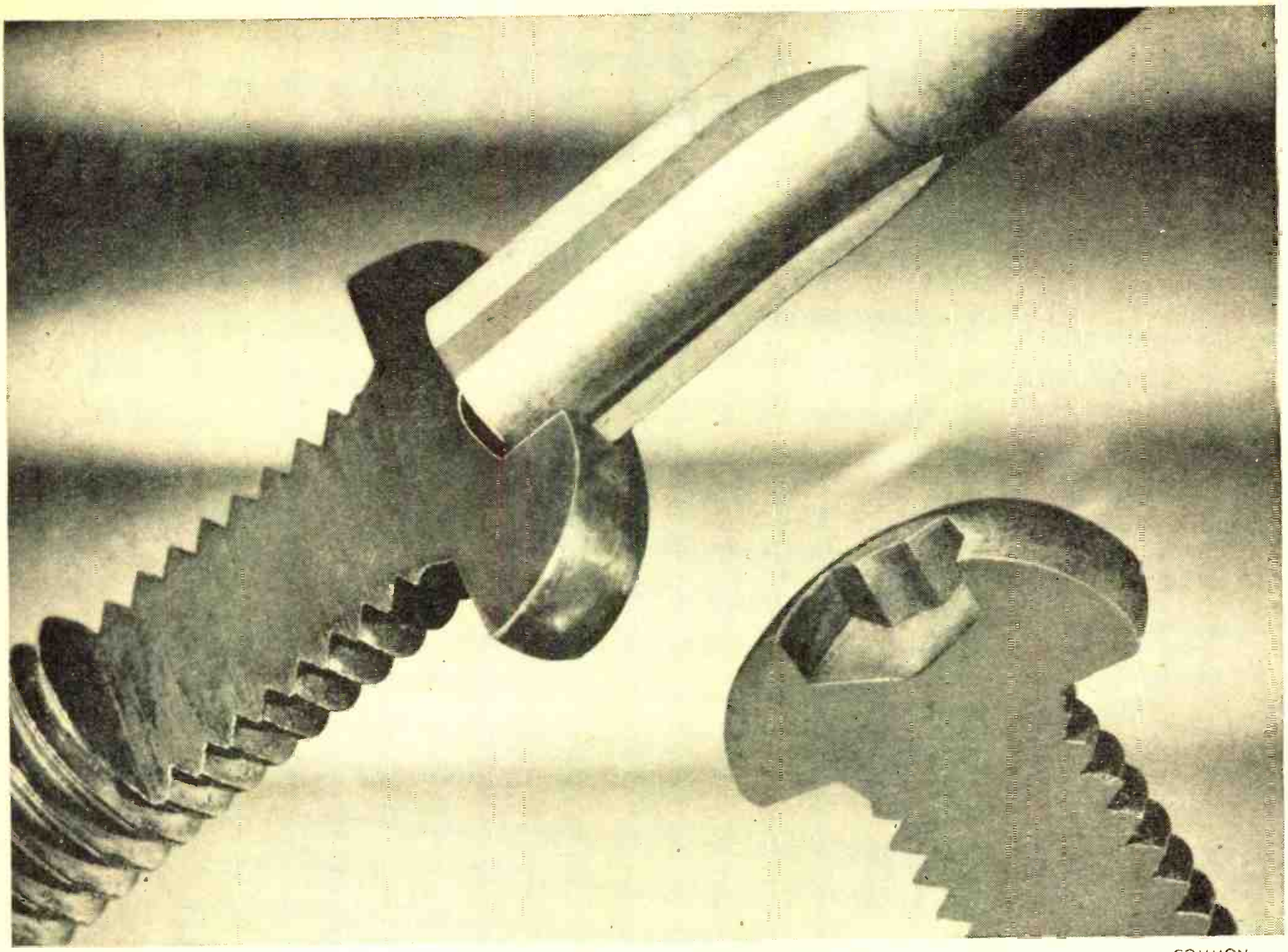
Editors and Engineers LIMITED 1302 KENWOOD ROAD Santa Barbara CALIFORNIA ably be noticed. Varying R_3 should spread the line produced by the sweep oscillator from a point to a line extending beyond the limits of the screen. (Caution: Do not allow a point to focus for any length of time at one position on the screen of the cathode-ray tube as this may cause a dark spot on the screen.) If the sweep line is not reasonably straight, errors will be usually due to improper filtering of the power supply, stray hum pickup from some improperly shielded input connection, or stray magnetic fields from the transformers and chokes. To test for the effect of stray magnetic fields from the transformers, temporarily remove the CR tube socket from its mounting so that the tube may be turned up and away from the transformers as far as possible to check for improvement in the linearity of the sweep pattern. In most cases it will be necessary to encase the tube in a metal shield such as the one shown in the photographs, Figs. 3 and 4. This shield was made from a piece of 5" stovepipe cut to the correct length and formed and mounted as shown in the photographs.

If the linear sweep is functioning properly, a signal from an audio amplifier or oscillator may be coupled to the vertical input, either directly or through the 6SJ7 vertical amplifier, to produce a pattern suitable for viewing on the tube screen. A short length of wire coupled to the vertical input terminal and held in the hand should produce a sine wave through body-capacity pickup from the 60 cycle power line. This may be used as a simple test to check the functioning of the vertical amplifier. After being checked and placed in satisfactory operating condition, the instrument should be enclosed in a suitable case. The case shown in Fig. 1 was made of plywood and covered with imitation leather. Such a case is superior in many ways to a metal box. It looks and wears well, and there is less danger of shock or short-circuit. A ventilating hole in the top of the case, and one in the back, covered with screen wire, will insure adequate circulation of air to prevent overheating. Under no circumstances should the oscilloscope be enclosed in a box without holes for adequate ventilation.

Applications

It is not the purpose of this article to go into detail as to the uses of the completed oscilloscope. However, some applications to radio service work might be mentioned briefly. One of the most important and valuable uses is in the location of hum, noise pickup, and causes of intermittent operation. For this work, the portion of the radio circuit under test should be coupled to the vertical input through a short length of shielded wire. A small capacitor may also be used if necessary. Radio chassis and oscilloscope should have a common ground connection. S_1 will usually be set in the middle position, and R_1 adjusted to give adequate deflection



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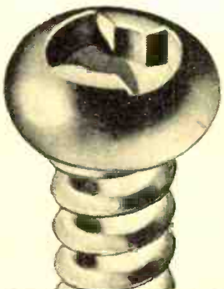

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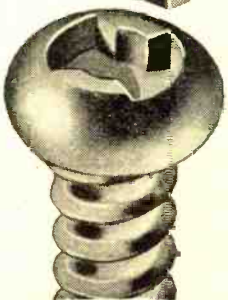

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for observation. Connection may be made to various points in the receiver and differences in hum, noise, and signal level noted directly on the CR tube screen. The gain in the vertical 6SJ7 amplifier is sufficiently high to permit tracing the audio signal through from the detector to the loudspeaker. This can be accomplished by moving a probe connected to the vertical input from one part of the circuit to another. The linear sweep will usually be set on one of the lower ranges while making these tests. The same general hookup is used for checking alignment and audio distortion. A square wave generator is a practical necessity for checking distortion in audio amplifiers. The squared wave is fed into the amplifier under test, and the output as observed on the oscilloscope will show deviations due to distortion. The square waveform makes it easy to detect minor variations.

—30—

Practical Radio Course

(*Continued from page* 64)

respective conversion conductances of these types. Experimental data[2] shows that when such high-quality circuit components are used, the 6J8 and 6A8 converter tubes have practically the same translation gain and over-all stage gain at standard broadcast frequencies. At higher frequencies, up to 18-20 megacycles, these values for the 6J8 are substantially the same as at broadcast frequencies, whereas, at 18 megacycles the over-all stage gain using a 6A8 pentagrid converter may be less than one-third of that realized at 1500 kilocycles. These differences are due partially to the better conversion efficiency obtainable with 6J8 and to the low input loading of the tube.

It is evident from this discussion that through the use of a 6J8 triode-heptode converter tube (and similar types) the advantages of a separate oscillator and mixer combination are attainable in a single converter tube, with the added advantage of reduced space requirements and simplifications in wiring. Because of its low noise level and high conversion gain realized, the 6J8 has found wide application in compact midget receivers that have no preselector or r.f. stage.

One disadvantage of the triode-heptode converter is that since the triode section shares a portion of the cathode area, the area that can be used for the oscillator is quite small, and as a result the oscillator transconductance cannot be made high.

6K8 Triode-Hexode Converter Tube

The 6K8 *triode-hexode* converter represents another important advance in the development of stable electron-coupled converter tubes. Due to the

[2] "Converter Performance of Type 6J8 Triode-Heptode." *Sylvania Electric Products Corp.* "Engineering News Letter 43."

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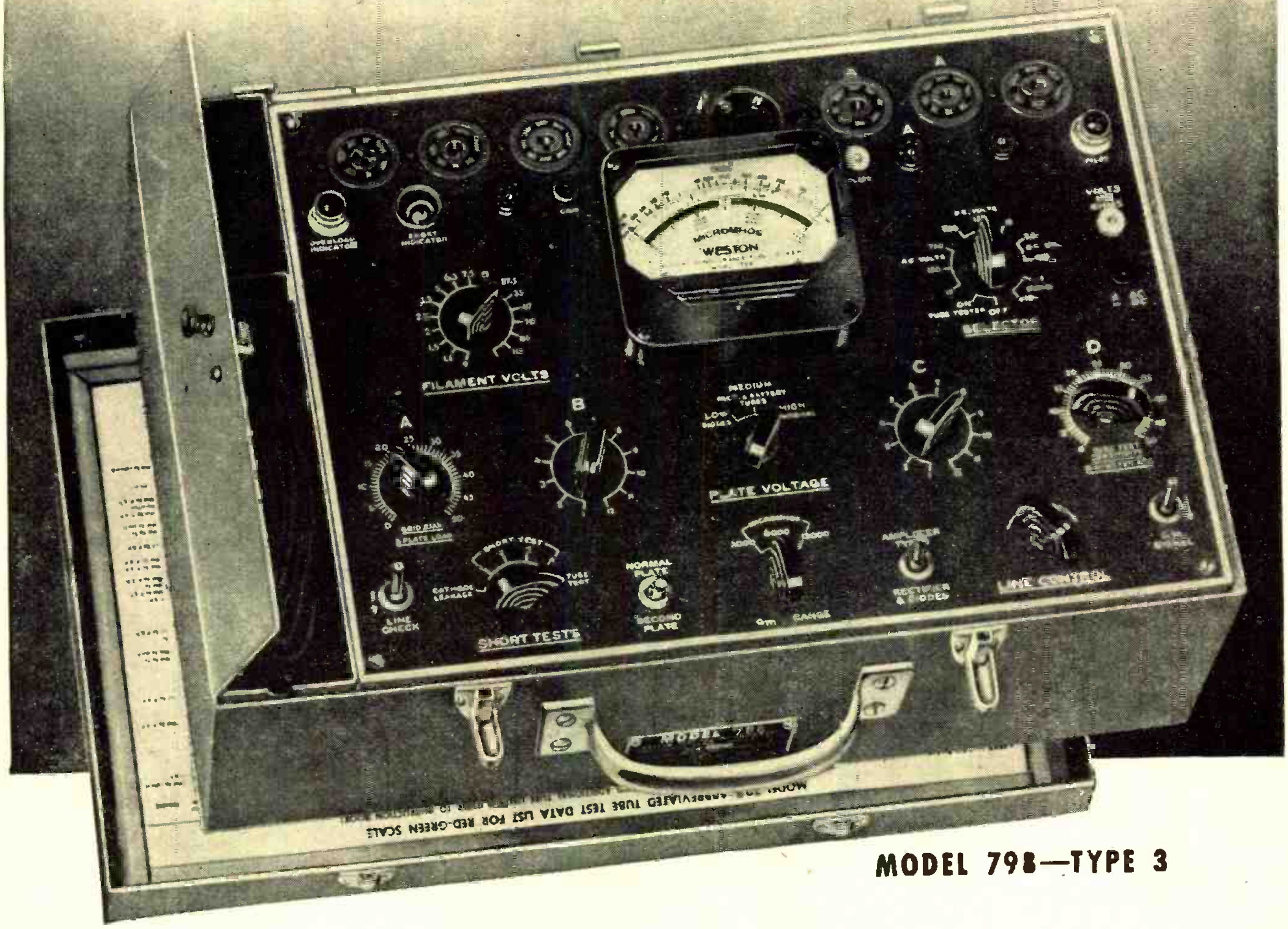

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special design of its elements, it eliminates some of interactions between the signal grid and oscillator grid that are present in some of the other types of converters. Also, the unique arrangement of its oscillator electrodes eliminates the oscillator cathode area limitation found in the triode-heptode converter.

The structure of the triode-hexode converter tube is rather unconventional. As shown at B of Fig. 10, the plate of the triode oscillator section has been removed completely from the electron stream between the cathode and mixer plate. The oscillator grid, which also forms the first grid, *G1* of the hexode mixer, completely surrounds the common cathode, the side towards the oscillator plate acting as an oscillator control grid and the side facing the mixer serving as an oscillator injection grid to modulate the mixer's cathode stream at oscillator frequency. Owing to this peculiar construction, a single enclosing grid, *G2-G4*, is used to serve the multiple function of acting as an electrostatic screen between the signal grid *(G3)* it encloses and both the oscillator injection grid and the mixer plate outside of it. The signal control-grid of the mixer is made in the form of a flat-wound grid with one-half of the windings (those facing the oscillator plate) removed. Two specially-designed metal side-shields suitably connected to the cathode prevent stray electrons from producing undesirable couplings, and also serve to isolate the oscillator and mixer sections. The fact that the plate of the mixer section is situated at some distance from the screen grid, and the extremities of the two side shields are brought sufficiently close to the electron stream to cause a point of minimum potential between the screen grid and the plate, is sufficient to result in considerably higher plate resistance than would otherwise be the case. Consequently, sufficiently high plate resistance is obtained so that a suppressor grid is not required with this construction.

The action of the 6K8 tube in converting a radio-frequency signal to a similarly-modulated signal of intermediate frequency depends on (1) the generation of the local frequency by the triode oscillator section, (2) impressing the oscillator voltage on the hexode oscillator injection grid *G1*, and (3) the electronic mixing in the hexode mixer section of this frequency with that of the r.f. signal applied to the hexode signal grid *G3*.

The oscillator injection grid *G1* is situated between the cathode and inner screen *G2* as in the pentagrid converter. In fact, the mixer portion of the tube operates in much the same manner as a pentagrid converter, with the voltage that the oscillator section impresses on injector grid *G1* causing pulses of electrons that form a virtual cathode between *G2* and *G3*. Consequently the same undesirable space-charge coupling effects and resulting

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decrease in sensitivity at the higher frequencies that are present in the pentagrid converter are present also in this tube. However, since the oscillator elements are separate and independent from those of the mixer, and sufficient oscillator cathode area can be employed, the triode-hexode converter possesses an advantage over both the pentagrid and the triode-heptode converters in that its oscillator can be designed for higher transconductance. Furthermore, the presence of the shields connected to the cathode greatly reduce all interactions between signal and oscillator sections so that the signal grid potential does not appreciably alter the oscillator plate current. Consequently, the oscillator frequency is independent of the a.v.c. bias on the signal grid. The oscillator frequency is not completely independent of screen and a.v.c. voltages, but in most designs the frequency drift caused by one is offset by the other so that excellent frequency stability is obtained.

The 6K8 tube produces less gain on the broadcast band frequencies than does the 6A8 pentagrid converter, owing to its lower conversion transconductance, although its plate resistance is higher. However, it offers better conversion gain at the very high frequencies than any of the converter tubes—in fact at very high frequencies its conversion gain rises. The oscillator section is considerably more stable than are those in the previous types of converter tubes, the frequency drift being small enough to permit the application of a.v.c. bias voltage to the signal grid at all frequencies within the working range. The drift of the oscillator frequency with variation in this voltage is much less than with the types 6A8, or 6L7, and somewhat less than with the type 6J8. Consequently, the 6K8 converter

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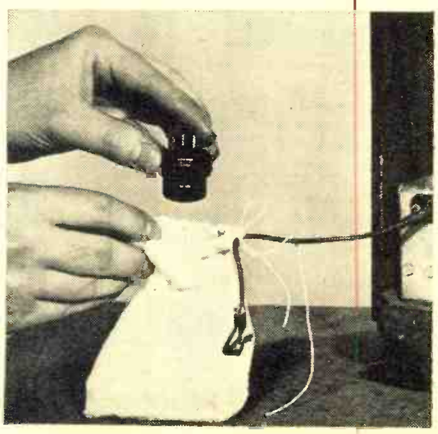

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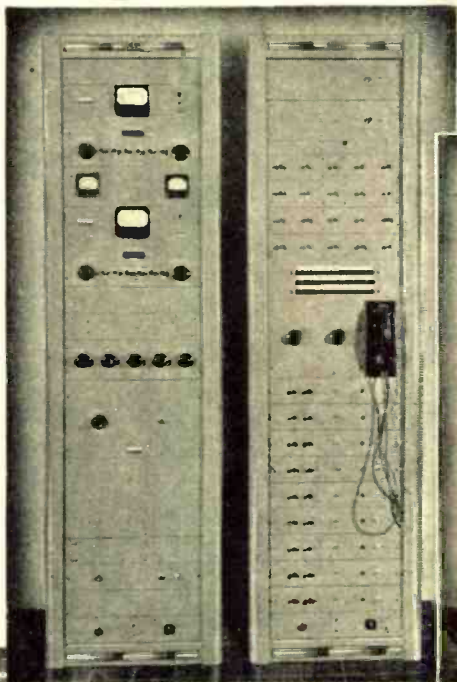

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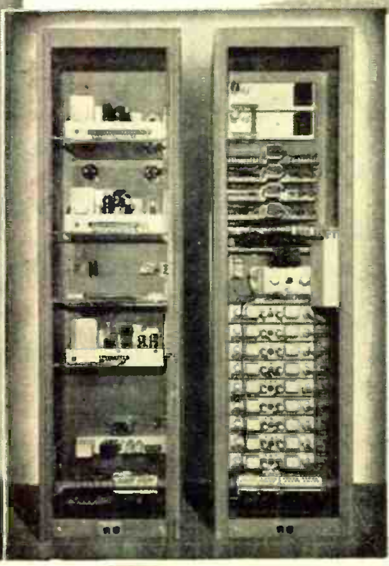

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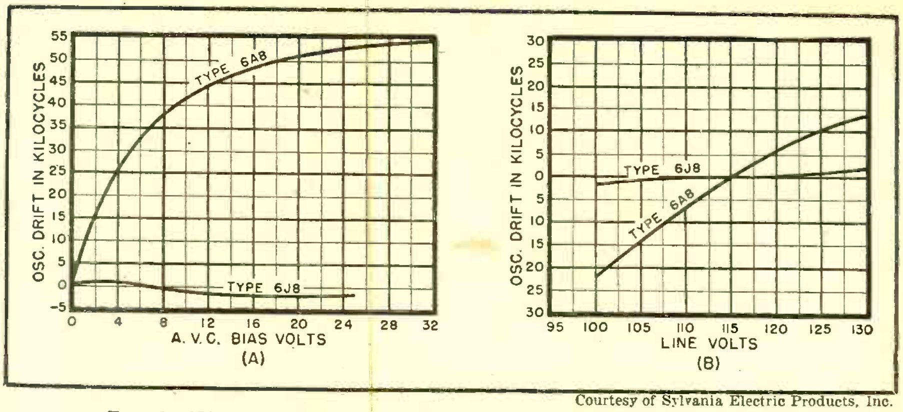


Courtesy of Sylvania Electric Products, Inc.

Fig. 9. (A) Comparison of oscillator frequency drift vs. a.v.c. bias voltage for 6A8 pentagrid converter and 6J8 triode-heptode converter at 18 mc. (B) Comparison of oscillator frequency drift vs. line voltage for 6A8 pentagrid converter and 6J8 triode-heptode converter at 18 mc.

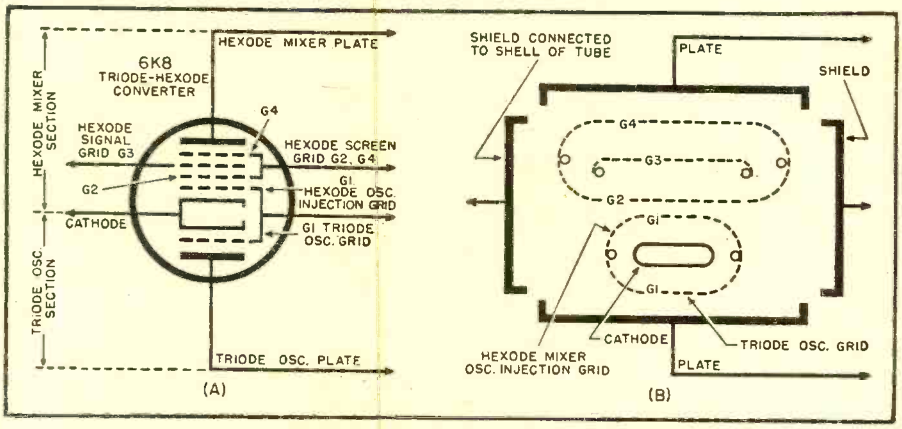


Fig. 10. Schematic representation and actual electrode structure of 6K8 and similar triode-hexode converters.

has become extremely popular for high-frequency applications, as in FM and television receivers, when a *converter* tube is required.

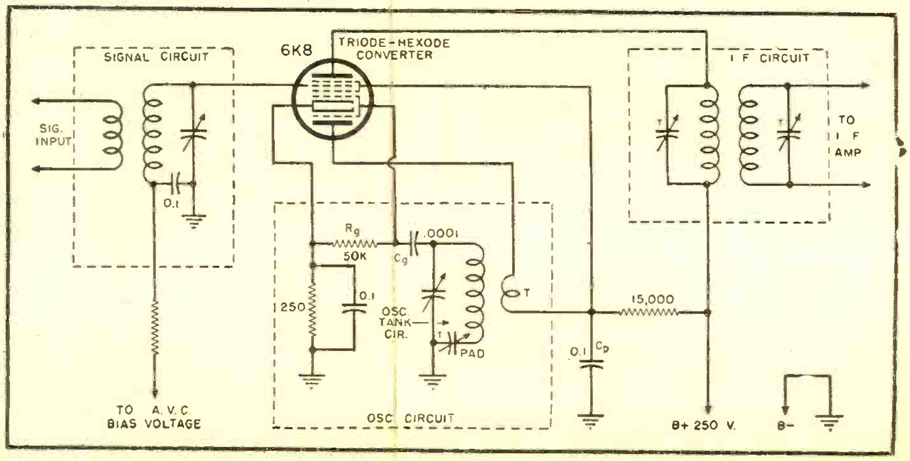
Fig. 11 shows a typical frequency converter circuit employing a 6K8 triode-hexode converter tube. Feedback for the grid-tuned triode oscillator is obtained by means of plate tickler coil *T* coupled to the oscillator tank coil.

The 6K8 sometimes shows a tendency to "motor-boat" or "flutter" because of fluctuation in the bias voltage applied to the signal grid, particularly when the bypass capacitor in the oscillator plate circuit has a high impedance. This capacitor (C_p in Fig. 11) is usually an electrolytic type whose impedance will rise as the capacitor ages and dries up.

A comparison of the gain and signal-to-noise ratios of the various types of mixer and frequency converter tubes will be presented in the next article of this series. The special types of frequency converters employed in u.h.f. and microwave receivers will also be studied.

(To be continued)

Fig. 11. An improved type of converter particularly suited to high frequency reception, such as in FM and television receivers. A 6K8 triode-hexode converter is used.



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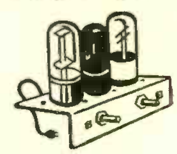

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International Short-Wave

(*Continued from page 100*)

2A3's and modulated by a pair of 833A's. Diesel power supply.

Bulgaria—*Radio Sofia* is reported now on 9.301, 11 p.m.-1 a.m., 5:30-7 a.m., 11 am.-1:30 p.m., 2-3:40 p.m., *English* at 3:30-3:40 p.m. sign-off. This station still asks for reports to Radio Sofia, Information Service, Sofia, Bulgaria.

Burma—*Radio Rangoon* is reported to have been heard on 9.54 recently at 10:30 a.m. with weak signal; probably testing but may use this frequency for regular transmissions soon. On 11.845 was heard to announce a 19-meter band frequency, but the exact frequency and time used is not known; *watch for this one!*

Canada—CKNC, 17.820, Sackville, N. B., is heard nightly at 6:25-7:30 p.m. with a new transmission in *English* beamed to the West Indies and Caribbean Area. *English* news is usually given at 6:30 p.m. and a program preview is given just prior to closing. VE9AI, 9.540, Edmonton, Alberta, usually has good signal in 1 a.m. news.

Celebes—*Radio Makassar*, 9.358, now calls its 8:15 a.m. *English* commentary (Monday-Wednesday-Friday *only*), "The Voice of Indonesia," *not* "Free Indonesia."

Ceylon—Latest *official* schedules received from *Radio SEAC*, Colombo, are as follows: 7:30-9:45 p.m., 11.77; 10:15 p.m.-6:45 a.m., 15.12; and 7:15 a.m.-12 noon, 6.075, all listed for the 100-kw. transmitter on the main beam antennas; the 15.12 frequency, however, now runs to 12 noon sign-off (paralleling 6.075), and it is presumed it uses the 100-kw. transmitter, with 6.075 using the 7.5 kw. one. The 6.075 frequency is scheduled, 7:30 p.m.-5:45 a.m., and 3.395 is scheduled 6:15 a.m.-12 noon, with 7.5 kw., for local coverage.

Colombia—HJCD, 6.160, Bogota, has *Spanish* news nightly at 10 p.m., while HJDE, 6.145, Medellin, has *Spanish* news nightly at 10:30 p.m.

Cuba—Havana's COX, 9.640, "*Radiodifusora Ministerio del Educacion*," has returned to the air and is heard to 11 p.m. sign-off, but is QRM'd by GVZ, London, on same frequency.

Curacao—PJC1, 7.250, Willemstad, "*Radio Princess Juliana*," heard strong around 9 p.m., signs off at 9:30 p.m.

Czechoslovakia—Various and conflicting reports on transmissions from Prague have been received lately; most reliable information is that OLR5A, 15.230, is being used in North American beam, 7-7:30 p.m., but it may be that *English* news is still radiated at around 7:15 p.m. over OLR4A, 11.840 with Czech *only* on 15.230. OLR2A, 6.010, is off at present.

Denmark—*Statsradiofonien* (The Danish Broadcasting Corporation) is to build a new transmitter in Copen-

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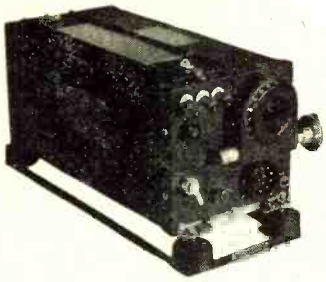
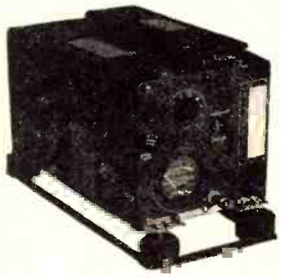
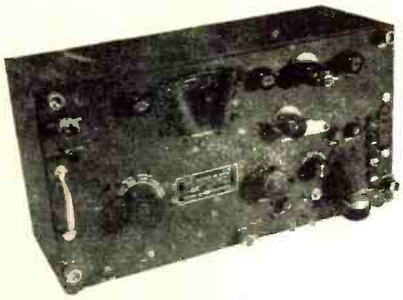


Western Electric Aircraft Radio Receiver, 187-13,950 kc. Complete with coils and six tubes $57.50

Western Electric Aircraft Transmitter, GF-11. Uses 2 - 89 and 2 - 837 tubes. Frequency range 3000-4525 and 6000-9050 kc. Output 12-15 watts. Complete with tubes and coils for operation on voice, C.W., or M.C.W., each $57.50

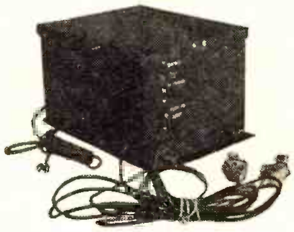




BC-342 Communications Receiver, 110V, AC Operation. Six band continuous coverage, 1500-18,000 kc.—high sensitivity—extreme stability—frequency calibrated dial — antenna compensation — crystal filter—phasing control—send receive relay. A receiver at a price hard to beat. Each $62.50

Antenna Tuning Unit, BC-939-A, 2-18 mc operation. Made for Hallicrafters BC-610, but usable on any transmitter. Parts worth in excess of price. Each $32.50

Triumph Model 333-S Multirange Tester. 3-15-150-600-3000 volts ac. and dc. 6-60-60-300 m.a., DC. 0-14-34-46 DB. 100 megohms. Used by Signal Corps but in new condition, each $27.50



Rectifier Unit RA-63-A. Use for battery charging—auto radio operation, etc.

110V, AC—12V, DC—5 amp... $16.75
110V, AC— 6V, DC—5 amp... $18.75

BC-745 "Horsie Talkie" crystal tuned receiver and transmitter. Complete with crystals and tubes, each $14.50

Chest unit for above .... $ 5.00

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hagen, according to a Swedish correspondent, who adds that the transmitter will operate on a wavelength of 3 meters, the shortest wavelength in Europe, and that if this low wavelength is successful, *Statsradiofonien* will build 10 such transmitters.

Dominican Republic—HI9T, 6.175, Puerto Plata, broadcasts late evenings to 12:15 a.m.; signs off then with the National Anthem, "Valiant Quisqueyans." Verifies with a fine, big card showing three views of Puerto Plata's beach, with general information about Puerto Plata in Spanish on reverse side of card. (Moss)

Egypt—SUV, 10.055, Cairo, is being widely heard with news relays to America around 6:20 p.m.; signals quite good. Also calls the BBC irregularly, usually around 4:30 p.m. SUX, 16.373, Cairo, calls the BBC early afternoons. SUV2, 16.100, Cairo, heard testing for New York at 1:15 p.m. with clear speech, then uses inverted speech.

El Salvador—YSS is back on the air and is heard on a *new* frequency of 9.250, recently vacated by YSR.

England—GRP, London, is reported heard daily now on 18.130, formerly used 17.870.

Finland—The Home Service is relayed from OIX1, 6.122, Lahti, 11 p.m. to 4 or 5 p.m. next day, Sundays runs 12:45 a.m.-4 p.m.; OIX2, 9.500, is believed to be in parallel. A Swedish correspondent, however, airmails this schedule for OIX2, 9.500, Bjorneborg —11 p.m.-1:50 a.m., 4-7:10 a.m., and 10 a.m.-4 p.m.

France—Here is a late list of locations and powers of French s.w. stations: Allouis I, 100 kw., 15.240, 11.730, 11.700, 9.550, 9.520; Murat I, 25 kw., 17.765, 11.845; Murat III, 25 kw., 17.850, 11.885; Realtort I, 25 kw., 15.350, 9.620; Les Essarts, 10 kw., 9.560. Excellent signals are being received from Paris nightly in the North American beam on 9.550 and 11.845, 8:55-10:45 p.m., *English* continues to be given at 9-9:30 and 10:30-10:45 p.m. sign-off.

French Equatorial Africa—*Radio Brazzaville* on 9.440, 9.984, and 11.970 is being heard now to new sign-off of 8:20 p.m., formerly signed at 8 p.m.; it is noted that the *English* news is generally read last at 7 p.m.

French Indo-China—*Radio Saigon*, 11.778, is being heard with good level early mornings here in the East; has news at 5:30 a.m. read in fluent *English* by a woman.

French Niger Territory—A French station, giving an announcement that sounded like "Neeame-Niger," was reported recently as heard early evenings on 9.982 to 9.984, interfering with *Radio Brazzaville* on latter frequency. This may be Niamey, French Niger Territory, which some years ago used 9.905, but which has not heretofore been reported in recent years.

Germany—Berlin, 6.072, is reported heard well during the opening news in *German* at 11 p.m.

DTYC, 5.3025, is a new one reported

located in Munich and testing 8-8:30 a.m.; reported as operated by the U.S., using 100 kw. Frequency was announced; asked for reports; sign-off is with "Star-Spangled Banner."

The AFN, Munich, on 6.078, is reported on at 11 p.m. with news in *English*, but suffering heavy QRM.

The British Forces Network station, 7.290, Hamburg, is sending out verifications. Officially opened April 14; operates daily now, 11:30 p.m.-5 p.m. with 50 kw. Staffed by RAF personnel; has BBC Home Relay at 3 p.m.; gives list of frequencies of the BFN at 3:30 p.m., and between 12 midnight and 1 a.m. there is a request program.

Leipzig has moved to 9.732 from 9.688 where it is heard better, with no QRM now from GRX.

Greece—*Radio Athens* is still reported heard daily at sign-on of 3 p.m., but suffers interference from the BFN station at Hamburg, Germany, on about the same frequency (actually, 7.290).

Direct from G. N. Marinos, Pallini Attikis, Greece, comes this letter: "*Radio Athens*, 7.295, is scheduled 2200-2245 local time (3-3:45 p.m. EST). Transmission is made from *"Pallini"* Wireless Station, operated by Cable and Wireless, Ltd., using a simple dipole aerial. It is expected to use proper aerial when the erection of the masts blown up by the Germans will be completed. The transmitter is SWB10, Marconi, with 2 CAT9, water-cooled valves (tubes) in the main amplifers and 7 kw. power on the aerial. The program is preceded by sheep-bells and a flute, repeated at short intervals during the transmission which contains Greek popular songs and news in Greek, *English*, and French. *Any report on this transmission from America will be welcome.*" (The *English* news normally is on the air at 3:30 p.m.).

Guam—KU5Q is now operated by Public Information Radio under the Secretary of the Navy; studios are on Mt. Aluton, southwest of Agana; shared with WXLI on BCB. The 10-kw. station is on 13.360, 9 a.m.-12 noon, sometimes is heard as early as 7 a.m.; 7.645 with 3 kw., 4 a.m.-12 noon; 18.050 is a comparatively *new* channel used. The 10-kw. station uses a HT4 as a driver for TEC Press Wireless transmitter. All transmitters feed 860-foot unidirectional rhombics. Incidentally, more reports come to KU5Q from Sweden than from any other part of the world. (Report by Fern, Guam, via URDXC)

Guatemala—TGWA, Guatemala City, recently changed from 9.760 to 9.685, heard well evenings; this station has fine marimba music. TGWB, 6.540, Guatemala City, heard nightly to 12:15 a.m. when signs off with "Guatemala So Happy"; verifies with TGW's prewar card.

Haiti—HH3W, 10.135, Port-au-Prince, has good signal evenings; also heard mornings. Uses French chiefly, but sometimes has *English* announcements.

Holland—PCJ, 9.590, Hilversum, is being widely reported in its "Happy Station Program," Wednesday and Sunday, 10-11:35 p.m. Eddie Startz, m.c., informs me that expansion of programs will take place as conditions warrant, probably by the first of 1947. It is reliably reported that the PHI call is no longer used, *only* PCJ. Regular transmission (mostly in *Dutch*) is also well received now, 8-9:40 p.m. *daily,* since WLWO is no longer operating on 9.590. Incidentally, Eddie Startz asks me to thank the FCC, WLWO, and all others who in any way made it possible for PCJ to again have a clear nightwave to the Western Hemisphere.

Iceland—Swedish observers write that sometimes TFJ, 12.235, Reykjavik, begins transmission (which is Sunday *only*) at 8:45 a.m. instead of at 9 a.m.; sign-off is at 9:30 a.m. Verifies.

India—Latest Indian schedules as reported from New York by Roger Legge are:

VUC2, 4.840, 8:15-11:30 a.m. VUD3, 4.860, 12 noon-12:40 p.m.; VUB2, 4.880, 9:15 a.m.-12:30 p.m.; VUD2, 4.960, 8:15 a.m.-12:30 p.m.; VUD3, 6.010, 8-8:30 a.m.; VUC2, 6.010, 8-10 p.m.; VUM2, 6.085, 8:30-10:30 p.m.; VUB2, 6.150, 9-9:45 p.m.; VUD7, 6.190, 10 a.m.-12:30 p.m.; VUD2, 6.190, 9-11:30 p.m.; VUD10, 7.210, 8:30-9:15 a.m.; VUB2, 7.240, 10-11 p.m.; VUM2, 7.255, 5:30 a.m.-12 noon; VUD11, 7.290, 8:45-11:10 a.m. and 12 noon-12:40 p.m.; VUD3, 7.290, 8:40-10:45 p.m.; VUC2, 9.530, 1-3:30 a.m. and 5:30-8 a.m.; VUM2, 9.565, 2-4:30 a.m.; VUD2, 9.590, 2-4 a.m. and 6:30-8 a.m.; VUD5, 9.590, 9 a.m.-12:30 p.m.; VUB2, 9.630, 1:30-4 a.m. and 5:50-9 a.m.; VUD4, 9.670, 8:40-10:45 p.m., 12 midnight- 5:15 a.m., and 7:30 a.m.-12:30 p.m.; VUD11, 11.760, 8:40-10:30 p.m.; VUD3, 11.850, 8:45-11:30 a.m.; VUD9, 11.870, 10:15 p.m.-2:30 a.m. and 3:40 a.m.-12:30 p.m.; VUD3, 15.130, 7:30-7:45 a.m.; VUD7, 15.160, 10:15 p.m.-2:30 a.m. and 3:45-9:45 a.m.; VUD5, 15.190, 8:30 p.m.-8:30 a.m.! VUD11, 15.290, 10:45 p.m.-12:30 a.m., 1:25-4 a.m., and 4:45-8:15 a.m.; VUD8, 15.350, 10:15 p.m.-2:30 a.m. and 3:40 a.m.-12:30 p.m.; VUD3, 17.760, 12 midnight-5:15 a.m.; VUD10, 17.830, 10:15 p.m.-2:30 a.m. and 3:45-8:30 a.m. VUB is in Bombay; VUC, Calcutta; VUD, Delhi; and VUM, Madras.

Italy—A Swedish correspondent says that *Radio Audizioni Italia,* Rome, is heard on 6.165, transmitting the station on 6.030.

Jamaica—ZQI, 4.700, Kingston, is scheduled *daily,* 4:30-6:30 p.m.; takes news relays from BBC; verifies.

Japan—News in *English* is reported heard at 4:30 a.m. on JLG, 7.285, Tokyo network; *English* lessons have been introduced at 4:45 a.m. on the other Japanese network—JVW, 7.258, JLT, 6.190, and JLG2, 9.505. JLU2, 9.525, is reported heard, 3-8:30 a.m. in place of JLT.

Java—Many reports continue to come regarding the various Indonesian stations now taking to the airwaves by literal "leaps and bounds." *"Radio Bandoeng"* and *"Official Station of Bandoeng"* are identifications heard on the new station on approximately 10.060; listed call letters are PLY; schedule appears to be 5:30-9:30 a.m., usually first hour in Dutch, next two in Indonesian, and last hour in Dutch. Reception is generally fair here in the East.

PLV, 9.415, is still being heard well on West Coast from as early as 4 a.m. to the usual sign-off of 7:30 a.m., occasionally later.

The new *"Radio Republic Indonesia"* on 7.960 signs off with the "Beer Barrel Polka" at times varying 8:30-9:30 a.m.; this transmitter may be in Sumatra.

Our West Coast expert on Javanese short-wave stations, Paul Dilg, after "playing around" with these transmissions for many weeks, writes me that "they do not 'stay put' and their schedules are quite irregular, sometimes signing off at 7:30 a.m. and at other times running to 10:30 a.m.; one of the best is *Radio Bandoeng,* 10.060, opens at 5:30 a.m. and usually signs off at 9:30 a.m. but may run to 9:45 a.m. some days; they are not on daily, however, as I have checked them for more than a month and have not heard them on either Saturday or Monday, and only once on Wednesday; it may be their schedule has some relation to that of PCJ, Holland, as I believe they do relay PCJ at times; I am informed that 18.135 *may be in parallel with 10.060."*

Korea—A verification received by a New Zealand DXer from JODK, 2.510, Seoul, gives power as 3000 watts, but I am informed by a correspondent in the Korean capital that the power is 5000 watts, with a capacity of 10,000 watts.

Malaya—Complete schedule of Singapore's 4.780 transmitter is 5:30-10:30 a.m., with *English* news at 9 a.m. On 7.220, Singapore is scheduled 11:30 p.m.-1:30 a.m. with *English* news at 12 midnight.

Mexico—XERQ, 9.610 (announced), Mexico City, heard from 10 p.m. to sign-off at 1:03 a.m.; is one of a chain of five or six stations known as *"La Cadena de Radio Continenta"* (Continental Radio Network). Best after midnight. (Moss)

New Caledonia—A letter just in from the Directeur du Service de l'Information, New Caledonia, indicates that transmissions *(all in French)* are on the air daily at 7 p.m., 8 p.m., 2 a.m., 2:30 a.m., and 4 a.m., on a frequency of 6.210 (48.32 m.). No other information on *Radio Noumea* was given.

New Zealand—ZLT7, 6.715, Wellington, is being widely received now throughout the United States, *daily,* in *English* news period, 4:30 a.m.; sometimes signs on shortly after 4 a.m. with music. Will verify, address ZLT7 in care of the National Broadcasting Service, Wellington, New Zealand. Officials there advise that the two new 7½ kw. transmitters are being installed at Titahi Bay and will operate on the previously-reported frequencies of 6.080, 9.540, 11.780, and 15.280; these long-promised stations are being eagerly awaited by DXers all over the world!

Norway—Bengt Jonsson, Sweden, has received this reply from the Klofta station: "The short-wave station Klofta transmits on 6.200 (48.39 m.); power is 10 kw.; and operation time is 1630-2200 GMT (11:30 a.m.-5 p.m.)."

Palestine — After an absence of about a month, the Jewish Underground transmitter, *"The Voice of Israel,"* was reported to be back on the air in August; frequency is reported as 6.589, heard at 7 a.m. in Hebrew, with *English* on the Sunday period *only.*

A late report indicates that the *Sharq-al-Adna* stations at Jaffa, on 6.135, 6.710, and 6.790, now sign on at 10:30 p.m.; station can be recognized by its signature tune of Arabic music, followed by the announcement, *"Mahattat Asharq-al-Adna."* Usually runs to 12:30 a.m. Often has setting-up exercises at beginning of transmission. A test program in *English* is reported from another source as on the air *Saturdays,* 1-5 p.m. Additional frequency of 3.320 is listed in operation. Verifies.

Panama — HP5H, 6.122, Panama City, parallels 900 kcs., 7 a.m.-11 p.m., but on Fridays runs to 12 midnight, and on Sunday signs off at 10 p.m. Sign-off is with "The Thin Red Line" and National Anthem. HP5G, 11.780, Panama City, heard evenings to 10:30 p.m., signs at 9:15 p.m. Sundays; sign-off signature is National Anthem, "At last, we've attained final victory." *English* is used irregularly.

Peru—OAX6B, 6.038, Arequipa, *"Radio Landia,"* heard to midnight. OAX4Q, 6.010, Lima, *"Radio Victoria,"* heard irregularly Sundays to 3 a.m., relays OAX4X. OAX4M, 6.315, Lima, signs off at 12 midnight with "Lover, Come Back to Me." OAX4W, 9.390, Lima, broadcasts nightly to 11:45 p.m. sign-off with chorus singing Peruvian National Anthem, "For long the oppressed Peruvian dragged his hateful chain." (Moss)

Philippines—KZRH, 9.640, Manila, is reported scheduled 5 p.m.-11 a.m., and is heard fair here in the East early mornings, but has QRM from XGOY, Chungking, 9.635 (listed, but appears on exactly 9.640); KZRH announces as *"The Voice of the Philippines"* and has a medium-wave outlet on 750 kcs.; this station, destroyed during the war, is now run by RCA, is being widely heard, plays records a great deal, and announces in *English.*

Poland—*Radio Warsaw,* 6.1149, now has *English* news at 3 p.m.

Portugal—CSW3, 11.035, Lisbon, is heard 1:55 p.m. on, has severe fade. (Bromley) A Swedish reporter, Carl-Eric Petersson, lists CS2WI, 12.400, Parede, as heard *daily,* 6:45-9 a.m. and 1:30-5:30 p.m., and says CSW6 (which he lists on 11.040) is scheduled, 4-6 p.m.

Roumania—*Radio Bucharesti,* 9.255, uses a 7-note musical chime before identification at 11:30 a.m.

Siam — *Radio Bangkok,* approximately 5.99, has a greatly improved signal now, but a short peak, signs off around 9:30 a.m. (This report comes from Paul Dilg, Monrovia, California, who, after listening to the station for some months, still comments, "I *hope* this is Siam." Reports from "down under" confirm this *"hope"* as factual.)

Spain — Swedish observers report that the *English* transmission from *Radio Nacional de Espana,* Madrid, on 9.370, Tuesday, 3-3:30 p.m., is heard at good level there. On Sundays, this station has *English* between 3:45-4 p.m. It is also reported from Sweden (by Hansson) that EDV10, 7.100, *"Radio Seu,"* Madrid, is on the air, 3-6:30 p.m. and that verification has been received.

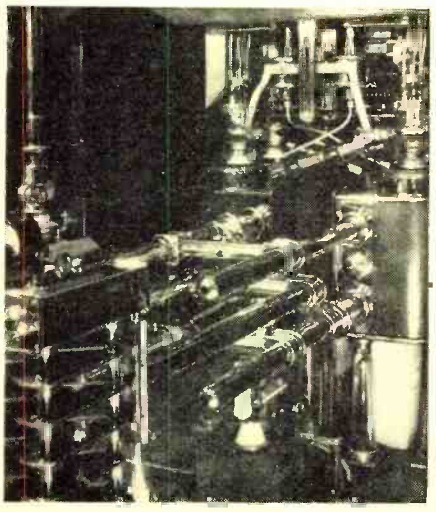
South Africa—ZRK, 5.878 (varying), Capetown, is the most widely reported South African, heard well 11:45 p.m.-1:30 a.m., relays the BBC news from London at 1 a.m.

Sumatra—A station heard on about 7.448, signs off usually at 8:30 a.m., but later some mornings, is believed to be Sumatra.

Surinam—PZC, 15.405, Paramaribo, heard at 1:26 p.m. calling Amsterdam, Holland, then went to inverted speech. (Bromley)

Sweden—In about 3 years, two new 100-kw. stations are expected to be completed at Horby, in southern Sweden. (Skoog)

Switzerland—HER3, 6.165, Bern, has replaced HEI2, 6.345, in the North American beam, 8:30-10 p.m., *except Saturday,* but signals are not as strong as on 9.539 which continues in dual. HER6, 15.305, Bern, is being heard *Saturdays,* 10 a.m.-12 noon, beamed to Africa. A new frequency assigned to



Power amplifier and transmission line coupling for 100 kw. transmitter, VLA, "Radio Australia." VLA was designed and built in Australia during the war. Good reception of its signals have been reported from all countries except from those in South America.

Bern, but not in use yet, is 9.545 with a call of HED5. HBZ3, 14.462, Geneva, is heard Sunday, 12 midnight-1 a.m., to Australia, but is better on the Bern transmitter, HER5, 11.865, in dual. (Legge, VRC) This Australian transmission via 11.865 is best current signal from Bern to the West Coast.

Uruguay—CXA6, 9.623, Montevideo, *"Radio Electrica,"* is on the air, 10 a.m.-12 noon and 3-9 p.m. (Petersson, Sweden)

U.S.S.R.—Kiev has replaced 6.020 with 11.718 in the relay of Moscow to North America, 6:20-9 p.m., but usually has QRM from Bern until around 8 p.m. A Pennsylvania DXer reports hearing Moscow on 15.442, beamed to England, with *English* news at 1 and 3 p.m.

Announced Moscow schedules to North America are—7:20-8:15 a.m.—17.82, 15.36, 15.17, 11.63, add 15.23 and 11.88 at 7:45 a.m.; 6:20-9 p.m. (some nights to 9:15 p.m.)—15.17, 11.72 (*new*, and usually at good level), 11.83, 9.48, with 15.44, 15.23, and 11.88 (all believed to be Komsomolsk, Siberia), 6:20-7:30 p.m. *only*. Morning news is at 7:30, 8 a.m.; evening news, 6:30, 7:30, 8:30, and Moscow Newsreel is usually at 7, 8 p.m.

The Latin American beam, 7:30-10:00 p.m., is radiated on 11.89 and 9.71, usually weak.

Vatican—HVJ, 15.095, is reported, 1:03-1:35 a.m. *Tuesdays*, with Papal appointments and church personal messages; at good level and in the clear. (URDXC) A Swedish correspondent reports HVJ, 15.120, is heard in *English* at 9-9:20 a.m. Kernan, Massachusetts, reports HVJ, 17.445, Tuesdays, 10:15-10:40 a.m.

Venezuela — YV5RN, 4.920 (announced), Caracas, verifies with a colored postal card showing a silver microphone rising from the city of Caracas on a map of Venezuela. YV5RU, 4.860, *"Ondas Populares,"* Caracas, heard in usual nightly broadcast to 11:30 p.m., Saturdays to 11 p.m., in the clear; signs with National Anthem, "Honour to a Brave Nation," as do nearly all other Venezuelan stations. (Moss)

Yugoslavia—*Radio Belgrad*, 9.420, is reported heard in New York at 2:30 p.m. with announcements in broken *English;* three sets of chiming tones, and occasionally three toots on a horn, are used as identification. (VRC)

* * *

Last Minute Tips

As promised to me some weeks ago by Fung Chien, Director of XGOY, The Chinese International Broadcasting Station, Chungking, the early morning news at 6 a.m. EST has been reinstated for the benefit of listeners in the Eastern United States and Canada, and is heard well now on 9.635 (listed, but actually appears here to be on 9.64), but there is sometimes a severe heterodyne (probably from KZRH, 9.64, Manila, the Philippines). This news is read by a woman announcer in fluent *English* and station identification is given, also in *English*, at the beginning and end of news period. This affords a good opportunity for those who wish, to verify Chungking. Verification is by letter. (This news period is referred to as "the 7 o'clock news" by the XGOY reporter.)

A widely reported *new* station is HOXA (reported by some as HOXC), Panama City, Republic of Panama, on an announced frequency of 15.000, which has been testing afternoons and evenings. Announcements have been reported as in Spanish, *English*, and German. Reports are requested and some have been acknowledged over the air. Expects to go on regular schedule this month (October). Address: W. T. Morrison, Chief Engineer, Radio Station HOXA, Box 1335, Panama City, Republic of Panama. Announces as the "Voice of Central America." Tests reported heard as late as 11.55 p.m., with *English* period running from 10:55 p.m.; afternoons is heard around 4:15 p.m., on some days earlier.

JLU2, 9.525, and JLV2, 11.845, Tokyo, are reported around 6:30-7:30 a.m. contacting RCA, San Francisco, good level. (Brewer)

From Eva Deak, Section of Foreign Relations of the *Hungarian Radio*, Budapest, comes this message: "Unfortunately, due to the destruction caused by the Nazis, we are unable to transmit on short-wave for the time being. The new, democratic *Hungarian Radio* makes great efforts in the work of reconstruction and we hope that our short-wave station will be in operation before long. All depends on surmounting the technical difficulties and the great shortage of raw material. We shall let you know as soon as we shall be on the air again."

Bill Croston, Ohio, reports hearing *English* news at 8:45 a.m. from *Radio Rangoon*, 6.035, Burma. Also, *Radio Saigon*, 11.778, French Indo-China, is heard signing off the *English* program at 9:30 a.m.; All-India Radio on 15.160, usually has *English* news at 9:30 p.m.; Singapore on 15.275 is being heard with *English* news at 7:15-7:30 a.m.

ZQP, 7.226, Lusaka, Northern Rhodesia, is heard best on *Sunday*, 4-5:30 a.m. (This program *should be in English*.) (Kernan)

ZFY, 6.000, Georgetown, British Guiana, carries the BBC news (sometimes) at 7:30 p.m., just prior to closing down; sometimes has its own "Caribbean News." (Aldridge)

From New York, Carl Beck reports *Radio SEAC*, 11.77, Colombo, Ceylon, is on 7:30-9:45 p.m., and relays the BBC news at 8 p.m., at good level until KCBR signs on at 8:30 p.m. He also reports OLR5A, 15.23, Prague, Czechoslovakia, still used to North America, 7-7:30 p.m., with *English* news around 7:07 p.m., and OLR4A, 11.84, also Prague, at 12 midnight-12:20 a.m. in *Czech*; the *Sharq-el-Adna* stations at Jaffa, Palestine, on 6.135, 6.71, 6.79, now begin at 10:30 p.m. with setting-up exercises in Arabic, signals fair to inaudible; Warsaw, 6.100, does not *always* broadcast as late as 8 p.m., but does so on Wednesdays and Saturdays, has heavy QRM; ZPA3, 11.87, Asuncion, Paraguay, now has a clear channel except for Bern, 11.865, Switzerland (during the Swiss Latin American beam from 6:30-8 p.m.); Bern has a broadcast in German and French on 9.539 and 6.165, beginning at 12:20 a.m., seems to be a relay of their Home Service.

OTC2, 9.738 (varying), Leopoldville, Belgian Congo, is beamed to South America and the Philippines, 5:45-6:10 p.m. Brazzaville's afternoon *English* news at 1:45 and 3:45 p.m. is heard well on 11.97 and 17.530 (but I notice that some days the 17.530 frequency does *not* carry the *English* news). *"The Voice of America in Hawaii,"* KRHO, Honolulu, 17.80, has English news at 4 p.m., good signal. (Harvey)

Martin Harrison, England, reports *Radio Wien*, Vienna, Austria, as heard signing off at 3 a.m., and on the air, 7-9 a.m., at 11 a.m., and *after* 5 p.m. on 9.875; announces as *"Radio Linz,"* identifies with clock ticking. Also, OLR4A, 11.840, Prague, Czechoslovakia, is heard in *English*, 2:30-3 p.m., identifies as "Praha," and often has woman announcer; SUV, 10.055, Cairo, Egypt, heard often around 1:30 p.m. with Radio Newsreel pickup for the BBC; DHTB2, 15.860, Frankfort, Germany, phones WBE irregularly around 1:30 p.m., usually also works in 15-meter band; DHTH, 13.250 (approximately), Nuremberg, Germany, is heard irregularly on this channel; IQD, 14.730 (approximately), Italy, works WOK around 1-2 p.m. in *English*, then goes into inverted speech; FXE, 8,015, *Radio Levant*, Beirut, Lebanon, is heard 10 a.m.-4:10 p.m., mostly in French and Arabic, but has *English* news at 10 a.m. and 1:30 p.m., weak signal; Poznan, 9.530, Poland, heard coming on the air at 4 a.m., uses trumpet and piano interval signal; EAJ5, 7,035, Valencia, Spain, schedule apparently is 2-6:30 p.m., has bad QRM, and frequency varies; *Radio Falange*, 7.951, Alicante, Spain, sign-on believed to be 2:30 p.m., both this and EAJ5 anounce as *"Radio Nacional de Espana"*; Singapore's 9.558 transmitter is heard in England working the BBC to 10:45 a.m. with pickups and messages, in the clear. Mr. Harrison reports that the AES station at Rome, 6.135, is "only temporarily off the air," according to letter received.

Brazil's PSH, 10.220, heard signing off at 6 p.m. in Portuguese; BFN, 7.290, Hamburg, Germany, heard signing on at 11:30 p.m. with good signal; *Radio Milan*, 11.810, good around 3:15 a.m.; NICO, 9.140 and 11.240, Atom Bomb Expedition, heard almost every morning around 6 a.m.; NCLG, 9.280 and 10.640, heard irregularly mornings with fair signal, contacting *Panamint* and others. (Ferguson)

Radio Dakar, 11.715, French West Africa, is widely reported with good signals, 2:15-2:30 a.m. (all in French).

VLA8, 11.76, Melbourne, in the Pacific-Southeast Asia beam, mornings, relays the BBC news at 6 a.m.; announces VLC6, 9.615, Melbourne, as in parallel. (Miller)

VLA4, 11.77, and VLC, 15.320, heard testing around 1-1:30 a.m. to Switzerland recently. Described VLA4 as "our new 100-kw. transmitter." (Beck)

Paris is still jumping from 11.845 to 11.886, irregularly, 9:30-10:45 p.m. and 12-12:45 a.m. Canada has been heard testing to Australia over CHOL, 11.72, 2-2:40 a.m., each test lasting 4 minutes. VLQ3, 9.66, Brisbane, Australia, is back on its old schedule, signing off at 2:15 a.m. Melbourne's VLG5, 11.88, has replaced VLG10, 11.76, early mornings, news at 9:30 a.m., with sign-off 15 minutes later. London's GWT, 9.675, is being heard 11-11:50 p.m. in Russian. VUD5, 9.59, Delhi, India, is now heard to 12:15 p.m., news at 9:30, 10:30 a.m. Singapore's SEAC, 15.275, 11.735, and 6.77, is being heard from 4 a.m. on to sign-off at 9:30 a.m. now, with last *English* news at 9:15 a.m.; the 15.300 frequency, announced as in parallel, is not audible on West Coast. The station on 7.46, reported as Sumatra but may be Java, signs off at 9:30 a.m. Borneo's *Radio Balikpapan*, 9.125, which appeared to be off the air for a while, is being heard again to 9:30 a.m. XGOY, 11.92, Chungking, is being heard 9:45-10:40 a.m., with *English* news at 10 a.m. PLP, 11.000, Bandoeng, Java, heard 4-6 a.m. or later, weak to fair signal. The Java station on 10.060, believed to be PLY, is strongest and clearest signal from Indonesia, usually signs off at 9:30 a.m., some mornings a little later. (Balbi)

VONH, 5.970, St. John's, Newfoundland, signs off at 9 p.m. (Bromley)

VE9AI, 9.54, Edmonton, Alberta, Canada, can be heard now at 8:15 a.m., as soon as VLC5, Melbourne, leaves that channel. (VRC)

Masts and wires of the 200 foot directional array from which "Radio Australia's" programs are beamed to Japan and the Pacific.

CKRX, 11.720, Winnipeg, Manitoba, Canada, sends a nice signal to the East now at 10 p.m. when news is given. (Harris)

From Australia, it is reported that VLA3, 9.680, Melbourne, is to have special DX programs to British Isles, 10:45-10:57 a.m. *Saturdays,* and that VLC9, 17.840, Melbourne, will have similar programs *Saturday* evenings, 8:10-8:30 p.m. for the U.S. and Canada. (VRC)

An airmail letter just in from F. P. Chen, director, The Shanghai Broadcasting Station of the Central Broadcasting Administration, XORA, address 7, Chung Cheng Road (Western), Shanghai, China, indicates that XORA operates on "11.690 megacycles in the 25-meter band," although Chungking lists it on 11.780. Director Chen reported that "this Administration is making certain additions and alterations to our broadcasting facilities and we shall keep you informed on any and all changes which may be made in the future. *We send verification cards and/or letters in reply to all communications received by this Administration* whether accompanied by IRC or not." (Schedules, listed as enclosed, did not accompany the letter.)

Radio Centre, 17.820, Moscow, is being heard at 10 p.m. in Russian. (Bromley)

Announcing at VLA8, 11.760, Melbourne, *Radio Australia* is being heard early mornings here in the East with powerful level; English news is at 7:30 a.m.; is beamed to Pacific area. (deBrier) Is like a local at my listening post here in West Virginia. VLC6, 9.615, Melbourne, is heard daily at 4 a.m. signing on with excellent signal, reports Green, Indiana.

KLL, 13.79, San Francisco, calls Hawaii at 11 p.m. and has news relay at 11:30 p.m. (Kernan)

VUD5, 15.190, Delhi, India, is being heard well in Ontario at 9:30 p.m. in *English* news, goes into an Indian dialect at 9:45 p.m.; clear, steady. (Bromley)

Sweden is best heard in the East between 11 a.m.-1:15 p.m. on SBT, 15.155. (Kernan)

SUX2, 16.737, Cairo, Egypt, is usually heard Sundays, 9-9:50 a.m. in Massachusetts. (Kernan)

XEBT, 9.625, Mexico City, sends good signal in the evenings; identifies in Spanish as "*Stacion XEBT emissora de Mexico.*" (Novak)

According to an article on "Singapore Radio" in Kortvags-Lyssnaren (Sweden), the Blue Network of Malaya handles *English* and Malayan programs, while the Red Network is used for Chinese and Indian programs. Schedule on 4.870 is listed as 11:30 p.m.-1:30 a.m., 5:30-7:15 a.m., Blue Network; 7:15-9 a.m., Red Network; and 9-10:30 a.m., Blue Network. On 7.220, 11:30 p.m.-1:30 a.m., Blue Network; 4:30-8:30 a.m., Far East Service. And on 11.860, 4:30-9:30 a.m., Far East Service.

Radio Martinique, 9.708, Fort-de-France, Martinique, is heard well evenings, to 7:55 p.m. sign-off. HH2S, 5.948, Port-au-Prince, Haiti, is heard best evenings around 8:45-9 p.m., with announcements in French and *English*; slight CWQRM. (Novak)

Leopoldville, 17.770, Belgian Congo, is heard afternoons to 4:45 p.m., no *English* noted; modulation appears poor.

As this copy was being made up, a flash came in from John Znaidukas, Philadelphia, that Bern is to use higher frequencies to North America during late summer and early autumn (he understood announcement as 16.32 for First Transmission and 11.865 for Second Transmission.

Mr. Znaidukas confirms my hearing VLA3, 9.680, Melbourne, in a 4:45-6:30 p.m. beam to "British and Allied Forces in the Pacific, Asia, and Northern Europe." He reports they mentioned a transmitter on 34.90 meters as in parallel, but a recent Sunday I heard them say they were using a VLC- in the 19-meter band as a parellel station; asked for reports to Radio Australia, Melbourne. (This transmission, if continued, should grow better as the season changes.

XEFT, 9.548, Vera Cruz, Mexico, heard at 12 midnight. XEBT, 9.625, Mexico City, heard signing off at 1:15 a.m. XEWW, 9.500, Mexico City, heard signing off at 1:10 a.m. (Brewer)

Radio SEAC, Singapore, is now scheduled 3:45-9:30 a.m.; two new frequencies have been added—15.275 and 15.300; at times the 19-meter band frequencies carry a different program, but for some programs (including the *"Voice of Britain"* period) are in parallel with 6.770 and 11.735. Starting August 1, the *English* periods are at 3:45, 6:30, 7:30, and 9 a.m. Here in the West the 19-meter band frequencies do not open up early, but I believe in the East these should be good around 6 a.m. As to *Radio Balikpapan,* 9.125, Dutch Borneo, this "sleeper" is back again after being inaudible for a month; probably has the same schedule, to 9:30 a.m. sign-off, but even now some mornings is not heard at all; program consists chiefly of "canned" music. Since *Radio SEAC,* Colombo, Ceylon, is using the 15.120 frequency now to 12 noon, in parallel with 6.075 (from latter's 7:15 a.m. sign-on), it is presumed that the 100,000 watt xmtr is in use on 15.120 as 6.075 is now much weaker than formerly and generally fades out around 9:30 a.m. At sign-off, the announcer states the 15.120 station will return "tomorrow morning at 6 a.m., Indian Standard Time" (7:30 p.m. EST). (Dilg)

Mr. Dilg reports that XGOY has been using 11.920 around 9:30 to 10:45 a.m. sign-off, carrying the *English* news at 10 a.m., with 7.152 in parallel; and that XGOY on 9.635 is not being heard then, is either smothered by QRM or has been replaced around 9:30 a.m. by the 25-meter band transmitter (logical move to escape interference from KZRH, returned to the air on 9.640). However, the 9.635 frequency is still heard as late as the 8 a.m. *English* news period. Says, on

6.035, *Radio Rangoon* is now scheduled, 6:15-8:30 a.m., all in Hindustani and Burmese. He maintains that although Madras, India, schedules for 7.255 give sign-on at 5:30 a.m., he hears them "coming on at 9:15 a.m."

A later flash from Mr. Dilg says: "Rangoon now on 9.545, 8:45-10:15 a.m., replacing 11.845. Java, 10.060, now irregular. Indonesian on 9.865 signs off *English* program at 8:30 a.m., continues with Indonesian languages until 8:45 a.m. or later. Singapore is still on approximately 9.55, with news at 9 a.m. Japan is using 6.67/8 in dual with JLG, 7.285, 8-8:30 a.m. Have not heard Canton, 11.65, China, lately. *Radio Balikpapan,* 9.125, Dutch Borneo, not heard lately, may be off the air again. Java, 11.000, heard weak to 8 a.m. *Radio Makassar,* 9.358, Celebes, is only reliable Netherlands East Indies station."

Last flash in before deadline is from August Balbi, Los Angeles, who reports Singapore *is* on 15.31 in addition to 15.275, 11.735, 6.77, mornings; that VUD5, 15.19, Delhi, is heard at 6:30 a.m. with *English* news; that the Aussies announce at 7 a.m. as being on VLA8 and VLG5, "find 11.76 excellent, 11.88 fair, so VLA8 must be on 11.76." Also, "Swiss woke up at last by putting HER5, 11.865 on instead of 6.165, continue to use 9.539 in dual, to North America, 8:30-10 p.m., HER5 is good here. *Radio Rangoon,* 9.54, is being used from Burma, 5:45-7:15 a.m. with news at 6:15 a.m. Java stations are a 'mess'; PLP, 11.000, on still at 7:30 a.m.; PLV, 9.41, is off; PLY, 10.060, is off; PLU, 9.87, heard at 6 a.m. on, fair. Balikpapan phone only near 7-7:30 a.m., with 7.46 fair, 7.96 also fair."

* * *

Acknowledgements

ALBERTA — VE9AI. ALGERIA — Eileen Reis, "The Voice of American in North Africa." ANGLO-EGYPTIAN SUDAN—Public Relations Office, Khartoum. AUSTRALIA — Gillett, *Radio Call;* Maher, *Radio Australia,* Hallett; Clark, V.R.I. Wireless Club. BRITISH-COLUMBIA—Park, Cooper. CALIFORNIA—Balbi, Dilg, WestDyke, Beaty. CEYLON—Radio Unit SEAC. CHINA—F. P. Chen, XORA. COLORADO—Woolley. CONNECTICUT — Georges. DISTRICT OF COLUMBIA — Havlena. ENGLAND — BSWL, Rowden, Cheffins, Harrison, Hayes, Short Wave News, Harris, ISWC FLORIDA—Rowland. GERMANY—Sudwestfunk, Baden-Baden; AFN. GREECE—Marinos, Pallini Attikis. HOLLAND — Startz, PCJ; Koelmans. HUNGARY — Eva Deak, Hungarian Radio. ILLINOIS—Hofert. INDIA—The Madras Radio Co. INDIANA—Green. KENTUCKY —Harvey. LOUISIANA—Miller, Brennecke. MARYLAND — Weyrich, Grivakis. MASSACHUSETTS — Kernan, Harris, Sohlberg, French, Forsberg. MISSOURI—Kierski, IRT. NEW CALEDONIA — Directeur du Service de l'Information. NEW JERSEY — Wooley, deBrier, NNRC. NEW YORK

—Kentzel, Yates, Beck, Legge, Australian News & Information Bureau, BBC, Contoupie, Wohl, Taylor. NEW ZEALAND—Cushen, Milne, Barr, Gray, *N. Z. DX-Tra,* Watson. NORTH CAROLINA — Aldridge, Ferguson. OHIO—Novak, Croston, Sutton, Riggle. OKLAHOMA — Brewer. ONTARIO—Brockett, Moss, Bromley. OREGON—Hayre. PENNSYLVANIA —Jones, Znaidukas, Cooley, Callahan; Hankins, VRC; Gonder. POLAND—Polskie Radio. QUEBEC—Gauvreau. SOUTH AFRICA—Ecksteen. SWEDEN—B. Jonsson, Frick, Kortvags-Lyssnaren, Forrstrom, Skoog, Roster i Radio, Nattugglan, Hansson, Jardenius, Lindhe, Astrom, Thomasson, Petersson. TEXAS—Giles, Rice, Spoonts. VIRGINIA—Mayo; Howe, URDXC; Norris. WEST VIRGINIA—Rupert.

—30—

Midget Transmitter

(Continued from page 34)

voltage divider R_{17}, and choke CH_2. The 200 and 300 volt potentials then may be taken from R_{16}. The writer would point out, however, that the extra filter appears to give improved stage isolation and this desirable feature more than justifies the slight additional cost if the reader is inclined to use the extra filter anyway.

The relay terminals are connected in series with ground and the high-voltage center tap of the power transformer. These terminals, which are on the back of the chassis, are visible in Fig. 6. The entire transmitter is placed out of operation when these terminals are not connected together by an external send-receive relay or switch. However, the tube heaters are not extinguished unless power switch S_1 is opened. The transmitter goes into operation quickly and cleanly when the relay terminals are "shorted."

Layout

The author's transmitter layout is given in Fig. 4. This drawing should be compared with the photographs, Figs. 3, 5, and 6.

The reader is at liberty to employ another sort of layout, provided the usual rules governing arrangement of audio and r.f. circuits on the same chassis are followed. These, briefly are: The input speech amplifier stage must be positioned as far as possible from both the r.f. and power supply components; the modulation transformer must be mounted in such a position (which must be determined by experiment) that it does not pick up hum from the power transformer or filter chokes; the two r.f. tank coils must be mounted a reasonable distance apart, in such a position that their turns are at right angles, in order to prevent feedback coupling; and all parts must be mounted in such position that connecting leads can be made as short and direct as possible. It will be found advanta-

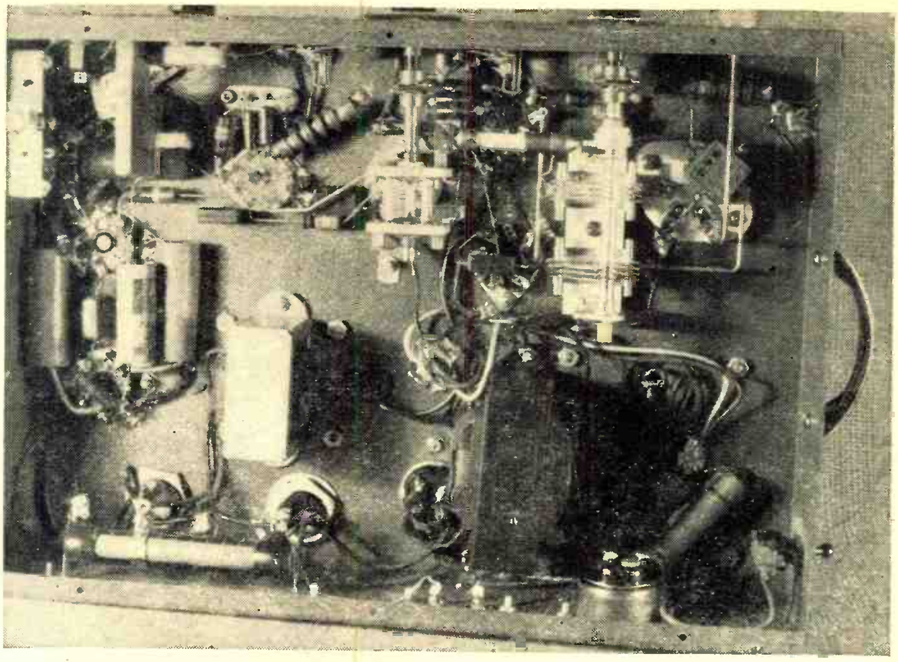


Fig. 5. Under chassis view. Note shield partition (upper left) for 6SJ7 stage.

geous to wire all tank circuit leads with rigid conductor such as No. 14 bus wire.

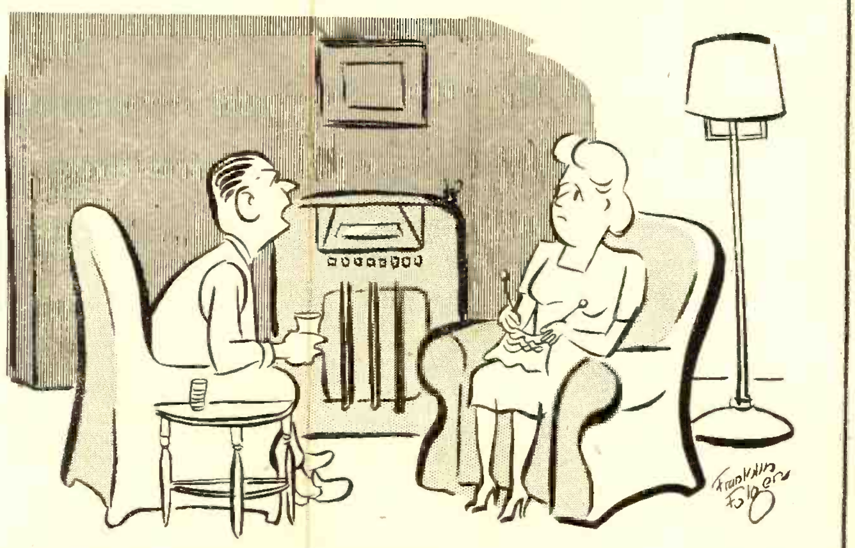
The under chassis photograph, Fig. 5, shows wiring and the mounting of parts beneath the chassis. Note that the variable tuning capacitors are mounted as close as practicable to corresponding coil sockets. Fig. 5 may be compared with Figs. 3, 4, and 6 in order to examine the author's layout more critically.

The rear view, Fig. 6, shows placement of the line cord receptacle and relay terminals, as well as components mounted on top of the chassis.

The chassis shown in the photographs is 14" x 10" x 3" in size. The ventilated cover is 6¼" high. An amplifier foundation unit was used, since this was the only thing to be found in town that resembled a cabinet. After completing the transmitter, it seemed a good idea to have used the foundation unit.

Tuning Up

(1) Set R_9 to *"Off"* position. (2) Insert desired crystal into crystal socket. (3) Plug corresponding coils into oscillator and amplifier coil sockets. (4) Plug 0-5 d.c. milliammeter into jack J_1. (5) Temporarily remove connection between RFC_3 and R_{16} to remove plate-screen voltage from final amplifier. (6) Connect single-pole, single-throw switch to relay terminals but leave switch open for time being. (7) Insert line plug into 115 volt a.c. outlet. (8) Close switch S_1 and allow about 3 minutes for tube heaters to stabilize. (9) Close switch across relay terminals and quickly adjust sliders on R_{17} to give the 200 and 300 volt potentials indicated in Fig. 2. (Use voltmeter having sensitivity of



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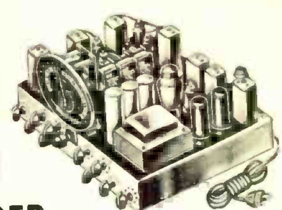

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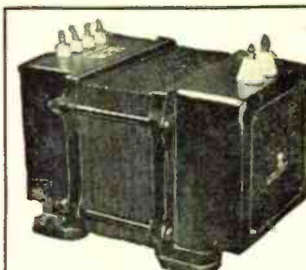

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1710v- 7ma; 2.5v @ 3a; 6.3 @ 3a	7.95
1600v- 2ma; 2.5v @ 1.75a; 6.3 @ .6a	7.50
1230v—tap at 630v—150ma, 500v 2ma, 100v-2ma; 6.6 @ 8a; 6.3 @ .6a; 5v @ 3a; 2.5v @ 1.75a	9.95

XFORMERS, FILAMENT 115v-60c.

2.5v @ 1.75a; 6.3 @ 1a, H.V. Ins.	$ 3.95
2.5v @ 10 amps	3.25
2.5v @ 2a, 6.3v @ 1a, Hi Volt, Ins.	3.95
6.3v @ 21.5a, 2v @ 2a, 4v @ 1a	6.95
5.0v @ 115a	14.95
5.0v @ 190a	17.50

FILTER CHOKES

1 henry—200 ma—3000 V Ins.	$2.25
4 henry—250 ma—3000 V Ins.	3.95
10 henry—250 ma—3000 V Ins.	3.25
12 henry—150 ma—2000 V Ins.	2.95
12 henry—300 ma—6000 V Ins.	3.95
15 henry— 30 ma—1500 V Ins.	1.95
20 henry— 30 ma—2500 V Ins.	2.25
75 henry— 8 ma—1000 V Ins.	1.95

PLEASE SPECIFY DEP'T "RN" WHEN ORDERING. 20% DEPOSIT REQUIRED WITH ALL ORDERS

RADIO HAM SHACK Inc., 63 DEY ST., NEW YORK 7, N.Y.

EXPORT DIVISION: WESTERN INTERNATIONAL—168 WASHINGTON ST., NEW YORK 6, N. Y.

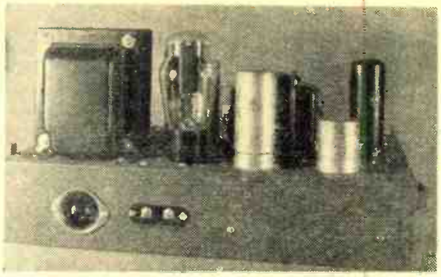

Fig. 6. Rear view of chassis. The power line receptacle is shown directly below the power transformer. To the right of receptacle is the relay contact strip.

at least 1000 ohms per volt). (10) With relay-contact switch closed, adjust C_5 for peak deflection of milliammeter plugged into J_1. (11) When peak deflection is obtained, swing C_9 through its entire range, noting whether meter reading changes. Sharp flicks of the meter pointer as C_9 is tuned indicates lack of neutralization. Adjust neutralizing capacitor C_8 a small fraction of a turn at a time, using insulated screwdriver or alignment tool, until point is reached where meter reading no longer changes as C_9 is swung through its entire range. At this point, final amplifier is completely neutralized. If transmitter is neutralized at highest frequency at which it will be used (for example, 30 mc.), it will be neutralized automatically at all lower frequencies, and the neutralizing adjustment need not be disturbed when changing bands. (12) Open relay-contact switch and restore connection between RFC_3 and R_{16}. (13) If necessary, reset sliders on R_{17} to give voltages shown in Fig. 2. (14) Plug 0-150 d.c. milliammeter into jack J_3. (15) Rotate C_9 until sharp downward deflection of 0-150 meter indicates final amplifier tank is resonated. If necessary, reset C_5 and then C_9 for *minimum* dip of the 0-150 meter.

In the absence of meters, tuning and neutralizing may be accomplished with the aid of a 2½- or 6.3-volt pilot lamp to which has been soldered a pickup coil of 2 turns of insulated hookup wire, 1¼ to 1½ inch in diameter. When neutralizing, place pickup coil over L_1 and adjust C_8 for maximum brilliance of lamp. Rotating C_9 will not affect brilliance when 6L6G stage is completely neutralized. To tune 6L6G stage to resonance, place pickup coil over L_2 and adjust C_9 for maximum brilliance of lamp. Pickup coil must be removed from L_1 or L_2 after operation is completed. When using this method, employ loose coupling between transmitter coils and lamp pickup coil, since close coupling will not permit most accurate tuning.

(16) Insert microphone into jack J_2 and couple pickup coil and lamp to coil L_2. (17) Advance gain control R_9 slowly while whistling or speaking into microphone. Brilliance of pickup lamp should increase with whistling or speaking, indicating upward modulation. Downward modulation usually will indicate insufficient oscillator output (low amplifier grid cur-

rent) or poor power supply regulation. The remedy is obvious in each case. (18) Check voice quality and modulation depth by listening to modulated signal with suitable monitor (diode or crystal detector) or with loosely coupled receiver and headphones. In this way, determine best setting for gain control R_9. (19) Plug coaxial line from antenna into jack J_1, noting rise in 6L6G cathode current (meter in jack J_3) indicating antenna loading. If necessary, retune C_5 and C_9 for lowest dip of cathode current.

If a half-wave doublet antenna cut to the operating frequency is employed, the 72-ohm coaxial line may be connected directly to the center of the antenna in the conventional fashion and no antenna coupler or other feeder will be needed. If, instead, some other type of antenna or feeder line is employed, the coaxial line from the transmitter may be link-coupled by means of a 2- or 3-turn coil to the remotely-located antenna coupler.

(20) After antenna is connected and final adjustments are made to both tuned circuits, inspect modulation again (by means of monitor, receiver, or oscilloscope) and vary coupling between L_2 and L_3 for best linearity and modulation percentage.

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NEW CREDIT PLAN

By Sgt. George Toles

A NEW credit plan for radio and electrical appliance dealers, which eliminates red tape for installment buying and ends the responsibility of store operators for the credit standing of their customers, has been inaugurated by the Buffalo Industrial Bank, Buffalo, N. Y. It is the first bank in the country to launch such a program.

Approximately 200 Buffalo area radio and appliance dealers are participating in the plan, according to an executive of the bank. It is expected 600 dealers in Western New York will participate "as rapidly as consumer goods are made available."

Under the plan, the individual goes to the bank, establishes his credit and gets a credit card, renewable yearly. The bank will tell him the amount of installment goods he can purchase under the arrangement. Then when he wants to buy, he presents his card to the dealer and credit is extended immediately, with no checking except a telephone call from the dealer to the bank.

The customer does not have to give confidential credit information to each dealer because the bank accepts full responsibility. The customer simply signs an installment contract with the dealer, and the dealer sells this to the bank. The customer than pays his installments to the bank, with interest at bank financing rates. He makes his payments separately on each installment contract.

"We are the first bank in the country to inaugurate such a plan," said Vice President Kenneth R. Reed in charge of business development. "We expect to see the idea spread. We think customers will like the plan of establishing their credit before they go out to buy."

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What's New in Radio
(*Continued from page* 70)

quest to *Techno-Craft Products,* 200 Hudson Street, New York 13, New York.

AUTOMATIC RECORD PLAYER

Deliveries on the new *Symphonic* Automatic Record Player, Model YCA 3, are currently under way to many cities throughout the country.

This unit, one of four models now being manufactured, is available in solid mahogany with a hand-rubbed cabinet which has been designed for

acoustically perfect tone quality. This record player incorporates a 6½" speaker and a 3 tube amplifier. Full range tone control is also provided.

The Model YCA 3 has a foolproof, gearless automatic changer that plays ten 12" records or twelve 10" records. The featherweight pickup arm is designed to eliminate all surface noise and lengthen the life of the record. The pickup is equipped with a Permo Fideltone Deluxe Floating Point which is good for over 5000 playings.

Symphonic Radio and Electronic Corporation will furnish additional information upon request to the company at Cambridge, Massachusetts.

DIELECTRIC CAPACITORS

Two complete lines of Plasticon Glassmikes are now available, according to *Condenser Products Company* of Chicago.

The Plasticons are plastic film dielectric capacitors in hermetically sealed and metallized glass tubes.

The Type ASG Glassmikes are silicone-filled with an operating range of minus 60 degrees C to plus 125 de-

grees C; Type AOG are mineral-oil filled with an operating range of minus 40 degrees C to plus 105 degrees C. This line is available in working voltages of from 600 to over 30,000 volts. Glassmikes are made to a tolerance of 1% and to an insulation range of 20,000 megohms per microfarad.

Literature and additional information on this line are available from *Condenser Products Company,* 1375 North Branch Street, Chicago, Illinois.

LOW COST OSCILLOGRAPH

An instrument designed to meet the need for an oscillograph for routine laboratory and production testing, as well as radio servicing, is currently in production at the Passaic, New Jersey plant of the *Allen B. Du Mont Laboratories, Inc.*

Known as the Type 274, this oscillograph is equipped with the *Du Mont* Type 5BP1-A 5" tube and is housed in a sturdy green wrinkle-finished steel cabinet with plastic carrying handle. The green front panel has white lettering and black knobs. Measurements of the oscillograph are 14" x 8⅝" x 18⅜". The weight is 35 pounds.

The linear time base has a range of 8 to 30,000 c.p.s. Synchronization may be from the vertical amplifier or an external signal. Identical vertical and horizontal amplifiers have a range from 20 to 50,000 c.p.s. Provision is also made for intensity modulation.

Additional technical data, and prices of this unit, will be furnished by *Allen B. Du Mont Laboratories, Inc.,* 2 Main Street, Passaic, New Jersey, upon request.

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Spot Radio News
(*Continued from page* 14)

that jeopardized life, public safety, or important property. Now they will be able to use radio to speed service and repairs.

ALL SIGNS POINT toward this nation developing the most powerful radio arm of law enforcement in the world within the next few years, following release by FCC of plans now being crystallized in the police field. The FCC outline indicates a vast network of police radio communication covering every nook and cranny of the nation, rural as well as metropolitan. The long-range program has been worked out in close cooperation with organizations representing both police and fire departments, and today is nearing completion, with the development by the Commission of a geographic area assignment plan. With completion of the plan, FCC will notify all parties concerned, and development of the network can go forward accordingly.

CHIEF DIFFICULTY ENCOUNTERED in attacking the problem of police radio lay in the rapid expansion of its use. Before the war, state police systems had been required to share in the joint use of frequencies with municipalities. This policy worked all right in those days—the number of state systems in operation were few and far between. But a huge expansion of state facilities has been paralleled by further growth of municipal networks. Result—the Commission in its recent allocation of frequencies made provisions for an increase of more than 400 per-cent in the number of channels assigned to these services. In addition, provisions were made for police point-to-point, facsimile, printer, repeater and control circuits above 940 mc. Latest step has been to propose allocating to state police frequencies in the 30-40 mc. band on a geographical assignment basis.

THIS ACCOUNTS for the recent FCC announcement shifting metropolitan police frequencies from the 30-40 mc. band to the 152-162 mc. band. In this way, city police communications will not interfere with those of state-wide officers. FCC added that police networks in big cities now operating in the 30-40 mc. band need not make the change immediately. No deadline on jumping to 152-162 mc. has been set. "It is probable that existing systems will be permitted to operate on frequencies in the 30-40 mc. band over a reasonable period to allow for depreciation of equipment," an FCC spokesman stated recently. Reasonable notice will be given if a shift is necessary and even new 30-40 mc. equipment may be installed by a municipality if it can show that it is necessary.

THE MORE RADIO DEVELOPS, the higher up in the air it seems to get. Latest stratosphere stunt is the development of a transmitter to help the weatherman find out what's going on twelve miles above the earth's surface, and most surprising thing about the unit is that it's powered with four midget storage batteries about the size of a candy bar and weighing less than six ounces each. Credit for the batteries goes to the Army Signal Corps Engineering Laboratories. They supply enough electrical energy to operate radiosondes, balloon borne radio devices used to gather meteorological data in the upper air. They are four inches long, an inch and a half wide, an inch thick. They come vacuum-packed, four in a set, in a small metal container and in a dry "precharged" state. They are activated with electrolyte (acid solution) by simply puncturing the can with a pointed hollow steel rod and permitting the acid to be sucked up from a jar through a neoprene tube attached to the rod. The can is then fully opened, excess acid poured off, and the batteries are ready for use.

RADAR ALSO COMES IN for its share of the war-time, and continuing job of exploring the higher atmosphere. Latest report is that it is being used, again by the weatherman, to figure the velocity and direction of the winds at various elevations. The method employs balloon-borne reflectors which can be tracked by the radar to their bursting point, sometimes approaching 100,000 feet above the earth's surface. Darkness and weather conditions, limiting visibility, used to handicap this type of work before the war, but radar takes both conditions, of course, in its stride. Signal Corps again gets credit for the development, aided this time by the Radiation Laboratory at the Massachusetts Institute of Technology. Hardest nut to crack in the problem was the design of a reflector. It had to be of such shape that it would reflect a maximum signal to the radar set, present a large cross-sectional scattering area, and be light in weight and of such form that it would not seriously impede the rate of rise of the balloon.

TWO TYPES OF REFLECTORS were designed for use with radar at frequencies ranging from 200 mc. to 3000 mc. For use with the horizontally polarized, 200 mc. radar set SCR-268, a dipole-target was developed consisting of three short, foil-wrapped sticks, joined in the center to form 60-degree angles in a horizontal plane. The dipoles are one-half the wavelength of the radar transmitter. This reflector may be borne aloft by a 100-gram, hydrogen filled balloon. A second, for use with microwave radar sets such as the SCR-584, is an eight-cornered, triangular target, somewhat resembling a box kite. The non-resonant, reflective surface consists of paper-backed aluminum foil supported in a triangular form by slender balsa sticks, each edge measuring 36 inches. Two of the sticks are removable so that the target may be collapsed into a flat triangle for shipment. This reflector is carried by a 350-gram balloon, whose rate of rise with the reflector is 1100 feet a minute.

PERSONNEL

J. D. McLean of the *General Electric Company,* heads the new broadcast transmitter section of RMA's transmitter division. The recently reorganized division is under the chairmanship of **S. P. Taylor** of the *Western Electric Company,* who succeeded **C. J. Burnside** of *Westinghouse.*

John S. Garceau of the *Farnsworth Television & Radio Corp.,* has announced a new RMA promotion program since his appointment as chairman of the association's advertising group. Among other things, the program embodies a woman editors' clinic in New York in the early fall.

Lester W. Spillane is the new FCC assistant general counsel in charge of safety and special services, and **Walter E. James** has been appointed assistant to the general counsel. Mr. Spillane has been in radio legal work since 1928. Mr. James has been with the Commission since before the war, joining it as assistant to Commissioner **Clifford J. Durr.** He served in the Navy as a lieutenant during the war, and saw considerable action in the Pacific.

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Within the INDUSTRY

COLLINS RADIO COMPANY of Cedar Rapids, Iowa, recently acquired a new Beechcraft Model D18S plane that will serve as a combination radio test airplane and executive transport.

The new "flying laboratory" is used for flight testing radio communication and radio navigation equipment.

* * *

VIEWTONE TELEVISION & RADIO CORPORATION has moved into the nine story building at 81 Willoughby St., Brooklyn, in order to provide greater production space for the company's line of television receivers.

Despite the moving process, production has continued on the *Viewtone* television set, the "Vanguard."

* * *

TEMPLETONE RADIO MFG. CORP. of New London, Conn. has made recent additions to its sales department with the appointments of George A. Ford as assistant sales manager, Sidney Karr as advertising and publicity assistant and Bernard A. Newman and George D. Targer as field representatives.

* * *

KARL F. KELLERMAN, recently released from active Navy duty, has been placed in charge of Commercial Sales and Advertising by *Aircraft Radio Corporation,* Boonton, N. J.

During the war years Mr. Kellerman served with the Navy Bureau of Aeronautics as Commander and Head of the Electronics Coordination Section of the Bureau of Aeronautics where he was responsible for the introduction and development of a standardized test equipment program, the practice of pre-installation "systems test" of over-all electronic systems for aircraft, and for much of the work done on the interference reduction program.

* * *

LEON PODOLSKY has recently been appointed to the post of manager of a new Field Engineering Department now being organized by the *Sprague Electric Company.*

Mr. Podolsky's new department will be responsible for all *Sprague Electric Company* engineering contacts with customers and will provide any technical assistance required by the Sales Department. It will also be responsible for the field engineering work of the *Sprague Products Company,* a subsidiary organization with which Mr. Podolsky was previously associated and which handles the distribution of *Sprague* equipment through the jobbing trade.

* * *

GEORGE C. CONNOR, who has been with *Sylvania Electric Products, Inc.* since 1934, has been appointed general sales manager of the Electronics Division of that company.

During the early part of the war, Mr. Connor was liaison agent between *Sylvania Electric* and the government on the engineering development of radio and radar products, and in 1943 he established the company's West Coast sales office.

* * *

FADA RADIO is currently sponsoring a half-hour quiz program over the Columbia Broadcasting System, Monday through Fridays.

Known as "Winner Takes All," this program which is aired at 3 p.m. EDT, features 1946 *Fada* radio receivers as prizes. The program is currently being carried by 200 stations on a coast-to-coast hookup.

Commercials on this program are designed to assist dealers in marketing *Fada* receivers.

* * *

TERMINAL RADIO CORPORATION, New York distributors of Radiotone recording equipment, recently made air delivery of the *Ellinwood Industries'* Radiotone recorder, rushing one of the units from New York to Hollywood.

Pat Clayton, CBS singing star, was on hand in Hollywood to meet the shipment and tested it out on the spot by waxing one of her favorites.

* * *

STEPHEN HORBACH has been named sales manager of *Press Wireless Manufacturing Corporation,* a subsidiary of *Press Wireless, Inc.*

Before joining the *Press Wireless* engineering staff in 1945, Mr. Horbach spent four years with the Army Communication Service in this country and overseas.

* * *

HARVEY TULLO, who recently rejoined *Emerson Radio and Phonograph Corporation* as director of purchases was electing vice-president in charge of purchasing, at a recent Board of Directors meeting.

Mr. Tullo recently left the *Zenith Radio Corporation* where he was vice-president in charge of purchasing. Previously he served in purchasing capacities for the *Kolster* and *Pilot Radio Companies*.

* * *

HERBERT G. HART has joined the Los Angeles sales office of the *Collins Radio Company* of Cedar Rapids, Iowa.

Mr. Hart was formerly employed by the *Bendix Aviation Corporation* as assistant sales manager of the *Bendix Radio Division*. In 1942 he became administrative assistant in the Aircraft Radio and Radar Section of the U. S. Navy and later served as price analyst and negotiator in the procurement and distribution service in Office of the Chief Signal Officer.

* * *

R. C. COSGROVE, president of the Radio Manufacturers' Association has recently reorganized and appointed RMA committees for the ensuing year to handle some of the problems facing the radio industry.

The Production Problems Committee, under the chairmanship of vice-president M. F. Balcom, provides new and enlarged facilities to deal with new and continuing RMA activities, including expanded industry statistics.

This new Production Problems Committee, with Mr. Balcom as chairman and J. J. Kahn, *Standard Transformer Corp.* as vice-chairman, includes; Ben Abrams, *Emerson Radio & Phonograph Corp.;* W. R. G. Baker, *General Electric Company;* Herbert A. Bell, *Packard-Bell Company;* Ray C. Ellis, *Raytheon Manufacturing Co.;* Walter Evans, *Westinghouse Electric Corp.;* Frank M. Folsom, *Radio Corporation of America;* Paul V. Galvin, *Galvin Manufacturing Corp.;* Joseph Gerl, *Sonora Radio & Television Corp.;* Larry F. Hardy, *Philco Corporation;* W. P. Hilliard, *Bendix Radio;* F. A. Hiter, *Stewart-Warner Corporation;* Fred R. Lack, *Western Electric Company;* R. C. Sprague, *Sprague Electric Company;* A. S. Wells, *Wells-Gardner & Co.,* and I. W. Wyckoff, *Pilot Radio Corporation.*

* * *

EDWARD N. WENDELL, who has been associated with the *International Telephone and Telegraph Corporation* since 1925, has been appointed vice-president in charge of the *Federal Telephone and Radio Corporation,* domestic manufacturing affiliate of I. T. & T. Mr. Wendell in his new post assumes full managerial authority of *Federal.*

Mr. Wendell has been with *Federal* since its formation in 1942 from predecessor companies, and has served as head of the concern's radio division, manager of its telephone division and prior to his recent appointment served as vice-president of the company.

* * *

WILLIAM J. NEZERKA has been named vice-president and sales manager of the *Turner Company,* Cedar Rapids, Iowa and elected to the Board of Directors. Mr. Nezerka has been sales manager of the *Turner Company,* manufacturers of microphones and electronic devices, and has been largely responsible for the development of their sales organization which now covers the entire United States and export markets.

* * *

GENERAL ELECTRIC'S adaptation of radar for merchant shipping, the electronic navigator, was recently installed on the S.S. Stavangerfjord of the Norwegian-America Line.

The console of the electronic navigator is installed in the Stavangerfjord's auxiliary pilot house. The circular viewing screen, similar to the screen of a television receiver gives a complete picture of above-water obstacles, such as lighthouses, buoys, icebergs, other ships and land at distances up to 30 miles, depending on the size and shape of the object.

Adequate coverage both fore and

aft is insured by the placing of the rotating antenna on a pedestal six feet, six inches above the auxiliary pilot house. The antenna is connected to the transmitting and receiving circuits housed in the console by 20 feet of coaxial cable, eliminating the need for costly wave guides which military radar normally used.

* * *

THEODORE K. BURGENBAUCH has been appointed Electronics Division production manager of *Ellinwood Industries,* Los Angeles.

Mr. Burgenbauch was formerly assistant factory engineer in the Electronic Tube Division of *General Electric Co.* in Schenectady, New York.

His new position will entail supervision of production engineering, stock control, assembly and product test.

* * *

LEAR, INCORPORATED of Grand Rapids, Michigan, following a recent reorganization of its engineering activities, appointed new chief engineers for the three internal divisions of that company.

Harry E. Rice now becomes chief engineer of the *Lear* Home and Aircraft Radio Division. Harry S. Jones is chief engineer in charge of research and development and William J. Perfield will head engineering activities of the *Lear* Electro-Mechanical Division.

* * *

WALT ZUKERMAN, W2LBF, now heads the Amateur Sales and Technical Department of the *Sun Radio & Electronics Co., Inc.* parts distributors in New York City, after serving for three years with the Army Signal Corps overseas as Communications Engineer.

In this capacity, Mr. Zukerman was in charge of the intercommunications, public address, and teletype engineering sections at Oahu, T. H. as well as engaging in major radar installation work.

* * *

SENTINEL RADIO CORPORATION has started production in their new plant in Evanston, Illinois.

All of *Sentinel's* facilities are now consolidated under one roof. 125,000 square feet of floor space accommodates four continuous assembly lines, each 250 feet long, with a single shift production capacity of 3000 radio receivers per day.

* * *

DR. R. O. CURRY has been appointed audio and acoustical engineer for the *Farnsworth Television & Radio Corporation.* In this capacity Dr. Curry will assist product engineers in audio and acoustical work on radio and television receivers, phonograph instruments, and all other electronic product lines.

Dr. Curry was previously engaged in audio research for the *Capehart Division* of the company.

* * *

EDWARD ROJO has been appointed manager of the export division of the *Electronic Corporation of America, International Corporation.*

Prior to joining *ECA,* Mr. Rojo was associated with the *Andrea Radio Corporation* as manager of the export division.

In his new position Mr. Rojo assists in *ECA*'s greatly expanded export program for which special equipment has been recently developed.

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Visual-Aural Signal Tracer

(*Continued from page* 37)

amplifier output of the tracer is available at the *"Output"* panel jacks, as for testing an external speaker or for employing the tracer as an a.f. amplifier to temporarily bridge a defective a.f. stage in a p.a., broadcast station, or other audio system. This switch thrown to the right connects the built-in speaker to the *"Output"* panel jacks, when the built-in loudspeaker of the signal tracer may be used as a test speaker or for experimental work.

Fig. 4 illustrates the simplicity of mechanical construction which may be achieved through careful instrument design. At upper right is the 6E5 electron-ray indicator tube, in the center the loudspeaker and at upper left the 5Y3GT power supply rectifier and its phenolic mounting panel carrying the basic high-voltage d.c. resistance-capacitance filters R_{11}, R_{12}, C_{10}, C_{11}. The front panel is of 3/32" thick aluminum, 7" high and 12" long, the exterior surface finished to the appearance of Fig. 1 by frosted white lettering on the gray-enameled surface of the panel. The rear surface is finished in frosted, satin-white natural aluminum, as is the long narrow channel shown along the bottom of Fig. 4. This channel extends from the panel-stud mounted power supply transformer T_1 at left to its own panel mounting stud at the right. Along it, from right to left, are disposed in electrically symmetrical progression the 6C4 miniature triode first a.f. amplifier, 6C4 second a.f. amplifier and the 6AK6 miniature power pentode third a.f. power amplifier stage. No attempt has been made to cause a single tube to function for a multiplicity of unrelated purposes such as rectification and amplification.

The channel construction of the a.f. amplifier lends itself to short grid and plate leads and to location of bypass capacitors and bias and filter resistors close to the tube circuits they serve. As a result of such circuit-progressive construction the physical amplifier stages follow each other almost exactly as they do in the diagram of Fig. 3. Input is at the right side of Fig. 4, output at the distant left through the output transformer T_2 mounted on the channel. Ample physical and electrical circuit isolation results in an over-all gain of substantially 65 db. with no trace of instability or motorboating. This gain is so high as to add another test function to the tracer—it may be used to test low-level crystal and dynamic microphones as well as carbon mikes and may function as a small p.a. amplifier in an emergency.

The circuit diagram of Fig. 3 is so basically simple and conventional that any service technician, amateur or experimenter should have little difficulty in tracing its essential conformation. It is possibly notable for the extensive use of *RC* decoupling filters such as C_6, R_{10} and C_9, R_{14} to thoroughly isolate the successive stages of what is, in fact, a quite high-gain a.f. amplifier—not to mention their value in keeping down hum. The main power supply filter is also *RC* instead of usual *LC*, and "choke input" in the interests of maximum voltage stability. R_{11} acts as the input choke in addition to dropping "B" voltage, initially higher than required by the tubes employed, down to a suitable value. It is followed by filter capacitor C_{10}, this first filter "section" in turn followed by a second filter section consisting of R_{12} and C_{11}.

The over-all audio frequency response holds up very well to below power line frequencies, in fact down to nearly 20 cycles. At first glance this seems impossible when using a 3½" PM speaker. Since the speaker is enclosed in a discreetly port-holed cabinet, a combination of bass-reflex and cabinet resonance produce this desirable low-frequency range in a system which would appear to be incapable of such performance. The net result is good bass response, which is necessary when checking seriously for a.c. hum in receivers or amplifiers.

The input potentiometer R_2 is intentionally provided with a linear curve rather than the usual logarithmic audio volume control curve. Thus the user, knowing that the 6E5 electron-ray tube shadow will fully close when 3.5 volts of d.c. is applied to its grid, is potentially provided with a d.c. voltmeter. The potentiometer scale is graduated 0 to 10. Suppose the *"Indicator"* switch be thrown to *"Osc."* position, and a d.c. voltage source contacted with a pair of leads plugged into the *"Input"* jacks. Further suppose it is necessary to then retard the *"Gain"* knob to some figure below 10 to just prevent 6E5 shadow over-closure. If the user has previously made a calibration curve of d.c. volts versus gain figures, he may read the approximate unknown voltage from his calibration curve.

Used as a d.c. voltmeter the input resistance is that of R_2 shunted by R_5 or 333,000 to 500,000 ohms.

Exactly the same process may be used to estimate a.c. voltage to quite good accuracy, but using the crystal diode to rectify the a.c. so it will properly actuate the 6E5. The input resistance will approximate 500,000 ohms on a.c., again it is no great problem to prepare a calibration curve for the particular diode probe by applying differing a.c. voltages to it from a potentiometer connected across a 60 cycle a.c. line (instead of a d.c. voltage source as for d.c. calibration) and so determine the values of a.c. voltage necessary to just close the "eye" at the 10 successive *"Gain"* knob settings.

The above described voltmeter operation is what allows this new tracer to determine presence or absence of a.c. and d.c. operating voltages, as well as to trace signals in equipment being tested. Thus, d.c. plate, screen and grid voltages and polarity can be observed using it as a d.c. voltmeter, as may a.v.c., a.f.c. and other d.c. control voltages, also, a.c. operating voltages in power, as well as signal circuits, may be observed using it as an a.c. voltmeter.

Thus the desirable ideal of having a signal tracer which will also reveal the presence or absence of operating voltages, plus allowing a good estimation of their magnitude, is satisfied by this instrument to a degree where, for all except precise voltage measurements up to approximately 100 volts, it may substitute for a voltmeter—may do so for quite close measurements if the *"Gain"* knob is first calibrated and two charts prepared for the different a.c. and d.c. voltages required to full 6E5 shadow closure.

In checking gain or amplification in radio receivers and audio amplifiers it is easiest to estimate gain aurally by increased loudness of the signal delivered by the tracer as, with one setting of the *"Gain"* knob, the diode prod is shifted from antenna to input grid to first plate and so on along the circuit from input to output. In a good receiver of high gain, overload will soon vitiate the value of this process. It is then that the *"Gain"* control becomes most useful, for it may be retarded as successive stages adding to the initial signal voltage are included between antenna and tracer. Since gain is close to the ratio of *"Gain"* knob settings required for equal volume, or equal "eye" closure on differing voltages, the gain of a particular amplifier or stage may be taken as the ratio of *"Gain"* knob settings required for equal "eye" closure. This may be done with the *"Indicator"* switch in the *"Output"* position, and then in the *"Input"* position. The difference in voltage required to fully close the 6E5 shadow when this switchover is made is then the gain of the amplifier, which is 65 db. voltage-wise, or 1778 times in voltage. It is believed that the above indicates how this new tracer functions as a gain measuring set, with the gain or loss of the equipment under test taken as the ratio of *"gain"* knob settings required to produce equal 6E5 shadow closure.

Not only has this new instrument proved valuable in saving time in servicing of radio equipment, but it has proved its worth in the design laboratory where on experimental receivers and amplifiers it permits location of faults and malperformance with speed and certainty.

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For the Record

(*Continued from page* 8)

radio men, use common sense and plenty of it when we select the proper tool with which to do the best job. It applies to the fixing of a radio at a customer's home, at the work bench, in the laboratory, yes, even flying high above Bikini, thousands of miles away.

Disc recording has been perfected and is here to stay but wire recording too must be recognized as an important new factor. It is a new baby but a healthy one in this industry we call radio and electronics.

MANY of you have written in asking the present status of the Call Book. For the present time we have had to drop plans to publish this international listing because the critical shortage of paper is still plaguing the publishing industry. All available paper stocks are being used to bring you the bigger and better RADIO NEWS that you hold in your hand. In addition, many revisions are being made in amateur listings at the present time with the result that before we could get the book to you many of the listings would be obsolete. When paper stocks become sufficiently large and the listing situation becomes more stabilized, we expect to publish this new Call Book.

O. R.

Jack Rice, W6RTH and Oliver Read, W9ETI, enroute to Kwajelein, compare recording and camera equipment each was carrying. Mr. Rice's equipment is shown at lower left of picture while your editor's recorder is enclosed in the small case shown in the front center of the photograph.

Solid Dielectric R.F. Transmission Lines

(Continued from page 48)

volume for wartime radio and radar uses. The Army and Navy standardized on certain designs for specific applications and assigned a type designation (RG series) to each. Since many of these same designs will have valuable features for peacetime radio use a brief summary of the more popular Polyethylene cables is given in Table 2.

Fig. 5 illustrates the transmission loss for several well known types of lines. The improvement over rubber insulated designs can be recognized and it is further significant that the efficiency of a solid insulated line is now of the same magnitude as certain air-spaced types.

Fig. 6 gives the power rating of some standard RG cables and indicates complete safety factors for all amateur services. It is in this particular characteristic that the Polyethylene insulated coaxial cables far excel the air-spaced coaxial lines. It is believed that RG-8/U, RG-11/U, RG-13/U, RG-17/U and RG-59/U will be the most popular and practical Army-Navy types for amateur applications. In addition to these, other new types (coaxial, dual coaxial, twisted pair, and twin) designed for specific applications will be available.

These flexible cables are adaptable to any method of installation. They may be suspended in air, buried in the ground, or fastened to any convenient support without hazardous or operational effects.

Splices should be avoided due to impedance variations. When necessary, a conventional conductor splice may be wrapped with sufficient rubber insulating tape with a protective layer and the shield joined by connecting a wire to each side of the joint. Manually prepared terminals are satisfactory; the preferred procedure is to remove all coverings and shields about 4 inches from the end and permit the Polyethylene insulation to remain intact to the end. The value of 4″ should be increased to about 12″.

Type of Antenna	Impedance (Ohms)	Untuned Line Connection
Dipole (half-wave)	55-75	RG8U, RG11U, RG13U, RG17U, or proper pair
Quarter Wave	35	Parallel connection (dual) of RG11U, RG13U, or RG59U
Long wires 3/2 Wave	100	Series connection (dual RG8U, RG17U, RG59U
5/2 Wave	115	Series connection (dual RG8U, RG17U, RG59U
7/2 Wave	123	Series connection (dual RG8U, RG17U, RG59U
9/2 Wave	135	Series connection (dual) RG11U, RG13U, RG59U
11/2 Wave	142	Series connection (dual) RG11U, RG13U, RG59U
13/2 Wave	147	Series connection (dual) RG11U, RG13U, RG59U
V beam 1 to 3 wavelengths	90-125	Series connection (dual) RG8U, RG17U, RG58U
V beam 4 to 6 wavelengths	130-150	Series connection (dual) RG11U, RG13U, RG59U
Folded dipole	300	300-ohm twin
Parasitic—2-element close spaced array	20-25	Parallel connection (dual) RG8U, RG17U, RG58U

Table 3. Suggested methods of feeding some of the more common types of antennas.

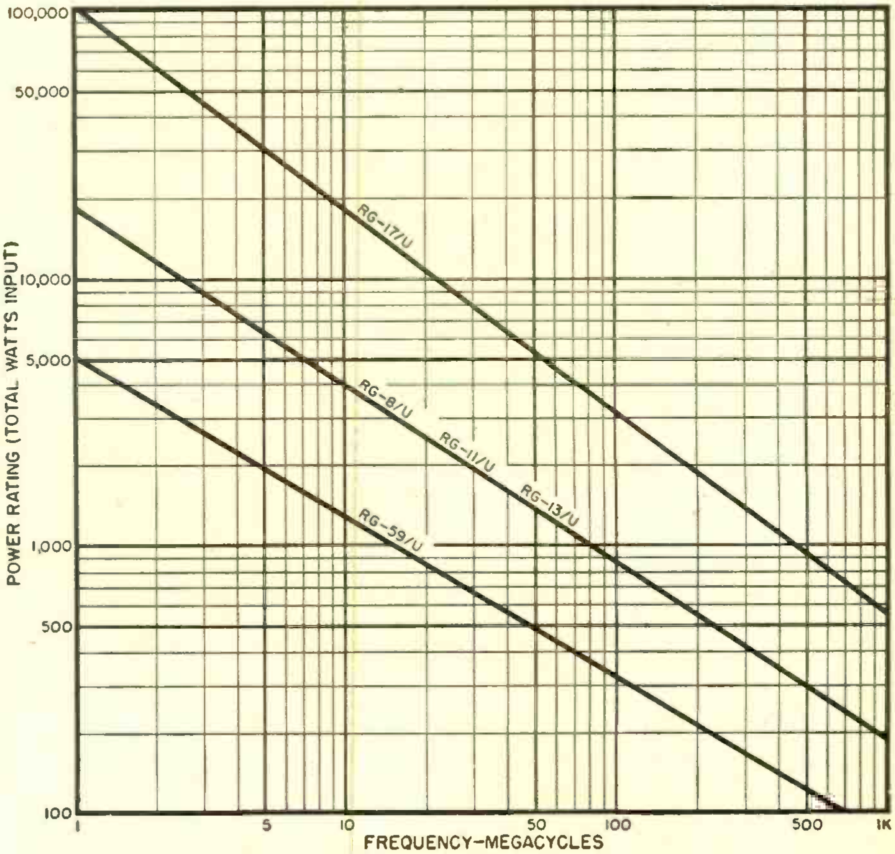
for outside or exposed connections. Protective tapes or paints are not recommended or needed at terminals.

A series of standard male and female shielded connectors are available for the Army-Navy type cables. A description of these devices may be obtained from any of the several connector manufacturers.

In connecting a shielded or coaxial cable to the antenna it is advisable to provide a good ground connection to the shield at the transmitter (or receiver) end. No additional ground connections are required. If a dual coaxial arrangement is used it is recommended that the two cables be maintained as physically close together as possible and that frequent electrical bonds of the two shields be made.

It should be remembered that Polyethylene is thermoplastic and may soften and deform under excessive heat. Therefore, careful soldering technique is advisable.

Fig. 6. Graph indicates power rating of several standard RG cables. Power rating is based on center conductor temperature of 175 degrees Fahrenheit, and an ambient temperature of 104 degrees Fahrenheit.



When used as untuned lines these cables may be used in any desired length—the efficiency of which may be determined from Figs. 2 and 5. For example, let us assume we wish to maintain at least a 75% line efficiency at 28 megacycles. Fig. 2 indicates that the total line loss must not exceed 1.25 decibels for this condition. Reference to the 28 mc. loss given in Fig. 5 and subsequent multiplication then shows that we could use any length up to 350 ft. of RG-17/U, 130 ft. of RG-13/U or RG-11/U or 300 ohm twin, or 120 ft. of RG-8/U. Coupling of the untuned line to the transmitter is conventional in that link or impedance network devices are satisfactory.

When used as tuned lines it must be observed that the velocity of propagation along Polyethylene insulated coaxial lines is about 67 per-cent of that of free space (air). Consequently, a half-wave in electrical length is 67 per-cent of that determined for an open wire line. The formula, length of half-wave, feet $= 468 \times .67/f_{mc}$ is reasonably exact. For the twin line this formula becomes $468 \times .85/f_{mc}$.

It would be impossible to cover all of the different methods of solid dielectric line arrangements that could be used for each of the many types of antennas. However, some of the more common antennas are listed in Table 3 together with some suggested methods of feeding. The use of these lines to feed close-spaced arrays is also possible as can be determined by analysis of the following relationship:

$Z_o = \sqrt{Z_1 Z_2}$
Z_o = impedance of quarter wave matching section
Z_1 = antenna impedance
Z_2 = line impedance

For a 3-element, close-spaced parasitically excited array Z_1 is equal to 9 ohms. If a quarter wave matching section of Z_o equal to 35 ohms (parallel dual connection of RG-11/U, RG-13/U or RG59/U) is used it will then be possible to connect an untuned line ($Z_2 = 140$ ohms) of a series dual arrangement of the same cables to the transmitter.

ELECTRONICS TRADE SHOW

THE second annual Electronic Trade Show for the West Coast area will be held in Los Angeles, October 18 through 20th.

Plans are being made for 113 exhibits, covering all types of electronic devices manufactured in the West.

This annual event is being sponsored by the West Coast Electronics Manufacturers Association through its industry committee which is made up of the following men: Ed Grigsby, chairman, D. F. MacLachlan and Russell Dietrich, all of Los Angeles, and Les Logan of San Francisco.

Management of the show has been vested in The Tabery Corporation, 3443 South Hill Street, Los Angeles, California. Requests for reservations, information, or display space should be made to Mr. D. D. Durr, show director, at the Hill Street address.

—30—

Similarly, for a 4-element array Z_1 equals 5 ohms and if Z_o is made equal to 25 ohms (quarter wave section of parallel dual connection of RG-8/U, RG-17/U or RG-58/U) it is then possible to use a series dual connection of RG-11/U, RG-13/U or RG-59/U for the untuned line (Z_2 = 140 ohms) and obtain a reasonably satisfactory impedance match.

—30—

QTC

(*Continued from page* 43)

the Maritime Commission. The four modern freighter-passenger ships will replace the company's former fleet the Imperial, Aconcagua and Copiapo. Under an agreement with the U.S. Government when all tonnage was at a premium during the early war years, the three ships were purchased from the Chilean Line with the agreement that tonnage would be sold to the line after the war.

JOHN DEARING sailed recently as chief aboard a Victory from the East Coast. S. R. Ballam has taken out a cargo assignment. Ernest S. Bailey recently assigned to a "Knot" vessel. Clifford L. Johnson was relieved from his "Cape" berth. Don Campbell still aboard the Turrialba out on the West Coast at last reports. W. C. McGaughey still aboard his cargo craft. Nace Campbell of TRS still out on the sick list. S. Barone, former Press Wireless engineer in charge of manufacturing has formed his own company in New York.

WE HAVE often wondered how many (if any) of the boys in the seagoing end of the business spend their spare time aboard ship — do many of them spend it in study that they may some day take a berth ashore or do they figure on a seagoing berth until retirement? This fast changing business requires constant study to keep abreast of modern developments — probably there is no radio-electronic engineer who can truthfully state that he knows, in great detail, all the modern branches of the art. Electronics has become such an inclusive field as to almost stagger the professional man who tries to keep up with the developments in the various branches of the industry . . . it is well for the present day man to decide what branch of the industry to enter and concentrate his study in that field—and it is necessary to keep up with the modern changes—we can only urge those who wish to get ahead to continue their education—either ashore if possible or by home study courses—there are any number of good schools throughout the country.

RADAR installations are on the increase aboard merchant ships —Holland America Line recently ordered new equipment and will eventually have their entire fleet so equipped. Other shipping lines not so fitted are making plans for modern radar or loran gear to be installed aboard their vessels in the near future. 73

Radio Receivers
(Continued from page 39)

out of alignment that no signal can be heard when the signal generator is connected to the antenna post, it must be first connected to the stage nearest the detector while the detector stage is being adjusted and then moved back a stage at a time while each stage is being adjusted. The above outlined procedure may then be followed.

Occasionally a receiver or tuner is found which employs a TRF circuit in the interest of high fidelity. In sets of this type, the trimmers are not all peaked to the same frequency, but alternate to each side of the frequency to which the set is tuned. More data on this type of alignment is given in the discussion of "flat top" i.f. stages.

Superheterodyne Receivers

Fig. 5 shows a block diagram of a superheterodyne receiver. The number of r.f. amplifier stages is, of course, optional and many sets do not have any r.f. amplifier at all. Briefly, this type of receiver operates on the principle of combining the received signal with another signal generated by the set's oscillator and by heterodyne action producing a third frequency, the i.f., which is then amplified and demodulated. That portion of the set following the mixer or first detector is in reality a fixed tuned TRF receiver. The oscillator is generally operated at a frequency equal to the intermediate frequency plus the frequency of the received signal although it may be operated at a frequency lower than that of the received signal by an amount equal to the i.f. Some sets may be found where the oscillator operates on the high side of the received signal on some bands and on the low side on other bands.

Since the tuning of the i.f. amplifier and the second detector is fixed, it is imperative that the frequency difference between the received signal and that generated by the set's oscillator remain constant. The methods employed to keep this frequency difference constant are called "tracking" the oscillator.

The ganged tuning condenser of a superhet is usually designed with the oscillator section smaller than the r.f. sections so that the number of kilocycles covered by all sections is nearly equal although the range covered by the oscillator is higher. The minimum capacity of the oscillator tuning condenser is generally adjusted by the use of a trimmer condenser in parallel with the tuned circuit. As this trimmer determines the minimum capacity of the tuned circuit, it is adjusted at the high frequency end of the band.

The maximum capacity of the oscillator tuned circuit is controlled by the insertion of a padder condenser in series. The padder condenser is adjusted to track the oscillator at the low frequency end of the band.

Some sets employ coils with adjustable iron cores rather than padder condensers to obtain the desired effect. For the sake of simplicity, we will refer to the low frequency adjustment as a padder, even though in some sets it may be an adjustable iron core in the oscillator coil.

Several common circuit arrangements are shown in Fig. 4. Upon inspection it will be noted the same result is accomplished by all of these circuits.

Superhet Alignment Procedure

Using a signal generator and a suitable output indicator, the superhet is aligned as follows. The signal generator is coupled to the grid of the mixer tube through a blocking condenser of approximately .05 μfd. In multiband receivers the band switch should be in the broadcast position to prevent the appearance of a low impedance, high frequency coil across the output of the signal generator. The oscillator section should be shorted out with a short wire jumper or a paper condenser to avoid interference from local stations. The signal generator is then tuned to the intermediate frequency of the set and the i.f. trimmer condensers are peaked for maximum output, starting at the second detector and working toward the mixer. The process should then be repeated to compensate for interaction. As was mentioned in connection with oscillator circuits, a variable inductance may be found instead of a variable condenser.

Some i.f. transformers are designed to pass a wide band of frequencies to provide high fidelity reception. They have been given the name "flat top" from the shape of their resonance curve. In sets employing this type of i.f. transformer, the trimmers are peaked alternately higher and lower than the intermediate frequency. For example, if the intermediate frequency is 455 kc., one trimmer may be peaked at 450 kc. and the next at 460 kc. and so on, thus providing a bandpass of 10 kc. The response of such an i.f. system may be checked by varying the tuning of the signal generator over a range of a few kilocycles either side of the intermediate frequency and noting the variations of the output indicator.

When separate coils are used in the r.f. and oscillator stages for each band covered, the order in which the bands are aligned is unimportant, since the alignment of one band has little or no effect on the others. However, when a single coil is used with a tap for each band, the high frequency bands should be aligned first, as their ad-

STEP	TUNE SIGNAL GENERATOR TO	TUNE RECEIVER TO	CONNECT SIGNAL TRACER TO	TUNE SIGNAL TRACER TO	SHORT OUT OSCILLATOR	ADJUST
1	1400 kc.	1400 kc.	Plate of mixer tube	1400 kc.	Yes	R.F. Trimmers
2	1400 kc.	1400 kc.	Plate of mixer tube	I.F.	No	Osc. Trimmers
3	600 kc.	About 600 kc.	Plate of mixer tube	600 kc.	Yes	Tune set to resonance with signal generator
4	600 kc.	About 600 kc.	Plate of mixer tube	I.F.	No	Low frequency padder
5	Repeat Step No. 2					
6	1400 kc.	1400 kc.	Plate of I.F. tube	I.F.	No	1st I.F. Transformer
7	1400 kc.	1400 kc.	Diode of 2nd detector	I.F.	No	2nd I.F. Transformer
8	Repeat Steps Nos. 6 & 7					

Table 2. Alignment procedure to follow when using signal generator. Generator is coupled through a dummy antenna to the antenna post of the radio receiver.

justments do affect the lower frequency bands.

The alignment of the i.f. stages being completed, the signal generator is then coupled through a dummy antenna to the antenna post of the set. Both the signal generator and the set are tuned to the same frequency near the high frequency end of the band, about 1400 kc. for the broadcast band. The oscillator trimmer is first adjusted for maximum output then the r.f. trimmers are peaked. The signal generator and set are then tuned to a frequency near the low frequency end of the band and the padder condenser is adjusted for maximum output. The tuning condenser should be "rocked" back and forth while this adjustment is being made. The purpose of rocking the tuning condenser while adjusting the padder is to locate a setting of the padder that allows the r.f. stages to be tuned to resonance with the signal and the oscillator to track as perfectly as possible. After the low frequency padder has been set, the high frequency alignment should be repeated. Many sets have no low frequency oscillator adjustment on the short-wave bands and many of the smaller sets have no low frequency oscillator adjustment at all. The usual procedure in this case is to tune the signal generator and the set to the high frequency limit of the band, about 1700 kc. in broadcast band, and adjust the oscillator trimmer for maximum output. The signal generator and set are then tuned to a lower frequency still at the high frequency end of the dial, about 1400 kc.

Detection of illegal transmissions is the task of the newly expanded monitoring section of the Federal Communications Commission. Stimulated in its growth by the increased interest in radio, this section is charged with the responsibility of policing the air lanes. Shown in the photograph is one of the steps used in tracking down an illegal transmitter. L. E. DeLafleur, left, and A. P. Walker are closing in on an illegal signal by means of portable receivers or "snifters" which are designed for sensitivity to a signal on any frequency. As they near the sending set, the signal on the receivers becomes louder. If they move in the wrong direction, the signal gets weaker. Actual location of the transmitter is then assured.

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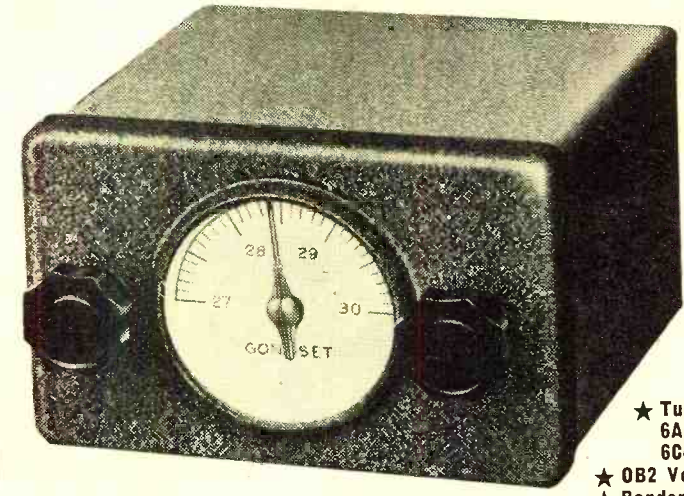

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in the broadcast band, and the r.f. trimmers are adjusted for maximum output. These adjustments should allow the oscillator to track over the entire band. If it is found necessary to align the set at the low frequency end of the band, this must be done by bending the plates of one or more sections of the tuning condenser after which the high frequency adjustments should be repeated.

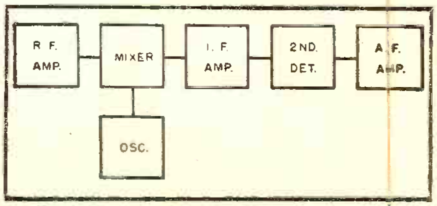
Alignment Procedure with Signal Tracer

The proper procedure to be followed when using tuned signal tracers is somewhat different than that given above. Here the r.f. and oscillator stages are aligned first and i.f. section last. The signal generator is coupled to the set through a dummy antenna and the r.f.-i.f. probe of the signal tracer is connected to the plate of the mixer tube. All three, set, signal generator and signal tracer are tuned to a frequency near the high frequency end of the band, the oscillator section of the tuning condenser is shorted out and the r.f. trimmers are adjusted for maximum indication on the signal tracer. The short is then removed from the oscillator tuning condenser, the signal tracer is tuned to the intermediate frequency of the set and the oscillator trimmer condenser is adjusted for maximum indication. Signal generator, receiver and signal tracer are now tuned to the low frequency end of the band. The oscillator is again shorted out and the set is tuned to resonance with the signal generator even though the dial calibration may not be accurate. The signal tracer is then tuned to the intermediate frequency, the oscillator short removed and the low frequency padder is adjusted for maximum indication. As in other methods given above, the high frequency alignment should be repeated.

It will be noticed that, when using a signal tracer, it is not necessary to rock the tuning condenser while making the low frequency oscillator adjustment nor is it necessary to change the coupling of the signal generator to the set. However, what has been said regarding the order of alignment of multiband receivers and sets not having padder condensers applies equally as well when using a signal tracer.

The i.f. stages are aligned, one at a time, by placing the probe of the signal tracer on the plate of each tube while the trimmers in the grid circuit are being peaked. While the output i.f. transformer is being peaked, the

Fig. 5. Block diagram of superheterodyne.



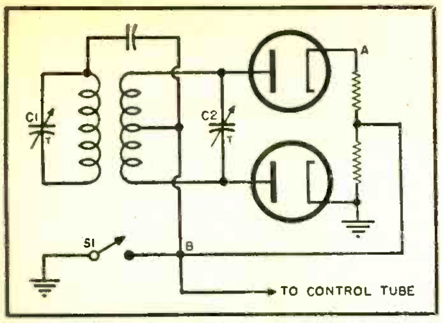


Fig. 6. Conventional discriminator stage.

probe should be on the diode plate of the second detector.

Automatic Frequency Control

With the exception of the discriminator stage, sets employing a.f.c are aligned exactly as any other set would be. During the alignment the a.f.c. must be turned off.

A typical discriminator stage is shown in Fig. 6. This stage is aligned with the signal generator tuned to the intermediate frequency and coupled to the grid of the mixer tube. A vacuum tube or high resistance voltmeter is connected between points A and B and C_1 is adjusted for maximum indication with the a.f.c. switch still off. The v.t.v.m. is then connected between point B and ground. If the stage is properly adjusted there will be no change in the meter reading when the a.f.c. switch is turned on. If, however, there is a difference in readings when the a.f.c. switch is thrown, C_2 should be adjusted until the meter reads the same with the switch in either position.

The most commonly used alignment procedures mentioned in the article are presented in outline form in Tables 1 and 2. —30—

PHONOGRAPH NEEDLES ON SPEAKER

On phonograph players and radio combinations used needles often fall through some opening to the speaker.

If near to the pole piece of the speaker the needles will be attracted by the magnetic field and will vibrate against the cone.

The illustration shows needles being removed from such a position . . H.L.

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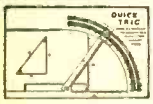

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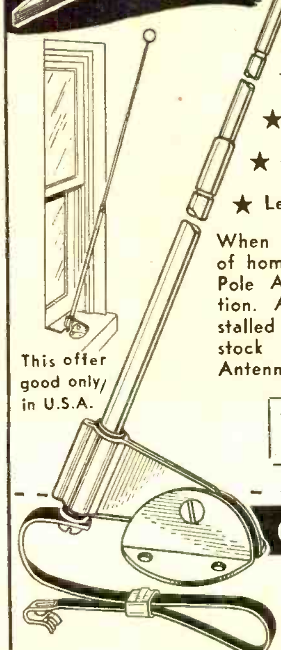

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CONTEST WINNERS

THE judges of the first "All-Amateur Transmitter Contest" recently announced the winners in two classifications.

Jay C. Boyd, W6PRM, 3276 DeWitt Drive, Los Angeles, California was declared the winner in the 250-watt transmitter class, while the winner of the kilowatt transmitter class is T. E. Atherstone, W7IV, 1921 Dover Street, Denver, Colorado. Mr. Boyd receives a complete transmitter, built to his winning specifications and $1125 (face value) in savings bonds. Mr. Atherstone is the recipient of $1000 (face value) in savings bonds and his prize winning entry built free of charge to his design.

The contest was sponsored by Taylor Tubes, Inc., with the following companies participating in donating the prize money: Aerovox Corporation, American Phenolic Corporation, Barker & Williamson, Bliley Electric Co., Gothard Manufacturing Co., International Resistance Co., E. F. Johnson Co., Solar Manufacturing Corp. and United Transformer Corporation.

Judges in the contest were: Fred Schnell, W9UZ (Chief of Radio Department, Chicago Police); Oliver Read, W9ETI (Editor, Radio News); Cyrus T. Reed, W9AA (Radio Buyer, Montgomery Ward & Co.); John Potts, (Editor, CQ and Radio); Lewis Winner, (Editor Communications); Frank Hajek, W9-ECA (President, Taylor Tubes, Inc.); Rex Munger, W9LIP (Sales Manager, Taylor Tubes, Inc.), and Karl A. Kopetzky, W9QEA (President, The Signet Corporation). —30—

ERRATA

It has been called to our attention that the tube V_2 appearing in the schematic diagram, page 53, of the August, 1946 issue, shows separate cathodes. In view of the fact that the 6N7 listed in the parts list has a single common cathode, we should have specified a 6SN7.

★ ★ ★

The screen resistors of the 6AC7 tube shown in the schematic diagram, page 124, August, 1946 issue should be shown as 240,000 ohms, instead of 24,000 ohms.

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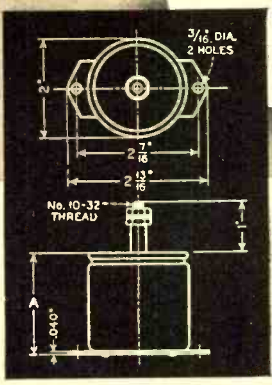

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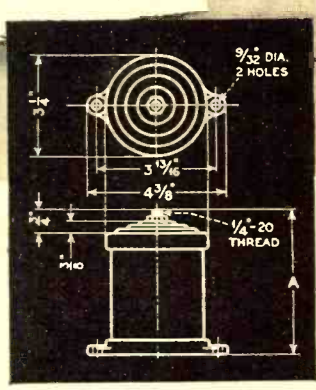

Type 1865 (no photo, but see drawing above) differs in the use of cast-aluminum case and steatite insulator to support terminal and withstand higher voltages. Dimension A is from 2-11/16 to 6-11/16".

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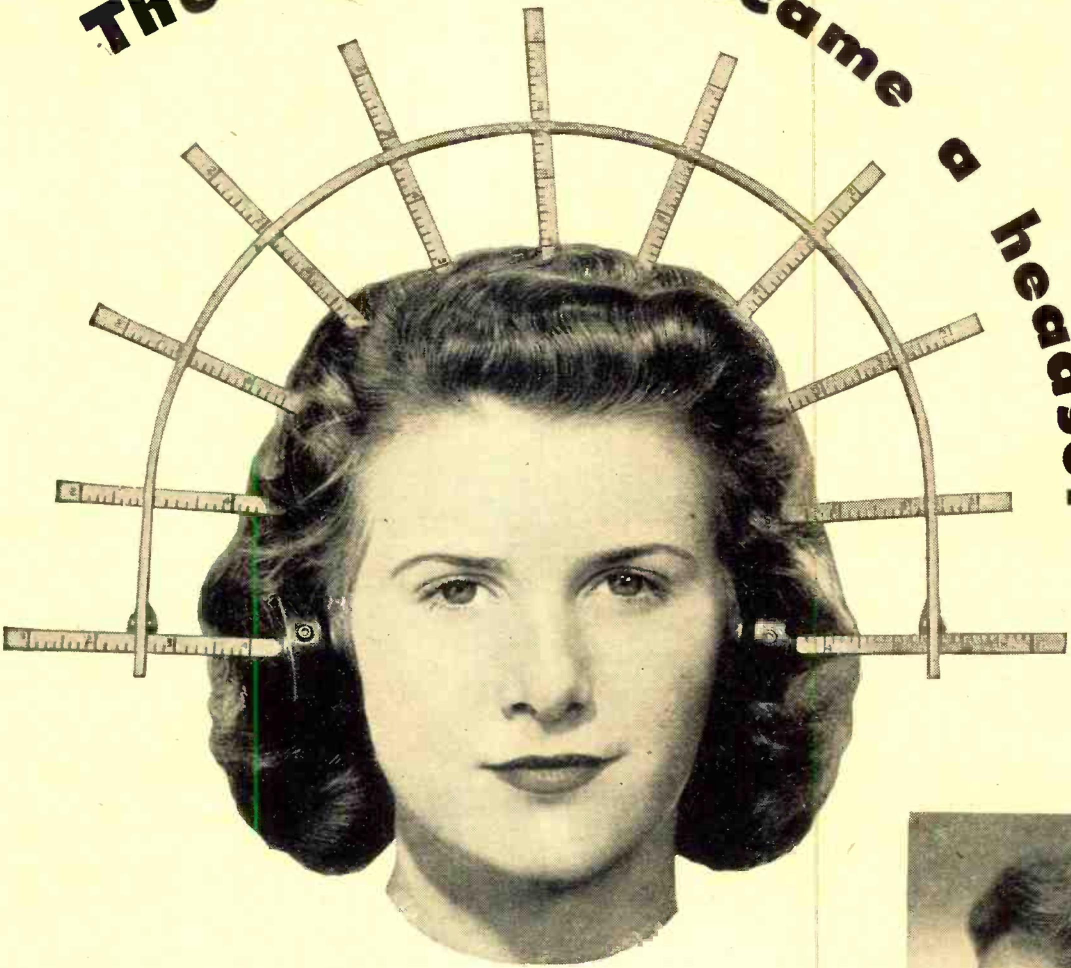

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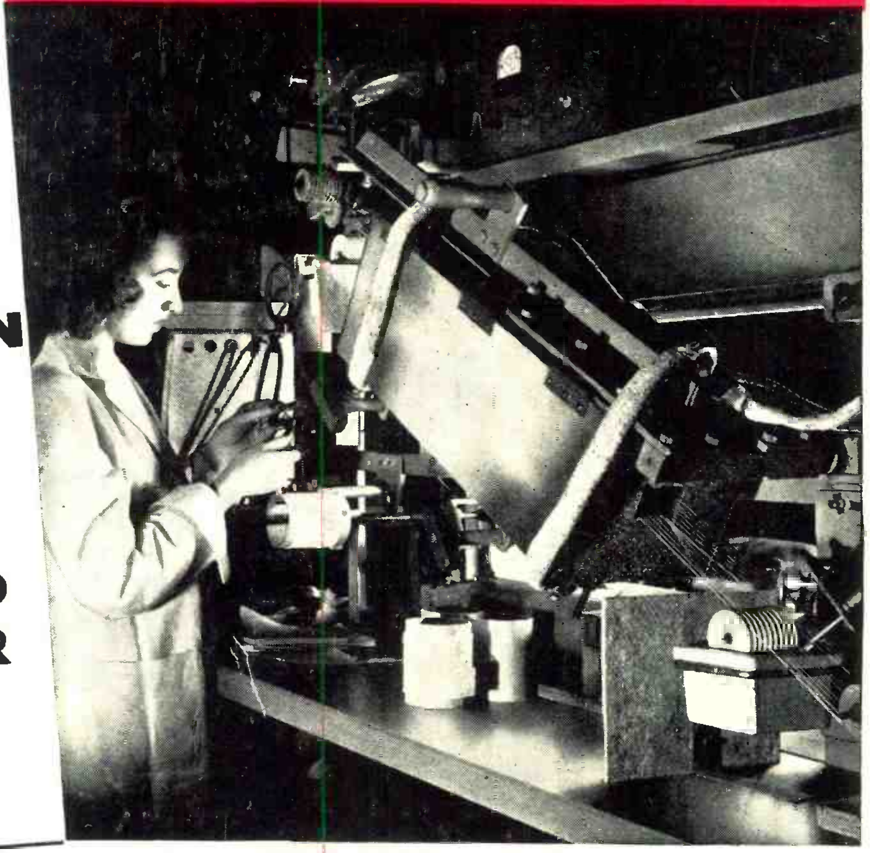

HYTRON KNOW-HOW MAKES EASY THE APPARENTLY EASY

MERELY to apply an insulating coating to tungsten heater wire—that should be easy. To say the illustrated heater-wire coating machine simplifies the job appears a paradox. Why, the machine looks like a product of Rube Goldberg's fertile mind!

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