RADIO NEWS

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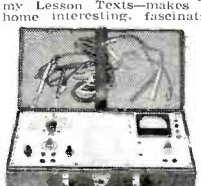

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by THE EDITOR

THE daily mail bag continues to bring in a large number of letters from our readers regarding the situation brought about by the article "Radio Service Men Will Gyp You, Etc." Most of these letters take issue of the statements made in that article.

Realizing the gravity of the situation, as far as the many honest servicemen are concerned, a group of influential radio men have definitely decided that *action* is needed more than at any other time to *organize* those men who are taking this job of radio servicing seriously and are attempting, to the best of their ability, to render Mr. and Mrs. Public a fair deal. One thing is sure; the servicing industry deserves a far better fate than to be steered on the rocks of disaster towards which it may be heading at this moment.

John F. Rider firmly believing that definite strong measures are necessary if the service man is to be saved, has recognized the danger to all radio servicemen. This well-known publisher of radio service manuals and technical books at a meeting held in New York just a few hours ago, analyzed this grave situation and offered what, in his opinion, constituted the only remedy for improving the situation.

"Keen competition from a hitherto unanticipated source looms upon the horizon of the independent radio-serviceman. This new threat, added to the extremely unfavorable publicity in which the spotlight was put directly on the entire servicing industry by the article which appeared in the recent issue of 'Reader's Digest' not only places the continued existence of the serviceman in jeopardy, but makes his survival doubtful."

As a result of *Mr. Rider's* efforts, an Association has been formed in New York, the members of which are radio and electrical appliance servicemen and jobbers. This Association is to be known as the *"Radio and Electrical Appliance Service Association."* The Association is amply financed and has the necessary facilities and leadership to insure the accomplishment of its purposes and aims which are:

1. The Association will guarantee financially to the public all work done by individual members of the Association.

2. The Association shall maintain paid inspectors to adjust complaints between the public and the Association members.

(*Continued on page* 65)

Vol. 26

RADIO NEWS

No. 6

Trade-Mark Registered

The Technical Magazine devoted to Radio in Defense, including articles for the serviceman, dealer, amateur, experimenter and recordist

Contents for December, 1941

FEATURES

Cover Picture: Fabricating a Television Tube in the Famous Du Mont Laboratory

DEPARTMENTS

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FBI Radio Traps SPY-RING

by

SAMUEL C. MILBOURNE

Microfilms gave full data for building a transmitter.

J. Edgar Hoover, Director of the F.B.I., Washington, D. C.

LITTLE did the Gestapo suspect that they had unwittingly communicated with Uncle Sam's F.B.I. when they exchanged transmissions with William G. Sebold. An International hoax was the result.

"REDRO wen eht fo sdnierf lla ot: noitamrofni si yltnegru deriuqer no eht ezis, ytitnauq, epyt dna noitpircsed fo lla detenusetats lanoitan esnefed lairetam; eht snoitanitsed dna gnippihs setad fo hcus lairetam; dna lla rehto tneniatrep noitamrofni. (signed) grubmah opatseg."

Translated from secret code into German, and from German into English, the text read substantially:

"To All Friends of the New Order: Information is urgently required on the size, quantity, type and description of all United States national defense material, the destinations and shipping dates of such material; and all other pertinent information. (signed) Hamburg Gestapo."

Such was the import of the message which on May 22, 1940, crackled out of the ether and into the "cans" on the head of the operator of a very complete radio receiver and transmitter installation at Centerport, Long Island, N. Y.

Acknowledging reception of the message, the operator shut down the equipment and turned with a grin to another man who was also in the room.

"Well, Bill," the operator exclaimed, "it looks like we'll have to fix up our friends with some more phony dope."

And "phony dope" it would be, for —strange as it might seem—the German Gestapo had just finished communicating with the *United States Federal Bureau of Investigation—but the Gestapo didn't know it!*

For almost a year and a half, this international hoax on Hitler's Henchmen was carried out by the FBI under the personal supervision of *J. Edgar Hoover,* its Director. Carefully, slowly, methodically, the FBI assembled facts and names which eventually allowed them to round up and arrest 33 German spies working in the United States, and to break up one of the largest and most deadly spy rings in the history of this country.

How did the FBI agents manage to fool the German Gestapo? First, through the eagerness of the Gestapo to obtain important U.S. defense secrets. Second, through the loyalty of a man who, though German-born, thought enough of the United States, the country of his adoption, to defy orders from the most ruthless body of men in the world.

Originally, the Gestapo dug their own grave by contacting a naturalized-American of German birth, one *William G. Sebold,* when he stepped ashore early in 1939 at Hamburg, Germany, after a trans-atlantic crossing. Hitler's secret agents plied *Sebold* with questions and then they threatened him with death unless he agreed to become a German Secret Agent—a spy—a traitor to the country of his adoption. *Sebold* finally agreed and was released with orders to report to the Gestapo before leaving for home.

But if the German Gestapo thought that they had a willing convert in *Bill Sebold,* they were much mistaken. Taking extreme care that he was not being trailed, *Sebold* went to the U.S. Consul in Cologne, Germany, explained the whole plan and asked for instructions.

The United States Consul, realizing the possibilities in the situation, advised *Sebold* to go through with the plan and become a German spy—as far as the Gestapo were concerned. This *Sebold* did. Just before he reembarked, he reported to the Hamburg Gestapo and was given five tiny micro films on which was complete data for constructing and operating a powerful transmitter and receiver, as well as a list of questions the Gestapo wanted answered. These questions dealt mostly with fantastic supposed U.S. "Secret" military weapons. There were 18 questions.

"Had the American Telephone and Telegraph developed a shell directed by a ray against a target and which crosses a ray before reaching the target, which ray releases the bomb?"

"Had a Professor Bullard of Hobart College perfected an army uniform which was impervious to mustard gas?"

"Did the United States possess a shell with an electric eye mechanism?"

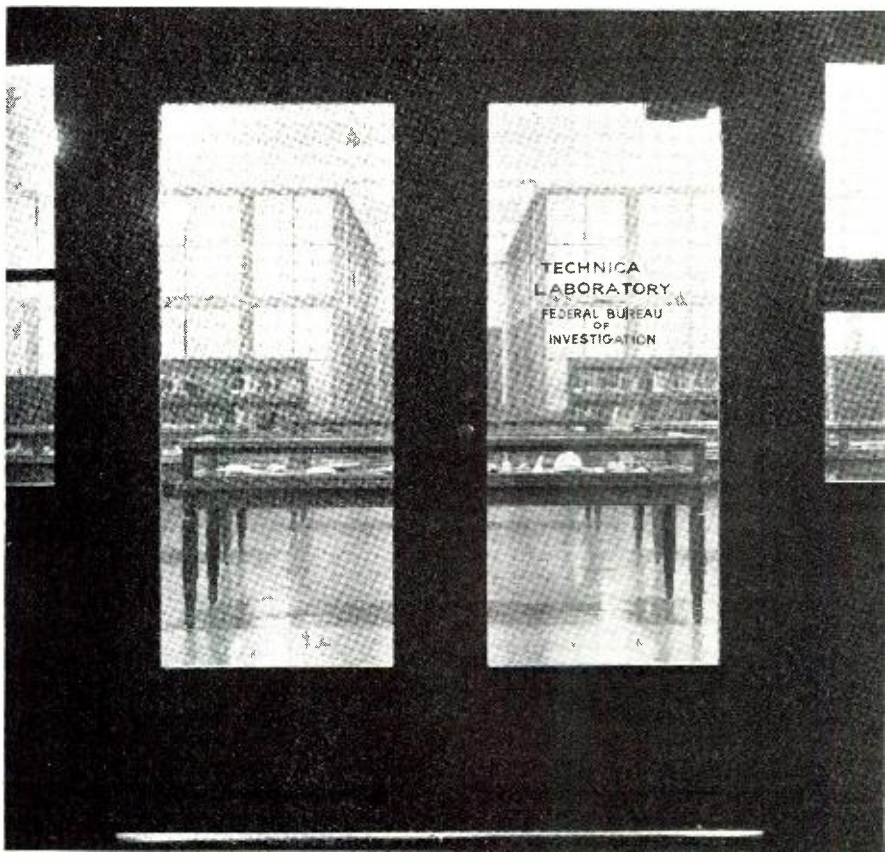
"What about anti-fog weapons?"

These are samples of the 18 questions which were written on a piece of micro-film smaller in size than a postage stamp, yet the text of which took 15 minutes to read.

William Sebold carried these instructions back to the United States. Before the ship docked in New York, he was contacted by FBI agents. The micro-film was taken to regional headquarters in New York City where it was enlarged and the instructions were carefully studied.

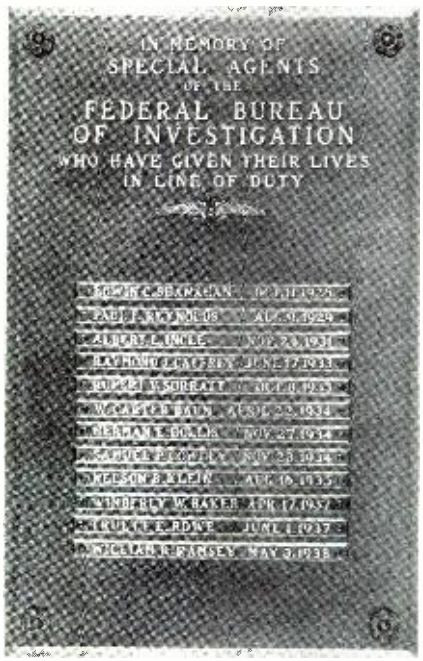
Then, the transmitter and receiver

(*Continued on page* 56)



Left: Entrance to the famous technical Laboratory of the F.B.I.

Below: Plaque dedicated to those who died in pursuit of duty.



Completed turntable and drive mechanism. Note "shock-mounts" used to float the table from the motor board.

Build Your Own MULTI-SPEED TURNTABLE

by MALCOLM P. ODELL
Sales Engineer

Four speeds are available on this home-built recording and playback assembly. It is practically free from any vibration.

BY THE use of some ingenuity on the part of the constructor a turntable of unusually high quality for recording may be had at little more than the cost of a good reproducing table. The turntable to be described not only has the conventional 33⅓ and 78 r.p.m. speeds but also has *two additional* speeds. This system features a heavy turntable platter mounted in properly designed bearings and carefully isolated from the driving motor.

Of the various components of the recordists' equipment possibly the turntable has received the least attention although this piece of equipment can well mean the difference between obtaining first class and mediocre results. In order to prevent "wows" and "rumble" it is very important that the turntable rotate at constant speed under all operating conditions and be as free from vibration as possible. After due consideration of these points it was decided that the turntable should be belt-driven and all bearings should be of the sleeve type.

The finished turntable platter weighs twenty-five pounds and as most of the mass is located around the outer edge the inertia of the platter is relatively high. Speed variations are greatly minimized by virtue of the fact that the turntable platter acts as a very effective flywheel and variations in motor speed will be absorbed by a slight belt slippage at the motor pulley. The motor is separated from the turntable by two sets of rubber *"Lord Mountings."* These make an excellent mechanical filter system that is very effective in preventing motor vibration from reaching the turntable.

The use of sleeve bearings for the platter was adopted as this type of bearing produces much less rumble than ball bearings.

The system is composed of four parts, the turntable platter, bearing and turntable shaft assembly, jackshaft bearing and drive pulley assembly and the synchronous motor. Figure 1 gives details of the machined cast iron platter. A wood pattern of the shape of the platter but of slightly greater dimensions (14⅛" diameter, 1⅜" thickness) must first be constructed, then any foundry can make the casting. In order that the platter may not warp it is suggested that the casting be put in a lathe and light cuts taken on the top surface, edge and bottom.

It may then be placed out in the weather to season for two or three weeks.

After the seasoning period the casting may be put back in the lathe for the final machining operation. A chuck should be selected that will firmly hold the casting by the inside edge. The top surface should first be "faced," then light cuts taken on the edge, finishing the platter to a diam-

eter of exactly 14". No attempt should be made to polish the platter although it may be smoothed with emery cloth.

The hole for the shaft should be bored and reamed to ⅜" (.375" ± .002"). If the platter is to run truly it is important that once final machining operations on the top surface, edge and centerhole have started that the casting *not be removed from or rechucked* in the lathe until these operations are finished. A small hole should be drilled through the top of the turntable and tapped for a 8-32 thread. The center of this hole should be *exactly* one inch from the exact center of the turntable. The turntable pin illustrated in Figure 1 should be placed in this hole when making instantaneous recordings to keep the blanks from slipping.

Next in line for attention is the turntable bearing assembly. This bearing features the use of *Oilite* sleeve and a ball thrust bearing. The *Oilite* bearings (⅝" I. D. length 1¼" cat. no. I-852) and the ⅝" hardened steel ball may be obtained from a local bearing supply house. Figure 2 shows constructional details of the bearing housing. After the outside housing has been turned down to proper diameter and the ends faced a hole 25/32" should be bored completely through the housing and then reamed to 13/16" (.815" ± .002"). The *Oilite* sleeve bearings should be placed in the ends and lightly tapped into place.

Do not force them by a press or pounding. If forcing is found necessary the hole in the housing should be reamed slightly larger. A word about *Oilite* bearings—these bearings contain 35% oil by volume and are designed to be operated without additional lubrication under normal operation conditions. If these bearings are forced into place their inside diameter will become smaller. Caution—*do not ream them* because this will close up the oil pores and ruin their ability to operate without additional lubrication.

Six holes should be drilled in each end as shown in Figures 2 and 3. These holes should be tapped for ¼"-20 screws. A bottom plate of 3/16" steel should be made to hold the ball thrust bearing in place. Although when using *Oilite* bearings additional lubrication is not needed the model herein described was equipped with a cork gasket placed between the bottom plate and the bearing housing. Before the turntable shaft was put into the bearing a small amount of vaseline was placed in it. This will offer additional protection against wear.

The jackshaft bearing is of similar design to the main turntable bearing but is of different dimensions. Details are shown in Figures 3 and 4. Two *Oilite* bearings (cat. no. T-401-5) and a 5/16" steel ball are used. As with the turntable bearing care should be exercised in boring the hole through the housing and fitting the bearings. This assembly is also equipped with a

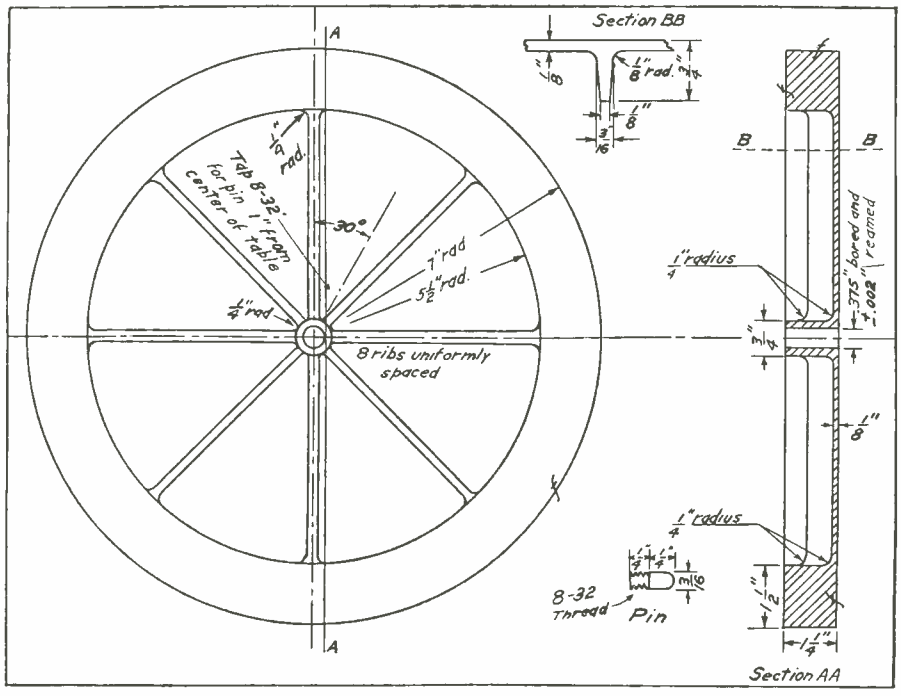
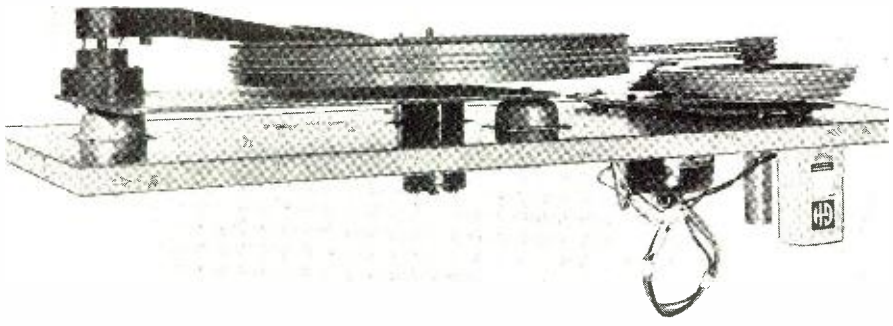


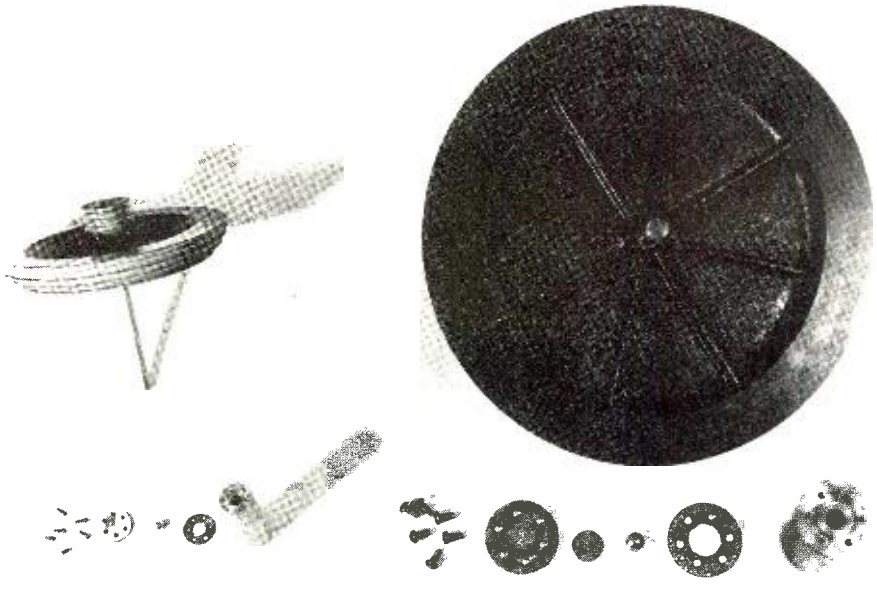
Figure 1. Here are the exact dimensions for the turntable pattern.



Above: Side view of the completed turntable and drive mechanism. Mounting must be parallel to motor board as well as the sub-panel.

★

Figure 3. Finished turntable and drive pulley. Note bearing parts. All pulleys must be entirely free from any burrs and imperfections.



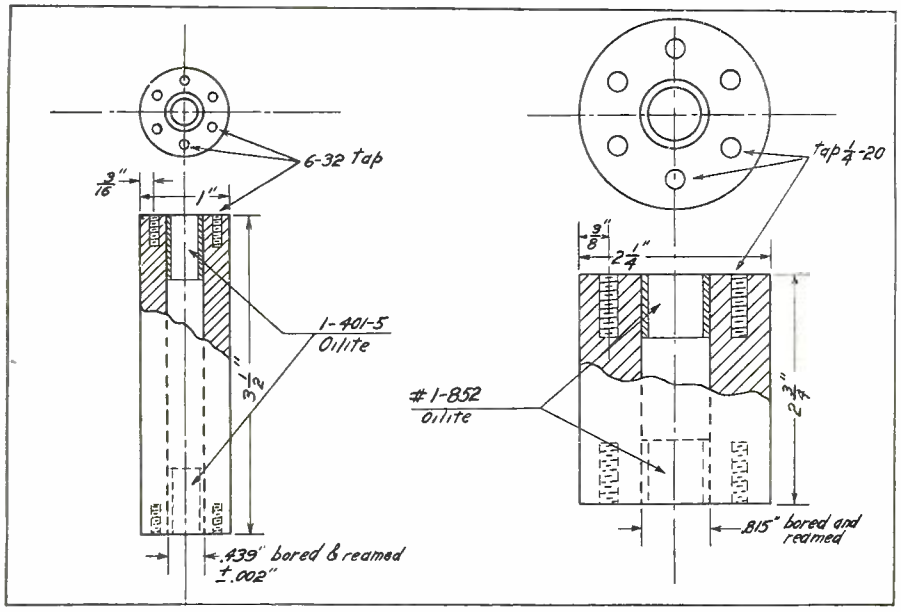


Figure 4. Details of the bearing assembly. Tolerances must be kept close.

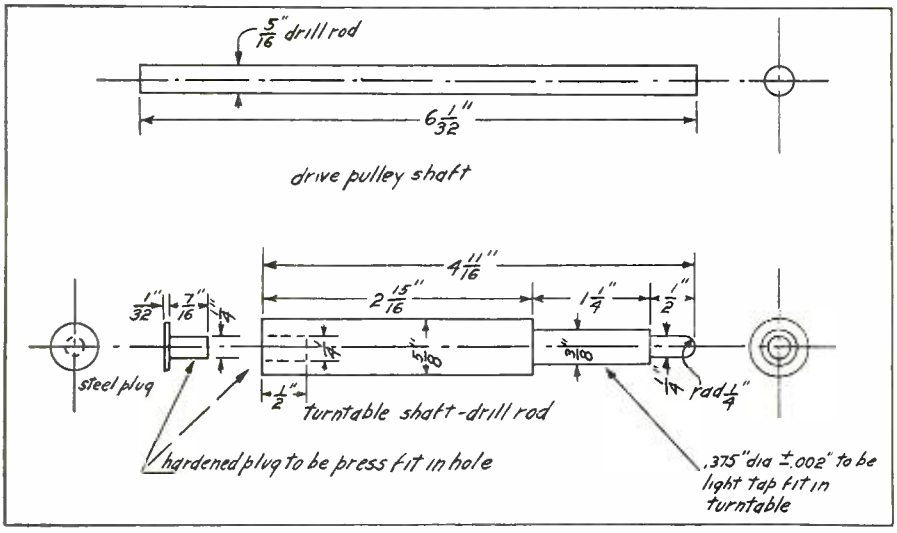
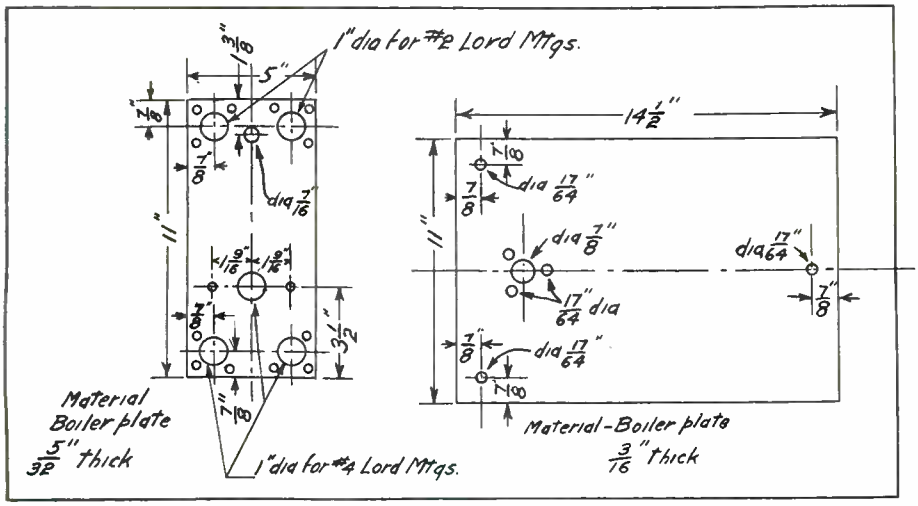


Figure 5. Drive-pulley shaft details, and turntable-shaft dimensions.

Figure 8. The four Lord shock-mounts support this metal mounting plate.



cork gasket to hold a small amount of vaseline placed in it before inserting the shaft.

The turntable and drive pulley shafts are made of ⅜" and 5/16" drill rod respectively. The turntable shaft should fit the turntable platter without forcing. A light tap fit will be just right. If the shaft is forced into the platter by a press or heavy hammer it might be bent slightly. The bottom of the turntable shaft contains a hole ½" deep and drilled to ¼" diameter. A steel plug that may be tapped into it is made up and hardened. The purpose of this hardened steel plug is to prevent wear on the end of the shaft. Figure 7 shows the plug in place.

The jackshaft is extremely simple as the 5/16" drill need merely be cut to correct length. Both shafts should be lightly polished on the lathe with very fine polishing paper. See Fig. 5.

The two mounting plates for the bearings are made of boiler plate. This may be readily obtained from any machine shop. The holes for the shafts and *Lord Mountings* may be drilled on a large drillpress. Important—when drilling the large holes use drills ground properly for hot rolled steel and reduce the speed of the drillpress so the drills will rotate as slowly as possible. The work should be clamped rigidly to the drillpress. After the four 1" holes for the *Lord Mountings* are drilled in the motor plate the mountings themselves may be used as templates for drilling the three small mounting holes that are required for each.

Three 6-32 screws ⅜" long are used for securing each mounting to the plate. Complete constructional data of the two plates are shown in Figure 8.

The turntable is supported by three no. 6 *Lord Mountings*. Two no. 4 *Lord Mountings* support the motor end of the small mounting plate and two no. 2 are used under the Jackshaft end. Figure 7 shows how the mountings are secured to the bottom of the motor plate.

It will be noticed that Figure 7 shows only three screws holding the main turntable bearing to the plate whereas Figure 3 shows six holes, actually only three screws are needed, but the original model (photographed) was equipped with the six holes in the bearing housing.

The pulley system is designed to rotate the turntable at speeds of 78.26, 33⅓, 50 and 20 r.p.m. 50 and 20 r.p.m. are, of course, not standard speeds, but were incorporated into the writer's system for experimental purposes only. 20 r.p.m. offers interesting possibilities for making speech records of longer playing time. Of course any records made at 20 or 50 r.p.m. can be played back only on a turntable designed to operate at these speeds.

The writer used 1" thick linen base bakelite for all pulleys; however, if only 78 and 33⅓ speeds are desired, ½" bakelite may be used for the motor and large jackshaft pulleys. A 1" piece of bakelite must be used for the three-groove pulley located at the top of the jackshaft. Details of the three pulleys are shown by Figures 9, 10, 11 and the completed pulleys are shown in the photographs.

The pulleys should first be roughed down to approximately the diameters of the ridges between the grooves and

the shaft holes bored. Holes should then be drilled and tapped for the setscrews. In order that the finished pulleys may run true it is important that the holes for mounting to their respective shafts be exactly in the center of each pulley. The easiest way to accomplish this end is to finish them about their shafts. The shafts should be mounted in collets rather than chucked in a three or four jaw chuck. In this machining operation the pulleys are kept from turning on the shafts by means of the setscrews. The tool for making the grooves should be carefully ground to a radius of 1/16". When machining bakelite the work should turn at a fairly high rate of speed and the cutting tool should be kept sharp. Light cuts should be taken and all grooves cut to exact diameter using the lathe micrometer.

All machining operations having been completed the system is ready for assembly. Figure 3 shows all the parts of the two bearings laid out in the order of assembly. It is seen readily from the photograph how these bearings are put together. The cork gaskets shown immediately to the left of their respective bearing housings, are placed between the housings and the bottom plates, the assemblies being held together by the screws. To the left of the thrust ball of the main turntable bearing is shown a small hardened steel disc. This disc is placed in the hole of the cork gasket and is located under the ball.

The jackshaft bearing does not require a hardened disc since the weight of the rotating assembly is not nearly as great as in the case of the turntable. The steel disc used in the turntable bearing is ¾" in diameter by 1/16" thick. After assembly of the bearings they may be bolted to the plates, the *Lord Mountings* attached and the plates then mounted to a piece of ⅞" plywood. The *Lord Mountings* are fastened to the plywood by means of wood screws. The plywood shown in the photos measures 18" x 30". Suitable holes must, of course, be cut in the case to take the bearings and motor as shown in Figure 7. Before inserting the jackshaft and turntable shafts a small amount of vaseline should be placed in the top of each bearing. The turntable platter is covered with a rather heavy grade of felt.

The driving motor should be designed to run on end and of course should be as free of vibration as possible. The pulleys of this system are designed for use with an 1800 r.p.m. motor. A *Robbins and Myers* 1/60 horse power synchronous motor was chosen as it meets these requirements exceptionally well. This motor furnishes plenty of torque in starting the turntable.

The two belts used are of the type used on dental drills. They may be ordered through any dental supply house. In determining lengths, pieces of stout cord should be placed in position, drawn up fairly tight and knotted. These string belts may be sent to the dental supply house for duplication with ⅛" belts of the same length. It was found that no idler pulleys were necessary; however, if the belts should stretch slightly after being in use a while they can be removed, dampened slightly with water and allowed to dry slowly. This will permit them to shrink to proper size.

The system is now ready for speed checking. A neon lamp and stroboscope disc are all that will be needed for this job. It is not at all necessary that the 20 and 50 r.p.m. speeds be exact because these speeds are not

(*Continued on page* 56)

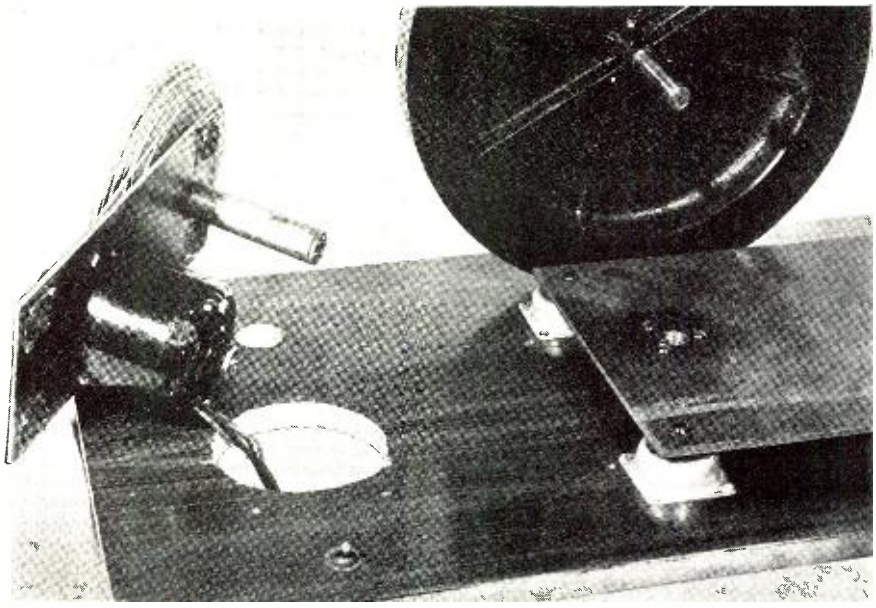


Figure 7. Cut-outs are made in the motor board to fit the motor, etc.

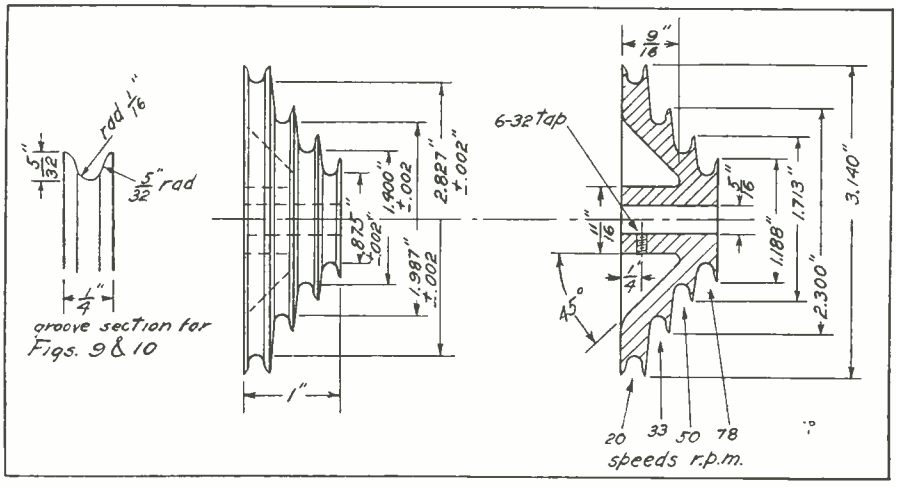
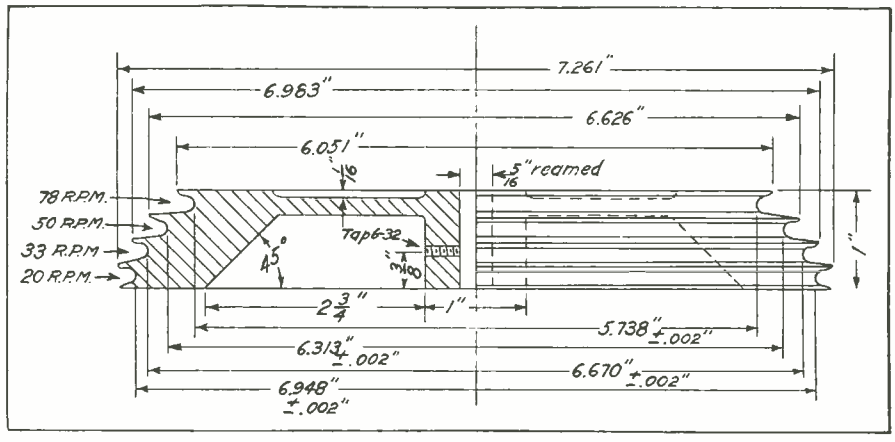


Figure 9. Complete details are shown for the various pulley assemblies.

Figure 10. It is extremely important to use care in making all pulleys.



EASILY BUILT SIGNAL TRACER

by TED BRADFORD, W2HAF

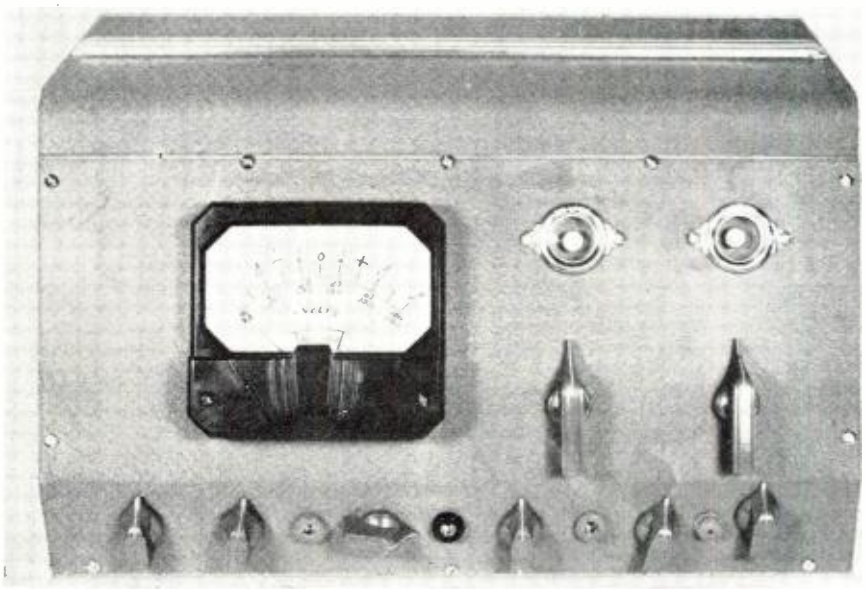
More and more Servicemen are adopting Signal Tracing procedure in daily radio trouble-shooting. This Tracer may be built at low cost.

IN the present day era of very complicated radio receiving sets, when trouble develops one of the easiest ways to find it is by tracing the signal through the set, and finding out at which place it becomes distorted, weak, or disappears entirely. Knowing that many technicians want the new signal tracing instruments but cannot afford to purchase them I believe that the instrument herein described will, while not doing as thorough a job as the expensive test equipment, be of untold value to the average radio service man. The only other instrument needed for the complete job of radio repairing is a good signal generator.

Basically the instrument consists of a tuned radio frequency stage with a diode detector and a 6E5 Electron Eye indicator, a moderately high gain audio frequency amplifier with its associated 6E5 Electronic Eye indicator. This can be coupled to a 41 second audio frequency amplifier to which is connected a speaker for the purpose of audibly monitoring the signal, and a vacuum tube voltmeter with ranges of zero to plus or minus five, twenty-five, one hundred, and five hundred volts. With this instrument direct current voltages can be measured in any part of a radio set with practically no current being drawn, as the input resistance is eleven megohms. Furthermore, it is almost impossible to overload the meter.

While not recommending it, I have applied five hundred volts across the five volt range without damaging the meter or blowing out the associated 1/100 of an amp. fuse. Last, but not least is a well filtered power supply consisting of not only the speaker field, but an additional 20 henry choke, which together with a 3 section 8 mfd. filter, gives pure direct current for the various sections of the instrument.

Looking at the front view of the instrument from left to right one sees first, the O-1 ma. meter movement, the Electronic Eyes, first the r.f.-i.f., and then the a.f. indicator. Directly below these are the line switch and the r.f.-i.f. band changing switch. Along the bottom of the panel under the chassis

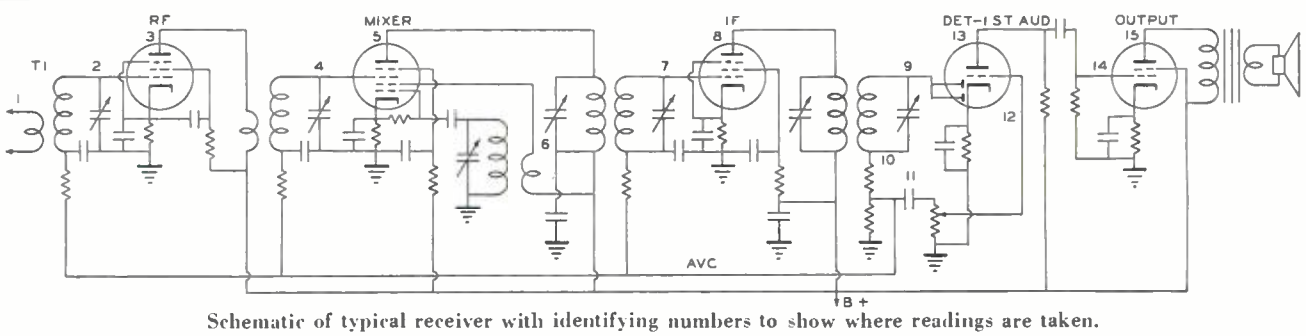


The completed unit fits into a metal cabinet having a sloped panel.

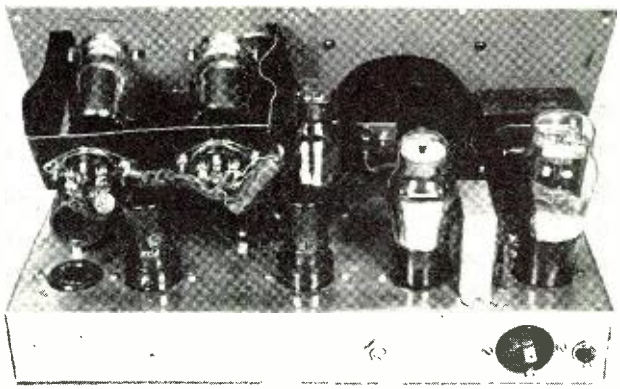
base for wiring convenience, we see first the Vacuum Tube Voltmeter range switch, the V.T.V.M. zero set, the input jack for the V.T.V.M., the r.f.-i.f. gain control, the first audio stage input jack, the first audio stage gain control, the r.f.-i.f. input jack, the second audio stage gain control, the r.f.-i.f. output jack, and lastly the r.f.-i.f. tuning condenser. In the rear of the chassis are the V.T.V.M. calibration resistor, the line plug, High-Low line voltage switch, and the jack for connection to the ground of the chassis to be worked on.

When the set was first constructed, bad feedback troubles were encountered, but the use of shielded wire where indicated and the adoption of the filter network R5-C7 completely eliminated these objectional disturbances. The 410 mmf. tuning condenser, whose plates had to be ground down somewhat to fit beneath the chassis, tunes with its associated coils the following bands: Band No. 1—4000 kc. to 1500 kc., Band No. 2—1600 kc. to 600 kc., Band No. 3—550 kc. to 110 kc.

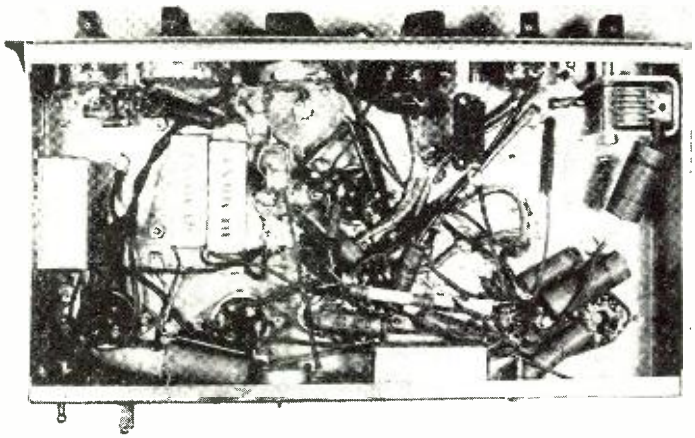
These three bands are all that are necessary to cover the oscillator, broadcast, and intermediate frequency bands of the present day receiver. Constructional details are simple: follow the photographs as closely as possible, keep the r.f.-i.f. channel as free from the wiring of the associated channels as you can, shield where



Schematic of typical receiver with identifying numbers to show where readings are taken.



Above: Special bracket is made to mount tuning eyes. Chassis and sloped panel are one integral assembly.



Above: All wiring is made point-to-point. All leads shown to be shielded are designated on the diagram.

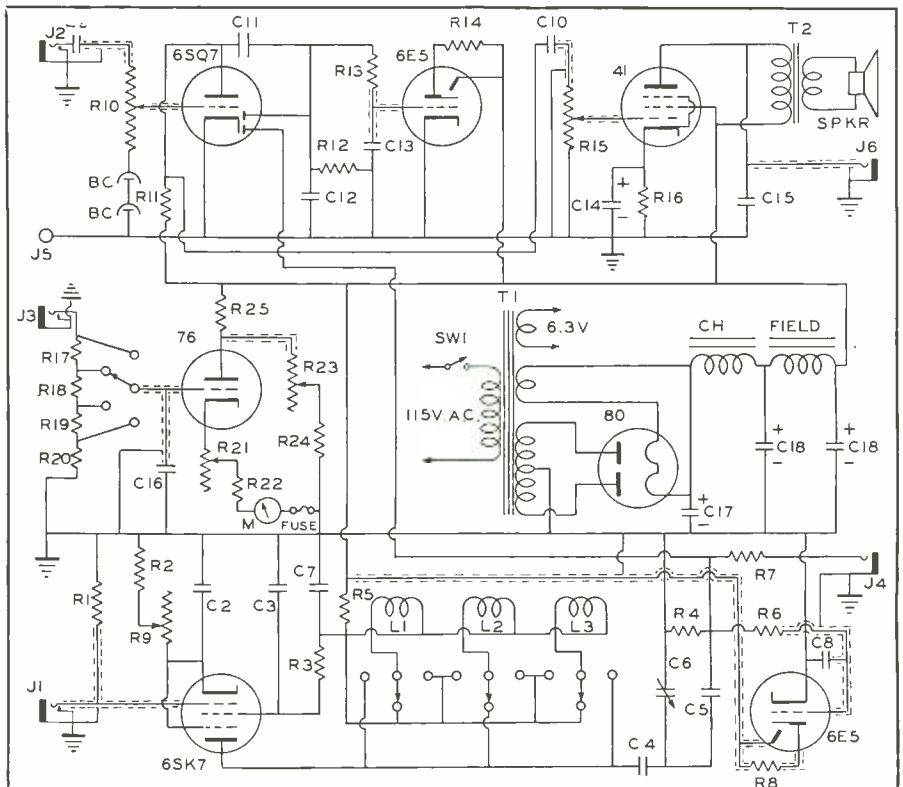
shown, carefully solder each connection, and no trouble should be experienced.

The calibration of the V.T.V.M. is as follows: using 2 good dry batteries, or two sections of a good storage battery, or some other source of constant reliable d.c., adjust the calibrating resistor until the V.T.V.M. reads the correct voltage (using the first input switch tap, of course) then remove voltage and re-zero by means of the zero set in the front of the panel, continue this procedure until a point is found on the calibrating resistor where the V.T.V.M. will read the correct voltage and return to zero (zero is in center of meter scale) when the voltage is removed. After this point is found the calibrating resistor will not need to be touched again unless tubes are changed, necessitated by loss of emission. The zero set is readjusted whenever the V.T.V.M. is to be used, the same zero setting applying to all ranges.

The various test leads *are all shielded,* with double circuit plugs on one end, and test prods connected as follows on the other. *HIGH* quality *LOW* capacity lead *MUST* be used. For the V.T.V.M. prod a one megohm resistor is connected between the prod and the center wire of the test lead. Audio center wire is connected right to test prod. R.f.-i.f. center wire is connected to prod by twisting about four inches of wire together using the center wire of the lead as one connection and connecting the other twisted wire to the prod so that no metallic connection exists, but forms a condenser of low capacity, about 2 mmf.

The actual use of the instrument can best be shown with the use of a simplified superheterodyne diagram as shown. First we connect our signal generator to point 1; and tune the receiver, test oscillator (using a modulated signal) and our signal tracing instrument to some spot in the broadcast range, say 600 kc. We adjust the gain of our tester with the r.f.-i.f. probe on point 1 until the r.f.-i.f. eye is almost closed. We then shift to point 2 with the probe and the eye should close, showing a gain thru T1.

Keeping the tuning controls as before, but reducing the gain we shift to point 3 and a further increase should be noted. In all these Electronic Eye indications if one prefers the use of the V.T.V.M. as an indicator, it is a relatively simple matter to plug in the V.T.V.M. lead in its proper jack and plug the prod of the V.T.V.M. into the r.f.-i.f output jack, thusly enabling one to compute the actual gain of each



R_1—200,000 ohms, 1 w., IRC
R_2—200 ohms, 1 w., IRC
R_3, R_7—20,000 ohms, 1 w., IRC
R_4—500,000 ohms, ½ w., IRC
R_5, R_{22}—5,000 ohms, 1 w., IRC
R_6, R_{12}—2 megohms, ½ w., IRC
R_8, R_{13}, R_{14}—1 megohm, ½ w., IRC
R_9—10,000 ohms, variable RF-IF gain, Mallory
R_{10}—2 megohms, variable audio gain, Mallory
R_{11}—250,000 ohms, 1 w., IRC
R_{15}—1 megohm, variable 2nd audio gain, Mallory
R_{16}—500 ohm, 10 w., Ohmite
R_{17}—8 megohms, ½ w., IRC
R_{18}—1.5 megohms, ½ w., IRC
R_{19}—400,000 ohms, ½ w., IRC
R_{20}—100,000 ohms, 1 w., IRC
R_{21}—3,000 ohms, variable "calibrating," Mallory
R_{23}—10,000 ohms, voltmeter zero set, Mallory
R_{24}—6,000 ohms, 1 w., IRC
R_{25}—20,000 ohms, 10 w., Ohmite
C_1, C_{12}—.0001 mfd., 500 v. mica, Aerovox
C_2, C_4, C_5, C_8, C_{10}, C_{11}, C_{13}, C_{15}—.01 mfd., 600 v. paper, Aerovox
C_3—.1 mfd., 600 v. paper, Aerovox
C_6—410 mmf., tuning condenser cut down to fit chassis
C_7, C_{12}, C_{14}, C_{16}—8 mfd., 450 v. dry electrolytics, Aerovox
C_9—.01 mfd., 1,000 v. paper, Aerovox
C_{11}—10 mfd., 25 v. dry electrolytic, Aerovox
C_{16}—.001 mfd., 500 v. mica, Aerovox
J_1, J_2, J_3—Double circuit jacks, Mallory
J_4, J_5, J_6—Single circuit jacks, Mallory
L_1—Short wave frequencies, 40 turns, 1¼" diameter
L_2—Broadcast frequencies, 100 turns, 1¼" diameter
L_3—Intermediate frequencies, 190 turns, 1¼" diameter
Switch (band changing)—3 pole, 3 throw rotary, Mallory
Choke—450 ohms, 20 henry, Stancor C1708
Speaker Field—1,000 ohms, Utah
Transformer—325 v. each side, 5 v., 6.3 v., Stancor P6120
Chassis—7" x 13" x 2", Bud
Cabinet—8" x 14" x 8", Bud
SW_1—SPST Toggle, Arrow

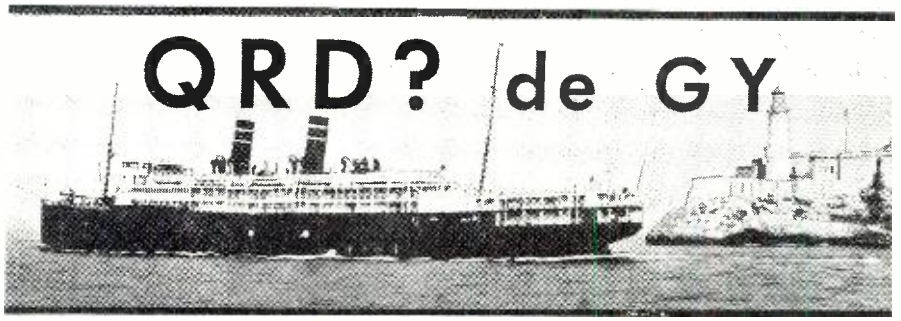
stage and, of course, the same can be done with the audio channel. Proceeding to point 4, still at 600 kc., we should again notice a slight gain necessitating the attenuation of the r.f.-i.f. gain control so that the eye barely closes. Now, check the presence of the 600 kc. signal at point 5; a slight loss here is normal. This point, however, is very important as we will get, if the set is working properly, another signal other than the 600 kc. output of the generator. This other signal is the intermediate frequency.

Knowing the i.f., first tune the tester to band C, which will in most all cases cover all i.f's. encountered; tune the tester to maximum indication on the eye, reducing the gain if necessary, and then disconnecting the signal generator from the radio chassis, connect it to the r.f.-i.f. input of the tester. Adjust the signal generator in the neighborhood of the i.f., and check to see if the reading of the test oscillator when it is in resonance with the tester is showing the correct i.f.; if it is, retune both oscillator and tester to 600 kc. to check overall resonance. Now, connect the r.f.-i.f. probe on point 6 and here we should get, in most cases, a frequency of the i.f. plus that of the frequency of the incoming signal, namely, 600 kc. plus 456 kc. or a total of 1056 kc. (the phrase, "In most cases," merely means that while most sets tune the oscillator to a frequency higher than that of the received frequency, a few isolated instances may be had where the mixer signal will be the received signal minus the i.f., i.e., 600 kc. minus 456 kc. or 144 kc. These, however, are very rare.)

This 1056 kc. signal should be checked with the test oscillator as shown in testing at point 5. Retune test oscillator to 600 kc. and the tester to the i.f's. and proceed to point 7. Here we should find a signal with an increase in gain at the intermediate frequency. Placing the r.f.-i.f. probe at point 8 with the tester still tuned to the i.f., we should get a further gain; this gain can be numerically calculated as explained with the use of the V.T.V.M. as an indicator and computing the gain between various test points. At point 9 we again find a signal at the intermediate frequency, but here a slight loss of signal level will be found because of the loading effect of the diode plates.

Average losses are from 1½ to 1 to 3 to 1. At point 10, since the r.f. signal has been rectified, it has been changed to an audio frequency, and as such we must use our audio frequency prod and the audio frequency channel. The first audio stage gain control controls the entire audio system, both that of the a.f. eye and the second audio stage, that is, providing you have turned up the second audio stage gain control, and the loudspeaker. At point 10 we will find an audio frequency signal, we set the a.f. eye almost closed with the a.f. gain control and then move to point 11 and then point 12.

(*Continued on page* 50)



by JERRY COLBY

IT IS with real pleasure we note the response of CTU-Mardiv to the newly graduated radiops from the U. S. Maritime Commission's school at Gallups Island, Boston. As Brother Fred Howe states in his "Journal", quote . . . These young men are intelligent, alert, physically and mentally sound. They possess a good education, have a good family background and, above all, they know their radio . . . unquote. What a hue and cry was raised when this radio school was founded and, especially, when the "Six-month's Law" was brought up for temporary suspension. But may we remind the CTU-ROU that there are many other true and tried radiops who are floating around this great USA who do not know where and how to apply for a seaside billet. At the moment we have requests by RR Androvic, RM2/c, USN, USS Southard (DMSLO) Pearl Harbor, T.H., and J. D. Cote, 1 North Avenue, Sanford, Maine, as to what, when and how jobs are available. Incidentally, as Brother Andy MacDonald sez, "give the young fellows a hand with their traffic. Remember we were all first trippers at one time and whether you like to believe it or not, if it hadn't been for the 'lids' helping us out during the past month or so we would have been taken over by the Navy."

WITH this column begins the tenth year of pounding out the wisdom, wisecracks and wishes of and for radio operators all over the world. We have received mail from almost every country in the world including Siam (Thailand), New Zealand and China during the past years. And we have been berated, overrated and underrated. We have been accused of everything under the sun and we have been praised. But we have never received any comment from any reader which might indicate that we haven't been faithful to the interests of radio men. In this pilot seat we have received the honest thoughts of radiops who wouldn't dare express themselves thusly on the floor of a union meeting; about policies, officials and other radiops. And we have tried to glean the wheat from the chaff.

Occasionally, we have been woefully disappointed in our judgment of certain personalities. But they did serve their purpose, for good or bad, until their sun set. Some have followed the line of least resistance. Others have been swayed by doctrines inimical to the welfare of our country. And the sum total of these seems to be final oblivion. Almost like "crime doesn't pay." We have been accused of being pro-ARTA and of being against ACA. Some have suggested to us to hire a hall whilst others have insisted that we go peddle our thoughts to a Honky Tonk. But you and us, both, have one thing in common and this is being fair to the interests of radiomen.

Right now we are being accused of being pro-ROU. We admit that we have been blowing the ROU horn for some time past because we believe that ROU is a thoroughly American-minded union headed by 100% American radiops who unselfishly have devoted their entire time towards the fulfillment of a dream. That dream was primarily to create a union in which every man would have a voice in the formation of its policies, in which there would be no backstage byplay or political shenanigans. And above all, that strikes could be avoided in all cases.

They have succeeded beyond their fondest hopes and our hats are off to the men who had the courage of their convictions, the courage to fight what seemed to be a losing battle. Yet they've won because of their faith and ideals. Not once have they resorted to strike action. This was never necessary because they have always been on the square—they have laid their cards, face upwards, on the conference table, giving their best for their membership. This, too, has been our faith and our ideal . . . to give our best to our readers without equivocation and without reservation. And that is why we are pro-ROU. We want to see aboard American ships only those radiops who have faith in this American form of government and who believe in the motto "America right or wrong."

OUR Seattle sleuth-hound, HC Craig, advises us that "The daddy of them all, James J. Delaney, the radiop who contributed over $2,000 of his personal funds to found the first ARTA local in New York back in '31, has been located at an FCC Monitor station near Kingsville, Texas. Jim was recently transferred from Marfa to Kingsville, and sez the heat down there is terrific. Like all old-timers he gets a hankering for ship-side duty and was almost aboard one of the new *Alcoa* boats when the FCC made him stick with a pay raise. So there Jim stays at his lonely vigil on the western plains of Texas. The man who saw it all. . ."

ALTHOUGH some wiseacres never figured on a Joe Stalin-Hitler shindig, our reporter sez he had it doped out long ago. He sez, "Why, Joe and Adolf never could see eye to eye, especially when it came to the women-folk. Herr Schicklegruber always said that woman's place was either bedside or kitchen-side. But Joe has insisted otherwise. As witness the SS Petrovsky which entered Seattle the other day with a woman medico aboard. Many of the USSR vessels carry three and four women in the stewards' department. And a recent arrival had aboard a radiop who was the wife of the First Officer. Such goings on!

HC wants to know why tuna fleet radiops like Ken Adams of the Lusitania, Ernie Kaufman on the Mayflower, Harry Kenny of the Rajo, Joe Moore of the Sao Joao, Al Good on the Prospect, Dick Mindte on the Invader, Earl Odergarde on the Belle of Portugal and many others remain on them for as long as ten years or more when big offshore freighters and passanger boat billets are available? It is no easy life. There is more hard work per square foot on board one of those oversized tugboats than on any other type of craft. Yet the boys hang on. Of course, there is always the lure of a quick trip to the local banks or islands and then there is always the gamble of a good haul and high prices. Especially today, with canned goods reaching all time peaks. Is Tuna on defense priorities as everything else seems to be?

BROTHER GB Angle checks on our Gulf sleuther by saying . . . quote . . . the carbons are getting weak, meaning business

(*Continued on page* 55)

Sound-on-Film Recording

by W. L. WOOLF
Chief Engineer, Recordgraph Corporation

Longer playing time at lower cost are but two of many features found in sound-on-film recording.

THE *Recordgraph,* like most inventions, was mothered by necessity. Suppose you were faced with any one of the following problems:

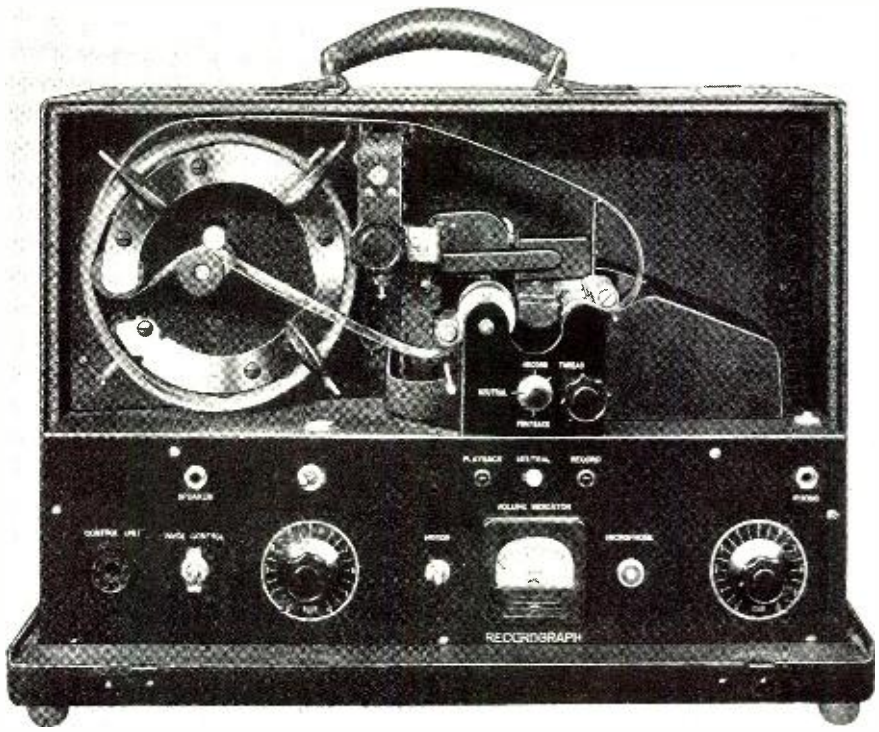
(a) You are charged, say, with the responsibility of apprehending a ship believed to be engaged in smuggling. The extent of the smugglers investment in ship and cargo makes you reasonably certain he will not risk a landing without communicating with his land accomplices to lay carefully timed plans for landing, unloading and disposing of the goods, and probably to get reports on the whereabouts of any known law enforcement officers. You set up radio equipment to scan the airways on all suspected wave lengths. You cannot personally remain at the radio dials day and night, and must therefore trust to the cooperation of assistants, not all of whom are equally skilled in languages, signs, codes, etc., so you resort to *recording* all radio audio signals in order that they may be studied deliberately and in detail. But to keep a complete record of all possible communications you find you are recording for days and weeks on numerous frequency bands, piling up hundreds of useless records at great expense in material and labor in order to get those few terse sentences you are looking for.

You need a recorder that is always ready, that goes into action automatically when the signal starts; stops when the signal disappears, and makes a faithful record of the signal received, whether or not the attendant was alert at the moment of its coming.

(b) Or you may be the engineer in charge of traffic control at a large city airport such as LaGuardia Field, New York City. In order to place responsibility and to make both pilot and control tower operators extremely careful, you install recording machines to record all messages between incoming pilots and the control tower. To do this you are compelled to cover some 16 radio frequency bands. The cost of keeping men available three shifts per day seven days per week to change records is prohibitive; nor do you wish a machine which runs all the time, but runs only when a signal is to be recorded in order to save expense on record materials. Again you need a recording machine which starts automatically with the incoming signal and stops when the signal disappears.

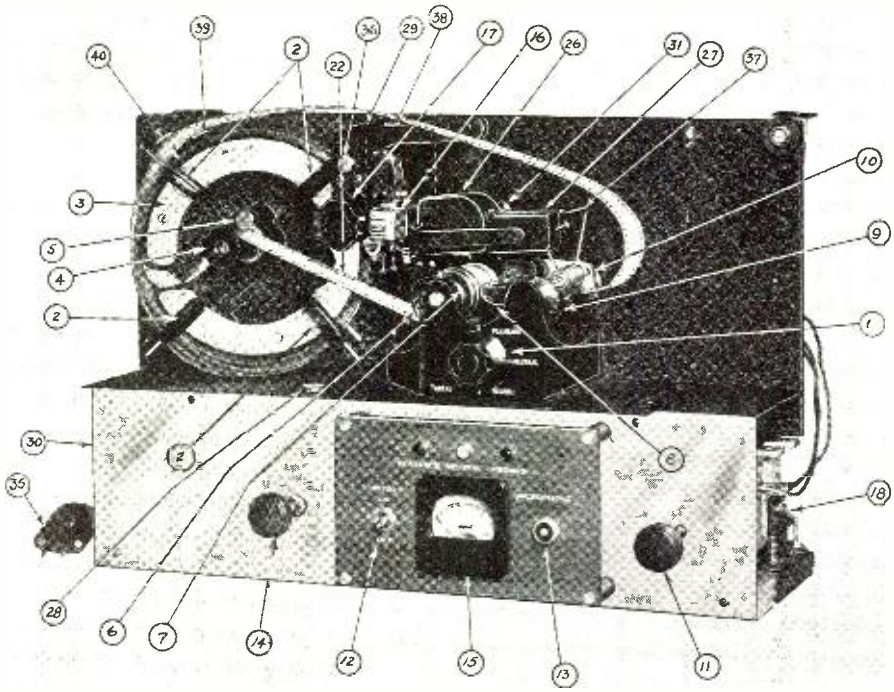
(c) Your problem may be that of the manager of a large power plant in which you record all orders to and replies from the dispatching room where an error of judgment or execution may prove very costly.

(d) Or your problem may be that of a postal inspector, a narcotic officer, a member of the F.B.I. or member of the state or city police force whose job it is to detect crime. With



A portable model film recorder, ready for service at a moment's notice.

Fig. 1. Identifying numbers on the parts are fully explained in the text.



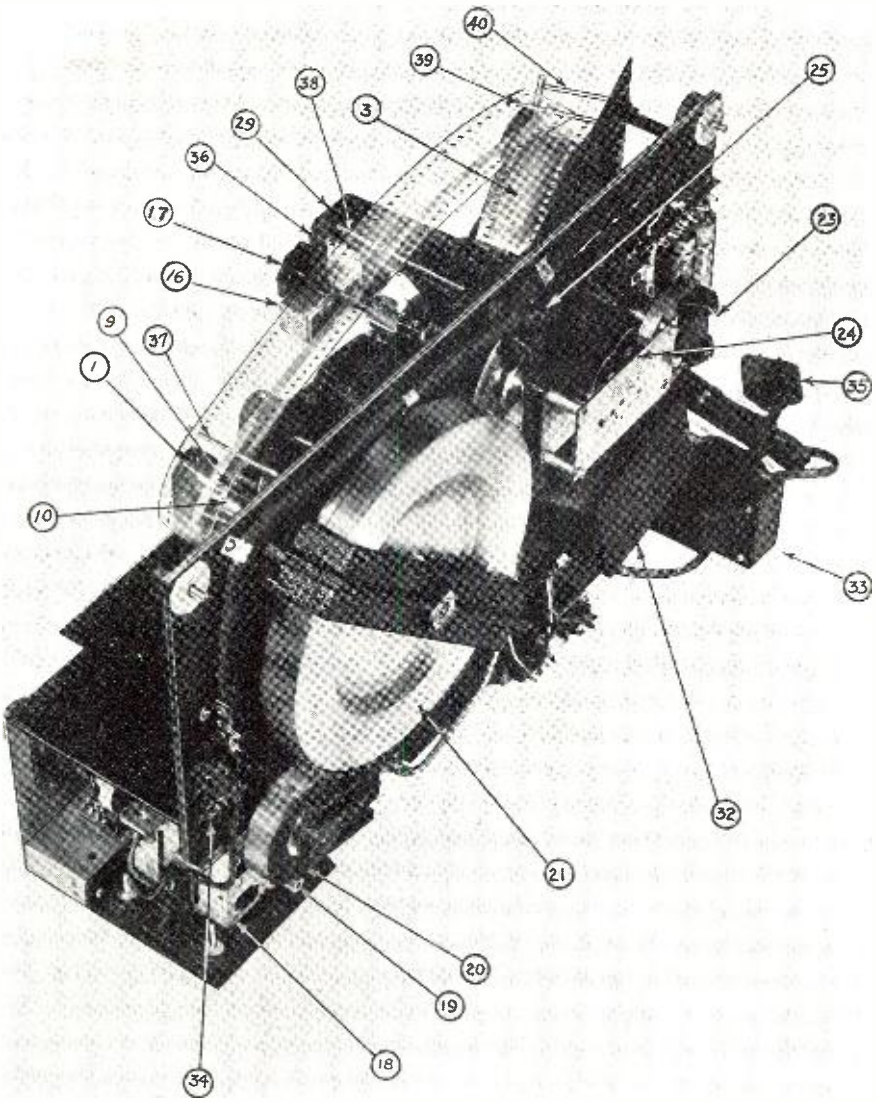


Figure 2. Back view shows heavy flywheel, used to stabilize speed. The assembly is very compact, in spite of the many parts required.

microphones planted and concealed in strategic hideouts or with telephones tapped, you may wait days for the watched-for signal. You require a recording machine which, regardless of your presence, will flash into action, recording every message and stand-by between messages without wasting recording material.

To meet such problems the *Recordgraph* recording machine has been developed. It records on 35 mm. safety cellulose acetate unemulsified film. It starts automatically with the incoming of an audio signal; it stops automatically when the signal decays. It records with a permanent stylus which requires no sharpening or replacement and plays back with a similar stylus. The recorded message may be reproduced immediately after the recording is completed or if desired it may be reproduced while the recording is being made. The recorded signal may be amplified for loud speaker listening or it may be listened to by headphones without amplification. A film roll of sufficient size to last for 8 to 12 hours of actual recording can be placed on the film magazine at a single loading. For intermittent recording this may prove to be enough film to last for one to two weeks, depending upon the duration and frequency of occurrence of the incoming signals. Recording may be made on both sides of the film without removing it from the machine or without any interruption to change the recording from one side to the other. At a film speed of 20 feet per minute and recording on both sides, only 6¼ feet of film are consumed per hour of continuous recording, there being 100 sound tracks available on each film. A Compressor in the amplifier tends to record weak signals with adequate volume without over recording the strong signals. The needle scratch level is very low. Frequency response, though less than that of high fidelity recording, is better than telephone quality and far superior to that of current dictating machines. Both speech and music are of a pleasing quality.

Mechanically and electronically the instrument consists of devices to perform the following functions:

(1) Means for propelling the film.

(2) Means for supporting and controlling the film.

(3) Means for effecting intermittent action of the film.

(4) Means for recording and reproducing.

(5) Means for moving the recording head and pick-up laterally of the film in order to advance from track to track.

Means for Propelling the Film
(See Figs. 1 and 2)

The film is propelled by a sprocket wheel (9) mounted on the same spindle with the fly wheel (21). The fly wheel is driven by a motor (18) provided with a pulley (19) which drives the rubber idler (20) thus rotating the fly wheel (21) and driving the sprocket (9) which propels the film.

Means for Supporting and Controlling the Film
(Fig. 1)

The film is retained in the form of a roll on a magazine (3). A loop of film takes off the inside of the magazine between rollers 4 and 5, passes under the recording drum idler (6), over the recording drum (7), under the safety switch bracket (8), over the sprocket (9), under the sprocket idler (10) and back over film guides (37, 38, 39 and 40), to the outside of the film roll on the magazine.

Means for Effecting Intermittent Action of the Film

The spindle, which is co-axial with the sprocket (9) and the fly wheel (21) is in two pieces, the two pieces being also co-axial. It will thus be seen that the fly wheel may rotate without causing rotation of the sprocket. The two abutting ends of the spindle are equipped with a toothed clutch which is normally open. With the incoming of an audio signal, however, a portion of the output of the audio amplifier is used to energize a relay which in turn causes the toothed clutch to close. When closed, both ends of the spindle are caused to rotate together, the fly wheel thus driving the sprocket. With the decay of the incoming signal the clutch opens, the fly wheel continues to rotate, but the sprocket is idle, thus when no signal is being impressed on the amplifier the sprocket does not rotate and no film is consumed. With the incoming of a signal, however, the sprocket goes into immediate action and the signal is recorded. The time required for the clutch to close is about 1/200 of a second.

Means for Recording and Reproducing

By means of a single knob (1) the instrument is set in any of its four positions, namely, Record, Neutral, Playback and Thread. Cams on a shaft which is turned by knob (1) (see Fig. 1 and drawing 132) perform all the necessary functions to convert the instrument into the above four positions.

When the arrow on the knob is turned to the "Record" position, the Recording Head (26) is lowered with

its stylus on the film by means of the Recorder Lifter Arm and the Record Cam. The Pick-up (27) is lifted by the Phono Lifter Arm and Phono Cam in order that its stylus clear the film. The incoming audio signal which is fed to the amplifier through a shielded plug (13) and may originate in a microphone, telephone, a radio tuner or a phonograph, is connected to the input of the amplifier by means of a 3-position four segment switch rotated by a U-shaped member M which is rotated by a pin N attached to a gear wheel L which in turn is rotated by gear K attached to the shaft which is rotated by knob (1). The output terminals of the amplifier are connected to the coil of the Recording Head and the toothed clutch is operated as above described which sets the film in motion thus recording the incoming signal.

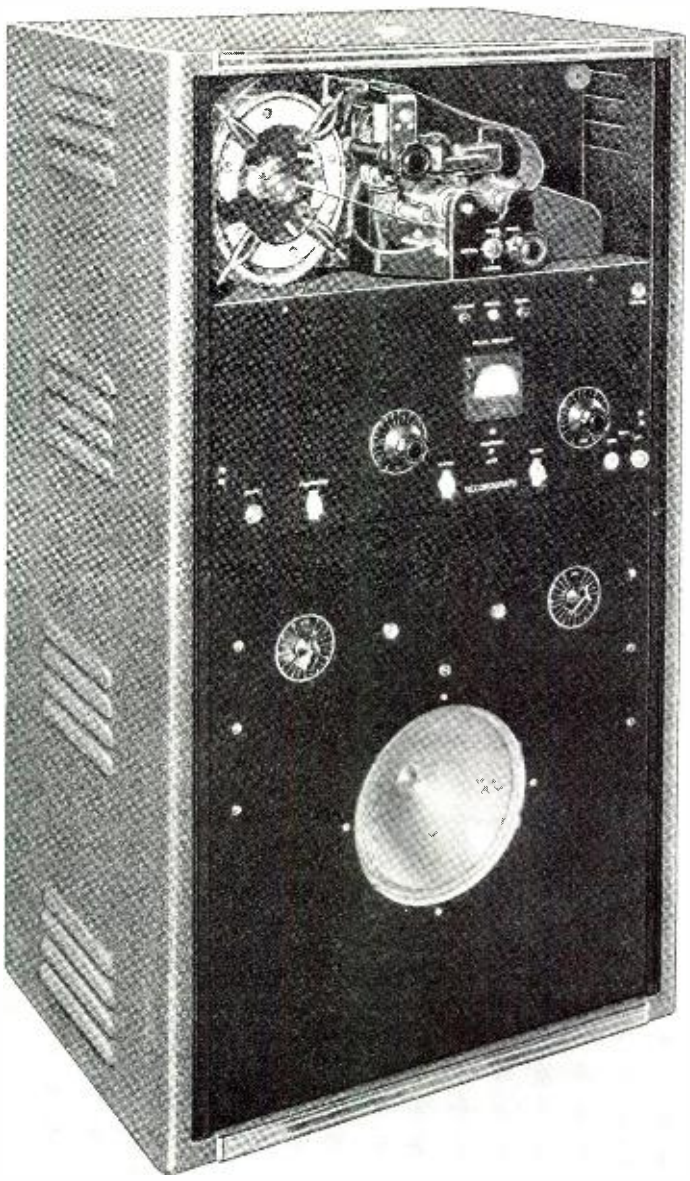
When the knob (1) is turned so that the arrow points to "Neutral" as shown in Fig. 1, the Record Cam raises the Recording Head clearing the stylus from the film by means of the Recorder Lifter Arm and the rotation of the shaft rotating gears K and L by means of pin N, rotates the U-shaped member M, thus setting the four segments of the three position switch to a new position in which the Recording Head is disconnected from the output of the amplifier and the loud speaker is connected in its place, thus converting the instrument into a public address system.

When the knob (1) is turned to the "Playback" position, the Phono Cam permits the right hand end of the rocker arm beneath it to rise, thus causing the left hand end to fall and with it the Phono Lifter Arm is lowered, permitting the pick-up stylus to rest on the film and in the groove formerly made by the Recording Head. The rotation of the shaft at the same time sets the four segment three position switch in a position which disconnects the microphone from the input circuit of the amplifier and connects the pick-up thereto, thus connecting the signal from the pick-up to the amplifier and out through the loud speaker.

By turning knob (1) to the "Thread" position, the Thread Cams A and B raise rollers 6 and 10, thus permitting the operator to remove the loop of film from the sprocket and recording drum. By turning the four film magazine knobs (2) through 90 degrees, the roll of film may be removed from the magazine.

Moving the Recording Head and Pickup Laterally from Track-to-Track

Recording film is provided for in the *Recordgraph* in the form of a continuous loop. As above stated, the loop is wound into a roll of several turns which fit over the magazine (3) leaving a portion of the loop to be threaded over the recording drum and sprocket, and back to the roll. An ingenious splice connects the two ends of the film to make a continuous loop.



The stationary model is ideally suited to Governmental Agencies, Schools, and Radio Listening Posts. It is equipped with monitor-playback speaker.

The splice has the same thickness and sound-characteristics as the parent film so that no unusual sound is made when the needle passes over the splice. The film is also provided with a number of small metal contacts (22).

Each time the film makes a complete round these metal contacts pass between rollers 4 and 5 thus closing a circuit which energizes relay (32) which in turn closes a contact and energizes the carriage motor (23). The carriage motor (23) drives a train of reduction gears (24). A spindle of the last gear of (24), with its speed greatly reduced, drives a disc (25) through a friction clutch which may be seen on Fig. 2.

The disc (25) consists of 3 concentric discs, the central disc serving only to space the two outside discs slightly apart. Each of the outer discs, known as the Indexing disc and Locking disc, respectively, is provided with 15 notches, the notches of the two discs being cut in the opposite direction. In the "Record" position, a locking cam on the shaft turned by knob (1) permits a Lock Index Arm to engage the notch of the Locking Disc (25) which prevents the operator from inadvertently moving the recording head laterally of the film by means of knob (17) and the mechanism hereinafter described. In any other position than the recording position, the Locking

Here's the film compared to a pen.

Cam removes the Locking Index Arm from the notch in the Locking Disc.

The Release Cam removes the Track Index Arm from meshing with the Indexing Disc when the instrument is set in the "Neutral" position, but in all other positions the Track Index Arm is meshed with the Index Disc. Through the center of the three concentric discs and co-axial therewith and at right angles thereto, passes a worm which terminates at its rear end in the discs and at its front end in knob (17). It will be apparent that the turning of knob (17) turns the Index and Locking discs. Also geared to the worm is a counter (16) so geared to the worm that one complete turn of the worm causes the counter to increase by 15 numbers. Since there are 15 notches on the Index Disc it will be apparent that as the Index Disc is rotated through the angle from one notch to the next (24 degrees) the counter will show an increase or decrease of one number depending on which direction the knob (17), the worm and the index disc are turned.

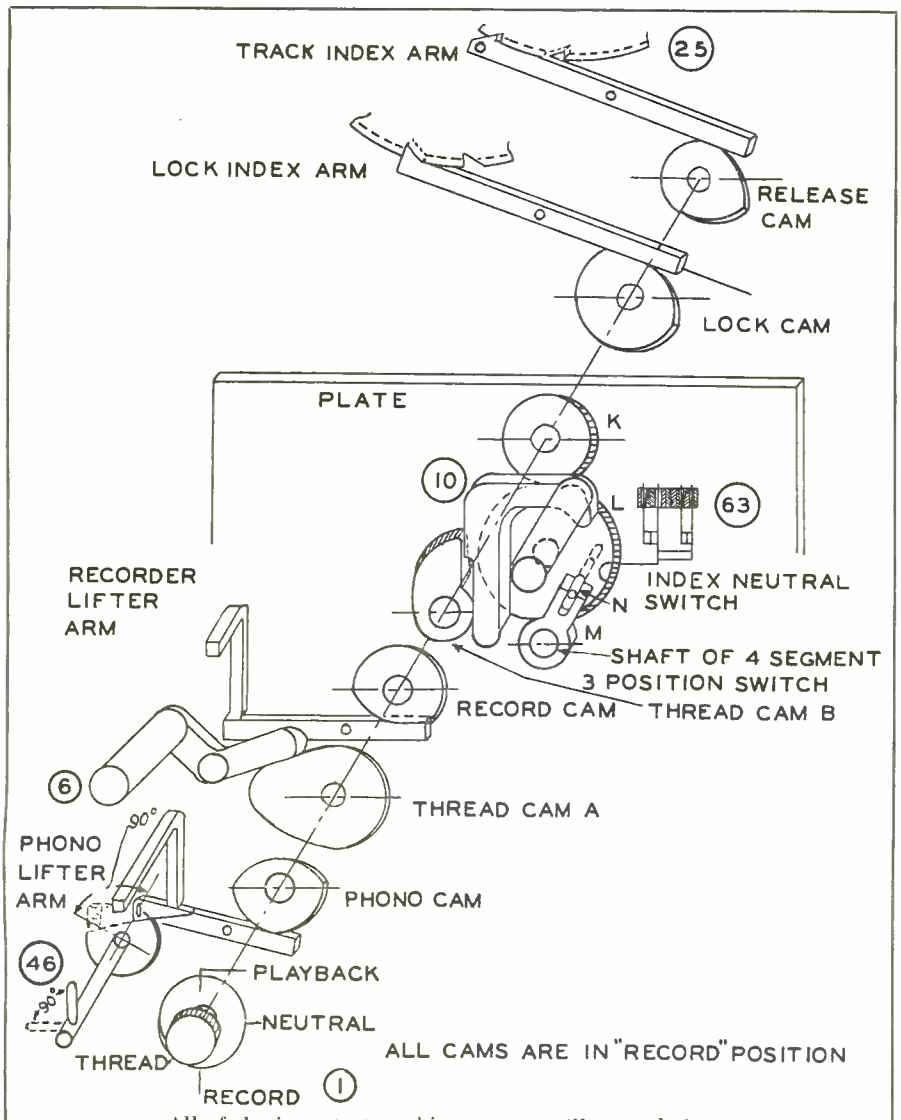
When the knob (17) is turned counter clock-wise (view from the front), the counter decreases; when it is turned clock-wise, the counter increases. It will be apparent that the knob (17) is locked against turning clock-wise by the Track Index Arm in all positions except the Neutral position. It will also be apparent that the knob (17) is locked against turning counter clock-wise when the instrument is in the "Record" position. Geared to the worm by a nut is a carriage which supports the Pick-up and Recording Head. When the carriage motor (23) is energized it rotates the Index Disc clock-wise (viewed from the front), rotates the worm and knob (17) clock-wise and moves the Pick-up and Recording Head laterally of the film toward the front of the instrument.

When, by means of knob (17), the worm is rotated counter clock-wise the Pick-up and Recording Head move laterally of the film away from the front of the instrument. When the metal contacts (22) carried by the film pass between the rollers 4 and 5, energizing relay (32), the relay pulls the left hand end of the track index arm out of the notch and closes a switch not shown which energizes the carriage motor. With the Track Index Arm removed from the index disc notch, the disc is free to rotate under the propelling influence of the carriage motor until the next succeeding notch reaches the pawl of the Track Index Arm, at which time the pawl fits into the next succeeding notch and opens the contact to the carriage motor, thus de-energizing it.

The motor is permitted to drift to a stop by a slippage of the friction clutch but the Index disc and therefore the Recording Head and Pick-up are brought to a fixed and sudden stop by the pawl and notch thus accurately positioning the stylus into the next succeeding track on the film. It will be apparent that the track number is always indicated by the counter and that by making an index as the recording is made, the operator may by means of knob (17) turn the counter to any track desired, at which point he may drop the Pick-up and play back any track selected. The distances between perforations on the film is adequate to support 100 recording tracks.

By means of a lever (46) (drawing 132), the Phono Lifter Arm may be dropped while knob (1) is in "Record" position, thus permitting the operator to monitor while recording.

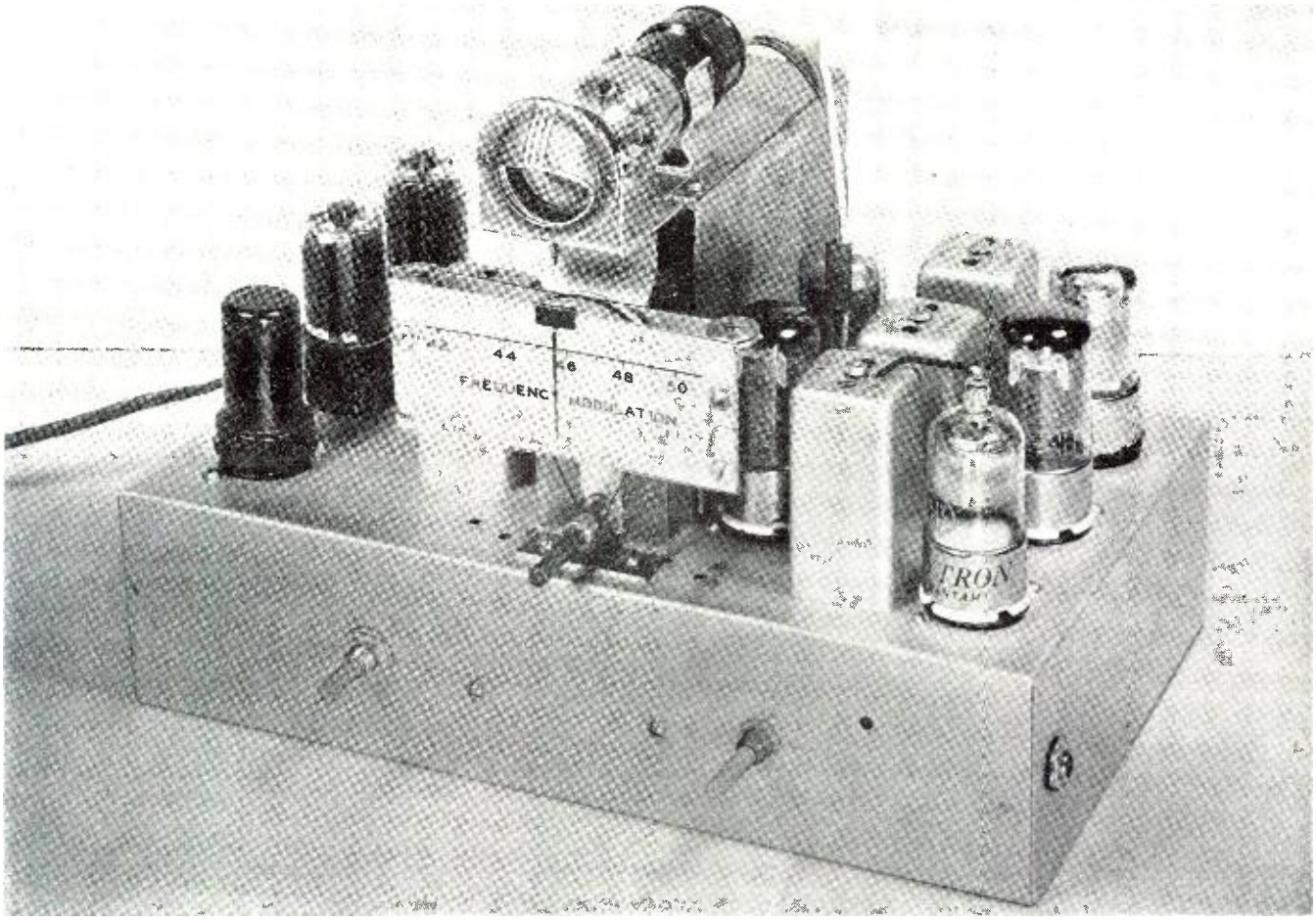
By the above described method there has finally been realized the age old dream of engineers to record sound with a stylus on safety film, with its allurement lying in the two fold fact that the method is the simplest form of recording known and its medium the most economical. The recording leaves no residue and no shavings; there is no processing, no developing, no record changing and no changing of the needle. The instrument performs automatically when there is a signal to record and ceases operation automatically when the signal disappears. Weak signals are recorded with high gain and strong signals with proportionately less. Monitoring may be done concurrently with recording which means volumes to the experienced engineer who has returned from his recording expeditions to find his recordings a failure. Hours, days or weeks of noise free recordings may be concentrated on one loop and stored in a tiny box to be reproduced tomorrow, next week or years hence. And the whole instrument is sturdily mounted in a portable package no larger than a medium sized suitcase.



All of the important working parts are illustrated above.

Editor's Note: We would like to hear from our readers regarding articles on Sound-On-Film Recording. We know that there is a tremendous amount of interest shown on Recording subjects in general, and that this is the first comprehensive treatment on the subject of Film Recording to appear in RADIO NEWS. *Your comments are invited.*

—30—



Finished receiver with tuning-eye.

Constructing an AC-DC FM Rcvr

by PETER T. WILLIAMSON

This up-to-date FM receiver includes many features. No power transformer is needed.

DUE to the rapid increase in popularity of frequency modulation receivers, especially so in the metropolitan areas of the country where several FM stations are already in operation, this simple, compact FM receiver is described for the constructor.

The question always arises as to which is the more practical, to build an FM converter or a complete FM receiver. Taking into consideration the following reasons, the complete FM receiver was decided upon. Due to the large number of tubes in an FM converter, it must furnish its own power. Since a power supply must be incorporated on the converter chassis, only the addition of two or three tubes, output transformer and speaker is needed to complete the receiver. This slight additional cost plus a few inches more of chassis space is negligible considering the disadvantages of employing switching arrangements to connect the converter to the audio channel of a receiver. The converter is of no value unless it can be attached to an audio amplifier, whereas the FM receiver is complete and can be set up wherever the necessary line voltage is obtainable.

Since it is very difficult to obtain certain radio parts at this time, the receiver is designed to achieve the utmost in simplicity and economy eliminating transformers, and providing a circuit which will yield the great amount of amplification needed for this type of service with the least number of tubes and components possible.

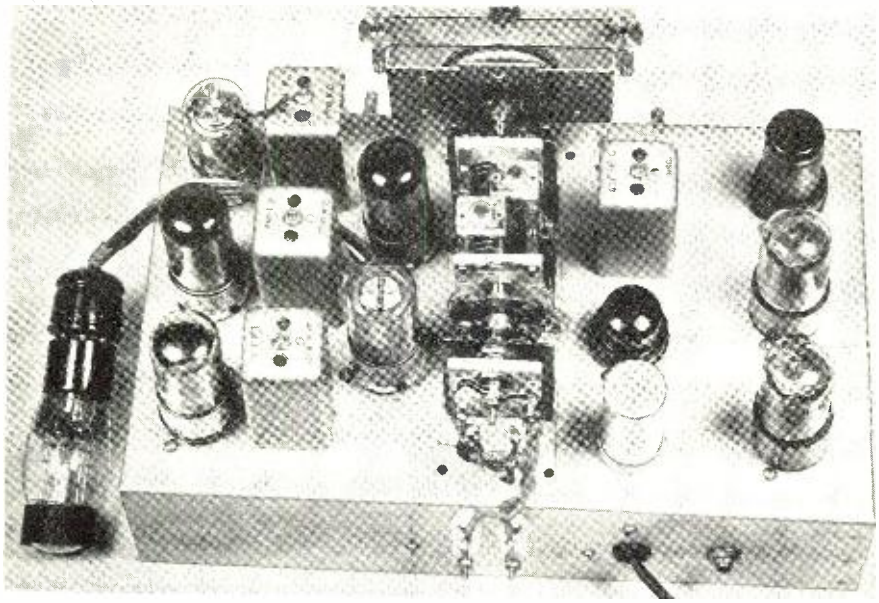
By incorporating dual-purpose tubes the entire tube complement is down to a total of ten. This number may appear large when thinking of ordinary Broadcast receivers, however, when considering the unusual high sensitivity needed for FM reception in most localities, the tube complement must necessarily be greater.

The power transformer was eliminated by using the rectifier sections of the dual purpose 32L7GT output tubes as half wave rectifiers, and choosing the tube complement so the filaments add to a total of 115 volts. This eliminates the line cord resistor and enables the receiver to operate on either a.c. or d.c.

Circuit

The entire circuit includes an r.f. amplifier, combination converter and oscillator, two i.f. stages, limiter, discriminator, dual triode phase inverter and audio amplifier, dual rectifier and pentode pushpull output stage, and magic eye.

The 6SK7GT r.f. amplifier tube couples into the 6SA7GT mixer and oscillator producing an i.f. of 4.3 mc. Two 6SK7GT i.f. stages amplify the signal further and feed it to the 6SJ7-GT limiter stage. This circuit is arranged to limit the amplitude of the i.f. signal to approximately three or four volts. The signal then proceeds



Details of the variable gang-assembly are shown. Padders mount above.

to the discriminator transformer and 6H6 diode dector where the radio frequency currents are changed into audio frequencies. The audio voltage is then amplified by one triode section of the 6SC7, the other section applying a 180 degree phase shift to feed the pushpull pentode sections of the 32L7GT's. The rectifier sections of these tubes are connected in parallel providing a usable current of 120 ma. The 6E5 magic eye tube receives its grid voltage from the d.c. drop across the limiter load resistor.

Construction

The entire receiver is constructed on a chassis 7" x 12" x 3". The placement of parts are symmetrical with the front end including the r.f., converter and oscillator circuits in the center. The right side of the chassis contains the i.f. and limiter section, with the left containing the discriminator audio and power section. The magic eye is assembled directly above the dial.

After the parts are laid out according to the photographs, the tube socket holes should be punched first. The i.f. transformer, magic eye cable hole, and filter condenser holes are next reamed to their proper size. The dial, gang condenser and coil mounting follow; the combination being left to the ingenuity of the builder. Since 3-gang 25 mmf. condensers are at a premium, the combination may be secured by ganging three small condensers, or coupling a two gang condenser with a single one. The arrangement used in this receiver is made by coupling a 2-gang 25 mmfd. *Cardwell* to a reconverted 100 mmfd. *Cardwell* with several plates removed. The angle brackets are made from 1/16" sheet brass. Using this type of gang condenser, enough space is left between each to mount the three coils.

The dial is placed on the condenser shaft, and a bracket made to secure it to the chassis. After centering the dial and condensers, the entire unit is now mounted to the chassis by means of the angle brackets. The tube sockets, IF transformers, and filter condenser are now assembled to the chassis. The volume and tone controls may now be mounted on the front of the chassis.

Wiring the receiver is next in line. The filaments are wired first. Since the magic eye cable comes through the chassis between the 6SK7GT and 6SA7GT, the filament terminals of the 6E5 are wired in series between these two tubes. The power circuits are next in line with the audio section following. The filter choke and audio output transformer, however, are not mounted under the chassis *until the wiring of the entire receiver is completed.* Shielded wire should be used in the plate and grid circuits of the audio amplifier. Most of the resistors are mounted between a pair of multiple tie lugs resulting in a neat and rigid mounting.

The i.f., limiter and discriminator circuits are now wired in, with screen and cathode bypass condensers and cathode resistors mounted on the tube socket itself. The 1000 ohm screen isolating resistors are mounted from tie lugs to the screen terminals. The line cord may now be brought in through the back of the chassis with one side of the line grounded to the chassis. The other side is wired through the switch to the filament and rectifier plate circuit. An open-circuit jack is mounted next to the line cord which is wired to the discriminator circuit for plugging in a voltmeter to assist in alignment. The output transformer and filter choke are now fastened to the chassis and wired to their respective circuits. The speaker jack is inserted in the right side of the chassis, however, it is insulated from the chassis with fibre bushings.

Coil Data

The r.f. detector and oscillator coils are wound on 1/2" "Quartz Q" standoff insulators sawed to 1 1/2" in length, with number 18 enameled wire.

At 1/4" from the ends of two of the coil forms, a hole is drilled to accommodate 6-32 bolts for securing the ends of the coil. The r.f. and detector coil are wound with 5 turns spaced between the 6-32 bolts. The oscillator coil form is drilled 3/8" from each end. and four turns of wire spaced between the 6-32 bolts. The coil is now coated with *Amphenol* coil dope to provide a rigid mounting on the form.

The antenna coil is two turns of number 20 d.c. hookup wire wound around the ground end of the r.f. coil. The antenna lead, which is part of the coil, is twisted and brought to the back of the chassis thru holes made in the condenser mounting brackets. The ends of the antenna lead-in are mounted to two standoff insulators secured to the back of the chassis. The coils are now mounted to their respective condensers, the r.f. section to the front of the receiver, the detector in the middle, and the oscillator at the rear. Number 14 enameled wire is used to make all connections from the coils to the condensers and to the terminals of the r.f. and mixer tube sockets. Spaghetti tubing covers the lead entering through the chassis to the tube sockets.

A shield is made of 1/16" brass stock covering the coils and ganged condensers. Threaded lugs are placed at the bottom of this shield for securing to the chassis. Atop this shield the magic eye assembly is mounted. Two holes are also drilled in line with the trimmer condensers. The tube is pulled from its clamp mounting when aligning these trimmers.

Alignment

Alignment of the receiver requires the use of an electronic voltmeter or a high resistance d.c. voltmeter, and a test oscillator with a frequency range extending to 50 mc. A phone plug is attached to the test leads of the voltmeter and inserted into the "alignment jack" on the rear of the chassis. The test oscillator is placed between ground and the grid of the limiter tube and tuned to 4.3 mc.

The receiver is turned on and the discriminator transformer first aligned. The *primary* trimmer is adjusted for maximum indication. The *secondary* trimmer, as it is rotated through resonance, will show *three minimum* signal indications on the voltmeter. One will occur when the trimmer condenser is too tightly closed, the middle one occurs between two maximum peaks, and the last one will occur when the condenser is too widely opened. The correct indication is the middle minimum reading between the two maximum indications. If the loudspeaker is plugged into the receiver during the tuning operations, the zero beat will be heard at the point of correct minimum indication.

The next procedure is the alignment of the limiter and i.f. stages. At this point it is advisable to note whether the magic eye is open or

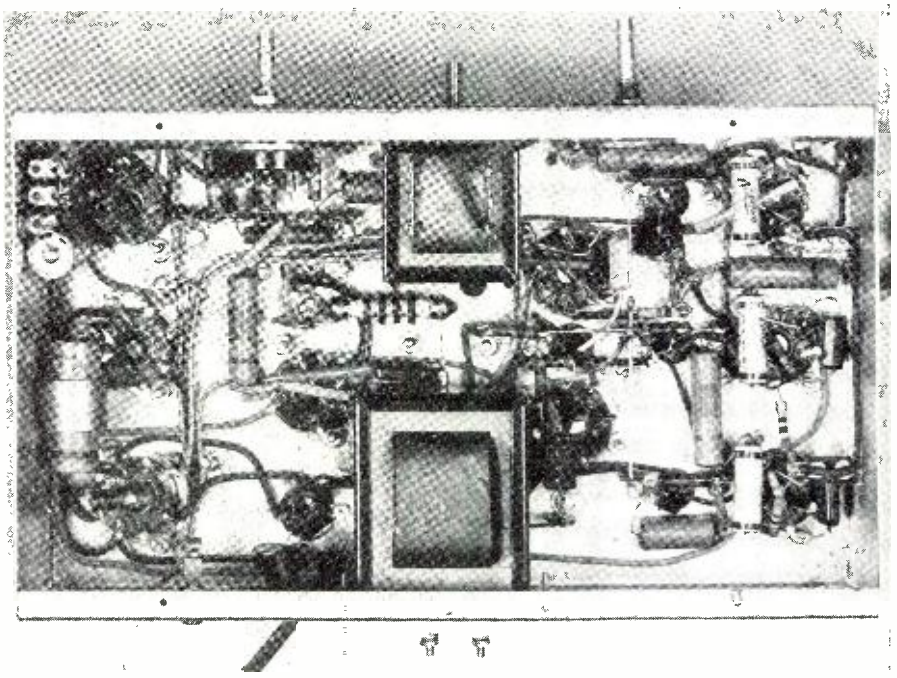
closed. It should be *open* at all times *except when an i.f. or r.f. signal is introduced into the circuit.* If the eye is closed, and there is no signal coupled to the receiver it is a definite indication of oscillation in the i.f. amplifier, and this condition should be remedied before proceeding with the alignment.

The voltmeter is now removed from the discriminator jack, the plug removed from the test leads, and the meter placed across the 100,000 ohm load resistor in the limiter grid circuit. By placing the oscillator probe on the control grid of the second i.f. tube under the chassis, and slightly detuning the secondary of the discriminator transformer to produce an indication on the voltmeter, the limiter trimmer condensers are now tuned for *maximum* indication. At this point the eye should again be checked to see that it does not fully close when aligning the trimmers.

If it should close at maximum indication of the voltmeter, decrease the signal of the signal generator. The second i.f. transformer is aligned in the same manner by placing the oscillator on the first i.f. tube grid, and first i.f. transformer resonated with the probe on the control grid of the mixer. The eye should never be allowed to close during any of these operations. It may be simpler to align the i.f. transformers by the indication of the eye instead of the voltmeter, however, the voltmeter is generally considered more accurate.

The next procedure is the alignment of the "front end" of the receiver. This is not as complicated as one would imagine, and anyone familiar with the procedure used in aligning a broadcast superhet will find no difference in the r.f. section of an FM receiver.

The signal-generator is set to 46 mc. Adjust the dial to 46 mc. and adjust the oscillator trimmer for maximum indication of the eye or voltmeter.



All wiring must be tied fast to prevent frequency changes from vibration.

The r.f. and detector trimmers are now adjusted for maximum indication. When tuning the oscillator padder during the first operation, a deflection of the eye may not occur. This will probably be due to the r.f. and detector being too much out of alignment. Several oscillator tuning operations may be needed, gradually decreasing the capacities of both r.f. and detector trimmers during these operations, until resonance of all three circuits is determined.

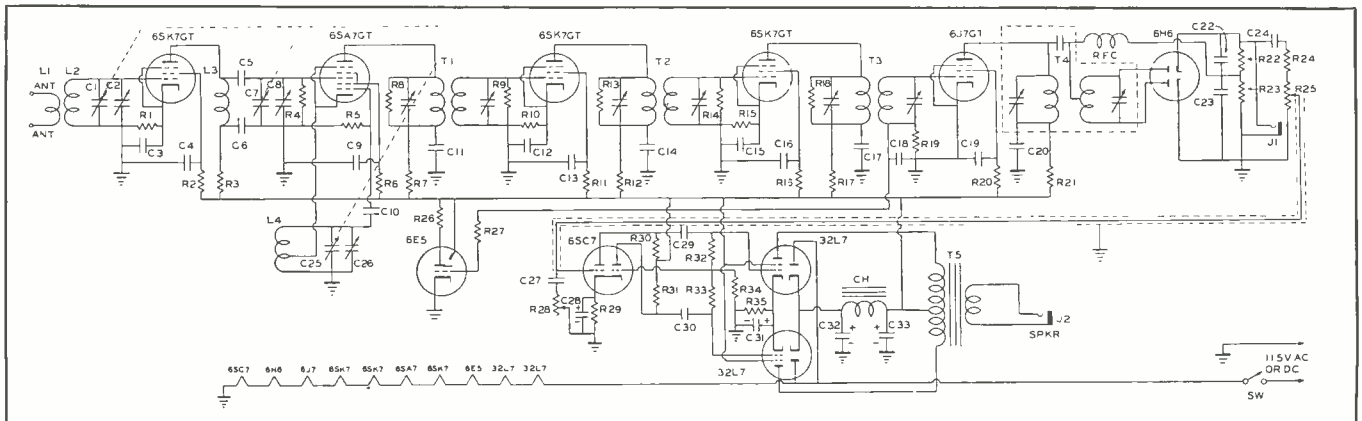
Antenna

The best antenna for this type of receiver is the common dipole with a twisted pair feeder. The antenna may be set vertically or horizontally depending upon the type of polarization used by the FM transmitter in the locality in which the receiver is being used. It should be placed as high as possible and clear from surrounding objects. It is a directional antenna and should be set up in a position which provides a maximum signal to the weakest signal desired. The usual method of construction is to cut the antenna to resonate at the middle of the FM band. In this case each side of the dipole will be 60 inches in length. A good insulating material should separate the two sides, and the twisted pair lead-in may be any length within reason.

Tuning

With the antenna connected, a hiss should be heard from the speaker. The dial is then turned until the FM

(*Continued on page* 48)



C_1 C_2—25-25 mmf., 2 gang var., Cardwell ER-25AD
C_3, C_{24}—3-30 mmf., mica padder, Hammarlund Mex
C_{12}, C_{15}—.001 mfd. mica, Mallory
C_4, C_6, C_{11}, C_{13}, C_{14}, C_{16}, C_{17}, C_{19}, C_{20}, C_{21}, C_{29}, C_{30}—.01 mfd., 400 v. paper, Aerovox
C_5, C_8, C_{22}—.004 mfd. mica, Mallory
C_{10}, C_{23}, C_{28}—.00005 mfd. mica, Mallory
C_{18}—.0001 mfd. mica, Mallory
C_{25}—25 mmf. var., Cardwell
C_{26}, C_{31}—10 mfd., 25 v. electro, Mallory
C_{32}, C_{33}—30 mfd., 150 v. electro, Mallory
R_1, R_{10}, R_{15}—200 ohm, ½ w., Aerovox
R_2, R_3, R_6, R_7, R_{11}, R_{12}, R_{16}, R_{17}—1,000 ohm., ½ w., Aerovox
R_5, R_{20}—25,000 ohm, ½ w., Aerovox
R_8, R_9, R_{13}, R_{14}, R_{18}—in cans with associated IF Transformers
R_{19}, R_{22}, R_{23}, R_{24}—100,000 ohm, ½ w., Aerovox
R_{21}—30,000 ohm, ½ w., Aerovox
R_{25}—500,000 ohm, gain control, Centralab
R_{26}—1 meg. (in "eye" assembly)
R_{27}—2 meg., ½ w., Aerovox
R_{28}—25,000 ohm, tone control, Centralab
R_{29}—2,000 ohm, ½ w., Aerovox
R_{35}—200 ohm, 1 w., Aerovox
L_1—2 T #20 pushback wound around "cold" end of L_2
L_2, L_3—5 T #18 PE, ½" dia., 1" long
L_4—4 T #18 PE, ½" dia., ¾" long
T_1—4.3 mc., 1st F.M. I.F., Carron S411
T_2—4.3 mc., 2nd F.M. I.F., Carron S412
T_3—4.3 mc., 3rd F.M. I.F., Carron S413
T_4—4.3 mc. discriminator, Carron S414
T_5—Universal output Transformer, Thordarson T57S01
Ch.—110 MA Filter choke, Thordarson T57C53
RFC—2.5 MH, RFC
J_1, J_2—Open circuit jacks, Mallory
Sw—SPST on R_{25}
Dial—Crowe
Tubes—Hytron
Sockets—Amphenol
Chassis—Bud or Par Metal

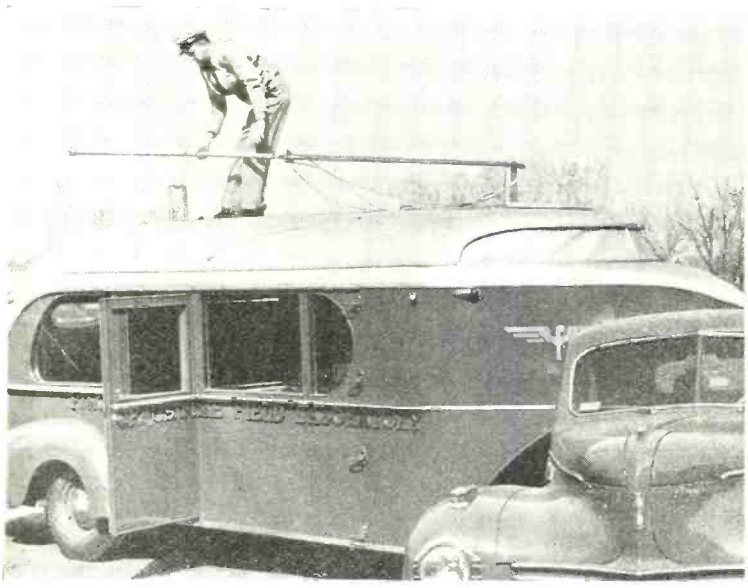
RADIO FACSIMILE Aids Defense

by Andre La Terza

A most important link in Radio Communications has been the part that Radio Facsimile is playing in Defense. Here is a complete story showing its use in Aviation.

Information has been received at Headquarters that troop concentrations are on their way to defend enemy oil tanks. A fast Facsimile-equipped plane is dispatched to fly high over the territory and main objective to take photographs of the new defenses and oil tanks.

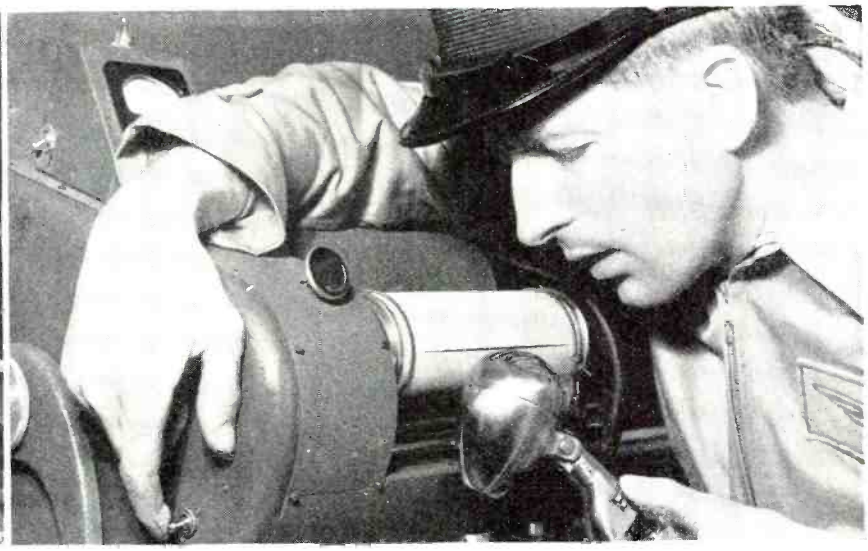
★ ★



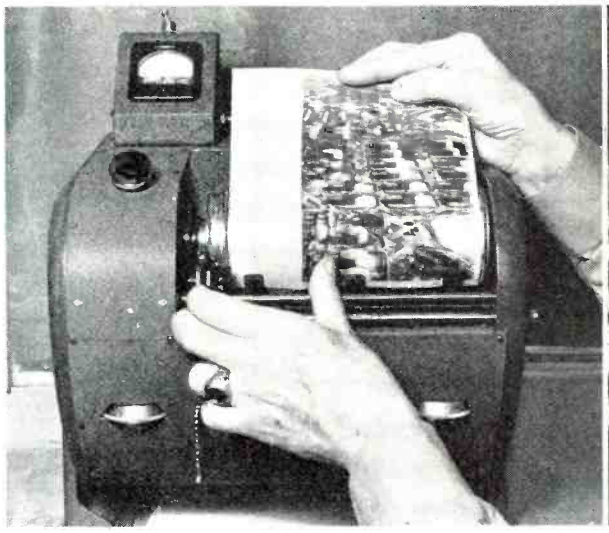
At the mobile field headquarters, antenna is erected for immediate reception of the radio facsimile photo from the reconnoitering plane. This military mobile laboratory contains complete telecommunications facilities and is manned by men especially trained in this type of work.

Over Enemy oil tanks, the reconnoitering scout maneuvers his aerial camera into position for the most revealing photographs of the new troop concentrations and gun emplacements which have been discovered to protect the oil tanks.

The wet photo of the enemy oil tanks is ready for facsimile transmission as the scout gets okeh signal through his headphones. Photo is clamped onto drum. Scout receives some new instructions while picture is being scanned.



Officer in the "Blues" mobile unit gives okeh to aerial scout to start transmission of photograph from the facsimile unit in airplane via multiplexed FM radio telephony which allows him to continue giving instructions for next objective simultaneously over the same wave on which the photo is transmitted. Operator is throwing starting switch for sending.



Completely transmitted, officer removes the facsimile photo from receiving drum of the automatic facsimile unit, releasing stylus from pressure on the paper with his left hand while removing the finished photograph.

The facsimile photo is then rushed to the commanding officer who determines the exact location by protractor and measurement.....on military map of enemy territory and orders are then given and the "Blues" bombing planes take-off immediately to attack the enemy oil tanks and concentrations.

WHEN a bombing plane blows up the enemies' hidden gun emplacements with an uncannily accurate stick of bombs, thus clearing the way for its own advancing ground forces to wipe out overnight dispositions of enemy troops, we have a sample of the rapid, almost eerie speed that has done much, say military experts, to put the "Blitz" in today's mechanical warfare.

It's a good guess that this remarkable piece of reconnaissance was accomplished by some sort of automatic facsimile device. What is this latest marvel of telecommunication? As employed by the Royal Air Force and in the United States Army and Navy, who have exclusive military rights, it is an ingenius portable machine weighing but 35 lbs. and packed in a container not much larger than a typewriter, which when placed in airplanes, war vessels, tanks, or any remote outpost, can send by radio or wire a perfect reproduction of anything written or printed on paper in a few minutes time, to an identical unit located hundreds or even thousands of miles away. The receiving unit may be located in other airplanes, battleships or tanks—in brief anywhere it is needed!

The military significance of this amazing fabrication of man is enormous. An army signal corps now gets an incomparably accurate, minute by minute report on paper, in absolute secrecy, of the enemy's moves. This is received from their own scouts in reconnoitering planes, tanks and outposts, practically as fast as these very moves take place! It provides perfect coordination of mechanized forces, essence of modern warfare.

In the last war military intelligence had to wait for their aerial scouts to return, if they did, to headquarters with their air photos of enemy positions. Now such photos are developed enflight in as little as 58 seconds and transmitted to the commanding officer through the facsimile unit via radio

(*Continued on page* 60)

Announcing

RADIO NEWS

CASH PRIZE CONTEST

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IT'S NEW! IT'S FUN!

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NO RED TAPE!

☆

HERE'S an opportunity for all radio servicemen, amateurs and experimenters to win $100.00 first prize or any one of nine other cash awards simply by describing home-made equipment! In addition RADIO NEWS will consider purchasing other articles at current rates, if you wish. Imagine being actually paid for describing equipment that you have built! That's exactly the opportunity the RADIO NEWS Home-made Equipment Contest offers you. Cash prizes totaling $245.00 will be awarded by RADIO NEWS for describing in detail home-made equipment coming under any one of the three classifications: (1) Service, (2) Amateur, (3) General. You don't have to be a RADIO NEWS subscriber to be eligible. This banner contest is open to all radio servicemen, amateurs and experimenters. Write as many articles, 1,500 to 3,000 words, as you like on equipment you have built. Remember, your chances to win are as good as the next person's. Contest closes at midnight February 1, 1942—so act now. Follow the easy contest rules and use the handy entry blank below. Prize winning articles will appear in forthcoming issues of RADIO NEWS.

Articles are to consist of not more than three thousand words. Are to be typewritten on white paper, using double spacing between lines, and are to be accompanied by illustrations and diagrams where required (may be pencil), and sharp, clear, glossy photographs, 2¼ x 3¼ min., showing details of layout and construction. Where required, a parts list giving manufacturers' names of products used, must accompany the diagram. All parts must be properly identified on the diagram (R_1, R_2, C_1), etc. Entries will be judged entirely on their own merits, with due consideration given to neatness of construction, originality of design, and in its presentation of constructional procedure.

(Continued on page 64)

IT'S an Army secret, but a complete overhaul of the radio communications service and the Signal Corps is in process as a result of the poor showing made by the field communications outfits in the recent maneuvers in the South.

The Signal Corps shakeup has affected some high ranking officers and will reach more in months to come. To a large extent, the administrative set-up of the Corps is being reorganized and demands are being made upon manufacturers of radio equipment, some of whom have been slow in delivering orders to the Army, to speed up. Plans are being studied for important changes in the entire field communications system and officers of other branches of the service are to be drilled more thoroughly in the disposition and use of radio in the war. Those officers who have shown, or do show, inability to adapt modern radio communications to war are to be pushed aside in favor of more alert men.

The Army does not like to wash its linen in public and so the details of the important reorganization are being kept quiet. But the overhaul will be the most extensive and most important shakeup in the Signal Corps since World War I.

When the Army began to take stock of itself after the Southern maneuvers, it was found that one of the longest and loudest complaints voiced by officers was against the field communications system, which had bogged down badly. Some officers referred to it as a "horse and buggy" system. It was singled out for criticism in the staff critique following the maneuvers.

During the mock war, it was found that corps commanders in many cases were unable to keep in touch with their division commanders by radio and were forced to resort to runners—just as if they had been fighting the Indian Wars. Commanders of smaller outfits lost contact with their headquarters. Frequencies were crowded and there was little evidence of any system of priorities on the air. Particularly poor was the contact between ground forces and aerial forces by radio. Fast moving blitz units found they got so far ahead of other outfits that they couldn't keep in touch with them.

Analyzing the causes of all this confusion in one of the most vital services, it appeared there were two main reasons for the failure of the field communications system. One was an acute shortage of equipment and the other was an appalling lack of knowledge on the part of officers—other than Signal Corps men—on the proper method of distributing and using their radio units and of the capacities of radio equipment.

The fact that the Army doesn't have enough radio equipment came as a shock to observers in Washington, who had noted the millions being spent on radio and had expected that in this department, at least, the Army would be strong. A little checking around at this date reveals the reason for this woeful shortage to be two-fold. Much of the radio equipment manufactured in this country in the last year has gone to the British—estimates run as high as 50 per cent. In addition, most of the equipment we have kept for ourselves has gone to our continental outposts, which get first call. Secondly, the manufacturers have not been turning out equipment at the hoped for rate.

It is patently impossible for an Army that doesn't have radio to make any decent showing in handling field communications these days. You can take a broomstick in maneuvers and say that it is a gun; you can say that a truck is a tank, but you can't simulate a radio message. Remember that!

But, in employing the equipment that was on hand, officers of the Army showed little knowledge of the proper methods of placing and using radio. The sets which had short range were sent far afield on missions and the commanders grumbled and fumed when they were unable to keep contact. Some headquarters net control stations were poorly placed, without regard for natural obstacles which interfered with their work.

The result of this experience has been the preparation of plans to reorganize the communication services. Maj. Gen. R. C. Richardson of the Seventh Corps Area has been working on recommendations along this line. The most immediate need, those in command believe, is to see that infantry and artillery and tank officers learn more about the proper use of radio.

Great credit was given to the enlisted men of the Signal Corps for the manner in which they tackled one of the Army's toughest jobs during the maneuvers. There was a distinct shortage of trained men, but all of them—experts and greenhorns—worked like Trojans to keep communications going.

The Signal Corps has a new chief in Maj. Gen. Dawson Olmstead and he is driving for a reorganization of his outfit. Maj Gen. Olmstead, who has commanded the Fort Monmouth (N. J.) Signal Corps center, was nominated to succeed retiring Maj. Gen. Maubourgne. His first activity was to streamline the Signal Corps.

Then he began to press the manufacturers to speed up delivery of radio equipment. Maj. Gen. Olmstead has begun quietly to move officers of the Signal Corps around, to bring younger and brighter men into the jobs of responsibility. The Signal Corps at present has a strength of nearly 40,000 men. It constitutes seven and one half per cent of the Army—which is a greater percentage than in the World War army. It has 2,000 officers and needs desperately hundreds more men who are trained in radio.

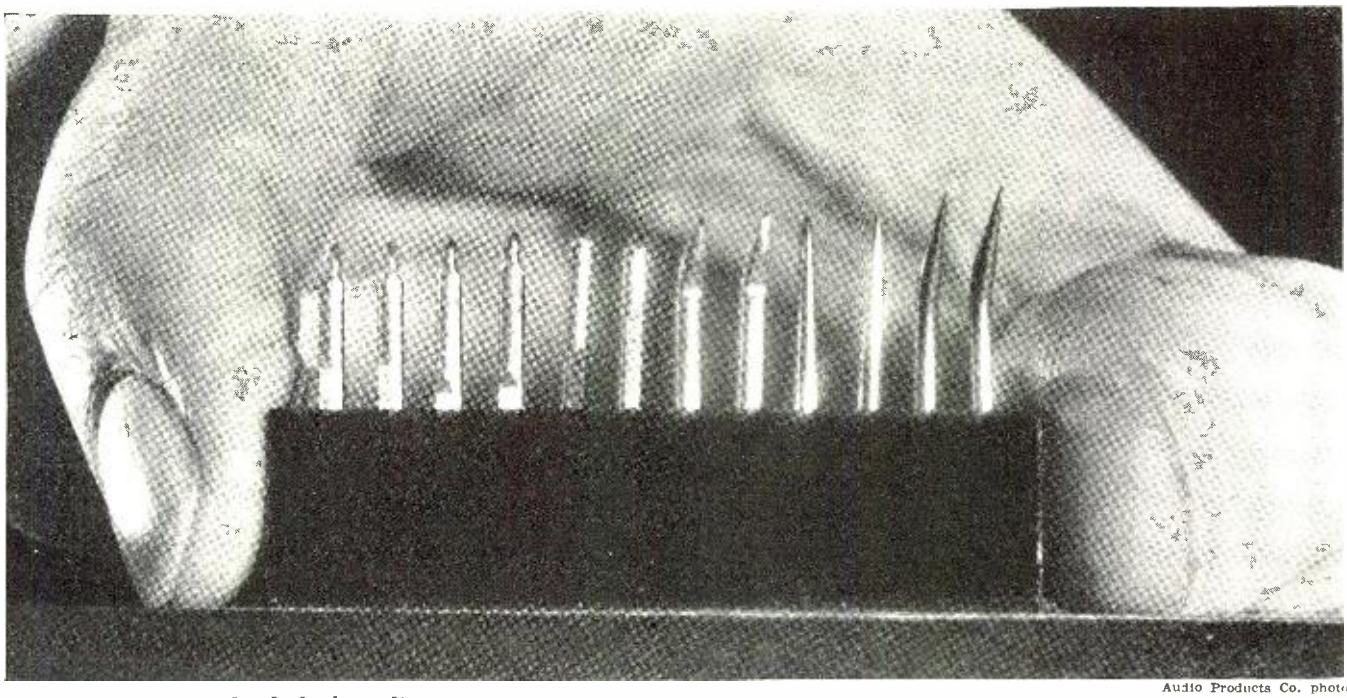
The principal objective of the maneuvers, of course, was to show up Army weaknesses. There was nothing about the communications service weakness that can't be corrected with more equipment and better officering. The object of the reorganization is to assure both. Maj. Gen. Omstead is determined to see that his outfit will not be found wanting.

Note: When the Army began maneuvers in the Carolina area, it was decided that steps should be taken to correct the radio equipment shortage. Scores of amateur operators were approached and they offered to lend-lease their equipment to the Army for the duration of the mock war. But at the last minute, the Signal Corps turned down the offer, decided instead to pick up what it could from manufacturers. However, the First Army Headquarters, located near Fort Bragg, N.C., did accept the loan of one piece of ham equipment. This was the powerful 1 kw. transmitter of Dr. Lawrence J. Dunn, W2CLA/WLMD, the War Department's civilian advisor on amateur radio.

WE have received letters from hams who ask, in view of the recent restrictions which have been placed upon amateur activities, who it is that represents the hams at court in Washington. Our correspondents have indicated that the hams were indignant at the recent turn of events and were beginning to wonder if their representatives were really looking after their best interests.

The men who speak most often for the

(Continued on page 51)



Audio Products Co. photo

Typical cutting and playback styli used for obtaining quality records.

Theory and Practice of DISC RECORDING

by Oliver Read

Modern Recording technique requires the use of cutting and playback styli that are made with quality-controlled production methods.

Part 1

RECORDING and playback styli may be classified in three groups: "Sapphire," this makes the finest cutting point because it is capable of taking on a fine polish, has extremely long wearing life, and has a low co-efficient of friction. This type of stylus is extremely brittle and requires great care in handling. However, if precautions are taken to prevent accidental shock, there is little danger that the cutting edge will be destroyed. This type of stylus is capable of approximately fifty hours use in recording and after that it may be resharpened and polished to its original condition for many times. It is, therefore, the most economical of all styli in the long run.

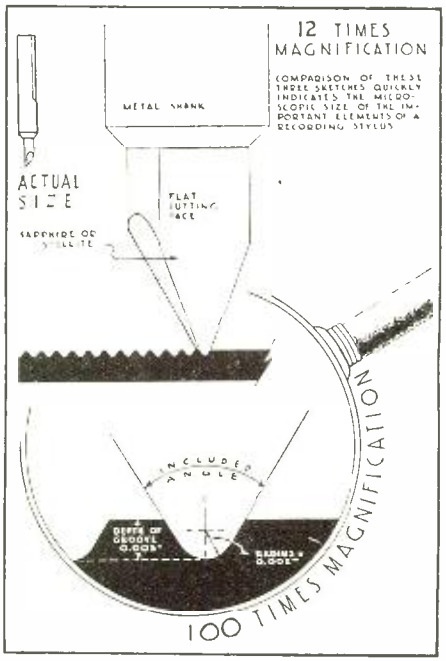
The second type is the "Stellite." This makes use of a hard metal alloy tip, which is inserted into a tube of proper diameter and it is finished in much the same manner as is the sapphire. They are less expensive to purchase and may be resharpened and polished several times before they must be discarded. Another type of popular stylus is known as the "Permo point." Construction of this stylus is similar to that used for the "Stellite." However, this type of needle cannot be resharpened and repolished.

The third is the "Steel" stylus. These are inexpensive and will be satisfactory for home recording providing the recordist uses a new one for each record. They cannot be economically resharpened, must be changed often and are not capable of retaining a keen edge, which is necessary for cutting the high frequency notes.

Only about 3/1000 of an inch of the tip on a recording styli is used when engraving a blank record. It is, therefore, highly important that one select a product that is held to close tolerances. The illustration shows the actual size of a "Sapphire" or "Stellite" cutting stylus. Note that there is a definite shape for the tip of the stylus and it is highly important that this shape be retained so as to cut grooves of proper shape, so that when they are reproduced with proper playback needle, all of the frequencies will be faithfully copied.

There is a tremendous amount of heat generated at the tip of the cutting stylus. This is due to the continuous friction that it meets in cutting through the record material. It stands to reason that if the tip is to retain a high polish and proper radius of point, that it must be constructed of both heat and wear-resisting material.

Playback needles must be ground so



Right: Illustration shows enlarged cross-section of high grade stylus.

that their point or tip will fit into the cut groove properly. If the tip of the cutting stylus wears rapidly, the grooves will change in shape and dimension as the recording progresses. This would cause unnecessary distortion and the only remedy is to use needles which are capable of maintaining their shape for the duration of at least one full recording.

A tremendous strain is placed upon the edges of the recording stylus and as the record revolves on the table, the side-to-side motion of the stylus under modulation is continually modulating the groove and is leaving its impressions on both sides of each groove wall. The amount of surface noise will depend largely upon the ability of the stylus to retain a sharp edge. In other words, the sharper the edge, the quieter will be the recording. If the edges are dull the result will be a tearing of the disc material in the groove and the background noise will increase materially. It is highly important that the cutting edges be extremely sharp in order that all high frequency undulations may be properly impressed on the groove walls. The humps in the vibration waves will vary according to frequency. The low notes, or tones, will have humps which appear farther apart within the groove than will the high frequency tones or high notes. This condition is aggravated where high frequencies appear at low record groove diameters. This is still another reason for using only the best material for a cutting stylus. Furthermore, if sharp edges are not retained, the soft plastic material on the disc will tend to flow instead of being cut properly. Such a condition will result in a recording which sounds "mushy" or distorted.

Three microphotographs are shown that will illustrate the effect of wear upon a stylus point. There is a terrific pressure at the tip which is equivalent to about twenty tons to the square inch. These illustrations are made on an ordinary steel recording needle. Note that the tip is not rounded but comes to a definite sharp point. Naturally this can only cut a V-shaped groove. The second photo, taken after a few minutes' use of the steel needle, shows how the tip begins to wear due to the abrasive action together with extreme pressure on the cutting edges of the stylus. Each succeeding groove will take on a different shape due to the continuous change in shape of the stylus and the background noise will increase as the recording progresses. The same needle is further illus-

(*Continued on page* 60)

AVIATION RADIO

by CHARLES J. SCHAUERS

About the Industry

AS each day passes, our aviation radio manufacturers here in the U.S. are turning out more equipment for use by our armed forces, and strange as it may seem, the output for civilian usage has not dropped to any great extent. As the defense program has passed through it's various stages, those radio manufacturers who realized that it was necessary from the start to coordinate military and civilian demands made early plans for anticipated equipment requests. These plans made for greater equipment output, plant expansion and more manpower. However, material shortages have slowed down certain stages of production, but these are being coped with by establishing priorities.

At the rate of twenty a week, upwards of 300 radio transmitters, designed for ground-to-plane communication are rolling off the assembly lines at *Western Electric's* Kearny, N. J., Works for delivery to *Pan American Airways, Inc.* These transmitters will form a vital part in *Pan American's* far-flung communications system which links the flying Clippers to terminals in the U.S., Alaska, South and Central America, Africa, New Zealand, the islands of the Pacific, and the Far East. There may be others. too.

The transmitters are of the 300-400 watt class, and were designed by *Bell Telephone Laboratories* to *Pan American* specifications.

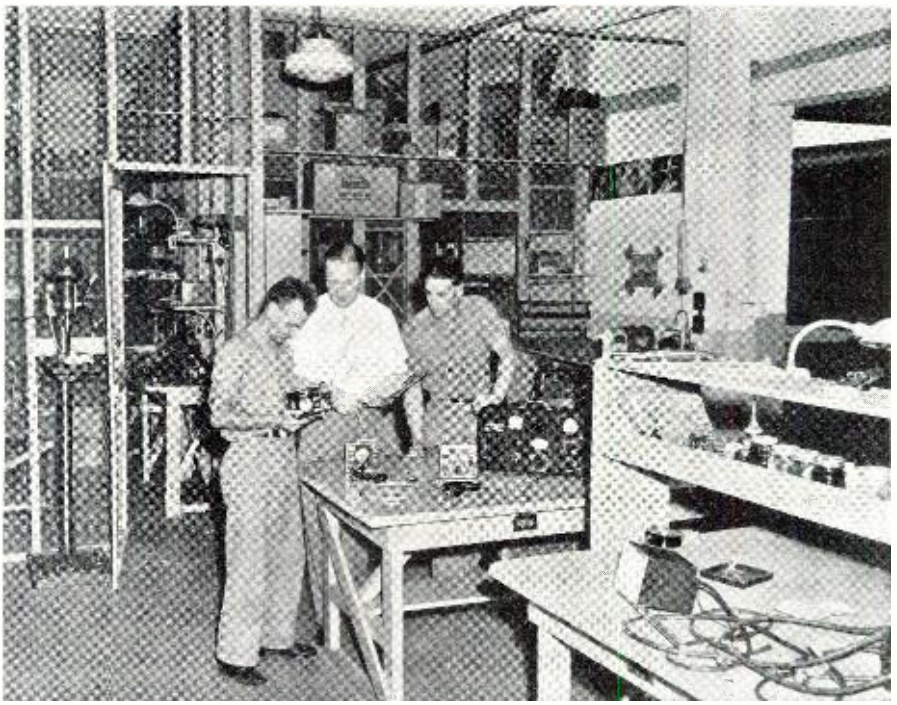
Despite the current emphasis of *Lear Avia's* production on national defense orders, shipments of new radio apparatus to private flyers continue to be made, with only a slight delay. Particularly impressive are the new deliveries of radio apparatus to approved schools for the CPT Program, where *Learadio* apparatus is exceptionally well suited to both cross country and instrument training needs.

The new Roosevelt Field office will greatly facilitate servicing of the ever increasing numbers of *Learadio*-equipped aircraft, according to Mr. Sydney M. Nesbitt, the company's sales manager.

The *RCA Manufacturing Corporation* of Camden, N. J., is steadily working on defense orders and from current reports they are way ahead of production schedule. This is encouraging because *RCA* is one of the big links in the radio manufacturing chain, so vital to our defense efforts.

Within the last few months many articles have been written about material shortages; raw material shortages. But taking every point into

(*Continued on page* 52)



Albert O'Donnell (center), service manager, and assistants, in new Lear Avia service station.

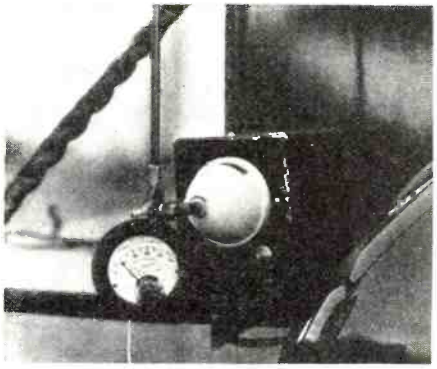
3415 kc talk-back circuit installation.

National Park Service patrol car equipped for two-way communication.

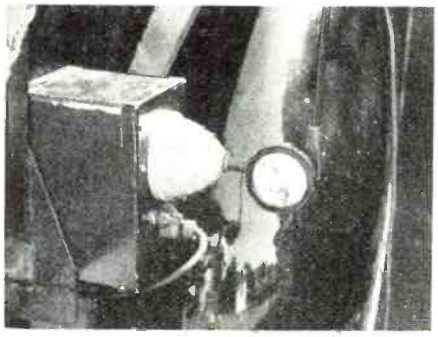
WSEL Protects Blue Ridge Parkway

by S. R. WINTERS

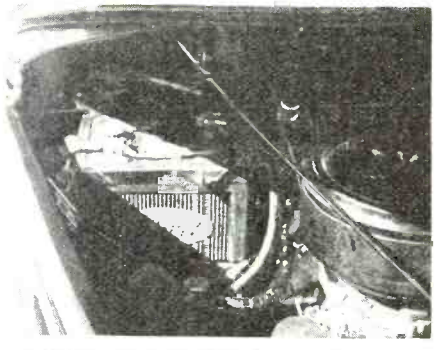
A highly efficient radio communications system guards Uncle Sam's great forests.



Reference antenna. Resonance is determined by means of galvanometer.



Approximately 300 mils was put into the base of this reference antenna.

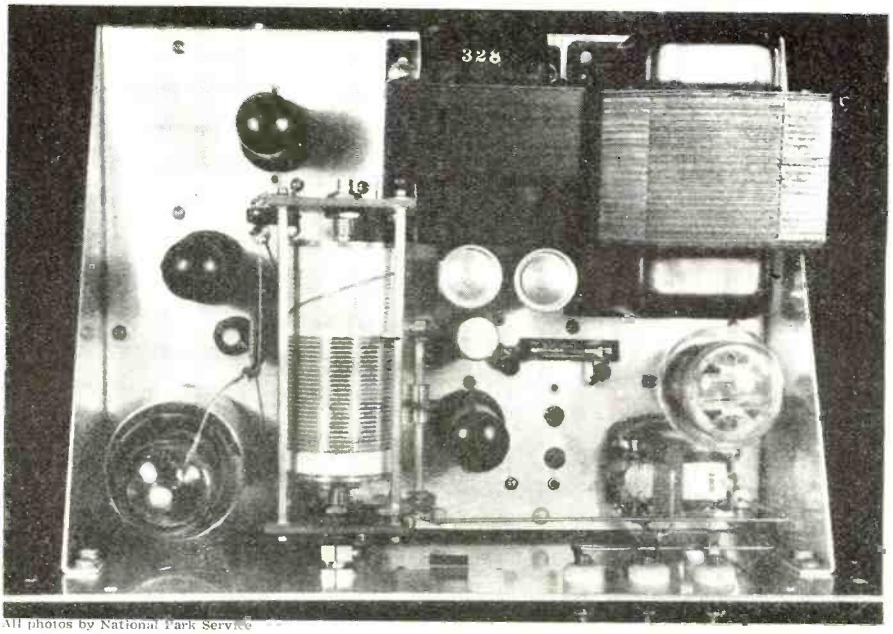


Storage battery and accessories are kept in the patrol car trunk space.

FROM a giant piece of geography, the Blue Ridge Mountains have been transformed by short-wave radio into a safe, friendly stretch of scenic parkway. Until recently, when a park service ranger found it necessary to report an automobile accident, a forest fire rapidly being fanned out of control by high mountain winds, or the fog, ice or snow which often settles suddenly on the high peaks of the Blue Ridge Parkway, he had to leave the scene and make his way to the nearest telephone to get help. Now, a few words broadcast from his automobile will bring assistance in record time.

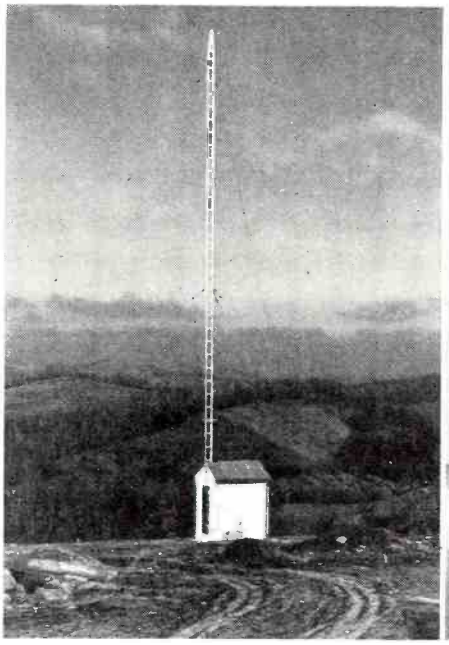
The 600-mile Blue Ridge Parkway system—a 5 to 20 mile wide range of the Appalachians which is given the name of Blue Ridge when it reaches Virginia—extends from the western central edge of Virginia down into Tennessee. Along its mountain-crest course, cruising park police now listen to directions from the first transmitting set of its type which uses the "loaded" antenna. This type of an-

Note the roller contact on the final plate amplifier coil assembly.

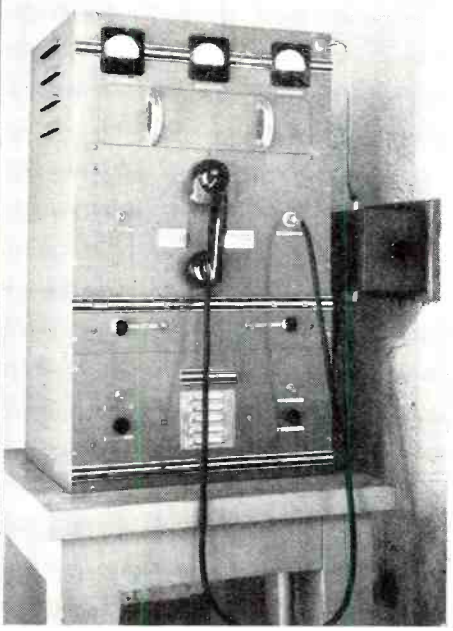


All photos by National Park Service

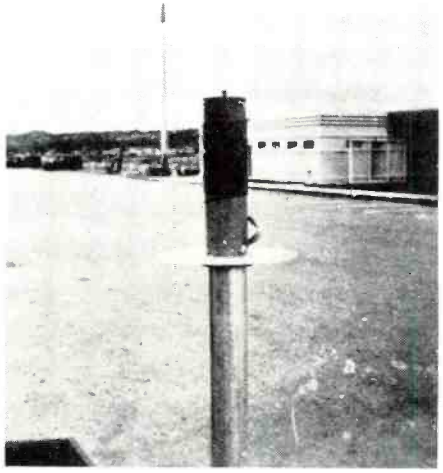
The transmitter is controlled from a small panel on the car dash-board. Push-to-talk mike mounts above meter.



Here is the Rocky Knob radio equipment house and tower installation.



100 watt radiophone transmitter at the fixed station nerve center.



The loading coil seen with the shield removed. Note large diameter tube. This antenna is now standard equipment.

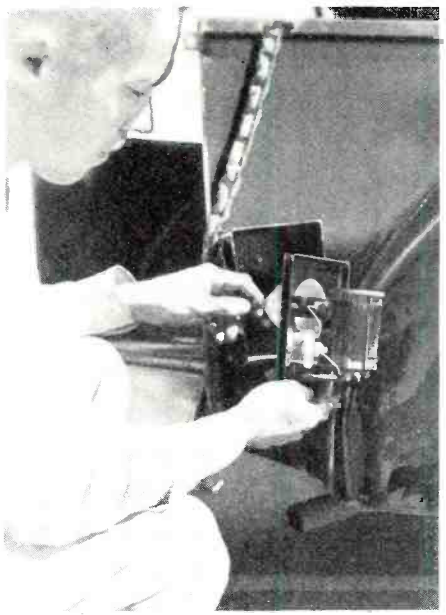
tenna permits a wider range of transmission for the two-way sets used in the six parkway's automobiles equipped with radios.

Let's see how this radio communication network, which has been assigned the call letters WSEL, operates. Perhaps Car No. 3 is going down the Parkway near Volunteer Gap. The Ranger finds a big rock or tree has fallen on the roadway, endangering traffic. He calls the station at Rocky Knob, which is the control station for this section of the Parkway, advising Rocky Knob what he has found and that he will need a truck-hoist to move the rock, or two men and a cross-cut saw to cut and move the tree.

The ranger is advised to stay on the spot and warn traffic around the obstruction, and that help is being dispatched immediately. The only operation the ranger in the car had to do to make this call was to take the microphone from the clip on the dash-board, push the button on the microphone, and talk. No other switching is necessary as the transmitter in the car is full push-to-talk control. Pushing the button applies both filament and plate power, thus eliminating any drain on the battery, such as filament power, during non-transmitting periods. In case there is no help available at Rocky Knob, this station can then call either Bluff Park or Roanoke or any other station on the Parkway where help is available.

It is not possible for highway mo-

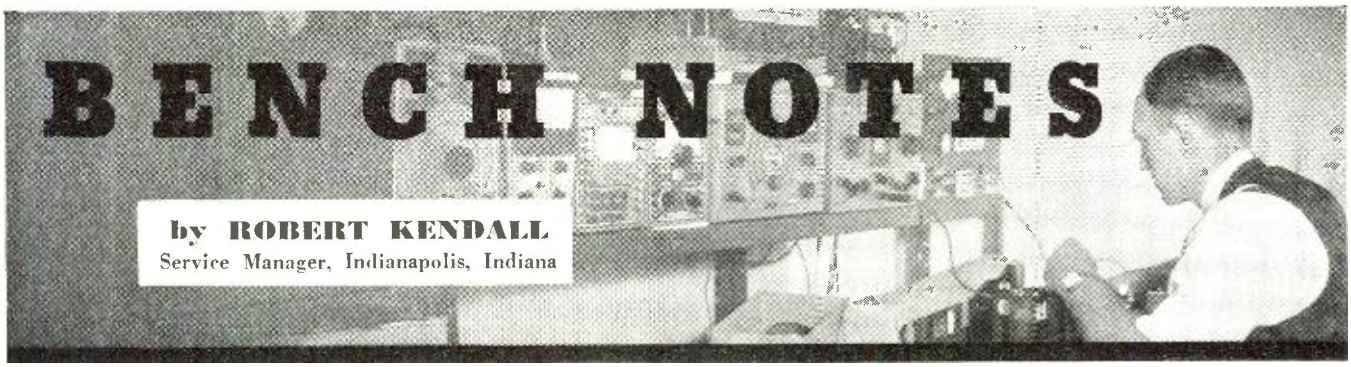
(*Continued on page* 46)



Interior view of the base-loading unit showing coil and condenser assembly. These are connected in a parallel-tuned circuit inside a shielded can.

Radio remote-control console at the Parkway maintenance office building.

All photos by National Park Service



BENCH NOTES

by ROBERT KENDALL
Service Manager, Indianapolis, Indiana

With a Quack, Quack Here!

WHAT has become of the tubeless radio gag? It occurred to us some time ago that this former perennial favorite of the screwballs had not appeared in public prints for quite some time, and from that it would appear that there is a limit to the gullibility of the newspaper men in such matters. As long as they persisted, these stories rather curiously took the same form, i. e. these marvelous inventions were always superior in every respect to the ordinary tube-using receiver, *but*, the proud inventor could seldom if ever give a demonstration as he had just sold the full rights for a million dollars to the panic-stricken tube manufacturers, who promptly locked up this menace to their business in a secret vault and threw the keys away. Generally, the only variation in this tale was the amount of the purchase price, which was sometimes given as two million dollars, but we were always inclined to suspect that the lucre was locked away in the vault instead of the tubeless receiver, as none of the few "inventors" we interviewed ever exhibited any signs of affluence, sudden, or otherwise.

While we never took any stock whatever in such reports, we did make an effort to investigate any of these proclaimed inventions that were within convenient reach, but it was not until 1931 that we actually saw a "tubeless radio." This instrument had been hatched out by a young gentleman of color in an Ohio city, and by persevering we finally obtained a demonstration. Upon inspection of the chassis, top and bottom, no tubes were to be observed, but it was noted that it was necessary to connect the set to the a.c. power line and after a few minutes of operation the chassis became as hot as a three-dollar pistol. This feature was explained volubly by the inventor in a discourse that was over this writer's head, as most of the technical terms were ones never heard before nor since. A few weeks later the inventor was installed in the local calaboose, on account of some sad errors in elementary mathematics, as it appeared at the ensuing trial he had sold three half-interests and seven quarter-shares to various local citizens, who were highly dissatisfied with such figuring. As for the "tubeless radio" subsequent investigation revealed that the term was a euphemism to say the least, as several tubes were discovered, sealed with pitch, in a false bottom to the chassis.

This episode marked the apparent end of the "tubeless radio" period, but not the end of such tales. Like other old jokes, it has been merely cleaned and pressed and brought out in a different version, at this time being known as a "death-ray" machine. Especially since the beginning of hostilities in Europe have these stories appeared with increasing frequency and oddly enough they all conform to a certain stock pattern, in much the same manner as the tubeless radio tale. The inventor is often a "doctor" of some branch of learning not even remotely concerned with electronics, and in the course of his researches to develop a machine to cure the ills of his patients, human or equine as the case may be, accidentally discovers the "death ray." After a test of this device, which is reported to shatter boulders and knock off innocent rabbits at a thousand yards, the inventor invariably becomes horrified by the thought of the base uses to which the machine might be put, and virtuously destroys the instrument with all data concerning it. When this is done, the newspapers are apparently notified that he has invented a death-ray machine, but he is not going to tell them anything about it. The inconsistencies of such fables should be readily apparent to anyone with an I. Q. over the age of twelve, and it is generally safe to assume that the originators are little better than clumsy liars to say the least.

"I have to do some shopping now, but I'll be back for it in a half hour!"

Having lived in a period that has seen the development of the horseless carriage, the airplane and wireless communications, we would be among the last to deny the possibility of future production of such devices, but we are inclined to think that when that time comes, the inventor will be a man with something better than a mail-order diploma to vouch for his qualifications.

Trivia

NO DOUBT many of you remember that chant of childhood which detailed the dire consequences that befell a king, "all for want of a horseshoe nail." As we remember it, what happened to the king shouldn't happen to a dog, and as a result in our nonage, at least, we concluded that a horseshoe nail was a mighty handy thing to have around. In this conclusion we were quite beside the point, which was, of course, that small details are important. The moral holds good in most everyday affairs, and while the proper operation of a radio set is not of such vital importance as the fighting of a battle, at the same time it should get proper attention as long as a man expects to get paid for repairing them, which leads up to our idea that the pilot light does not get as much consideration as it should.

This point was well illustrated by the behavior of a midget radio a few years ago. In this receiver the two pilot lights were shunted across a resistor in series with the tube filaments, and with the defunct original pilot lights in the sockets, the receiver performance was very poor, and only local stations could be received. A meter check showed that the 6-volt tubes were getting only 5 volts across their heaters, and the voltage for the 25L6 and 25Z5 was reduced to 20 volts. Installation of new pilot lights, of the proper rating, brought the filament voltages up to normal, and restored normal operation, such as it was.

In later model a.c.-d.c. receivers the failure of the pilot light may result in something more serious than poor reception. Most of the recent models connect the pilot light across a tapped portion of the rectifier tube filament, and when the pilot light goes out, it often takes the rectifier along with it. Typical tubes of this type are the 35Z5

(*Continued on page* 59)

AFTER all these years of abuse, I've finally managed to get Al on the spot.

Theoretically, he and I worked together to earn our living, but at the same time, there has always been sort of a strained relationship between us—like the antagonistic co-operation one finds in marriage. Out of our association, it is true, we have taken an income that supported two families; but it is very annoying for me to fight the whole world for bread and butter, and then contend with my partner on the side. It's only natural for me to expect, after a dayful of tough customer encounters, that I should find solace in the shop, from the one person in the world whose interests are supposed to be identical with mine. But no.

"Al," I remarked one day last week, as I watched him centering a Magnavox speaker cone, "sometimes I look at you and wonder."

"Humph!" he replied.

"What I mean is," I explained, "how did it happen, after we started in business together as equal partners, that you have managed to promote yourself to the senior position in *Salutary Sales & Service?"*

"I must be the leader type," he answered, shimming the voice coil with exaggerated delicacy of movement, implying great skill. He's an actor at heart, that guy.

"You've been standing by for years," I pointed out, "watching and criticizing—but you never stick *your* neck out. You and your negative personality! Haven't you formed any positive ideas about the profession? Why can't you stick *your* neck out once in a while, and let *me* do the axing?"

"You have been too immature," he explained. "But now, since you are soliciting my advice, I believe it would fall on fertile ground." He screwed the top on the bottle of collodion, lit a cigarette and sat down. "Climb upon my knee, sonny boy. Papa's about to tell you all about life."

I leaned my chair against the wall to express contempt.

"In my long career as a serviceman," Al said, "one of my most definite convictions is that my colleagues undercharge. When the average repairman comes face-to-face with a customer, he hasn't guts enough to ask for enough pay. Instead, he hexes himself with the thought the customer thinks he's a gyp. He is afraid of losing the job to some underbidding competitor, or of having the customer challenge his figures. He should convince himself, through a thorough study of his operating costs, that he is *entitled* to a better price—one on par with those charged by other businessmen. He's usually in for a shock after he divides his expenses by the number of calls he gets. Do you happen to know, Lee, how much it costs us every time the 'phone rings?"

"Nothing, of course," I replied. "The guy at the other end of the line pays the nickel!"

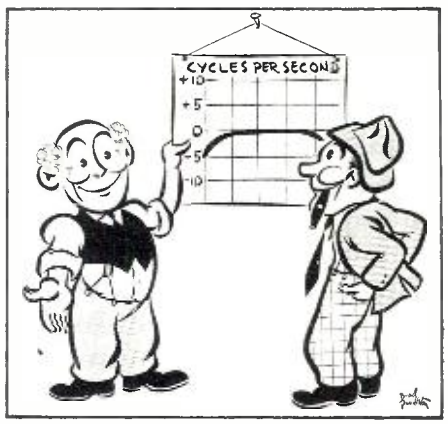
"Two dollars and one cent," Al declared. "In other words, if you find you can't make that much profit out of a call, it's cheaper to hang up—if, you can do it without losing good will."

"Does that include wrong numbers?" I asked. "If it does, we'd be better off if we had the 'phone disconnected!"

"Another conviction of mine," he went on, "is that about fifty percent of the nation's servicemen should never have entered a profession that required meeting the public. Many are unqualified. Lots of us overwhelm ourselves with the feeling we are supermen just because we know how to salvage a shorted condenser in a sealed i.f. can, forgetting the most important factor in any repair job is the set owner, not the set."

"Sure, sure," I said. "Smile at the customer, and neglect the set he called you to fix. Great advice!"

"It's too bad," he continued, not even bothering to look at me, "that no standards can ever be set up for tone quality, for the subject probably causes more conflict with the trade than any other. Despite all the frequency-response curves in the world, a listener either likes a set, or he doesn't. Nothing a salesman can say will ever change him in that respect. The customer's opinion is based upon such emotional intangibles as prejudice, previous psychological conditioning, acoustic setting, and—more importantly—how he thinks the Little Woman will like the furniture around the chassis. Outside of remembering that most women like bass notes to predominate, and that most men prefer highs for maximum intelligibility during a fight broadcast, the average serviceman would be better off to forget the whole thing, and simply confirm whatever belief the customer is already saddled with. Criticize, if you must, the buyer's religion, his choice of wife, or his race—but don't try to reform his ideas about tone quality by the use of mere logic."



"Sounds good—doesn't it?"

"Design engineers," I pointed out, "have been working for years—"

"If there's any one thing the profession needs badly," Al continued, as if he was alone in the room, "it's an article describing frequency modulation in less than thirteen thousand words. The definition should be simple enough to be understood by the trade without the use of the fourth dimension. It should be accompanied by an analogy. From such a definition we in the field could derive a simpler, shorter explanation which we could use when customers ask us—one we could use without waving our arms. This, perhaps, is a dream."

"The public library," I reminded him, "is open to—"

"Any chassis," Old Man River rolled on, "that requires the use of more than one tool should be taken to the shop. I never could understand why any serviceman, after spending ninety percent of his investment on testing facilities and tools in his store, should prefer his customer's living-room carpet as a work-bench."

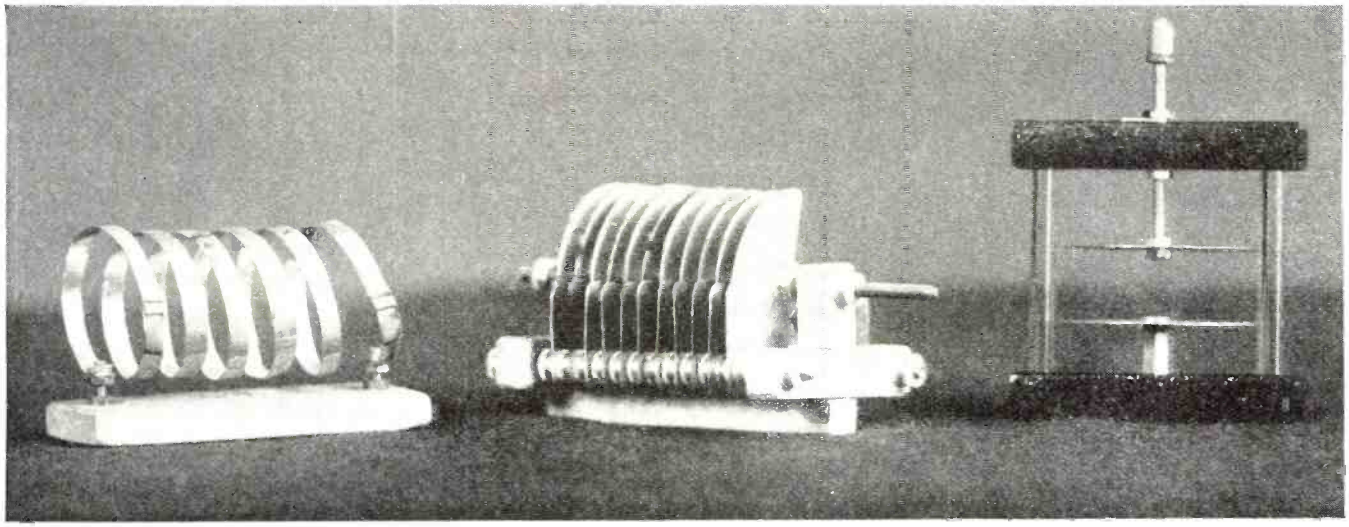
I sat still, just staring.

"No comment?" he taunted.

"How can I say—" I attempted.

"Good!" he said. "No comment. Here's another thing about taking chassis from the house: No set, with the exception of an 'intermittent', should be removed without quoting a price. An *exact* price. The *total* price. Of course, in the event of a hasty diagnosis, the repairman gets stuck for an additional part—but it teaches him to be more competent during subsequent calls. The best way is to leave an itemized bill on top of the empty console when you leave, listing parts and labor. Then, when you return, you'll find the set owner has laid the exact change on top of the bill, waiting for you when

(*Continued on page* 60)



Transmitter coil, variable condenser, and disc-type condenser made from tin cans and waxed-wood insulation.

Homemade Parts for Radio Construction

by RUFUS P. TURNER, W1AY

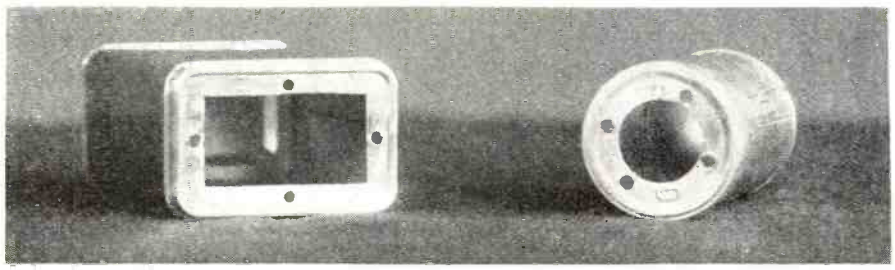
If worst comes to worst, amateurs and radio experimenters can always make their own parts.

IN these hectic times when our major national objective is the posthaste building of stout defenses, such terms as *priorities, requisitioning, rationing* and *substitutions* have entered the common language.

All of the flourishing peace-time arts and crafts have by this time felt the blow of materials shortages occasioned by immediate Government needs. The radio field is certainly no exception. Radio, eclipsing its status in the first world war, has leaped to a position of tremendous naval and military importance and is closely followed by its sister field, electronics. Thousands of pieces of radio equipment must be manufactured for the armed forces almost overnight. Labor is cooperating; but the war situation has reduced the supply of certain essential materials, our production tools are limited in quantity, and our industries must carry double load in trying to meet both Government and civilian demands. In such times, civilian radio consumers must tone down their requirements or find suitable substitutes for the parts so sorely needed for national defense purposes. By now, that is an old story.

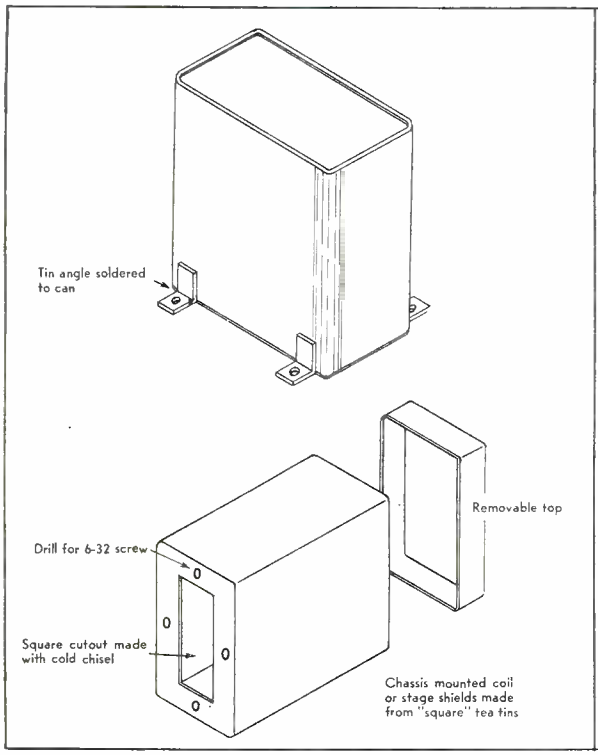
Aluminum, pampered pet of the radio industry, was the first metal to be rationed in the United States. Certain other metals have followed quickly in its wake. Progressively, the quantity of various common radio parts available to the public has become more diminished until now some private customers are compelled to wait many weeks for their orders to be filled, if at all. Even manufacturers are experiencing difficulty in obtaining certain parts unless these components are to be applied to defense work.

The amateur and serviceman have been viewing all of these proceedings with mounting fear, wondering what will happen next and both are now beginning to speculate with some alarm upon their immediate future as

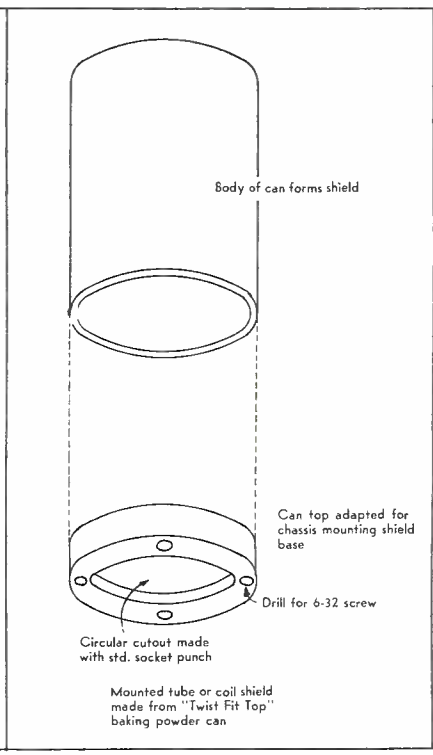


Above: Tin-can tube and coil shields are made in this fashion.

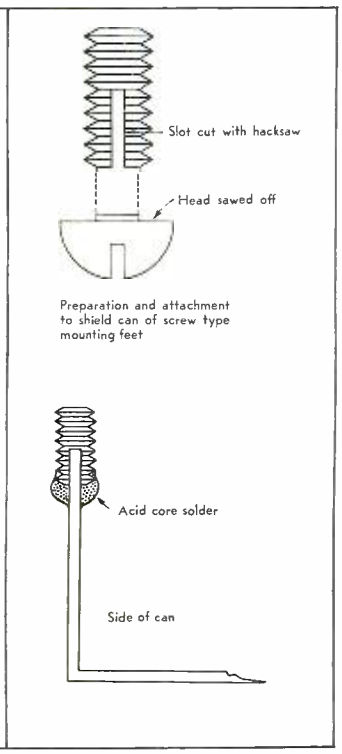
Below: Metal is scarce, but it may be obtained from the junk pile.



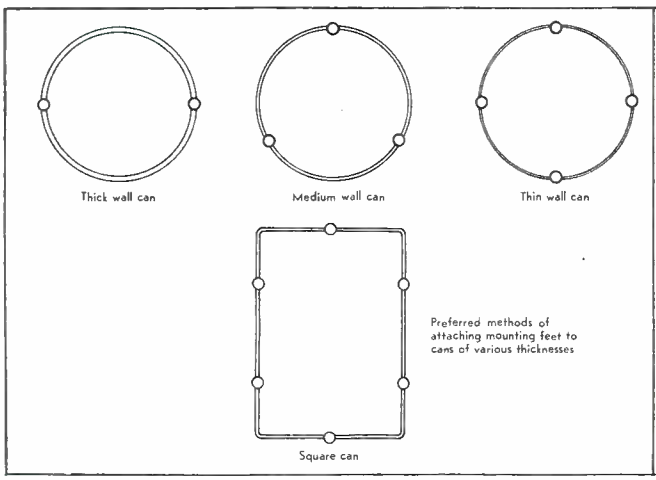
Neat looking shield cans may be made from tea tins.



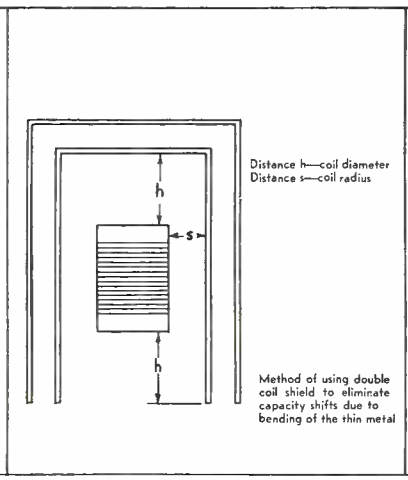
Baking powder can used as coil shield.



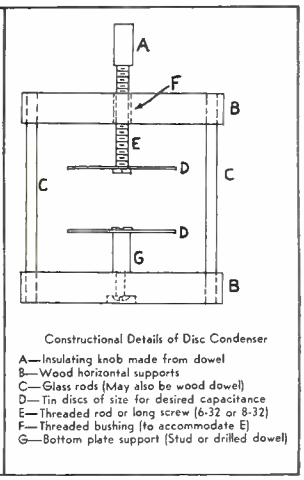
Mounting feet details.



Above: Several ways for attaching mounting feet.

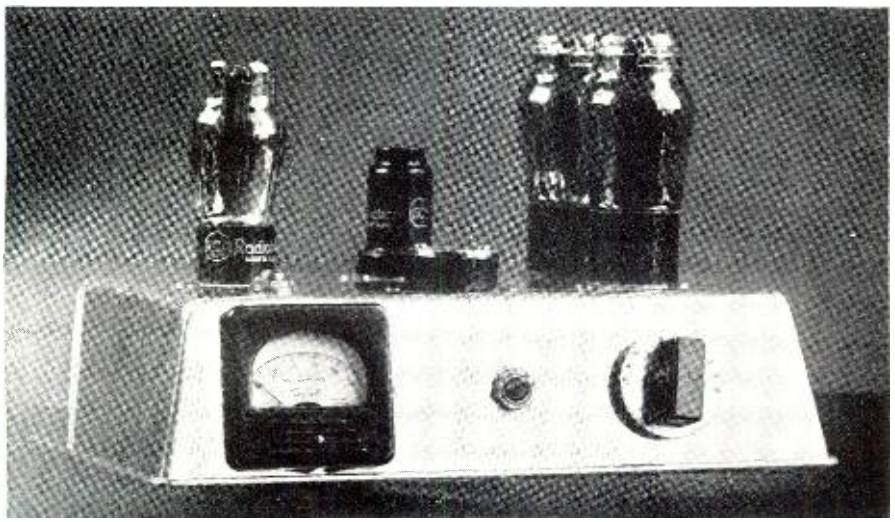


Above: Double can stops capacity change.



Disc-type condenser.

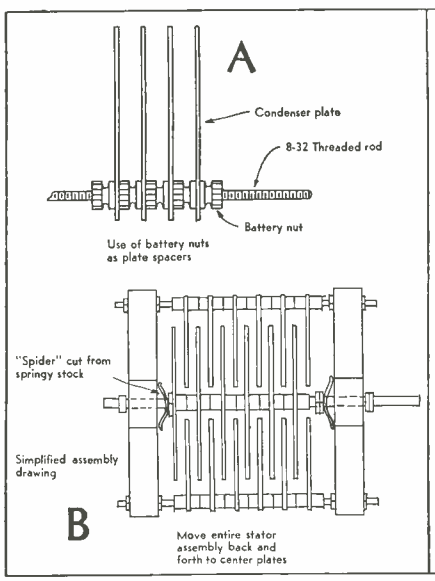
The "Blitz-4," 10-watt AC-DC Transmitter built on a tin-pan chassis.



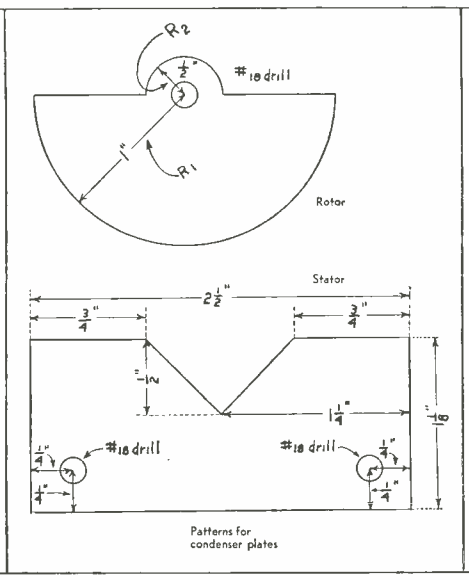
radio builders. "Are shortages and the rationing of materials," they inquire, "eventually going to deprive us entirely of the manufactured radio gear we have learned to take so much for granted?"

We regret to say that we do not have answer to that question. Where conditions dictated by the defense emergency are headed, we cannot predict with any more accuracy than can anyone else. All we know is what we read in the papers. We like to hope optimistically that increased industrial effort and the apportioning of our national resources will supply both the Government and ourselves. But we do know this; that the Yankee tinker brand of ingenuity characteristic of the American radio man will see him safely through any total lack of supplies.

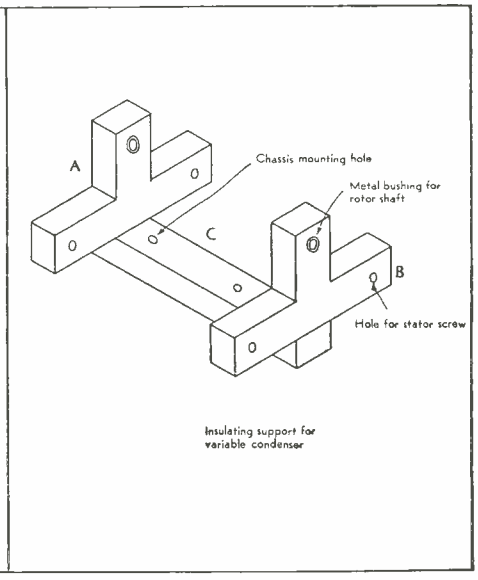
If the very worst comes to pass—*if*



Improvised variable condenser.



Condenser plates are cut from tin.



Wood support for condenser plates.

the supply of certain radio parts is temporarily cut off entirely from the amateur and serviceman, both of these fellows will have to make their own. And even if parts continue to be available, but in reduced quantities and on back order, it will still be the patriotic duty of every radio man to manufacture as much of his own equipment as possible out of whatever raw materials he can lay hands on, in order that larger amounts of factory-made materials may be diverted to Government use. It all boils down to a business of home-making.

We have tried making some equipment ourselves and find that we can make it work too. There have been no fancy tools for the job. Indeed, we were astonished at some of the results obtained. It seems perfectly reasonable that other radio men can do likewise and that radio repairing, radio transmitting, and experimenting will go on with just a little effort on our part.

Home-Making a Forgotten Art

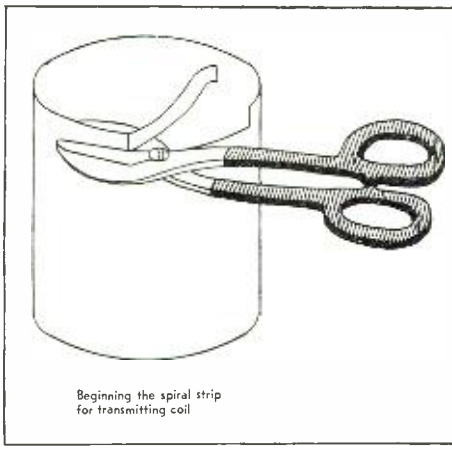
We grant that the idea of workable, home-made equipment is beyond the conception of most modern radio men who never had to do the job. But we do not believe that old-timers in the game need instruction in creating their own gear. A little over eighteen years ago, they were making, not assembling, quite everything they used. They made their own parts or went without. Some of the early experimenters even made their screws. In those days our towns just were not sprinkled liberally with well-stocked radio stores, nor were all of the prices within reach of the rank and file when the stores did come. The old-timers treasure a somewhat faded recollection of home-made equipment.

Factory-made components have become so commonplace and mass production has made their prices so reasonable that real radio building at home or in the shop has become a forgotten art. Today's experimenters do not build, most of them assemble.

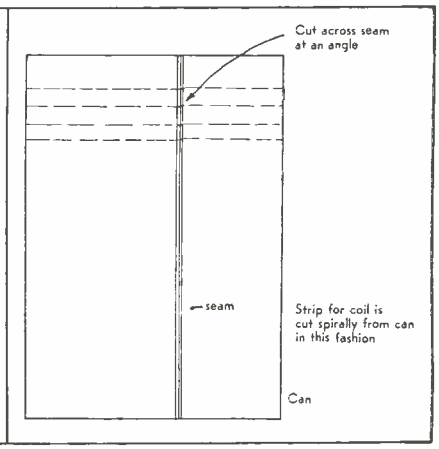
We hold that restriction is the mother of ingenuity, and the typical ham and serviceman is an ingenious animal. We like to believe that he is resourceful to the point that if he were lost on a desert island he could, with odd bits of trash gathered together Jules Verne fashion, hurl radio signals out into the still night air and call aid. Now is the time for him to prove it. The public has watched him whip together a nondescript aggregation of wire, sheet metal, and battered tubes to tell the world how flood and hurricane have laid waste to his homeland. Now that same public wonders why he should be over perturbed by a lack of equipment.

Let us not fail to consider at the same time the resourceful serviceman who often has been forced to manufacture a part "on location." Perhaps he was far from the nearest town, or maybe all stores were closed down for the week-end. That fellow also knows a useful trick or two.

We refuse to believe that men of such capabilities can be totally paralyzed by a shortage of parts if they should not be readily available.



The tin can is cut as illustrated.



The can seam must be cut properly.

A Return to Home-Building?

In this series of articles, we will try to rekindle interest in the building of parts in the home workshop *as an emergency* measure. We have spent the summer and autumn building and testing such parts ourselves and have endeavored so to simplify these components that they might be copied by any radio man possessing the tools commonly found in the experimenter's tool kit.

It will be seen that use has been made of common materials which the radio man can find in his own backyard, as it were, and which he will very likely be able to obtain throughout the emergency. Our materials and methods have doubtless been overlooked by many other individuals searching for the answer.

We do not consistently claim for the parts to be described in this series the peak efficiency of corresponding factory-made materials built of better quality stock. But we have endeavored to work out the best balance between efficiency, availability of material, and stark *emergency*. A few Q-points have been sacrificed here and

(*Continued on page* 42)

TECHNICAL BOOK & BULLETIN REVIEW

"ELECTRONICS," by Jacob Millman and Samuel Seeley, published by *The McGraw-Hill Book Company*, 330 West 42nd Street, New York, N. Y. Contains 721 pp. with illustrations. Price $5.00. The primary purpose of this textbook is to provide a development of basic electronic principles with applications to many problems in electrical engineering and physics. The book includes general considerations of both vacuum and gas-filled electronic devices.

Features of the book:

1. It coordinates the physical theory of electronics and the theory of operation of electronic devices.
2. Many unique and original methods of presentation are employed, and complete treatments are given of subject matter generally covered but briefly in other texts.
3. Attention is given to material of present-day commercial importance, including television pick-up devices, secondary emission multipliers, cold cathode gas triodes, vapor and fluorescent lighting, controlled rectifiers, modern photocells.
4. Many illustrative problems, showing how theory is applied, are carried out in detail. Many oscillograms show volt-ampere tube characteristics; and the wave shapes of the currents obtainable from many electronic devices.
5. A large number of homework problems are included at the end of each chapter.

This book is a "must" for advanced students in the field of Electronics and Radio Communications and Engineering.

"RADIO TROUBLE - SHOOTERS HANDBOOK." by Alfred A. Ghirardi, published by *Radio & Technical Publishing Co.*, 45 Astor Place, New York City. Price $3.50. The demand for Ghirardi's *Radio Trouble-shooters Handbook* among service men has made it necessary to bring out a new revised edition—the *second*—of this invaluable reference data book.

All of the features which made the old edition so popular have been retained, but every page has been completely revised and brought right up to the minute. In addition, over 200 pages of new material, much of it never before published, increase the size of the book 40%.

Featured among its 710 manual-sized (8½ x 11 inches) pages are 386 pages of trouble "Case Histories" covering over 4,600 receiver and automatic record changer models. (The largest "Case History" compilation ever published); a 50-page tabulation of i.f. peaks and alignment data for practically every known superhet receiver; 60-pages of tabulated data and

(*Continued on page* 61)

by **WILBERT T. PETERSON**
Illinois State Police Dept.

APCO Convention

AT THE recent national convention of the *Associated Police Communication Officers, Inc.* held in Oakland, California, September 10th to 13th, the following were elected officers for 1942: C. M. Smith, Jr., chief engineer for the North Carolina State Highway Patrol was elected president; J. A. Wilt, Police Department of Kansas City, Kansas, and R. M. Schuler of the Fresno, California, Police were elected first and second vice president respectively; H. H. Joy of the Iowa Department of Public Safety, Sergeant at Arms; re-elected to their respective offices were secretary-treasurer James H. Teeter, Police Department St. Louis, Missouri, and Bulletin Editor J. M. Wherritt of the Missouri State Highway Patrol.

The convention was held in the Hotel Leamington in Oakland, California, with an attendance of approximately 77 active and associate members from all parts of the country. Many important items concerning police radio communication were discussed and ironed out. One of the most important subjects involving much discussion was the ultra high frequency situation for State Police Radio systems. Since many of our state systems are installing two-way FM equipment, and with the results obtained many more will be following the same idea, it is readily seen that more ultra high frequencies will have to be obtained for the police services.

Interference between widely separated states is becoming quite common due to the skip effect at these frequencies. The characteristics of an FM system have proven that as long as the signal being received is twice as strong as another signal on the same frequency, no interference will result, however, the sky wave of a distant station may come within this two to one ratio and cause interference. In fact, it may become twice as strong as the desired signal resulting in a complete elimination of the desired signal. This situation may easily be experienced by a police car patrolling quite some distance from the central station and in a locality where the sky wave of a distant station may be unusually strong.

The FCC has offered the police services six frequencies in the medium high band (2326-2490) which, of course, are very welcome. These additional frequencies will considerably reduce interference between municipal police stations.

The subject of priorities also involved considerable discussion and a resolution was passed that the organization attempt to obtain a new classification to purchase new equipment. The present A-10 rating implies only to maintenance of equipment and no rating is given regarding purchasing new equipment.

The original $25.00 fee for manufacturers to receive a membership in the organization has been reduced to $2.50 which is the regular fee for active membership. The manufacturer's representative fee has also been reduced to this amount.

The convention in 1942 will take place in St. Louis, Missouri, under the direction of James Teeter, of the St. Louis Police. It is believed a much greater attendance will result by meeting in a central part of the country.

Muskegon Police

FROM Fred Castenholz, chief engineer of the Muskegon, Michigan, Police Radio System, we received the following report of activity in that territory.

Fred is doing some experimental FM mobile work to determine the type of equipment to place into the Muskegon County Sheriff cars. He claims the results of the tests so far show that FM is much superior to AM for the large territory he must cover.

At present he is operating 26 mobile units in the system, including units of the Muskegon Police, Muskegon Heights Police, and the Muskegon County Sheriff's Department.

The transmitter, which is a 300 watt job he built himself, is installed in the new city police building recently completed. The entire radio equipment is contained in two units, the operating console and a four section relay rack. The operator at the console has complete control of all equipment mounted in the rack. Besides the main transmitter, the rack also contains the original 50 watt transmitter now used as an auxiliary, 2442 kc. receiver, speech monitor, speech input equipment and frequency monitor.

The antenna is a quarter-wave pole mounted on the roof of the building. At the top is installed a *Link* coaxial

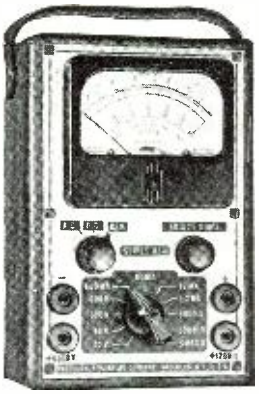
(*Continued on page* 58)

WHAT'S NEW IN RADIO

Precision Multi-Range Tester

A surprisingly rugged and simplified circuit tester has recently been marketed by the *Precision Apparatus Company,* 647 Kent Avenue, Brooklyn, New York.

Using an absolute minimum of controls, this new all-purpose tester and "troubleshooter" meter combines 31 ranges of a.c. and d.c. measurements



in a space no bigger than a man's hand.

The *Precision* series 834 instrument offers 18 voltage ranges, 0-12/60/300/-600/1200/6000 in a.c., d.c. and Power Output, at 1,000 ohms per volt; 4 current ranges, 0-1.2/12/60/600 mils; 3 resistance ranges, 0-5M/500M/5 Megs; and 6 decibel ranges, from —10 to 70DB.

All connections lead from only two pin jacks, with the exception of the 1,200 and 6,000 volt ranges, which have one additional jack each. The tester is completely self-contained, using no external batteries or multipliers, and comes with a new type extra large, easy reading 400 microampere rectangular indicating meter, and wire wound multipliers accurate to 1%.

Automatic Table Model RCA Victrola Announced

A compact, powerful, new table model automatic *RCA Victrola* phono-

graph-radio embodying a number of qualities new to instruments of this type, has been announced by A. B. Mills, *RCA Victor* Phonograph-Radio Sales Manager. Designated as Model V-135, the instrument is an addition to the 1942 series of *RCA Victrola* instruments recently announced.

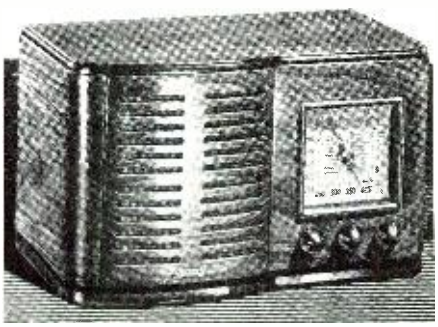
"Completely automatic operation is a principal feature of the V-135. The operation of the tone arm is controlled so that programs of recorded music may be enjoyed merely by stacking up to twelve records on the automatic mechanism, and pushing a starting button," Mr. Mills said. "Twelve 10-inch or ten 12-inch records may be played automatically."

"The V-135 employs the new *RCA Victor* Jewel-Point Pickup, with no needles to change," he said. "The scientifically designed point produces amazing purity of tone for an instrument so compact, and assures indefinite record life through reduced pick-up pressure. Five tubes are employed."

Radio features of the instrument include a built-in Magic Loop Antenna, electro-dynamic loudspeaker, automatic volume control, 2-point treble tone control, frequency locking magnetite core i.f. transformers, and Underwriters' Approval. The modern, chest-type cabinet is distinguished by a full wrap-around construction. Functional styling is employed for utmost operating convenience.

Sonora AC-DC Superhet

1942 in styling and performance is this new 6-tube a.c.-d.c. Superhet table model radio manufactured by the *Son-*

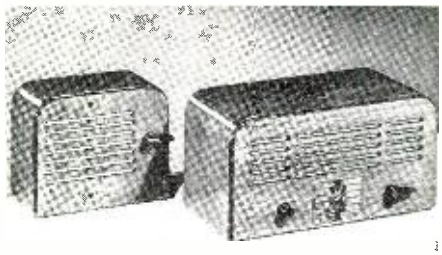


ora Radio & Television Corporation, Chicago. Tunes 535-1720 kc. to cover the complete standard Broadcast band and the 1712 kc. police channel. Features built-in "Sonorascope" loop; large 3½"x3½" Clock-type Gemloid Dial; Continuously Variable Tone Control; 6" Dynamic Speaker; Automatic Volume Control. The curved speaker grille is an unusual design detail that adds an elegance to the cabinet which is fashioned throughout of rich walnut veneers. Overall dimensions of the set are 14½" long, 7½" deep, 8½" high.

Knight Industrial Inter-Comm System

Allied Radio Corporation, Chicago, announces a 1942 innovation in low-cost Intercommunication Systems — the *Knight* Super-Selective—precision-engineered to meet the exacting requirements of diversified production methods of the modern industrial plant.

The *Knight* Super-Selective's unique versatility speeds up plant production,



eliminates time waste, cuts cost, overrides plant noise, reduces rejects, and material waste. Operation and service costs are negligible.

The Super-Selective Intercom System has 2¼ watts power output, enabling ten sub-stations to carry five simultaneous two-way conversations with absolute privacy. Up to 2,000 feet of cable may be used between each station. Housed in rich walnut-finished cabinets, 12" x 6" x 5¾". For 110-115 volt a.c.-d.c. operation.

A product of *Allied Radio Corporation,* 833 West Jackson Boulevard, Chicago, Illinois.

Table-Type Radio-Phonographs, New Portable in G-E 1942 Line

Three new versions of the popular table-type radio-phonograph combination, and a newly-styled "pocketbook"

size battery-operated portable have been included in the *General Electric*

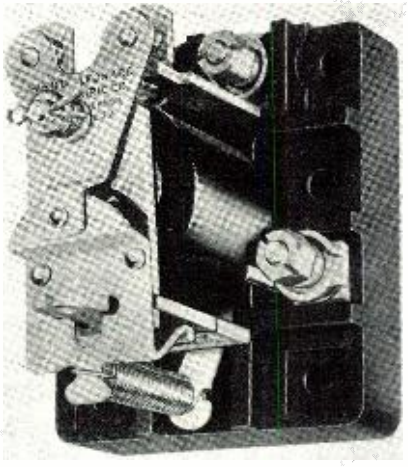
radio receiver line for 1941-42, as announced by the G-E radio and television department, Bridgeport, Conn.

Model LC-679 is a compact model accommodating a.c.-d.c. superheterodyne radio equipment which features built-in "beamascope" antenna, a 6½-inch dynamic speaker—slightly larger than the aforementioned model—six feathertouch tuning keys, illuminated dial, tone monitor circuit to extend the reproducing range, automatic volume control, and 2.5 watts maximum power output. The receiver is designed for the attachment of frequency-modulation or television sound through the provision of the necessary leads. The cabinet is of two-toned walnut with dual speaker grilles on the front corners. Greater emphasis has been given to radio equipment in this combination, but the phonograph facilities include the ability to play either 10- or 12-inch records with lid closed, automatic tone-arm which transforms radio into phonograph and starts turntable, a high-quality crystal pick-up and tone arm.

Improved Ward Leonard Relays

Bulletin 106 Relays have been improved in construction details and materials.

All Bulletin 106 Relays are now furnished with a molded bakelite base providing greater protection against



absorption of moisture, higher insulating qualities, increased mechanical strength, and lighter weight.

All Double-pole relays now have rubber insulated lead wires. On Double-pole, Double-throw relays, the contacts carried by the bakelite arm are now secured by a spun over riveting operation that requires no facing and thereby eliminate open end grain contact.

Ward Leonard Electric Co., Mount Vernon, N. Y.

New Speaker Control

Speaker Power Volume Control has an essentially constant impedance for use across the voice coil of any speaker. Provides uniformed tapered, gradual control of volume from a full ON to OFF position. Conservative rated power handling capacity of 10 watts. Electrical components include special tapered wire wound potentiometer and a fixed vitreous resistor for power absorption at minimum volume settings. Parts are mounted in an *Atlas* gun-metal finished CB Utility Box. Etched indicator plate and red molded bar knob supplied. Overall diameter 3".

Atlas Sound Corporation, 1449 39th St., Brooklyn, N. Y.

Anchor Type Elastic Stop Nuts

Following the successful use of their anchor type nuts in aircraft construction, *Elastic Stop Nut Corporation,*

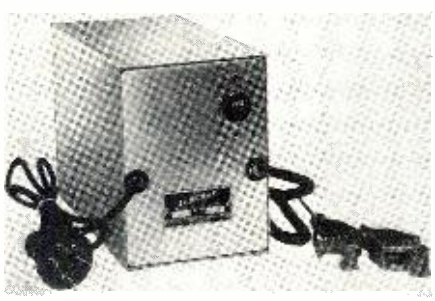
2332 Vauxhall Road, Union, New Jersey, now offers these nuts for blind-mounting applications on general industrial equipment.

Designed to provide vibration-proof fastenings for removable plates used to cover hand holes, access and inspection openings, and for other blind mount attachments, anchor nuts are permanently riveted to the inside of the structure. The bolts, which are inserted from the outside, pass first through the removable plate, thence through the structure into the stationary nuts.

These nuts are offered in a wide range of size, material, and thread system, every nut incorporating the basic Elastic Stop self-locking feature, a fiber locking collar which is an integral part of each nut. This locking fiber prevents the bolt from becoming loose after it is installed in the nut, regardless of the severity of the vibration to which it is subjected. In such mountings, the bolts may be removed and replaced many times, the anchor nuts retaining their locking ability because of the resilient character of the fiber collar.

Model 2500 Synchro Power Supply

A vibrator type power supply which furnishes 6 volts filament and 300 volts



100 milliamperes d.c. power from a 6 volt storage battery. Complete radio-audio filter system, input and output battery cable, plug, clips and fuse are provided with this unit. No experimenting necessary. Just connect it to your PA system.

Ideally suited for use as a power supply for portable public address systems, low power radio transmitter-receiver units and any service where high efficiency, light weight (8 lbs.), low cost power source is required.

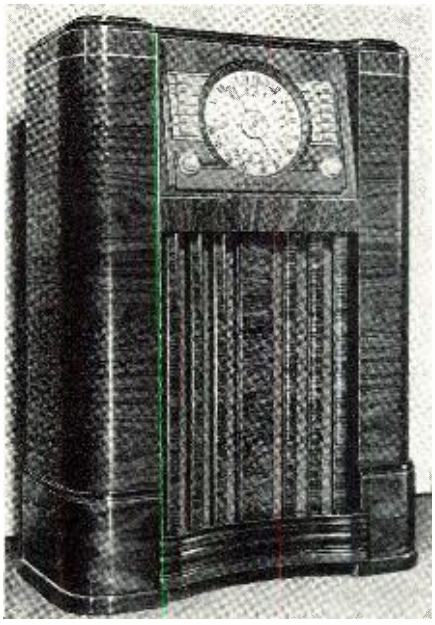
Electro Products Laboratories, Chicago, Ill.

New 1942 Crosley FM Sets

Fifteen exclusive *Crosley* FM features are included in the new 1942 *Crosley* FM radio receivers, three models of which have just been introduced, according to Robert I. Petrie, vice-president and general sales manager, of the *Crosley Corporation.*

These new *Crosley* FM receivers have been designed, Mr. Petrie said, to enable radio listeners, in every locality, to receive the standard AM programs, with maximum accuracy and clarity, and also to furnish the most modern and advanced reception of frequency modulation programs from the rapidly-increasing list of FM broadcasting stations.

Briefly, in non-technical language,



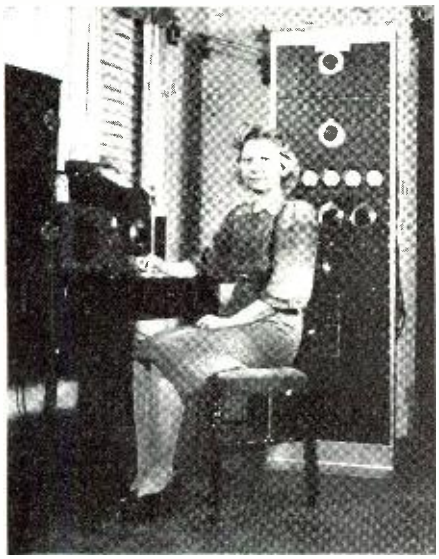
the exclusive *Crosley* features in the new 1942 *Crosley* FM receivers are:

(1) Band-width switching. The *Crosley* band-width switching feature makes it possible to change the receiver from broad to sharp tuning, thus reducing adjacent station interference.

(2) *Crosley* 13,700 kilocycle intermediate frequency. With the commonly-used 2,000 kilocycle or 4,000 kilocycle i.f. system, stations may often be heard at two or more points on the dial. The *Crosley* 13,700 kilocycle i.f. system eliminates this possibility.

(3) The *Crosley* special FM discriminator. With this discriminator, amplitude modulated signals are more ef-

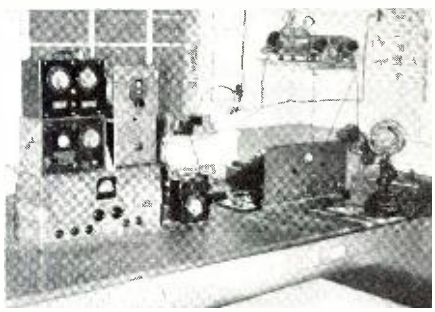
(Continued on page 48)



Emma W2 "Mary Jane Smith."

Impressive layout of W5HTX.

W9RDC rattles the "bug."



W5KBZ is designed for operating.

Jr op of W8SQM studies radio.

Ham Chatter

ONE of the best indications we have seen that the hams will stay on the air during the emergency, in recent months, is the establishment of a complete ham station at *Fort Monmouth*. This station operates under the call of W2OEC and is operated under the same rules as any other ham station. The station was installed in the *Radio School, U. S. Signal Corps Replacement Training Center,* and its primary purpose is to handle messages via amateur relay between trainees at Fort Monmouth and their homes. It is also intended to furnish operating practice and recreation for the many licensed hams in training with the Army. Two complete operating positions are installed with *Hallicrafters* transmitters delivering 450 watts on C. W. and 325 watts on phone. Various types of antenna are available and operation is on all bands from 10 to 160 meters. Such an installation appears far too elaborate to be a temporary one and it appears that in the opinion of the *Signal Corps* at least the hams are to remain on "for the duration." We sure hope so!

SOME chatter on the forty meter hams from W5JPC.

W4HQS, formerly of Miami, Florida, is now located in Ashtabula, Ohio. Bill is pounding key on 40 and is using a 6C5 Pierce Osc. and a 807 Final with about 70 watts input. The revr is a Howard 430 with a Browning Pre-selector.

Waco, Texas's gift to hamdom, W5JED-Tex, is now QRT due to revr troubles.

W5JUU, now operating on 14 mc. from Longview, Texas, is a former W8.

W5IIJ uses a Sky Buddy with a home-made pre-selector. "Beans" always puts in a fb sig with his 60 watts.

W5HUJ, of San Antonio, recently QSOed W5JPC, of Kilgore, for about 20 minutes without the use of an antenna. The distance between the two stations is about 250 miles.

W5JMU is QRT due to xmtr troubles es lack of time.

W8RUQ is a sign painter.

W5FGT now has a code certificate for 35 WPM. Karen now has a new receiver and is going back on the air after being QRT for sometime.

W8TOF is a world war vet. Gene uses a NC81X revr es is running 150 watts to a RK47 final.

W5FMH has a fb v.f.o. unit. Pearl is giving five meters a tryout at the present time.

W5DUX is a printer.

W5JOE is a Sgt. es radio instructor at Camp Livingston, La. Jim is on 40 es 160 regularly.

W4HBE puts in a whale of a fb sig hr. Zach uses a 6L6GX xtal oscillator running about 60 watts input es a Sky Champ revr.

W5JPC has recently put an emergency self-powered station on the air. The pwr is about 12 watts fone es c.w. es works from a vibrapack.

W8QEH, W8VLW, W9ZTD, es W5JGX can be counted on for a real QSO at any time.

AND from W8UPO:

W8RHI, Dearborn, Mich., has a commercial speech amplifier which really gives him excellent quality.

Another new ham on the air is W8WGM, of Curtice, Ohio, who is doing a fine job with his 85 watts. Incidentally, Glen is an amateur radio op, but he's no amateur checker player. I should know, because he walloped me two games in rapid succession last Sunday afternoon via the 160 meter band. Was my face red!

W8CHS, Findlay, Ohio, remarked that his last electric light bill is high, but he doesn't think it's so much in comparison to the way he's been burning up the 160 meter band lately.

W8OWY, Detroit, Mich., has a right to be proud of his double button mike. He has two mikes hooked together. One is an F-1; the other is an E-1. Jerry has exceptionally good quality, and operates on 75 meters in his idle moments. He's employed in the income office at the Ford plant, but intends to terminate that job shortly to accept a teaching position.

QRM never seems to bother W9DTJ, of Dillsboro, Ind., in spite of the fact that he is running only 60 watts. Good work, Johnny!

Why is it usually so hard to contact another station and carry on a successful QSO when "company" comes??? Has anyone else besides me ever noticed this aggravating fact? Hi, hi!

W8SRX erected a new ant recently, and he's getting FB reports on 160.

We sure miss W8UWR, who was transferred to a new job in Minn. quite some time ago. Don formerly worked at the Vickery Ohio Airport. It was always a pleasure to contact him on 160.

W8VDJ, Bob, has just returned to Findlay, Ohio, after spending a vacation in Mich.

Another comparative newcomer to the 160 band in this vicinity is W9FWP, operating Fixed Portable 8 at Port Clinton, Ohio. Danny is employed at the Port Clinton Police Station.

A few days ago we were in the vicinity of Van Buren, Ohio, so we stopped to see W8's, VOZ, CFP, and RXJ. Both VOZ and CFP have FB rigs. RXJ, who is located on a farm about a mile north of Van Buren, on the Dixie Highway, has a fine looking transmitter—and also some fine looking horses.

Apparently W8VOG (ex W8OFW) has deserted the 160 m band. We miss QSOing you, Johnny.

W8MRN is the chief op of WPPG for the Ohio State Patrol at Findlay, Ohio.

W8TAO, Dewey, who is in the 13th School Sqdn. at Scott Field, Ill., intends to rent a room in Belleville, a nearby town, so that

(*Continued on page* 65)

Manufacturer's Literature

Our readers are asked to write directly to the manufacturer for this literature. By mentioning RADIO NEWS and the issue and page, we are sure the reader will get fine service. Enclose the proper sum requested when it is indicated.

New Thordarson Book for Servicemen

Transformer Replacements for over 4,000 receivers are given in *Thordarson's* new edition of the Replacement Encyclopedia, No. 352-R, available free to servicemen. Receiver types have been carefully arranged to enable quick and accurate selection of power transformer, filter choke, audio or output transformer. A special feature of the Encyclopedia is the addition of electrical and physical characteristics of recommended replacement types listed in the book.

Ask your distributor for this new 32 page book, No. 352-F or write direct to *Thordarson* for your copy. Address, *Thordarson Electric Mfg. Co.*, 500 W. Huron Street, Chicago, Illinois.

Precision Test Equipment Catalog

All types of radio testing equipment are illustrated and described in the new *Precision Test Equipment Catalog* now off the press. Up-to-date Servicemen require a selection of units that will fulfill as many applications as possible with a maximum amount of speed and with a high degree of accuracy. Among the many items described are: EV-10 Vacuum Tube Multi-range Tester, Series 920 Electronamic Tester, the Precision "Electronamic" tube tester, Series 910 Tube Tester, Series 912 Tube and Battery tester, Series 914 counter-type tube and battery merchandiser, and a wide selection of portable compact testers that will appeal to those who do outside radio trouble-shooting. Copies of this new Catalog may be obtained by writing to the *Precision Apparatus Company*, 647 Kent Ave., Brooklyn, N. Y.

National Union Foto Log

The annual edition of *Radio Foto Log*, a listener publication edited by Samuel Kaufman, prominent radio feature writer, has just been issued by the *National Union Radio Corporation* of Newark, New Jersey.

The 28-page magazine contains station log for broadcast and short-wave listening as well as television reception. In addition there are features and photographs covering virtually every topical phase of radio programs. The publication is distributed exclusively by radio dealers and servicemen throughout the United States.

—30—

SERVICEMEN'S CASE HISTORIES

by

ALFRED A. GHIRARDI

AIRLINE 62-22

Intermittent reception, Fading	1)	"open" cathode by-pass condenser i-f stage
Distortion, Overloading on local stations	1)	if AVC plate voltage is somewhat high when receiver is first turned on, look for an open-circuited resistor between the oscillator and r-f screens to plate of AVC tube. Also check for an "open" in the "localizer"—especially at the "cathode" side of the control. The divider resistance should be 4,300 ohms total, tapped at the 1,100-ohm point. Make tests from suspected point to cathode instead of to ground
	2)	check for "open" cathode by-pass condenser in i-f stage

AIRLINE 62-68

Intermittent reception	1)	3,200-ohm "Candohm" resistor (furnishing cathode and suppressor grid bias to the '57 first detector-oscillator) "opens" periodically. Replace with 1-watt unit

AIRLINE 62-70

Intermittent fading	1)	"open" or "leaky" 0.04 mfd. audio-coupling condenser between '56 second detector and grid of '47 output tube. Cond. located between '47 tube (under chassis)

AIRLINE 62-72
ARVIN 1936 Auto Radio Sets

Vibrator hash	1)	make sure that chassis is well grounded to firewall of car, using shakeproof washer on bolt
	2)	be sure to secure good grounding for the transmission line box. Ground it to the frame of the car if an under-car antenna is used, or, if a "top" type antenna is used, ground the box to some metal part known to be at the same r-f potential as the firewall. Make sure that the transmission line shielding is making firm contact with the plugs at both ends
	3)	remove front cover of receiver, and tighten the four screws holding the power transformer in place. Wiggle the vibrator in the socket, and make certain that each "grounding" tooth makes good contact with the sides of the vibrator case
	4)	in addition to regular A-line condensers, try connecting a 1-mfd. condenser across the car's A-circuit by connecting it from "ground" directly to either terminal of the ammeter or fuse block
	5)	solder a 1½-inch piece of shielding or flexible wire from the 6A7 grid cap tube shield to the frame of the variable condenser
	6)	vibrator "hash," which may occasionally increase to an undesirable level after a period of operation, may often be corrected by tightening the four screws that hold the power transformer to the chassis after the receiver has been allowed to warm up for a period of about a half hour
Mechanical hum in vibrator	1)	In some of the first few 1936 receivers delivered, a mechanical noise develops due to chattering of the vibrator against the chassis. Remove the vibrator from the set and increase the tension of the vibrator-grounding spring cup which is riveted in the radio chassis over the vibrator socket
Switch remains in "on" position	1)	remove the small stop pin located just above the volume control on the rear of the remote-control head. This pin may be extracted by prying it up with a screwdriver and removing it with a pair of pliers

CLARION 51, 52, 53, 55, (A.C.)

Whistling, Intermittent reception, Noisy reception	1)	r-f cathode by-pass cond. "leaky," "open"
	2)	clean all rotor-wipers on condensers, or put them in if they are not already there to facilitate balancing
	3)	"open" ground strap between condenser frame and chassis
	4)	poor contact between variable condenser canopy and chassis
	5)	"open" screen by-pass condenser
	6)	"open" plate by-pass condenser
	7)	poor contact between the r-f choke and main choke
	8)	chassis base plate loosely attached to chassis
	9)	poor ground connection
	10)	tube shields not secure and making good grounding contact
Low volume, Low voltages	1)	"shorted" 1-mfd. condenser across the 900-ohm output bias resistor

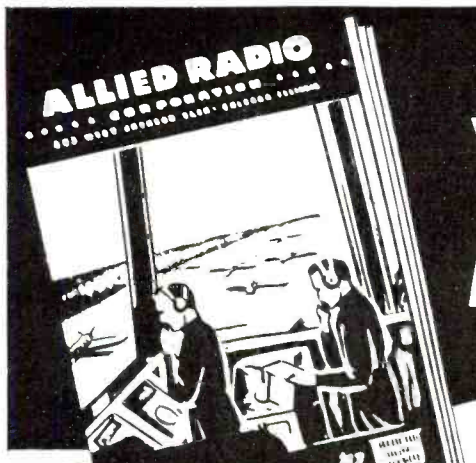
CROSLEY 40-S

Intermittent operation	1)	loosened rivets on the bias resistor for the screen-grid tubes. Solder each end to the supporting rivet. Frequently, it is necessary to unwind one or two turns of the resistance wire to make proper connections
Distortion, Low volume	1)	if analyzer check shows a positive bias on the first audio tube together with excessive plate circuit, replace the 0.5-mfd. coupling condenser connected between the detector and the first audio grid
Distortion after a few minutes of operation	1)	defective 750-ohm resistor on the resistor strip causing improper bias on the type '45 tubes. The defect is apparent only when the receiver heats up
Excessive hum, (hum disappears when set is removed from cabinet)	1)	condenser block punched by one of the screws which hold the chassis to the cabinet, thereby short-circuiting the condenser. When screw is removed, the hum ceases, since the condenser is no longer short-circuited

ECHOPHONES S-3, S-4

Inoperative (burned-out antenna coil)	1)	rewind the primary coil with 250-turns of No. 36 wire. One turn at the antenna end acts as a dead end (for capacity-coupling), i.e., the antenna connection is to be taken from the **second** turn, leaving the outer end of the first turn free
Low volume, Loss of sensitivity with volume control at maximum setting	1)	open-circuited 1-megohm resistor connected from B-plus to the screen-grid of the type '24 detector tube. If faulty, an increase in volume will be noticed when the unit is shunted with the fingers. Replace this resistor with a new unit
	2)	replace the r-f coils with litz-wound coils (used on the later type models). Realigning is necessary if this is done
	3)	replace the porcelain-type 1-megohm control-grid bias resistor located on the resistor panel (which is fastened on the side of the chassis) with a new pigtail-type carbon unit
Noisy reception, Low volume	1)	defective tone control condenser. Replace with new unit
	2)	tuning condenser plates touching at certain positions. Bend these out so that they will not touch
Whistling, Low volume	1)	if the condenser wiping contacts are all clean and all by-pass condensers check O.K., replace the 0.5-meg. resistor from detector screen-grid to ground. This is the smallest one mounted on the resistor panel. When "open" it increases the detector screen-grid potential by about 20 volts causing oscillation and low volume
Improving reception	1)	replace the screen-grid voltage resistor with a 200,000-ohm unit

(*Continued on page* 62)



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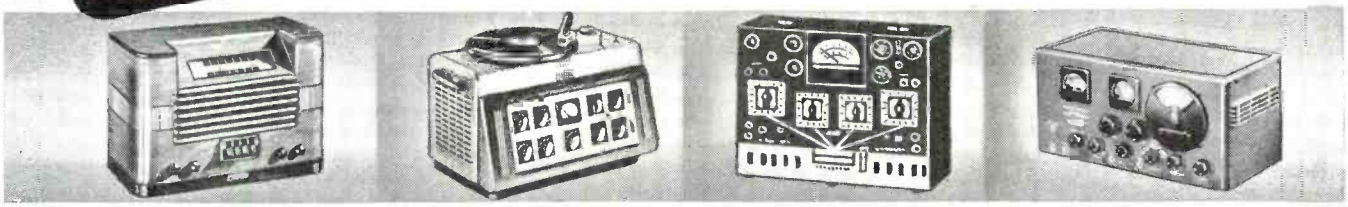

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Home-made Parts for Radio Construction, Part 1

(*Continued from page 35*)

there, as it will be pointed out in individual cases, and overall efficiency has been reduced in some instances by the quality of raw material employed. But these sacrifices will be tolerable in any emergency equipment.

In addition to describing the construction of actual parts, we will list and explain satisfactory substitutes for insulations, foundation units, coil forms, and the like. And in cases where certain parts such as tubes obviously cannot be easily substituted, we will describe conservation methods such as circuit simplifications which will reduce the number of such components required.

The articles will include matters of interest to hams, servicemen, and experimenters alike. It will be entirely an educational project and we believe that long after the present emergency has become history, craftsmen in each category who have acquired home-making skill will find their knowledge in good stead when they are subsequently thrown upon their resources.

Let it be understood fully, however, that we intend no implication that the ham and serviceman may be constructing their own apparatus permanently remove themselves from the peace-time parts market where they have customer value. No movement in that direction is designed. The gear we describe are *emergency substitutes* that, while entirely workable, the radio man would not choose to build except in an emergency, because of the labor involved and reduced efficiency obtained. With the return of conditions to normalcy will naturally follow lack of interest in the general use of emergency parts.

Our Answer to the Metal Situation

Our huge supply of tin cans is a prolific, though slightly amusing source of emergency sheet metal useful in home radio construction. Foods, beverages, and paint are products commonly supplied in these well-known containers, each of which will yield between several square inches and a few square feet of easily-worked sheet metal. Cans of various sizes are easily obtained. Every family discards at least a couple hundred each year. The tin cans piled high on every dump fringing our towns constitute a wealth of sheet metal which the resourceful radio man can convert into shields, condensers, dials, chassis, and other parts.

We began electrical tests and constructional projects on "tin-can tin" shortly after the first announcement of metal rationing and learned many things about the use of the material in short-wave radio. We have been entirely pleased with its performance as an emergency sheet metal and recommend it to amateur and experimental use in the parts to be described.

"Tin" cans are made of sheet iron or steel which is coated with a layer (often light) of metallic tin. This material is commonly called "tin plate" or "tin-steel" and in cans varies in thickness from a minimum in the neighborhood of 5 or 10 thousandths of an inch.

We expected that the r.f. resistance of tin-can tin would be such as to render it eminently inferior as a shield material. This possibility we expected to be further augmented by the facility with which the thin material may be bent. However, we have experienced no ill effects as long as we have kept our shields sufficiently large in size to clear coils and tubes amply. And where distortion in shield shape has been important in changing frequency or altering stray capacitance, we have employed *double* shielding consisting of one can mounted over a smaller one.

Consultations with various experts indicate that some form of metal can is very likely to be obtainable, as at present, throughout the emergency. Even in the event that the distributors of food products swing over to a non-metal container, it is unlikely that several years of war will exhaust the can supply on city dumps.

Tin-can tin is easily worked. A medium-sized pair of tinner's snips is the only tool required for cutting it, and it may be neatly flattened between two hardwood boards, drilled in the usual manner, and processed with standard socket punches, reamers, and circle cutters. It has a tendency to cut with a sharp, often ragged edge, that imparts about the meanest cuts we have had the displeasure of witnessing, but its edges and corners may be smoothed perfectly with a fine file or grinding wheel whereupon it becomes no more dangerous than the polished aluminum plate of a manufactured condenser.

A second prolific source of tinned stock, somewhat heavier than tin-can tin, exists in the form of dime-store kitchen utensils. Loaf pans make good chassis that are amazingly stout, and may be obtained in several sizes useful to the radio builder. A 20-watt a.c.-d.c. transmitter is shown in Figure 3 mounted on a 9" x 5¼" x 2½" loaf pan. This pan is reinforced by steel running through its rim and displays very little bending. Baking sheets may be formed into chassis, stage and tube shields, and to furnish stock for cutting out variable condenser plates. Lunch pails with tops are useful as cases for monitors and test oscillator. A visit to the dime-store household department will reveal many utensils with tremendous radio possibilities. The radio man's ingenuity and inventiveness will spring to the fore on sight of some of these common articles.

Shields

The first importance of tin-can tin is in shielding. Stage shields, coil shields, tube shields, and shield partitions may be constructed from this common sheet metal. Cans are available in many assorted sizes so that an entire can may be used in most cases for all but stage shielding without any cutting.

The square cans with tight-fitting, removable tops commonly used in packing tea make neat and reasonably efficient coil and r.f. transformer shields. Two shields made from such cans are shown in the drawings of Fig. 4 and in the photograph, Fig. 2. It will be seen from Fig. 4 that two methods are recommended for mounting the "square" shield to the chassis. In the first instance, it is assumed that the shield will not be removed, so it has been provided with small right-angle mounting feet cut from another tin can and soldered with acid-core to the sides of the shield and along its bottom edge.

In the second instance, a removable shield is illustrated. The removable lid or the bottom (as shown) may be drilled with mounting holes to clear the coil socket (as in a short-wave coil system) and a clearance hole cut with a cold chisel. The clearance hole need not necessarily be oblong or square. If it is desired to clear a standard tube socket used for plugging in the coil, the hole may be cut with a standard tube-socket punch.

The small round can with twist-clip removable top, such as the Rumford baking powder container, is also useful in particular tube and coil shield applications. This shield is shown in Fig. 5. Observe that the socket clearance hole has been cut with a regular socket punch in the removable top and that this top has also been drilled for mounting directly to the chassis. A slight counterclockwise twist of the can proper will remove the shield when it is desired to plug-in a new coil or tube.

Both round and "square" shields constructed by the author are shown in photograph in Fig. 2.

When it is desired to use lidless cans directly for shielding it will be necessary to provide them with mounting feet—small screws which pass through the chassis and take a nut on the under side. Figure 6 shows how to make these feet from standard screws, 6-32 being a convenient and handy size.

The head is first sawed from the screw with a hacksaw and then a lengthwise slot is sawed down the screw about ⅛ inch. The wall of the can is then passed into the slot of each screw-foot, the latter being pinched slightly to grip the can, and the screw soldered to the can as shown in Fig. 6. Acid core solder will have to be used in this operation if the job is to be done speedily and smoothly.

Mounting by means of screw feet must be carried out with a sufficient number of feet to impart rigidity to the can. Bending is undesirable in any application where change in frequency or change in stray capacitance is apt to result. Fig. 7 illustrates recommended methods of screw-foot mounting for cylindrical cans of thin-wall, medium-wall, and thick-wall construction and of "square" cans of any wall thickness.

A rule of good engineering practice to be observed in all home-made coil shield installation is illustrated pictorially in Fig. 8. The sides of the shield can should be a minimum distance, s, from the sides of the coil equal to the coil radius and the shield top and chassis should be a distance, h, from top and bottom of the coil equal to the coil diameter.

In a number of installations, such as oscillator or r.f. coil shields, the thin-walled tin-can tin stock is likely to prove undesirable because of easy bending, a deficiency which may easily be overcome by employing double shielding as shown in Fig. 8. Here the inner shield is a can of small dimensions meeting the *s* and *h* requirements mentioned above, while an outer can of slightly larger dimensions is mounted over the first can. Any bending then occurs when the outer can is disturbed and if the latter is spaced sufficiently from the inner can the effect does not reach the coil.

When baking powder cans are employed as glass-tube or GT-tube shields, they may be provided with vent holes by uniform drilling of 3/16-inch holes from top to bottom. A top-can clearance hole may be cut with the smallest-sized socket punch or may be reamed out from a ⅛-inch hole with a standard tapered reamer.

Shield Partitions

In a number of well-known applications, it is desirable to isolate stages or components by means of flat shield plates commonly termed shield partitions. These plates vary in area from a square inch in certain receiver applications to almost a square foot in transmitters and exciters.

Shield partitions may also be made from tin-can tin. Their shape is so simple and well-known that it needs no illustration. To obtain the sheet, a can of sufficient size is "unrolled" by cutting out its bottom and down its walls on each side of and close to the seam. After unrolling the sheet, it is hammered flat by placing it between two flat hardwood boards or heavy steel plates and pounding with a heavy hammer.

The edges and corners are carefully filed smooth with a fine-grained file, preferably finishing with a grinding wheel. A lip of approximately a quarter of an inch is folded at right angles along the bottom edge of the sheet and provided with holes for bolting the partition to the chassis.

Tin-plate shield partitions should not be mounted closer to a coil than a distance equal to the coil radius when the coil is mounted vertically, nor closer than a distance equal to the coil diameter when the coil is mounted horizontally.

Home-Made Variable Condensers

Our greatest surprise came when we completed several variable condensers made of tin-can tin, checked their performance experimentally, and found them to perform fine business. After success with several light-duty receiver-type condensers, we tried our hand

at high-voltage transmitting types with equal success.

In order to approximate conditions which might be expected to prevail under a total shortage of parts, we used no fancy insulation. Impregnated wood was chosen as the material that the civilian radio man would certainly have at his disposal when bakelite, ceramics, polystyrene, and even hard rubber would no longer be obtainable. We used scrap wood at that, from the author's fire box, and treated it by drying it out thoroughly in the kitchen oven and boiling it subsequently in a mixture of paraffin and beeswax.

Two types of variable condenser were constructed—the disc type and familiar rotating plate variety. Both are shown in Fig. 1. The disc type does not, of course, permit a great deal of capacitance, and will be recognized as the low-capacitance "screw-up" condenser popular for neutralizing transmitters.

The plate-type is identical with the design so familiar to all radio men. The entire set of rotor and stator plates for the condenser shown in Fig. 1 were cut with tinner's snips from a beer can. It is a transmitting type with plate spacing for 1000 volts. Its specifications will be given presently.

The two circular plates of the disc-type condenser, shown in photo in Fig. 1 and diagrammed in Fig. 9, were cut with snips from tin-can tin. As this condenser was intended for high-voltage transmitting use, the edges of the plates were carefully rounded and polished by filing, grinding, and buffing to reduce losses at high r.f. voltages. This is an added refinement too if the condenser is used for receiving purposes.

The bottom plate is fastened rigidly and the capacitance of the condenser is varied by turning the screw holding the top plate to vary the plate spacing.

Individual demands will determine the maximum capacitance chosen by experimenters who duplicate this condenser. For most transmitter voltages, it will be expedient to keep the minimum plate spacing not less than ¼ inch, hence the value of capacitance at this setting must be determined largely by the plate diameter.

Both plates should be of the same diameter. The maximum and minimum capacitances are determined from (1) the values of plate spacing (s) at maximum and minimum (in inches) and (2) the radius (r) of one plate (inches) by means of the following equation:

$$C = \frac{0.070\ r^2}{s}\ \mu\mu fd.$$

For large values of capacitance, disc-type variable condensers are necessarily bulky. For this reason they are not in general use for tuning purposes except in ultra high-frequency circuits where the plate diameter may be kept small. Nevertheless, in the early days of licensed amateur radio, it was quite common to find low-frequency disc-type tuning condensers made of pie plates and we shall very likely see a return to this ancient design during this present emergency.

The plate-type variable condenser, shown in photo in Fig. 1 and diagrammed in Fig. 10 (A and B), will no doubt be the most popular among modern home builders in both ham and serviceman groups, since it so closely resembles the condensers in present general use.

The particular condenser shown in the photograph has eleven rotors and eleven stators cut from tin stock obtained from beer cans. As will be seen from the drawings of Fig. 10, knurled terminal nuts from burned-out dry cells are used for both rotor and stator plate spacing. The insulating frame end-assembly was made from wood baked dry in an oven and boiled in paraffin.

Since this particular condenser was built for a high-powered transmitter where the r.f. voltage was apt to run high, its plates were carefully cleared of all burrs sustained in the cutting process and all edges were carefully ground round and buffed until a silk handkerchief could be rubbed along the edges and corners without snagging!

A set of dimensional patterns for plates of the size employed by the author are given in Fig. 11. The stator plates are supported at each lower corner by a threaded 8-32 steel rod that passes through the mounting holes and is secured to the end-assembly pieces with battery nuts. Another 8-32 threaded rod acts as a rotor shaft. The entire condenser is assembled as shown in Fig. 10-B. Although dimensions, patterns, and methods of assembly are given in the foregoing remarks and in the illustrations, the builder need not be held to points by these specifications. He may exercise his own ingenuity and please his own tastes in building similar condensers.

When the condenser is intended for receiver use, the high-voltage plate spacing is not required and thinner, flat-faced 8-32 nuts may be used for rotor and stator spacing in place of the battery nuts shown by the author.

The capacitance of the plate condenser (maximum value with both sets of plates entirely enmeshed) may be obtained approximately from the following variation of the classical semicircular plate equation:

$$C = \frac{0.353\ (R_1^2 - R_2^2)\ N\text{-}1}{2.54\ S}\ \mu\mu fd.$$

Where R1 and R2 are the rotor radii (in inches) such as shown in Figure 11,

N is the total number of plates in the condenser, and

S is the uniform rotor-stator plate spacing (in inches).

The above equation neglects the plate thickness, which is negligible in the case of the thin tin-can tin stock, the fact that the stator is not semicircular in shape, and the capacitance between plates and mounting studs. However, we find that the results obtained from the calculation are sufficiently close for most amateur, serviceman, and home experimental purposes. From this data, the practical radio man may plan himself a condenser whose maximum capacitance will be comfortably close to the value desired. It is a good plan, of course, to cut more plates than are calculated

Don't miss the Special Radio Defense issue next month!

as necessary. Then, a few may be removed from the completed model when it is checked for capacitance.

An Experimental Transmitter Coil

The question regarding wire substitutes seems to be the real sticker. The author has gone to work on this problem also and to date at least one workable substitute has come of the experiments.

In Figure 1, along with the condensers, will be seen a transmitter coil made of tin-can tin strip obtained by "unwinding" a can spirally with tinner's snips as depicted in Figures 13 and 14. This coil is an inch and a half in diameter, has six turns spaced about the width of the strip, and with the plate condenser shown with it in Figure 1 tunes through the 20-meter ham band with a Q that is quite tolerable and with none of the high-order heating losses that were expected.

This type of coil will be recognized immediately by old-timers as the "flatwise-wound strip coil" so popular up to around 1926. The only difference is that emergency junk-tin has been substituted for copper strip. More or less indistinctly in the photograph may be seen the ridges presented by the seam of the tin can which contributed this strip. The author finds that these seam sections are quite tight and cause no mischief. The strip was stretched out flat before coiling and carefully cleaned of all burrs and its edges were rounded and polished smooth as were the condenser plates described earlier.

This is only one of the successful coils which will be described. It is shown here by way of introduction of things to come, as a special section of one article will be devoted to several improved types of inductors, fixed and variable.

Working Tin Stock

A word is in order at this point regarding the best manner of handling the sheet metal obtained from tin cans. Many of our readers have had no experience whatever in working with such stock.

First, remember that this grade of metal may be cut very readily with medium-sized tinner's snips which need not be expensive. Likewise, it is easily drilled, bent, punched, and smoothed with the tools that are commonly found in any radio experimenter's or radio serviceman's kit. However, it is rather thin and requires careful handling to prevent folding in the process of cutting. It bends very readily when being processed and will need to be carefully flattened after all cutting and punching is finally completed.

Tin-can tin has a particular penchant for snagging and burring as it is being processed and it is capable, as a result, of imparting some of the meanest cuts we have seen. For his own protection, therefore, the worker should not be too proud to wear a stout pair of gloves when working with this sheet metal and he must not be in too much of a hurry to smooth down and buff all edges after he has completed all mechanical work. The

must finishing process should include a careful removing of all burrs, rounding of corners, and polishing off of edges.

No imposing array of tools is necessary for working tin-can tin. Tinner's snips will be the only article possibly foreign to the common radio tool kit, and this article may be obtained for less than a dollar. Naturally, the more special tools there are available to the radio builder, the more completely, easily, and quickly he will be able to turn out a professional appearing set of parts. A machine or sheet metal shop will not be essential.

The labels may be removed readily from most cans. Paper labels may be scraped or soaked off. Paint remover must be used on the painted-on designs of some cans. Residue from the substance originally contained in the can may be removed according to the nature of the stuff. Food products generally require only a hot-water washing. Paints will probably have to be dissolved out with turpentine, alcohol, or paint remover. Obstinate cases, like fish, might require a hot lye treatment.

Where the can is to supply a sheet of metal, first remove the top with snips. Then cut lengthwise down to the bottom on each side of the seam and as close to it as possible. After the completing cut is then made around the bottom of the can wall, the sheet of metal may be unrolled and pounded flat.

Soldering is best accomplished with acid-core solder and either a small blow-torch or a large iron capable of distributing a lot of heat more or less uniformly over a large area. After soldering with acid-core, the stock should be washed clean with washing soda and dried thoroughly.

(To be continued)

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WSEL Protects Blue Ridge Parkway

(Continued from page 30)

torists to tune in on bulletins from these stations along the Blue Ridge Parkway unless the automobile radio is of the short wave type, inasmuch as the operating radio frequency of these 8 stations is 3,207.5 kilocycles.

The initial installation of fixed and vehicular radio equipment consisted of three 100-watt fixed stations, situated approximately 60 miles apart along the Parkway, with locations at Bluff Park, N. C., Rocky Knob and Roanoke, Virginia. The Roanoke station is located a mile out of town and is operated by remote control from the Parkway office headquarters in Roanoke. The remote control console is approximately the size of a table model radio receiver, is mounted on a small stand, and is rolled between three of the offices so that different members of the staff may use the equipment individually.

Each of the three fixed stations has one steel vertical tower, 75 feet in height, for an antenna, and a small concrete block building at the base of each tower houses the radio equipment, which consists of a 100-watt transmitter and crystal-controlled receiver. This equipment is unattended and is operated by the small control console installed in the administrative offices of the particular area.

Six ranger patrol cars are equipped with 10-watt transmitters and receivers, and use a special top-loaded antenna.

Rangers, in their daily use of their car-radio sets, are able to communicate over distances of 100 miles, which exceeds the expected range. This additional signal strength is needed, however, when adverse atmospheric conditions prevail. Additional fixed radio-stations and radio-equipped patrol cars will be added from time to time to provide for the protection and operation along the entire Parkway Drive. Patrolmen talk directly not only to district headquarters, but also to other ranger cars. This new communication system has already demonstrated its value in directing patrol cars to the scene of motor accidents and in directing men and equipment to forest fires.

An important division of the Park Service radio program on which little scientific work had been done prior to the Blue Ridge network is that of mobile installations. A few months ago, a laboratory investigation of mobile antennas was made with the purpose of discovering if something better than the base-loaded antenna or tuned loop could be found. As a result, the mobile antenna was developed, which is approximately 16 times as efficient as the usual type of conventional base loaded antenna—formerly used as a standard—and more than 16 times as efficient as the tuned loop at distances of over six miles. The antenna uses approximately 90 per cent of the power which is supplied by the radio set.

This mobile type antenna has aroused considerable interest in several state highway departments and other organizations, since with the advent of this high efficiency antenna, communication may be had over much greater distances than have heretofore been possible.

The antenna is rather peculiar in appearance. It is a 2-inch dural tube mounted on the rear bumper of the car, extending upward to the level of the top of the car and terminating in an aluminum can, 8 inches high and 8 inches in diameter, from which extends upward a whip-type antenna. It thus makes the patrol resemble a Diesel-powered automobile with the exhaust up in the air.

With all previous antennas there are blank spaces where no response is possible at distances from six miles up, whereas this new antenna is giving solid communication up to the limit of distance for the power of the set.

The method of two-way communication which is used in many cities between patrol cars and headquarters with high efficiency cannot be used in national park areas due to the fact that the transmission is done on the ultra-high frequencies, UHF, of approximately 30 to 40 megacycles where the wavelength is of a short magnitude and a resonant antenna length falls between 6 to 8 feet. Thus, a highly efficient radiator or antenna can be mounted on a car without encountering mechanical difficulties. These frequencies, however, can be relied upon only for communication where the transmitting and receiving stations keep approximately within line of sight, which is not possible in

the mountainous regions of a national park. The Blue Ridge Parkway patrol cars, therefore, use lower frequencies lying between 2,496 to 3,415 kilocycles where communication can be obtained regardless of terrain.

In testing various types of antenna before deciding which to adopt, the National Park Service officials chose the base-loaded antenna used by the Forest Service because it is a well built unit of low-loss material and has all of its loading at the base. This base-loaded or reference antenna, was mounted on one side of the tail-gate and the test antenna was mounted on the opposite side. Normally, the base-loaded antenna is mounted on the running board and is braced to the car body.

These antennae were connected to a double-pole, double-throw switch so the transmission line from the transmitter could be taken to either antenna as desired. For each reading taken the final amplifier was loaded to the same point so the input to the antennae was the same and the field strengths resulting from each could be compared for a gain or loss.

Using the dimensions of the large can and coil, an antenna was constructed considering mechanical strength as well as electrical efficiency. Dural tubing was used for the supporting portion and the can. The coil was wound on smooth bakelite, using number 14 enameled on a 3-inch form.

If desired, the link at the bottom of the coil may be used for connecting in a meter. The polystyrene disc below the coil mechanically supports the base of the can. The braces at the bottom of the antenna are all welded and have shown no weakness in thousands of miles. The insulation at the braces and base is bakelite. This is a point of zero voltage, current loop, and the insulation problem is simplified.

The results which Blue Ridge Parkway rangers have obtained indicate that two-way communication from a patrol car under motion is entirely practical, especially if the headquarter's station is given sufficient power. A 15-watt set is all of the power necessary in the car.

The following figures show the esti-

mated cost of one of these complete installations:

15-watt transmitter	$175.00
Receiver	40.00
Heavy-duty battery generator	15.00
Antenna	20.00
Total	$250.00

Not only is the antenna applicable to patrol car installations, but the same type of loading can be applied to any short, random length of antenna where space is limited. —30—

Constructing an AC-DC FM Receiver

(*Continued from page* 23)

broadcast signal is heard resulting in a disappearance of the background hiss. By watching for maximum indication of the eye, and a complete disappearance of background hiss, resonance can be accurately determined. Proper tuning is very essential in this type of receiver in order to take advantage of the high fidelity, noise free reception that a frequency modulation system offers.

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What's New in Radio?

(*Continued from page* 38)

ectively excluded from FM reception.

(4) The *Crosley* multi-stage limiter more effectively reduces noise and signals from amplitude modulated stations.

(5) The *Crosley* band-pass input circuit (flat top), prevents a powerful unwanted signal from interfering with signals to which the receiver has been tuned.

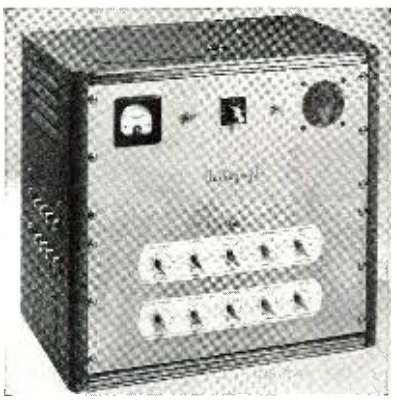
(6) The *Crosley* three-stage band-pass intermediate frequency (flat top) is effective in making possible reception of both weak or strong signals without distortion.

(7) The *Crosley* special FM oscillator makes any change in tuning unnecessary, because of shifting due to changes in temperature and humidity.

Many more additional features, while not exclusive with *Crosley*, complete the list of improvements that characterize the new *Crosley* FM receivers.

Duplex 70- or 140-Watt Amplifier by Audiograph

A high-powered duplex amplifier, either 70-watt or 140-watt power, is now offered by *John Meck Industries*, 1313 W. Randolph St., Chicago. It makes possible centralized control of



a complicated system of microphones and speakers. The dual channel feature permits accurate control of speaker sound levels, binaural sound effects, and absolute dependability of operation.

The Model B-70D contains two 35-watt chassis, which provide two 35-watt channels or one 70-watt channel. The Model B-140D contains two 70-watt chassis, providing two 70-watt channels or one 140-watt channel. Each model is mounted complete in a 17½" high streamlined cabinet. Built-in monitor speaker and volume level meter, with switch for monitoring and metering each output channel separately, are provided. Outputs of each channel may be used separately or combined.

Eight input channels are available, each with separate volume control. Lower feedback is obtained by individual master gain control which limits volume of each output channel, yet allows use of full microphone power.

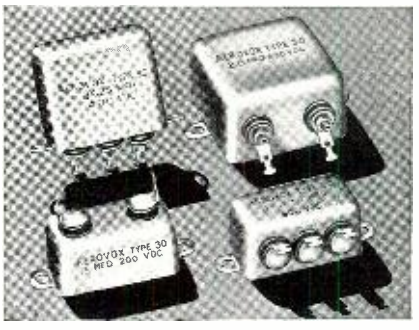
New RecorDisc Display

The *RecorDisc Corp.*, 395 Broadway, New York City, has prepared an attractive display fixture which is being

distributed to dealers through their jobbers. The base is of wood construction, patterned to hold 3 sizes of home recording blanks as well as consumer literature. The large double-wing poster in the background is devoted to the first of the *RecorDisc* promotion contests. This poster is interchangeable and will be replaced periodically with other timely display material. Colorful and attractive, the display complete measures 20" x 24" x 7".

Bathtub Type Oil-Filled Condensers

For still handier installation of the popular bathtub oil-filled non-inductive paper section condensers in commercial radio and electronic assemblies, the *Aerovox Corporation* of New Bedford, Mass., now announces a still wider choice of terminals. Normally not included among the standard metal-can types but rather intended for extra-heavy-duty requirements, these units usually have their terminals on one side of the case, but terminals can also be placed on top or bottom, on special order. The terminals are con-

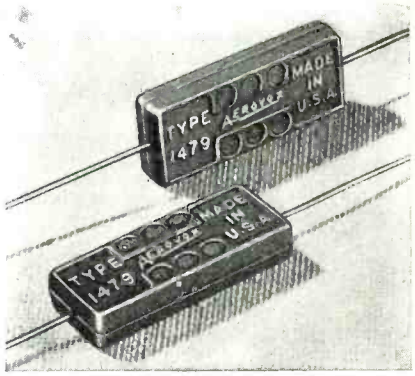


structed of the exclusive Aerovox "double-rubber" bakelite, permanently riveted to the case, for a sturdy, hermetically-sealed, absolutely immersion-proof terminal assembly.

New Midget Molded-in-Bakelite Mica Capacitors

A new midget or so-called "postage-stamp" molded-in-bakelite receiving circuit mica capacitor, Type 1478, is announced by *Aerovox Corporation* of New Bedford, Mass. This

capacitor is an elongated version of the types heretofore offered in the "postage-stamp" series—its body measurements are 1 1/16" long by 7/16" wide by 3/16" thick. Hot-tinned brass wire leads provide the connections. The same molded casing is used for Type 1479



with silvered mica section. Both types, because of the longer casing, provide for higher capacity values at the given 1000 v. D.C. Test (500 v. D.C.W.) rating. The standard mica Type 1478 is available in from .0001 to .002 mfd., while the silvered mica Type 1479 comes in .0001 to .001 mfd. capacity.

Sylvania Radio Tube Girl Crowned Miss America

When the judges at the Atlantic City beauty pageant crowned Rosemary La Planche, Miss America 1941, they un-

wittingly paid tribute to the advertising department of the *Hygrade Sylvania Corporation* and the *Einson-Freeman Lithography Company*, as the 1941 *Sylvania* Radio Tube girl appearing on the current window display. When picking her to pose for the display, the *Sylvania* and *Einson-Freeman* people felt that she was a bundle of charm, grace and personality that could hardly be surpassed.

One phrase of the display copy, which appears directly over the lovely head of Miss La Planche, says, "You'll Cheer Too." It almost seems like this copy, written a year ago, was coincidentally a prophetic phrase of encouragement for Miss La Planche, and had we been the seventh son of a seventh son, we would have added "When You're Crowned Miss America 1941."

"DK-3 Transceiver"

A 2½ meter "constant companion" for portable, mobile and fixed station use, ideal for emergencies, is announced by *Abbott Instrument, Inc.*, 8 West 18th Street, New York City.

The new DK-3 Transceiver introduces high-efficiency variable inductive coupling to the antenna, fully controlled from a special front panel knob. This enables optimum coupling under the most varied conditions and locations, resulting in maximum transmitter power transfer and high control of sensitivity when receiving.

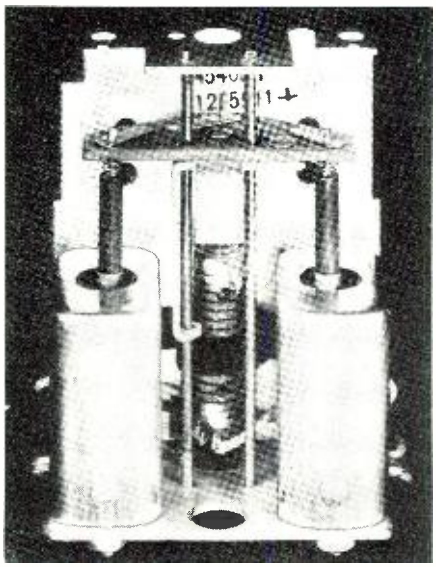
Three 45-volt B batteries, self-contained for portable use, or 135-180 volts d.c. from an a.c. power supply are used in a circuit employing one 6G6G in the audio and modulator positions, and one 6J5GT as the super regenerative detector and r.f. oscillator.

The DK-3 has an effective working range up to 30 miles, depending on terrain. Comes in army style grey wrinkle finish metal with removable back panel.

High-Frequency Iron Cores

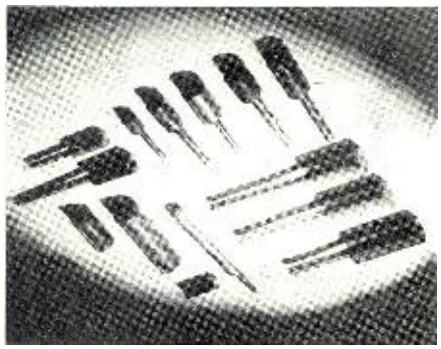
In addition to automatic high-speed molding machinery for turning out the usual pressed pieces, *Henry L. Crowley & Co.*, West Orange, N. J., is using a new and exclusive fabricating process

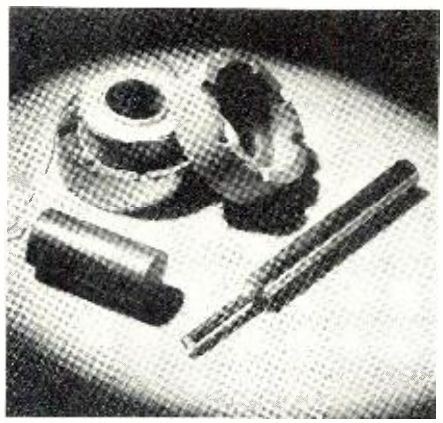
for a still wider variety of lengths and shapes. Pieces are also being machined with extreme mechanical accuracy, to meet precise requirements. The versatile fabrication of this plant which has long specialized not only in



high-frequency iron but also in custom-built ceramics, makes possible the economical production of either a handful of special pieces, or tens of thousands of standard pieces, thereby meeting the needs of instrument makers and special equipment builders, as well as those of the mass-production radio receiving set manufacturers.

Crowley iron cores are available in exceptionally large pieces. Large cores are produced for radio transmitting and carrier-frequency purposes, for fine instruments, for induction furnace and X-ray applications, and many





other out-of-the-ordinary usages. L-shape cores, discs, spools, rings, tubes and other shapes are being made, quite in addition to the huge output of cores and cuts and plungers for the coils and permeability tuners of radio sets.

Blackout-Panel Oscillograph

In keeping with the growing blackout consciousness of the times, the *Allen B. Du Mont Laboratories, Inc.*, of Passaic, N. J., announce their new Blackout-Panel Type 208 Oscillograph which can be used under adverse lighting conditions or in total blackness when necessary. This feature may be particularly desirable in certain military applications.

The specially processed steel panel is treated with a non-radio active luminous paint that retains its maximum luminosity for several minutes after exposure to ordinary light, and can be comfortably observed for an hour or more after that. The glow is of the same color and intensity as the standard medium persistence screen of the cathode-ray tube used, thereby minimizing eye-strain. The Blackout Panel is now an optional feature with the Type 208 Oscillograph, providing still another refinement in this outstanding general-purpose instrument.

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Easily Built Signal Tracer

(*Continued from page* 16)

If the signal is found at these points at the same level it shows that all audio coupling and bypass condensers are all right. At point 13 an increase in gain should be noted and at 14 the same voltage should be obtained as at point 13. At point 15 we again should get a gain, and here also we can check for distortion as we can reduce the gain of our audio channel and notice whether or not it sounds as clear as the speaker in the radio set does. Throughout all these instructions I have not gone into what might be wrong if one fails to get a signal at any one point, as I believe that anyone interested enough to build this apparatus will, of course, be technically minded enough to find the actual trouble when it has been localized.

Fading or intermittent sets become comparatively easy things to handle once one becomes used to this tester. Although many ways will occur to the serviceman I will tell of one way I have used successfully. We again take our standard diagram and connect the oscillator to the antenna and ground of the set. We then place the r.f.-i.f. probe on point 9; our V.T.V.M. prod on point 12, and our audio prod on point 15, using the channels separately. We adjust the r.f.-i.f. and the audio channels so that they just close and note the V.T.V.M. reading; we then sit back and wait for the fade to occur. When it does, we note which channels have become affected. Supposing that the r.f.-i.f. eye has remained unchanged while the V.T.V.M. reading has dropped and the audio eye is open, we know that the trouble is somewhere between points 9 and 12, probably a coupling condenser has opened.

We then move the V.T.V.M. probe back toward point 10 until we again get a signal and find the defective part. If only the audio channel had changed we would know that the trouble was between points 12 and 14 and could find it working backward as before. If all the indicators had changed it would show that the trouble was between points 1 and 10 and by moving the r.f.-i.f. probe backward we could finally locate the defective part, because in our moving backward we would again get an indication on the eye when we passed the defective part. All the probes are of such high impedance that it is unlikely that their introduction into the circuit would affect it in any way. Anyone who earnestly tries to understand that this tester works on the actual fundamentals of a radio set will readily see hundreds of ways that it can be used. AFC. alignment with the V.T.V.M. on each side of the discriminator transformer, finding shorted turns in coils, measuring AVC., AFC., and bias voltages with no current being drawn. I am sure this instrument will prove invaluable to your work. —30—

Washington Communication

(*Continued from page 26*)

American ham in Washington are George W. Bailey and K. B. Warner. Mr. Bailey, as president of the A.R.R.L. and as an amateur's representative of the quasi-official Defense Communications Board, speaks in the Capital with authority on amateur matters. Mr. Warner is in and out of town, doing much work behind the scenes.

Mr. Bailey is in somewhat of an anomalous position, being sort of a Government official and realizing what must be done in the way of regulation, yet being a ham at the same time whose natural impulses are to resist suggested new restrictions. Observers find it difficult to decide which Mr. Bailey is more of—Government man or amateur operator.

For those of you who want a harder fight put up by your representatives in Washington, there is this little story—complete, with a moral. When the Army broached the subject this summer of moving in on ham frequencies and suspending Class A licenses, there came no immediate strong reaction from the amateurs' spokesman. The fact of the matter was that the Army's proposal to take over some of the frequencies was much more drastic than was necessary. The A. R. R. L. spokesman took the Army's word that the frequencies were needed, without checking into it too closely. So that particular phase of the proposal went through, working an unnecessary hardship on the ham. For as things turned out, the Army didn't need the frequencies as immediately as was claimed.

But when the matter of suspending Class A licenses came up for hearing before the FCC, the A.R.R.L. spokesman lodged a strong protest. Letters had been coming in from hams all over the country bitterly assailing this proposal. Net result was that the FCC backed down.

Now for the moral: If you think that the hams are being pushed around by the governing authorities in Washington, tell Mr. Bailey. When the constituency begins to act up, Mr. Bailey can speak in a very loud voice, it appears. And that voice can be heard in the confusion which is Washington.

THE first suspected attempt to jam on one of the short wave stations which the United States is using to broadcast democracy's message to the world has been uncovered.

Several times, late in October, it was discovered that the broadcasts of Station WCBX, one of Columbia's international stations, were being interfered with. The FCC put its monitors on the job and traced the source of the interference to Germany.

Early this fall, European broadcasters launched an all-out "jamming" war. The English were jamming Italian broadcasts, the Italians were jamming the Russians, etc. In addition, there was the program of mutual heckling which was being carried on. Anarchy ruled the air waves over Europe.

The simplest method of jamming, of course, is to put a carrier on the frequency which causes a heterodyne whistle. Our experts who intercept foreign broadcasts in order to analyze them can get through this interference to make recordings. But the Europeans are using other methods of jamming which are more successful these days. So far, this country hasn't made any plans to jam the foreign broadcasts which are distasteful to us. It's not cricket, you know.

Note: The establishment of a new international station on the West Coast has been authorized by the FCC. This station will lambast the Japs with 100 kilowatts for the benefit of Pacific people. The station was authorized after our Far Eastern observers had been screaming for months that the Japs were poisoning the air without any effective answer from this country. Coordinator of Information Donovan arranged for establishment of the station and pressured General Electric into quick delivery of the 100 kw. transmitter.

Warning to hams: German amateurs are still trying to trap Americans into communication with them, the FCC reports, by twisting prefixes, etc.

THIS country is making a desperate effort to turn out new ships fast enough to outstrip the Nazi sinkings. More than 300 ships of a new merchant class, the Liberty Ships, have been built or projected. To match the speed with which the ships are being turned out, the Federal Telegraph subsidiary of International Telephone and Radio Corp. has built a revolutionary radio set which can be installed in the new ships in one-fifth of the time usually required.

These new shipboard sets, which are being installed in the Liberty Fleet, combine in a single cabinet, equipment which would require as many as 12 separate units ordinarily. All the complicated wiring which is found in most radio cabins is done away with. Instead, all the wiring in the set is done at the factory and when it is delivered it can be installed in the vessel in short order. These sets are of standard design and will look alike in all ships—which will be a big aid to inexperienced operators who may be used.

The Navy, by the way, is still making dire threats in its effort to get all suspected Fifth Columnists out of the radio rooms in the Merchant Marine. As we have said here, the passage of some measure incorporating the Navy's demands is inevitable. Undersecretary of the Navy Forrestal, testifying before Congress recently on a bill which would give the FCC power to suspend the license of any operator who held subversive beliefs, made this surprising statement:

"The Navy has knowledge that subversive operators are planted in key positions by subversive interests and has a list of men who are considered sufficiently subject to suspicion to require taking no chances with them as operators of radio stations engaged in ship communication."

Sternly, the Navy official warned that if legislation is not soon enacted barring opera-

tors suspected of disloyalty to the "Navy Department it would have no alternative but to recruit Navy operators to replace all our merchant operators." The CIO, at which the legislation is aimed primarily—although the Navy denies this publicly—is fighting against the proposal, urging instead that mechanical checks be used to prevent Fifth Column work.

The Navy, by the way, discovered that a German Army lieutenant had set up a radio transmitter near our Guantanamo (Cuba) naval base and was reporting movements of American ships and other military information. The Cuban police grabbed the Nazi.

SOLDIERS, sailors and Marines engaged in communications work will soon be sporting new type helmets. These helmets have a curved flange in back to protect the neck, are heavier and are built to accommodate headphones.

THE Navy will put its censorship of international communications into effect shortly. The censorship organization will include 7,000 enlisted men and 6,000 officers and will be a real headache for American operators.

Congress refused to appropriate money early this fall to train the censors, but the Navy got around this by dipping into funds which had been set aside for "confidential" projects. The result was that we now have a large force of trained censors.

THE Los Angeles Flood Control District has put into operation a radio transmitter operating on power generated by a windmill. It will be used in connection with undisclosed defense work. . . . The airlines will go on UHF exclusively before long. . . . A diligent search of Greenland, as well as other thinly inhabited outposts, is being conducted by the U. S. in the hope that more Nazi radio transmitters will be discovered. . . .

—30—

Aviation Radio

(*Continued from page* 28)

consideration it seems that our American engineers began long ago to plan on inevitable shortages of certain materials and today, substitute materials are being found in certain equipment destined for the same wear and tear as equipment manufactured with the "real stuff." Our engineers are "licking" the problem at every turn of the road, and it is predicted by those who are "in the know" that many new materials having parallel characteristics to those found in the raw will gradually find their way into apparatus for national defense, with the resultant saving usually realized by employing substitutes.

Of course, engineers won't utilize substitutes which will make the equipment inferior to that which uses "nature's own," but in every case where a substitute is found, over-all efficiency will not suffer.

Our Aviation Radio Servicemen

DURING World War I, very few radio servicemen were to be found in a community of any size; especially an aviation radio service agency!! Today it's different. The art of radio communication having progressed to it's "peak" within the last 24 years has brought many changes which had to be taken in turn by the layman as well as the technician. Today we find schools who specialize in teaching young and old what they need to know in order to work with aviation radio. The "war babies," born in '17 and '18 are to be found in every arm and service of Uncle Sam's military forces. Notable among the many arms, where our youth of today may learn radio, are the *Signal Corps* and the *Air Corps*. In these two arms men may be found who are experts in the field of Communications. Schools are conducted on high standards, and those graduates who later go to civilian life usually find their knowledge acquired in the Army an "in" to good paying jobs.

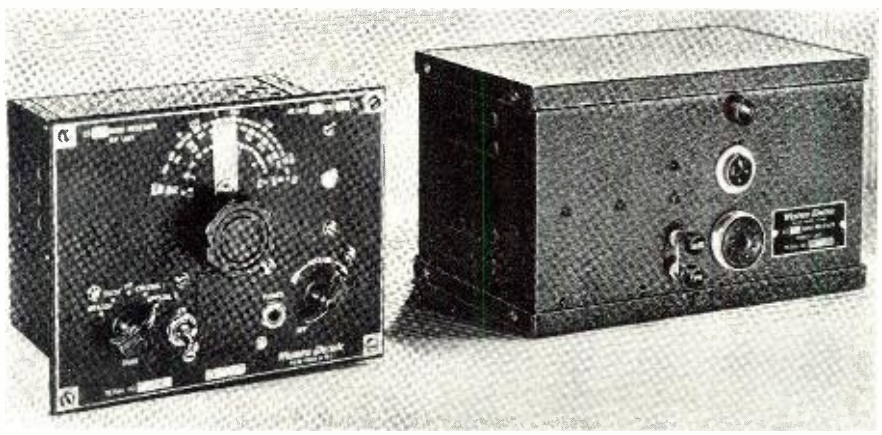
Today, believe it or not, (apologies to Ripley) there exists an acute shortage of radio servicemen; this is especially true of aviation radio servicemen. Even though we may see hundreds of radio shops all over the country, very few aviation radio servicemen are to be found in these. They may be able to adequately take care of an aircraft radio installation or they may even be able to maintain a ground transmitter and/or station. However, those radio servicemen who are acknowledged to be good aviation radio servicemen are hard to find.

There are many reasons for the apparent shortage but the most predominate one seems to be that of training. With all the schools we have in the nation there still are not enough men attending them. If we would but stop and realize the inevitable need for trained aviation radiomen, we would of course do something about the situation! It is quite true that the average home-set radio serviceman, with a minimum amount of training may make himself into a very capable aviation radio serviceman, but in the course of daily routine, in the course of making a living, many of our servicemen of today are contented with what they are doing and neglect to look into the future a "mite."

Aviation is looked upon by many of our experts today, as our "mainstay" in our problem of national defense. The *Air Corps,* with its gigantic school facilities are turning out thousands of men each year to take care of our military aviation radio needs; and the *Signal Corps School* at *Fort Monmouth,* New Jersey graduates wire and radio specialists who collaborate with *Air Corps* technicians to provide the necessary communications for our *Air Forces,* but still we need more aviation radio servicemen. Not only for our military forces but also for our private and commercial aviation enterprises.

Student pilot training today requires that radio equipped aircraft be used in order to properly train students in the many fine points of cross country flying; and only radio provides the necessary safety factor when many ships are in the air at one time. I could go on and cite instances where radio has saved many students' lives in the course of the daily flight training periods, but rather than use space to reiterate frontpage newspaper accounts, it will be sufficient to say that

The Western Electric 25 A Super Heterodyne Aircraft Radio Receiver.



radio is now just a little more than one of the pillars of aviation; it's a large part of the essential "framework."

In order to maintain those sets installed in aircraft used for student pilot training, we need expert aviation radio servicemen. When I say EXPERT I mean just that!! When a life or lives depends upon the radio installation, no chances can be taken with haphazard installation and maintenance. Those who don't know their "stuff" have no place around an aircraft radio installation.

Supervised training and supervised practice in acquiring necessary experience to become a good radio serviceman who can be trusted with aircraft radio installations are "cut and dried" requisities! Therefore, even though the aviation radio service field is a well paying field, those who have the "yen" to work in it must realize before they put their fingers in the "pie" that they can't go far until all requirements are met by them in the way of obtaining systematic training and experience.

Many letters have come to the attention of the writer which contained pertinent questions concerning aviation radio service. Among these many questions were these: "How can I obtain the necessary experience in order to be what one might call an "expert aviation radio serviceman? What school should I attend in order to obtain the necessary primary training? The military forces train aviation radio operators and mechanics; where do I find out about this? Would it be advisable to study teletype maintenance and installation along with my regular aviation radio studies? How long does it take to complete a good aviation radio course? Do the Airlines offer instruction in aviation radio servicing?

"I've heard a lot about licenses needed by a technician in order that he may legally tune an aircraft or ground station transmitter; does this rule also apply to transmitters that are calibrated at the factory and are supplied with a tuning chart? Is a knowledge of the code essential to becoming a good radio serviceman who works for the Airlines? I can't afford to attend a residence school, are there schools who offer extension courses in aviation radio?" These questions and many more have been received by the writer, and apparently, there are a few people who are interested in aviation radio!

Answering the questions above in order: Obtaining experience in the aviation radio service field isn't the hard job that some people think, but it does take a lot of effort to make the right contacts. Because of the shortage of trained radiomen today, most concerns having anything to do with aviation radio will usually take an aspirant and teach him as he works; giving him all the information that he must have in order to do the job that they have for him. He is usually placed with trained and ex-

perienced technicians who supervise his work, make the necessary constructive corrections, and in part give him a "lecture while you work" course.

It is of course realized that the Airlines will not take a young man who has no knowledge of the subject at all and begin his education from the "ground on up." Nor will any servicing agency take a man who has displayed major defects in his "technical makeup." Of course tolerance for minor faults is often entertained while the student is going thru his course of study, but not even the slightest error is tolerated when it comes to actual work on an installation, whether it be in aircraft or the ground station.

For those who wish to obtain experience in the field of aviation radio, it is suggested that personnel managers of the various aviation firms, airlines, etc., be contacted by personal letter. This letter should give a short digest of experience and contain a request for application blanks which must be executed in all cases. Prompt replies to letters requesting information about employment are usually received by those making the inquiries. Especially now! If you live near an aviation radio factory or near an airport which has aircraft radio maintenance facilities, contact the superintendent or chief engineer; a wealth of information can be had if personal contact is made.

This column does not take it upon itself to vouch for any particular school, although the writer of course may recommend his Alma Mater! However, now that national defense has already made its demands known for trained technicians, it is possible with little effort to make arrangements to attend any one of the many schools scattered from coast to coast who specialize in Aviation Radio. In many instances, courses may be financed, or the "pay after you graduate" channel may be taken by those who are financially incapable of paying for their education at the start, because many schools listed as reliable now have this plan in effect. Sometime ago, this column endeavored to supply a list of reliable schools to those who wrote in requesting the same. After the first 500 lists had been sent out is was found that new schools had come into existence. If the demand again warrants printing new lists, the old one will be revised and sent out.

Choosing the proper school is an individual problem. However, there are a few general rules that should be followed in choosing any school. By basing your choice on the number of successful graduates; school equipment available; tuition required; length of courses; practical experience on equipment available, etc., it is quite possible for the novice to choose a school which will take care of his educational needs nicely. A word of caution, however; be certain that the school you choose has a background of dependable service! A guarantee of a job after graduation doesn't necessarily indicate the school's worth as an educational institution. Be wary of those schools who promise jobs after graduation for a fee; they usually only want that fee and not too many satisfied graduates.

To find out about military aviation radio instruction, all that is necessary is a personal talk with any recruiting officer. A recruiting station operated by the military services is usually to be found in any city of the United States. At various times during the year, traveling recruiting parties make tours of every small town in nearly every state. Any member of the recruiting service is capable of advising you as to the opportunities offered by Uncle Sam's military forces. A letter dropped to: *The Recruiting Officer*, of any post, camp, or station in the United States will bring immediate information. That is, if you live near a Fort or Air Field, a letter directed to the person above will receive immediate reply.

About teletype installation and maintenance: this is a new field, comparatively so, taking into consideration the number now employed in this very interesting work. Nearly all airports used for scheduled transportation will usually have two or more machines to be found in the "weather office." The "electrical typewriter" as it is commonly called requires periodic maintenance and adjustment; this work can only be performed by experienced, well trained, technicians. The *Signal School* at Fort Monmouth teaches courses in teletype maintenance and operation as well as various *Air Corps* schools.

In some large cities courses of instruction may be taken by men and *women* in operation. However the maintenance instruction which usually takes from 5 to 8 weeks is usually taught at the factories where teletype machines are constructed; and select individuals are chosen from time to time to pursue this course. Information on this subject is lacking at this time but will be obtained as soon as possible and will be included in future columns. It wouldn't be advisable to study maintenance of teletypes unless the student is assured that the work will be sufficient to warrant following it through. Even though the average Airlines radio operator must be proficient in teletype operation, the actual maintenance is usually consummated by trained technicians employed by the company owning the machines.

The time it takes to complete a good aviation radio course varies with the student and course. Some schools have an "all around" aviation radio course which takes as long as 6 months to complete. Others have courses which take only as long as 90 days. It stands to reason that the longer the course is, the more detailed will be the instruction and the more information the student will obtain. One can never obtain enough information about any technical subject! The *Air Corps* takes from 4 to 7 months to teach her students the intricacies of aviation radio, but their courses usually include operation of the various sets used by the *Air Force* and code instruction is emphasized.

As far as this writer can ascertain the airlines do not teach courses in aviation radio servicing. However, in most instances they do teach new men the routine jobs necessary in order to keep the equipment aboard their aircraft in operating "trim." They teach their new men to fill out required forms, how to make daily and periodic inspections, etc., but very little technical instruction is provided.

A license is required to tune up a transmitter provided with a calibration chart. Of course it may only be a Restricted Class License, but no internal adjustment to the set can be made unless the class of license is a 2nd Class or higher. Calibration of a set at the factory does not create license exemptions; in every case where a transmitter is operated, depending upon its power and usage, a definite class of radio operator's license must be obtained by those who contemplate operation.

A knowledge of the code is not essential to becoming a good radio serviceman "who works for the airlines." It is generally recognized, that the man who knows the code must have had more than a little interest in radio, to take time out to learn it. Operators who work for *Pan American Airlines* do use code but those who do the maintenance are not required to know the code unless some special

situation requires that they do. This would come about when it is necessary for the technician to actually "flight test" a certain installation; both code and phone would be used for this test. It is to be remembered here though, that a radiotelegraph license must be obtained before code transmission is used. A radiotelephone license with a code indorsement "kills two birds" with "two tests"; the code test and the written test.

There are schools who offer "extension" courses in aviation radio. These schools are dependable and the student will learn much if he takes the necessary time out to study the lessons thoroughly and digest every detail. However, practical experience on actual equipment cannot be obtained by the correspondence student unless it is possible for him to work with a servicing agency or a company while he studies the course. For those who want to get ahead, and financial obstacles seem to present the largest problem, an extension course will provide the necessary primary training if studied correctly. Application of principles learned can always be done after the study of theory, although learning in this manner is very difficult.

Kink of the Month

IN order to keep a "paint crack" or "paint wrinkle" from spreading, until it is possible to paint the case of a transmitter, receiver, etc., over, ordinary fingernail polish such as is found in the 5 & 10 store can be applied to the spot. This stops the spreading immediately. This kink of course doesn't apply to crackle finish jobs!!

—30—

QRD? de Gy

(*Continued from page* 16)

is on the upgrade. Am still reading your column and am still asking that RADIO NEWS be made the VWOA mouthpiece. (mx-ed.) Your correspondent for these parts has failed to mention the abuse of operating signal "QRZ?" and question marks for soliciting purposes on 600 meters. The air is full of it from Hatteras to Mexico, and has been for two years. Personally, I believe it noteworthy and a matter of news . . . unquote. So. Radio Officers, please note.

AS is our custom to take it as well as dish it out, we herewith quote . . . Some months ago I wrote you a letter in which I outlined my qualifications for a marine operating job and asked your advice. . . . In reply you stated that you didn't see how I could get a Marine job, and you made no mention whatever of any union or even of whether it was necessary to join one at all. Unfortunately for your reputation for correctness I was aboard a ship and busily engaged in Marine operating when I received your reply. Now Jerry, me lad, one of us is sadly off his trolley and I suspect it's you. Here I am working away, blissfully ignorant of the fact that I can't, and receiving a reasonable monthly stipend for something I can't possibly do. Idiotic, isn't it? Well, never mind, all is forgiven if you will deign to stoop from those Olympian heights frequented by columnists long enough to enlighten me on a few points anent the various and sundry operators' unions and the advantages and disadvantages thereof. . . . Incidentally, it might interest you to know that King, of the ACA San Francisco office, is circulating a petition among the local membership to force the ACA heads to submit the matter of NMU affiliation to a referendum of the membership.

I have definitely decided that if ACA does go into the NMU, little Willie goes out, but quick, chum, but quick. I am strong for the idea of officer status, pay and privileges. By the pants of Julius Caeser, I've yet to meet a deck officer in the Merchant Service who didn't shy at a three syllable word or a slide rule, and if any one thinks they can shunt me down into the fo'c'sle, they'd better reconsider pronto. There are too many good jobs ashore or with the British . . . Well, enough of this chatter. Give me a few well chosen words and I'll try to help you

out a bit as a half . . . reporter of what I can pick up among the seagulls and static unquote.

We insist that getting a Marine job for a newcomer was practically impossible one year ago when the Six Months Law was still in effect and unemployed First Class tickets were as plentiful as government employees in Washington. Therefore, we had suggested other radio fields. But our young friend ups and scampers proving again that hesitation is not a dance step but a lost cause. Congrats, OM, and may we hope that the seagulls stay out of your hair. And as for ourselves, we say, like George M. Cohan of stage fame remarked when some fan sent him a ball of dynamite "May they write good or bad, as long as they write." So with best 73 . . . ge . . . GY.

—30—

Don't miss the big National Defense Issue of RADIO NEWS which covers all phases of radio in our Armed Forces!

Have your newsstands reserve a copy of the January, 1942, issue of RADIO NEWS now!

Build Your Own Multi-Speed Turntable

(*Continued from page* 13)

standard and any records made using them will be played back on this same equipment. Consequently, there will be no speed differences to be concerned about. Undoubtedly there will be slight adjustments to be made of the two standard speeds. These adjustments can easily be made by reducing slightly the groove diameters of either the motor pulley or jackshaft pulley.

For example, let us say that the 78.26 speed is slightly fast. Then the motor pulley will need to be reduced slightly in diameter. If the stroboscope indicates that this speed is a bit slow then reduce the diameter of the proper groove of the large jackshaft pulley. A piece of a fine grade sandpaper wrapped once around a 3/32" rod and held in the pulley groove to be treated will be found the simplest way to reduce diameters. Frequent checks with the stroboscope disk should be made in order that the speeds may not be changed too much.

The turntable shown in the photographs is equipped with a *Brush* Model *PL-20* high fidelity light weight pickup which operates at a needle force of only 30 grams. A lightweight pickup is important for reproducing instantaneous recordings if reasonably long life is to be realized from such discs. Lightweight pickups such as the *PL-20* have a rather low needle impedance which is good life insurance for the sidewalls of the grooves of instantaneous recordings.

A feedscrew is not shown in the illustrations; however, there are several on the market that may be used nicely with this turntable. *The subject of feedscrews was covered in the November issue of* RADIO NEWS *as part of the series "Theory and Practice of Disc Recording."*—EDITOR.

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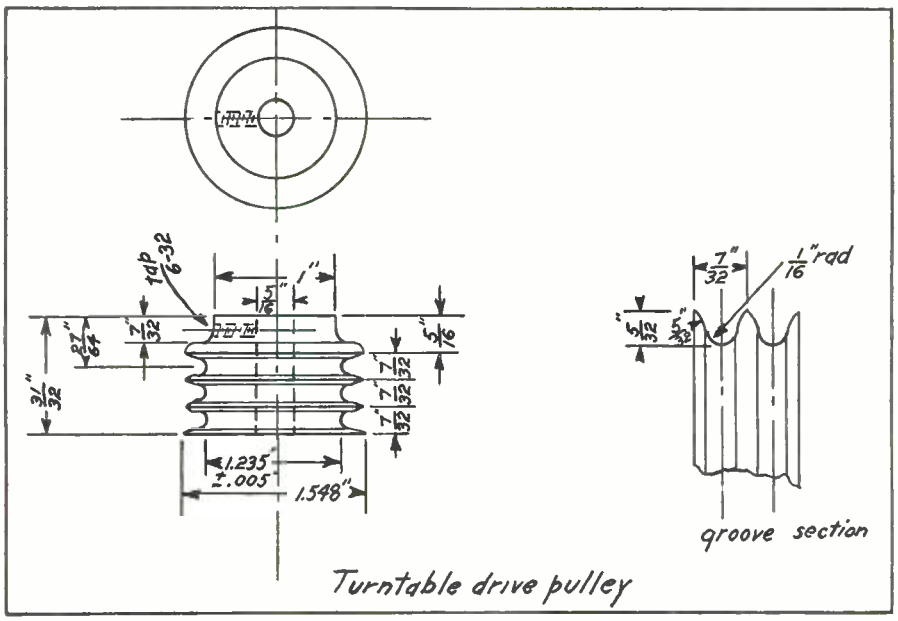
FBI Traps Spy-Ring

(*Continued from page* 9)

were constructed and installed by the FBI in a house at Centerport, Long Island, N. Y. FBI agents operated the equipment and initiated one of the strangest exchanges of spy messages in the history of the world!

During the 16 months of operation, over 450 messages were exchanged. The Hamburg Gestapo were highly gratified at the ability of "Herr" *Sebold* to furnish them with so much important information. Little did they know that every message was a carefully prepared series of misstatements regarding American defenses. In blissful ignorance, the Gestapo again and again placed valuable information directly in the hands of J. Edgar Hoover's G-Men. Names of "contacts" (other German spies), their addresses, bits of information explaining how these spies worked—all were helping to weave a web into which, eventually, would become tangled a jack-pot prize-package of German spies, saboteurs and fifth-columnists.

Much has been written about the German Gestapo. They have been pictured as a highly-efficient, omnipotent, relentless, infallible group—but this time they bucked Uncle Sam's FBI, and the results were a badly stubbed toe and a very red face for



PARTS LIST

1—Synchronous motor, 60 cycles, 1800 R.P.M. (Robbins & Meyers, Inc., Springfield, Ohio)
2—No. 2 Lord Mountings. (Lord Mfg. Co., Erie, Pa.)
2—No. 4 Lord Mountings. (Lord Mfg. Co., Erie, Pa.)
3—No. 6 Lord Mountings. (Lord Mfg. Co., Erie, Pa.)
Belting. (R. P. Merrell & Co., Cleveland, Ohio)
Pickup-Model PL-20. (The Brush Development Co., Cleveland, Ohio)

the secret agents of *Adolph Schicklgruber*, Hitler's *real* name.

By the way, can you imagine a man by the name of *Schicklgruber* becoming a second Caesar, or an all-conquering Napoleon? No wonder Adolph changed his name!

On September 8, 1941, the denouement occurred for the Gestapo. Swift action by FBI agents netted some very choice fish—33 of them. It was not until then that the Hamburg Gestapo learned to their rage and chagrin that they had been the unwilling actors in an international farce which is bound to bring laughter bubbling to the lips of millions of people now ground under the heel of the Nazi tyrants. German Gestapo agents learned another bitter lesson. It was that there are many thousands of naturalized-Americans who love their adopted country sufficiently to risk dying for it if need be.

The message which probably gave the FBI men their greatest bit of merriment was one which was received late in 1940. It read very dramatically: "Beware! You are under surveillance by enemy agents. Do not attempt to communicate with us for one week!"

The idea of the German Gestapo warning the FBI men engaged in this counter-espionage work that they were under surveillance by brother members of their own Bureau was almost hysterically funny to *J. Edgar Hoover's* men. Careful not to step out of their role as German spies, the G-Men solemnly gave an affirmative reply to the message and shut down the spy station for the period of the "surveillance."

How was it that the *Federal Bureau of Investigation* could assign one or two men to this case who were expert in radio operation, cryptography (code decipering), counterespionage work, law, and all the other fields which were drawn upon before the spy-trap was sprung?

The answer dates back to the year 1908 when the *Federal Bureau of Investigation* was founded to provide the *United States Department of Justice* with a permanent investigative force under its immediate control. It was first known as the *Bureau of Investigation*, later as the *Division of Investigation* and, finally, as the *Federal Bureau of Investigation*.

Its original duties were continually enlarged by succeeding Congresses. The White Slave Traffic Act of 1910 and the National Motor Vehicle Theft Act of 1919 brought within the jurisdiction of the Bureau two large classes of interstate violations.

In 1924, the Bureau was reorganized by *Mr. Hoover* and its present-day principles were established. Politics plays no part in the working of the Bureau. Every promotion is based solely upon proven ability and efficiency. Also in 1924, the *FBI Identification Bureau* was established with 810,188 fingerprint records as a nucleus. To-day, the number has increased to over 23,000,000 and it continues to increase by leaps and bounds.

There were many other fields into which FBI activities have been extended in recent years by legislative acts, but the National Emergency has brought to the FBI a most important duty—that of investigating espionage, sabotage, violations of the Neutrality Laws, and other matters pertaining to the National Defense.

When the scope of the investigations of the Bureau is realized, it can easily be understood why FBI agents must be trained men. To obtain successful convictions of malefactors, an Agent must be familiar with all types of laws. Thus, an Agent should be a graduate of a law school. If he is to investigate successfully bankruptcy frauds, anti-trust and National Bank Act violations, etc., he must be experienced in accounting or auditing. If he is to conduct investigations where foreign languages are used, he must be somewhat of a linguist. If he is to construct, install and operate a radio transmitter and receiver, he must be a radio engineer and operator. If he must code and decode messages, he must be an expert cryptographer.

Notice how a knowledge of many of these subjects was a necessity in the above-described spy case. After all, the personnel of the Bureau is limited and it would have been impossible to have six or eight specialists working continually on this one case—especially when, at the present time, there are over 10,000 cases pending!

How are these men trained to become FBI Special Agents? Possibly the best explanation of the FBI and its training methods is given by *Mr. John Edgar Hoover*, its Director for 17 years and a member of the Bureau for over two decades! (German Gestapo take note.)

"There is nothing secret about the manner in which the *Federal Bureau of Investigation* works. Its formula is a simple one—intensive training, highly efficient and carefully investigated personnel, rigid requirements in education, conduct, intelligence, ability to concentrate, alertness, zeal and loyalty, plus careful schooling in which we do our utmost to make every man to a degree self-sufficient. He must be a good marksman and have the courage to shoot it out with the most venomous of public enemies. He must know how to take fingerprints and what to do with them afterwards. He must learn that no clue, no matter how seemingly unimportant, can be overlooked. He must have constantly before him the fact that science is the bulwark of criminal investigation and neglect no avenue toward this end. And he must realize that no case ever ends for the *Federal Bureau of Investigation* until it has been solved and closed by the conviction of the guilty or the acquittal of the innocent."

Does this training pay dividends to the citizens of the United States?

Last year, $7,300,000 was appropriated for the regular operation of the FBI. Savings, fines and recoveries resulting from FBI investigative activi-

ties totaled *$58,390,000,* or over eight times the cost of the Bureau! This does not include the value of the many cooperative facilities to American law enforcement agencies which are rendered free of charge. Nor does it include the number of lives saved and the millions of dollars safeguarded by a fearless enforcement of national laws. To show how effective is the FBI, during their fiscal year ending June 30, 1941:

1. They obtained convictions in 96% of the cases investigated and brought to trial.

2. They obtained imposition of sentences totaling over *16,646 years* in addition to 5 life sentences.

3. They located *2,633* Federal fugitives from justice.

4. They assisted, through their Identification Division, in the location by law enforcement officers of *7,102* fugitives.

Unfortunately, there is too little space to describe the many fascinating phases of FBI work. Much of it is, of necessity, a secret. But for the young man between the ages of 23 and 35 who has the physical, mental and moral qualifications to become a Special Agent, there can be no more interesting work, no matter what the field. To those who desire the information, the FBI will be glad to furnish publications and data in reference to its various positions upon inquiry to Director *J. Edgar Hoover*, Washington, D. C.

Probably the position with the FBI which would be of most interest to radio men is that of radio operator in the FBI technical laboratory. Aside from the physical and other requirements, the applicant must be between 23 and 35 years of age, must have at least a high school education and must be able to receive and transmit 25 words per minute by radio. Transcription of messages must be direct on the "mill." Also, the applicant must be able to operate a teletypewriter and must be capable of doing ordinary repair and maintenance work on a radio station under the direction of a radio engineer. The starting salary is $2,000 per year.

Preferential consideration will be given to applicants having (1) a college education and degree in one of the sciences or in engineering; (2) commercial experience in electrical design, construction, operation or repair; (3) education and commercial qualifications in radio or communications engineering.

All in all, it appears to this writer that there are many hundreds of radio men who could qualify for this type of work.

Then, there is the sombre side too. For the past fifteen years, at the rate of about one per year, there grows a list of Uncle Sam's G-Men who have given their lives on the altar of Justice. For them, the case is closed—the chase is ended. But they leave behind them a grimly determined little band of patriots to whom "no case ever ends for the *Federal Bureau of Investigation* until it has been solved and closed by the conviction of the guilty or the acquittal of the innocent."

The score in this skirmish between the United States FBI and the German Gestapo reads—

Accused 33
Found Guilty ..... ?

—and Uncle Sam's G-Men chalk up another victory in the fight to preserve our freedom!

—30—

Police Radio

(*Continued from page* 36)

antenna which is used for reception of the cars on 30,580 kc.

His transmitter is remotely controlled by the Muskegon Heights Police located about two miles south of the police building. Through a single pair of telephone wires they receive transmissions from their two way cars (using the ultra high receiver at the main station) operate the transmitter, mute the 2442 kc. receiver, and place a monitor speaker in operation when they are transmitting. The desk sergeant at Muskegon Heights merely uses his press to talk switch to perform these operations.

Police Radio Priority

THE Office of Production Management has assigned an A-10 rating for police repair orders and effective September 9, 1941, preference order P-22 for the purpose of facilitating the acquisition of material for the repair of the property or equipment of certain industries and services has been issued.

This rating is issued only for the purchase of supplies for maintenance of police radio equipment. It does not include the purchase of new equipment, such as additional receivers, transmitters, etc. The rating will benefit the various police departments in the following manner: As an example, if a police radio transmitting antenna or transmission line is damaged due to lightning, and a new line or antenna is needed as soon as possible to place the station in service, the preference rating order P-22 is placed on order to the manufacturer, and if he has no further orders with a higher rating, he must fill the police radio order before any others. This rating will be particularly valuable when attempting to obtain material which is very scarce at the present time, such as condensers, transformers, etc.

Upon examination of preference rating order P-22 it can be seen that the Federal, state, county and municipal fire and police services are under the first heading in the entire group. This means that purchases made by police radio departments have a greater priority than purchases made by the other radio services, such as commercial broadcasting and communication and over all the other industries and services listed under the order.

A police department, in order to apply this preference rating to a delivery of material to it, must endorse the following statement on the original and all copies of the purchase order or contract for such material signed by a responsible official duly designated for such purchase by the department: "Purchase Order for Repair or Emergency Inventory—Preference Rating A-10 Under Preference Rating Order P-22."

This endorsement will constitute a certification to the Office of Production Management that such material is required for the purposes stated therein.

If the manufacturer with whom the order is placed does not have the stock with which to make up the material, he immediately applies this same preference order rating to his supplier.

The word "repairs" as defined in the rating means only the repairs needed because of an actual or imminent breakdown, from whatever cause, of a police department's property or equipment. The words "emergency inventory" are defined as the minimum inventory of material required to provide for repairs to meet an actual or imminent breakdown, from whatever cause, of a police department's property or equipment.

The only persons entitled to apply this preference rating on material are the industries and services listed on the rating and the supplier who furnishes such industries and services and these applications are restricted in our case to a police department who obtains material in excess of his requirements for repairs or for his emergency inventory unless the material cannot be obtained when required without such rating.

The *Federal Bureau of Investigation* has agreed to extend full cooperation to the various police departments in attempting to obtain priorities for materials that are in urgent need. Since the FBI in Washington can contact the central headquarters of OPM who in turn contacts the various branches throughout the country regarding priorities, it is suggested to work through them in extreme emergencies.

This can be handled in the following manner: When making up purchase orders, form the bill in triplicate, sending one to the manufacturer, one to the FBI in Washington and keeping one.

In many instances materials cannot be supplied to a police department by a manufacturer because the order is small and he cannot obtain the stock unless he has a larger order or a greater demand, and he must hold up the order until he can get the necessary supplies. A suggestion for eliminating this drawback was brought up at the APCO convention in the form of several police departments getting together and purchasing material for their emergency inventory on one order, thus enabling the manufacturer to show a greater demand for the material that he needs to make up the order. —30—

Bench Notes

(*Continued from page* 31)

and the 45Z5, and the set-owner may experience frequent trouble unless the source is eliminated. According to the tube manufacturers, the simplest method of doing this is to shunt the tapped portion of the rectifier tube filament with a resistor. When a pilot light is used, the resistor should be 300 ohms, and if a pilot light is not used, the value of the resistor should be 800 ohms.

Special Announcement

ORDINARILY, construction articles have no place in this department, which is intended to cover topics of a general nature but since the invention to be described solves a problem of long standing we take pride in presenting:

The Eureka Static Eliminator

A GREAT sadness descended upon the writer some time ago, after reading for the thousandth time of a marvelous correction made in a radio receiver, which it appeared had been designed all wrong in the first place—the engineers being unqualified ignoramuses in this instant, or is it ignorami? This sadness was due to thoughts of the years wasted in attention to books and periodicals devoted to the elusive electron and it allies. Each month it becomes increasingly apparent that the principal deterrent to the rapid advance of the radio art is the engineer with his slavish observance of the laws of physics.

However, as each cloud has its silver lining, a great light dawned upon the writer; since these laws have not been repealed, why not ignore them as so many other radio men have done, and accomplish great things too? With this comforting thought in mind, the writer assumed the proper position for such research by placing his feet on the bench and leaning back in the chair with the hands folded gracefully across his stomach. The proper frame of mind had scarcely been attained, when the telephone rang, and a client gaily announced that his *Philco* receiver had cut out again. Assuring him this was indeed strange, but would have our early attention, the research position was assumed again. Hardly had our eyes closed when the phone again disturbed the flights of genius. Ah, a lady in distress. It seems that her 1929 receiver, which has never had a thing wrong with it before, has mysteriously gone out of operation with a loud sizzle and a cloud of smoke. By firmly refusing to guarantee a repair for $1.25 we get rid of her, and return to the seat of wisdom.

Now fortunately arrives a period of quiet, unbroken by rude customers, and we return to deep cogitation, reviewing the unsolved problems of radio. Naturally, the primary curse is thought of first, the problem that has defied all efforts until now, namely: *Static.* By adhering closely

to our new resolution to avoid all hampering rules, a solution is found in ten minutes. Momentarily slipping back to the ways of erudition, we murmur "Eureka—Eureka," an old Greek word meaning "Why didn't someone think of that sooner?" With no thought of personal gain, but simply to show what chumps the engineers are after all, we hasten to give the sensational details of this amazing discovery—absolutely free, no box tops nor facsimiles required.

Most of us know how the radio waves from a transmitter look when viewed on the oscilloscope, a smooth symmetrical design. Then let us pick up bursts of static and reproduce them on the magic screen; the result is a rough jagged pattern. It is easy to see that these jagged impulses can readily hook on the wave from the transmitter, and are thus pulled thru the receiver and thrown out of the speaker with the well-known distressing results. So far, so good—but what to do about it? Pin back your ears, my lads and hearken.

We all know that static covers a broad band, several megacycles wide, whereas transmission from the station is restricted to a 10 k.c. channel—thus the answer is practically under our noses. We will simply remove the static as it comes down the antenna.

First obtain a piece of copper screen about one yard square, connecting one edge to ground. In the center of the screen, carefully cut a round hole, *exactly* ten kilocycles wide and run the lead-in through this hole, centering the lead-in carefully. The action is obvious—as the radio wave passes through the ten-kilocycle hole, the static hanging on the edges is scraped off by the screen and diverted to ground!!! While this super-achievement would be sufficient in itself, this is not all the benefit that may be had; by inserting a lamp socket in the ground lead from the screen, free light may be obtained as well. The idea is free to all, the writer asking for nothing more than the feeling of a good deed well done.

—30—

Military Radio Facsimile

(*Continued from page* 25)

hook-up, while the plane continues its scouting, simultaneously directed by radio telephone from headquarters as facsimile unit in plane is multiplexed, at least as far as the U. S. Army's facsimile unit is concerned, so that answering voice of scout and photo or map is carried simultaneously on the same waveband.

The facsimile unit is the invention of a British-born American, named *William G. H. Finch,* a former Assistant Chief Engineer of the U. S. Federal Communications Commission.

After years of experimentation, *Mr. Finch* was the first to solve and patent his ingenious solution of the baffling problem that prevented successful telecommunication facsimile machines—critically perfect synchronization between the stylus, the wire needle which burns in the image on dry chemically-treated paper on the drum of the receiving facsimile unit, and the scanning movement of a tiny beam of light traveling across the message at the rate of 100 scanning lines an inch. *Mr. Finch* finally succeeded by employing a special "Synchronizing Impulse" instead of the costly, inadaptable and cumbersome system of tuning forks.

—30—

Serviceman's Experiences

(*Continued from page* 32)

the set is installed. Then all that has to be done is to receipt the bill and say good-bye."

"You are very opinionated," I said, "and everything you have told me is open to—"

The 'phone rang. Al answered it, said "yes" a few times, hung up, and turned to me.

"Did you promise Harrison's *Philco* at four p.m.?" he asked.

"Yeh," I replied, "but you were so long-winded that—"

"I should have included something about tardiness in my lecture," he snarled, and handed me the set. Then he walked to the door, opened it, and swung his arm toward the truck.

"It seems the senior partner is an oracle," I said as I passed.

"Do you mean to say," he came back, as if aghast, "that you don't agree with me in one of my points?"

"In none of them," I said, just before I put the truck in gear. "If your statements ever appeared in print, you'd have to open your fan mail under water!"

—30—

Theory and Practice of Disc Recording. Part 1

(*Continued from page* 28)

trated, after approximately 30 minutes of use on a nitrate recording blank. Note how the tip has worn very jagged and irregular. It is impossible to make high-grade recording with any kind of needle having a tip such as this. The time in which the breakdown of the point occurs naturally depends on the disc material, the recording speed, and the type of the cutting stylus.

Playback Needles

We must consider the shape of groove when selecting needles that are to be used for playback instantaneous recordings. These needles fall into the same classifications as do the cutting styli. They must be of the proper included-angle and radius in order to match perfectly with the shape of the stylus and the groove which it cuts. It must be able to retain a high polish, be free from any imperfection which will distort to the walls of the groove and must be made of a material which

will stand up under extreme frictional heat.

The best known material for the playback needle is the "Sapphire." These possess the same characteristics as do the "Sapphire" cutting styli. Like their brothers, they must be handled with care as the tip is extremely brittle and subject to breakage under shock. A sapphire point or tip is capable of retaining proper included - angle and general shape for playing back thousands of records. In fact, the life is so great that manufacturers have adopted them as permanent equipment on their playback reproducers or pickups.

Steel needles may also be used, such as the "shadowgraphed" type which is essentially an ordinary steel needle with a rounded point and one which is entirely free from burrs or other imperfections. Needles such as thorn, cactus, wood, or fibre cannot take a high polish and should never be used on records which have a soft coated material. They are not capable of retaining any definite shape and the small particles of material which are torn off, due to friction, will rest down in the grooves and in turn will greatly increase the normal surface noise.

In order to retain a high degree of reproduction, it is necessary that the playback stylus receive the same attention as that given to the cutting styli.

Manufacturers have helped tremendously in aiding the home recordist to get better results from his efforts. It is only with a complete understanding of the problems at hand that one can appreciate the need for using the best possible styli that money can buy, as in the long run they will be the most economical to use.

The next article in this present series will appear in the Feb. 1942 issue of RADIO NEWS, inasmuch as our entire contents next month will be devoted to Radio in National Defense. This article will cover the subject of "Pick-up Tracking Error," a highly important subject for the recorder.

—30—

Book Review

(*Continued from page* 36)

charts for the auto-radio specialist; replacement and comparable battery specifications and data charts for 1,250 portable radio receiver models. Of special value is the most complete tube chart ever published—20-pages long—giving for the first time anywhere, complete information on the characteristics, classification, interchangeability and socket connections of *every type* of American receiving tube ever made.

Included among the remaining 180 pages are comprehensive trade directories of all manufacturers related in any way to the radio industry, and 53 more reference charts and graphs presenting permanently useful data on a variety of important subjects such as ballast resistors, dial lamps, tubetesting, magnet wire, tuning coils, grid bias resistors, resistor "preferred" values and tolerances, condensers, transformers, all RMA and manufacturer's color codes (including two original and ingenious resistor and condenser color code and value identification charts) parallel and series circuit network calculations, decibel, volume and tone controls, filters, conversion factors, "Time constants," reactance, radio servicing formulas, and many other important subjects. It does not duplicate any material found in other servicing manuals.

An important innovation in this new Handbook is the fact that every chart and data table is preceded by a clear, detailed explanation of its contents, together with instructions and actual examples for its use. This entirely eliminates "dead" material such as is found in so many other data books—"dead" because the owner does not understand the data as it is arranged, or does not know how to apply it to his needs.

The revised Handbook is bound in handsome gold-lettered black Fabrikoid with a stiff cover meant to stand constant handling in the shop. To really appreciate its completeness and merit, every service man should examine a copy for himself—page by page.

"THEORY of GASEOUS CONDUCTION and ELECTRONICS," by Frederick A. Maxfield and R. Ralph Benedict, published by *McGraw-Hill Book Company*, 330 West 42nd Street, New York, N. Y. 465 pp. plus index. Price $4.50. In this important new book the chief aim has been to interpret in a systematic way the underlying phenomena upon which the properties of all types of gaseous conduction devices depend. Thus the authors discuss not only high vacuum conduction as found in radio tubes, cathode ray tubes, and phototubes, but also the theory and application of corona, sparking, glows, and arcs.

Both in plan and treatment the book is designed to give undergraduate students in electrical engineering and applied physics a knowledge of the fundamental theory of high vacuum electronic equipment and of the theory of gaseous conduction.

Stress is placed upon the scientific principles involved in the conduction of electricity through gases, rather than upon specific apparatus and applications. As far as possible, the authors have given a quantitative rather than a purely descriptive treatment. Examples of the application of gaseous conduction drawn from engineering practice are included, but no detailed description of devices and circuit applications is attempted.

The following topics are among those discussed in considerably greater detail than is customary in textbooks

on electronics:

—the relationship between pressure and temperature and molecular energies and speeds;

—the velocity distribution laws and the concept of free paths and the distribution of free paths;

—mobility, diffusion, and recombination;

—the theories of ionization by collision and the development of self maintaining discharges;

—sparking potential and corona discharges, and glow discharges;

—methods of determining plasma characteristics by the use of a probe.

This excellently written book should be in the library of every undergraduate student in electrical engineering.

"PRACTICAL RADIO MATHEMATICS," by M. N. Beitman, published by *Supreme Publications*, 3727 W. 13th St., Chicago, Illinois. This booklet is designed for home study by students in radio servicing or communications. The man engaged in radio service work and possessing a working knowledge of arithmetic and elementary algebra sometimes fails to connect his knowledge of mathematics to everyday radio problems. This booklet will clarify those problems and will help to ease the difficulty that many may have in applying their present knowledge to problems that come up in the daily work.

—30—

Servicemen's Case Histories

(*Continued from page* 40)

	2)	replace the 0.1-mfd. screen by-pass condenser, as it often causes trouble due to "opening"

FORD-PHILCO 1935 Auto Radio

Intermittent reception. Low volume	1)	header speaker cone leads short-circuiting to steel spring support
Intermittent reception (tubes O.K.)	1)	tap and wiggle the 0.01-mfd. condenser connected to volume control. If faulty, replace
Dial jumps calibration	1)	remove gears from dial assembly. Carefully "peen" out teeth of gear which holds pointer until it meshes closely with intermediate driving gear

FORD-PHILCO 1936 Auto Radio

Intermittent reception (tubes check O.K.)	1)	tap and wiggle the 0.01-mfd. condenser connected to volume control. If faulty, replace
	2)	check for poorly soldered connection at one of oscillator coil lugs
Hum (loud and deep)	1)	check all filters condensers
	2)	if filter condensers check O.K., check the 0.25-mfd. condenser in the grid return of output tube for "open" condition
Volume decreases when volume control is turned "on" full. Distortion	1)	secondary winding of second i-f transformer "open"

GENERAL ELECTRIC A-85

Inoperative. Weak reception	1)	check voltage across 3,000-ohm first-audio cathode resistor. If less than 2 or 3 volts, replace the electrolytic condenser by-passing this section. Use a 5 to 10 mfd. 25-volt unit

GENERAL ELECTRIC J-85

(Uses same chassis as RCA-R-12 receiver.) See also the Case Histories listed for the RCA-R-12 receiver

Weak reception. Motorboating sound. Whistling or squealing	1)	replace **entire** filter block (do not replace only any individual sections that may test "faulty")

GENERAL ELECTRIC K-85

(Uses same chassis as RCA-240 receiver.) See the Case Histories listed for the RCA-240 receiver

GENERAL ELECTRIC 86 Series

Noises like static but station cannot be tuned in	1)	condenser in "Sentry box" under 6A8 tube "shorted." Unsolder all leads on Sentry box, remove front dial screws, lift up dial assembly, pull out band shaft, remove front section of sentry box from bottom

GENERAL ELECTRIC A-86

No signals on all bands. Static	1)	short-circuited 0.1-mfd. condenser **(C-30)** in "sentry box" (part **No. RC-096**)
Inoperative on "C" band. (operates perfectly on all other bands)	1)	open-circuited 0.0013-mfd. condenser **(C21)**, preventing the receiver from oscillating on that band
Loss of volume, Poor selectivity, (abnormally high screen voltage on 6K7 i-f tube)	1)	open-circuited 10,000-ohm resistor section **(R18)** or tapped resistor **(R11, R17, R18)**

MAJESTIC 500

Inoperative over part of dial	1)	replace the small 50,000-ohm oscillator grid leak connected from cathode to grid of the 6A7 tube. This resistor often increase greatly in value
Inoperative when nearby house light is turned on	1)	short out the AVC 300,000-ohm resistor in the grid-return circuit of the 6A7 tube. The trouble is caused by over-biasing of the 6A7 by the surge, paralyzing its operation
Inoperative (nothing coming through tubes ahead of the '42 tube)	1)	check for an open 0.05-mfd. tubular type condenser going from the triode plate of the 6F7 to the control-grid of the '42
Motorboating sound (all voltages check O.K.)	1)	"short" between the primary and secondary windings of the third i-f transformer. Replace the unit
Motorboating sound when tuned off resonance	1)	0.25-mfd. by-pass condensers on 6A7 and 6F7 cathodes need replacement. (These are in the container containing four 0.25-mfd., one 0.06-mfd. and one 0.03-mfd. units)
Selectivity poor	1)	drill a hole in the top of the second i-f transformer case (being careful not to damage the parts inside). Mount a balancing condenser in this position, connecting it across the transformer primary. Adjust it for maximum selectivity

MOTOROLA 82A

Whistling or squealing, or thumping on high-freq. end of short-wave band around 20 mc	1)	connect a 60-ohm non-inductive resistor directly in the grid lead at grid cap of mixer tube. This will act as a suppressor of oscillations

MOTOROLA 88 (Super "8") Auto Radio

Inoperative over part of dial	1)	try several new tubes in critical autodyne detector-oscillator circuit
	2)	if this fails to remedy trouble, try a 4,500-ohm cathode-bias resistor and resolder all oscillator circuit connections (including coil wires to terminal lugs and connecting leads)
Low sensitivity	1)	"faulty" i-f unit
	2)	receiver circuits not aligned properly
	3)	faulty '36 tubes
	4)	if plate voltages are low, check for faulty "BR" rectifier tube, faulty buffer condensers, faulty Elkonode
"Noisy" operation	1)	coil shield cans not properly grounded
	2)	voice coil lead broken
	3)	poor connection on chassis plug
	4)	faulty volume control

PHILCO 39-30, 39-31, 39-35

Inoperative	1)	see **Note (P)** listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories
	2)	see **Note (N)** listed under "Philco Receiver General Servicing Data" at beginning of Philco case histories (indicated by resistors **No. 45** and **No. 46** burning)—check for "shorted" rectifier tube first
	3)	"open" field coil **No. 44**
	4)	"shorted" condensers **No. 27** and **No. 13**
	5)	"open" primary in i-f transformer **No. 12** and **No. 20**
	6)	"open" winding in oscillator transformer **No. 6**
	7)	"shorted" integral compensating condenser parts **No. 20B** and **No. 20C** in i-f transformer **No. 20**
	8)	"shorted" compensating condenser assembly **No. 5**
Push-button troubles	1)	refer to Case Histories for these troubles listed under Philco 39-25 receiver
Intermittent reception. Weak, "tinny" signal	1)	"open" condensers **No. 30** and **No. 35**
Weak reception on push-buttons on broadcast	1)	"open" secondary in antenna transformer **No. 2**
Distortion at low volume	1)	"shorted" condenser **No. 35**
	2)	check electrolytic condenser **No. 43** for a ground through its mounting
Distortion at	1)	"shorted" condenser **No. 35**

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high volume	2)	if tone is extremely high-pitched, try reversing the line plug. If this does not help, change position of the wires around volume control leads and grid lead to 75 tube
Whistling or squealing	1)	"open" condensers Nos. 3, 13 and 27
Whistling as volume control is advanced	1)	replace 250-mmfd. mica condenser No. 34 by-passing 75 audio tube plate. Use a 0.01-mfd. replacement
Crackling, Noisy	1)	check 250-mfd. mica condenser No. 34 by-passing 75 audio tube plate

RCA R-37, R-37P, R-38, R-38P

Inoperative	1)	"open" filter condenser—usually the 4-mfd. unit.
Weak reception.	1)	the 0.00025-mfd. plate by-pass condenser on the 2B7 socket touches the diode terminals of the tube socket. Move this condenser away and tape it
Poor control of volume (all parts and voltages check O.K.)		
Low volume. Distortion	1)	replace the 60-megohm resistor between the first grid and cathode of 2A7 tube
Low volume	1)	defective 10-megohm bleeder resistors. Replace with 10-watt wire-wound units
Fading out of signal when set warms up	1)	check screen by-pass condenser for lowered capacity or "open"
	2)	check B-supply by-pass condenser
	3)	condenser C17 "leaky"
	4)	heat of bleeder resistor melting rubber insulation between wire and shield of type '2B7 tube grid lead, causing a short-circuit. Rewire with cotton-insulated wire
Whistling or squealing.	1)	decrease in capacity of condenser C30. Replace with a 4-mfd., 600-volt paper type unit
Motorboating sound (stops when type '2B7 tube grid cap is touched with the finger)	2)	replace 2B7 tube
	3)	see that shield to second detector grid cap fits tightly in tube shield slot and is well grounded to chassis
Motorboating sound (at all times)	1)	decrease in capacity of screen condenser C4. Replace with a 10-mfd. unit
Motorboating sound (between stations only)	1)	move antenna and ground wires away from the 2A7 tube to the 2A5 side of the 2B7 tube
Constant "popping"	1)	"open" filter condenser—most likely the 4-mfd. unit

SILVERTONE 1709 Powr Shiftr
(for 6-volt Battery Receivers)

Excessive hum in receiver connected to Powr Shiftr	1)	some radios are not equipped with three or four-wire cables which bring the vibrator and filament circuits out of the chassis to the power source. Excessive hum will

probably be a problem in this type receiver until the vibrator is disconnected at its lugs or terminals inside the chassis and brought out with separate wires and connected to the Powr Shiftr direct. For obtaining minimum hum it is important that the filament load is connected to the "F" terminals, which supply power with minimum voltage ripple. An open input condenser on the "F" supply will introduce excessive hum also and the output voltage will drop to 6.4 volts without load.
The filter condenser open on the "V" supply will also introduce hum and cause the voltage to drop to 4.53 volts without load.

STROMBERG-CARLSON 115 Chassis

Removing chassis from cabinet	1)	be sure to remove the two screws in the corners of cabinet before trying to remove the chassis, or the glass dial will break
Weak operation. Inoperative	1)	open-circuiting r-f, oscillator, or antenna coil. Coil leads breaking (usually at terminals). Remove coils and repair
Distortion at medium or high volume	1)	"leaky" or "shorted" 0.01-mfd. condenser connected in series with 10,000-ohm resistor connected from plate-to-plate of push-pull 6L6 tubes
Background hiss	1)	insufficient antenna. Use an antenna 100 to 300 feet long
	2)	check antenna, and antenna coil primary, for open circuit
	3)	defective 6A8 oscillator tube. (Trouble does not show in tube tester.) Replace
Setting of fidelity-tone control	1)	normal setting of the fidelity-tone control is at the middle—half red, half white. All red (High Fidelity) broadens the tuning and should not

be used for distance reception. All white (Low Fidelity or Tone Control fully operated) causes muffled tone and reduced volume. A definite "bump" when passing through Normal shows that the selectivity is maximum and Tone Control is set for Standard Fidelity

(To be continued)

AMERICA ON GUARD!

Above is a reproduction of the Treasury Department's Defense Savings Poster, showing an exact duplication of the original "Minute Man" statue by famed sculptor Daniel Chester French. Defense Bonds and Stamps, on sale at your bank or post office, are a vital part of America's defense preparations.

Cash Prize Contest

(*Continued from page 26*)

List of Prizes

First Prize	$100.00	cash
Second Prize ...	50.00	"
Third Prize	25.00	"
Fourth to Tenth, Inclusive	10.00	"

Total Cash Prizes Amount to $245.00

The rules of the contest are as follows:

1. The contest is open to all, except to employees of the Ziff-Davis Publishing Company, RADIO NEWS, and their families.

2. Entries may be made in any or all of the three groups—namely, Service, Amateur, and General.

3. "Service" articles should describe and illustrate test equipment which may be built by the average serviceman—such as Tube Testers, Signal Tracers, Signal Generators, etc.

4. Entries for the "Amateur" section should deal with the design and construction of various types of ham gear, such as Transmitters, Receivers, Frequency meters, U. H. F. Equipment, etc.

5. Entries for the "General" classification include P. A. Equipment, Amplifiers, Radio-Control Devices, Recorders, Broadcast and S. W. Receivers, F. M. Receivers, Television Receivers and Transmitters, etc.

6. More than one entry may be submitted by an individual. All prize winning manuscripts, diagrams, and illustrations become the exclusive property of the Ziff-Davis Publishing Company. Excluded from the contest are articles which have been published in any radio magazine in the United States. Entries will be returned only if postage is included with the entry. While exercising utmost care in handling RADIO NEWS does not assume any responsibility for loss or damage of entries. Any entries not winning a prize may be submitted at regular space rates.

7. Each entry must be accompanied by a properly filled out entry blank or reasonable facsimile. Entries must be postmarked not later than midnight February 1, 1942. Winners will be announced in the March, 1942 issue of RADIO NEWS. In case of tie duplicate prizes will be awarded. You do not have to be a subscriber to win a prize. In all cases the decision of the judges will be final. The judges will be: B. G. Davis, Editor of RADIO NEWS; Ulmer Turner, ex W9UG, Radio Commentator; Raymond B. Frank, Technical Editor of RADIO NEWS.

8. The Contest Editors regret that they are unable to entertain correspondence of any kind regarding entries.

ENTRY BLANK

CASH PRIZE CONTEST EDITOR
RADIO NEWS
540 No. Michigan Avenue
Chicago, Illinois

Please enter the enclosed in your CASH PRIZE CONTEST. I agree to all the Rules of the Contest.

My name is .....
(Call if any) .....
Address .....
.....

RADIO NEWS Subscriber?

YES ☐ No ☐ (Check correct answer)

I am a Serviceman, Licensed Amateur, DX Listener, Experimenter, Student, Engineer .....

The equipment was built by .....
.....
.....
in (date) .....

Check here if article is submitted at regular space rates (not contest) ☐

Revolutionary Radio for Liberty Ships

A NEW type of commercial marine radio equipment of revolutionary design which can be installed on board ship in one-fifth the time usually required has been developed in connection with the emergency shipbuilding program. Among the vessels on which it is to be installed are the 312 Liberty type ships now being built by the *Maritime Commission*. The new unit combines in a single cabinet, radio equipment which ordinarily requires as many as twelve separate units and eliminates the intricate system of interconnecting wiring in the radio cabin. It includes all of the radio apparatus necessary for safety and communication purposes.

The equipment was designed to meet the speed requirements of the emergency shipbuilding program in making it possible to do at the factory practically all wiring and other work usually done on the ships at the building yards. The new unit is practically ready to "plug in" at the power supply and radio antenna system when it arrives at the ship. This not only results in a great saving of time—but releases many hours of highly skilled labor for other National Defense work since the installation job is comparatively simple.

The time saving advantages and the great simplicity of design and operation combined in this new type equipment are regarded by ship radio engineers as one more of the many permanent technical contributions made possible by the *National Defense Program*.

—30—

Television Leads RCA Research Laboratories to Clue That Cuts Reflections from Glass

Research in television in *RCA Laboratories* has led to a new chemical process to reduce extraneous reflections from glass. It now becomes possible virtually to eliminate the streaks that glare across show windows, framed pictures, ground-glass screens on cameras, and other glass surfaces or panels. For example, the glass faces of electric meters and the multiplicity of dials that confront airmen, as well as those of automobiles, now can be made reflection-proof, minimiz-

ing chance of error in reading.

Success in the conquest of reflections, which have bothered man ever since he first used glass, has been achieved by scientists in *RCA Laboratories* while striving to improve contrast on television cathode-ray tubes. They observed that the picture contrast always is greater when the screen is viewed in a dark or semi-darkened room. Since the images are "painted" on the glass face of a cathode-ray tube, thence to be passed on through a thick glass protector plate to a glass mirror, the challenge of reflections was baffling. The experts in their study went back as far as 1900 to pick up an important clue dropped by Lord Rayleigh, noted English physicist.

Extending the investigation of the effects of hydrofluoric acid liquid and vapor on glass, new signposts were found for clearer vision in television and in the wide fields in which glass is used, whether in tiny lenses or big show windows. Of particular interest to the optical field is the fact that, as the amount of reflection is reduced, the light transmitting quality of the lens substantially increases and greater contrast results.

Dr. F. H. Nicoll, research scientist of *RCA Laboratories*, developed the new formula. His process is based upon the exposure of the glass surface to hydrofluoric acid vapor. The vapor etches away a small amount of surface, leaving a thin, transparent film of calcium fluoride measuring in thickness approximately one-quarter wavelength of light. This film is purple, indicating that yellow and green, to which the human eye is quite sensitive, are not being reflected. Exhaustive tests show that the film withstands hard rubbing, that it can be washed with water, alcohol and a number of other solutions, and can be subjected to relatively high temperatures without impairment.

Ordinary window glass, it is explained, has an average measured light transmission of approximately 90 per cent. The other 10 per cent is lost through reflection. It is this relatively small amount of glass reflection that often troubles human vision. By reducing the 10 per cent to one per cent or less, Dr. Nicoll achieves a minimum power of reflection.

The process differs from another method of treating glass, recently introduced commercially by the *Photophone* Division of the *RCA Manufacturing Company* for use in the optical systems of motion picture cameras and projection units. Developed by G. L. Dimmick, another RCA scientist, the latter method deposits a thin, transparent coating formed from a mixture of fluorides and other minerals on the glass surface without etching. This method must be carried out in a vacuum and is, therefore, applicable only to comparatively small pieces of glass. This treatment also results in a highly efficient and tough surface.

Discussing the numerous applications of his new method, Dr. Nicoll sees it as a boon to accuracy and safety in cases where aviators and engineers must glance quickly at meter dials and respond instantly to what they see. Details of numerous commercial applications are being worked out by the *RCA Manufacturing Company* at Camden, N. J.

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Ham Chatter

(*Continued from page* 39)

he can put a rig on the air.

KEITH MATHIS of Americus, Ga., returns with:

Rumors to the contrary, the old chicken eating champion is still among the living, after rambling around with Florida sand for the past several months. Thanx to W4GFF down Cordele way for doing a nice job in your scribes absence.

We spent seven months in Tampa where we met a nice bunch of hams but didn't get on the air while there. W4FZR a nice 600 watter certainly was nice to your scribe while there as well as others. Thence we moved to Americus, Georgia, where we are glad to announce that we will be for some time.

W4FFJ spent a while with us the other day and helped yours truly plan a vertical so that we can qrm some other guys that have got sorter sassy during our absence to the ham bands. Also bumped into W4GHW, ole goat headed willie the other day and he is on road as a salesman during summer months after which he will go back to school teaching.

W9IBH and his rig.

What has be come of our ole W 9 friend who used to burst forth in these columns about our chicken eating every once in a while? And also what editor do youse guys know that got some peace and sleep while our old mill was gathering dust? (It was reliably reported that the circulation of RADIO NEWS jumped 100 percent after the Hamchatter page got rid of our scribing.).

W4DSB of Americus is planning to get back on shortly after his brand new house is completed. He also has a new addition to the family which might be why he is building.

W4AUO of Montezuma tells us that he is on ten meters with medium power once in the while. Also W4EQB is still active there.

We recently had a personal QSO with W4FDE who has a nice job at Naval Air base at Jacksonville and he is planning to get on air there shortly. Everybidy we know is getting a government job except us.

A letter from a friend recently quering us when was some Southern radio capital going to get intrested in television. But sh—sh— don't wake it up, commercial radio in the South is asleep and must not be roused out of its slumber.

—30—

For the Record

(*Continued from page* 4)

3. The Association shall establish standard trade practices for the protection of the public and the members.

4. The Association shall offer in-

sured operations to the public in connection with pick-up deliveries and handling of appliances and radio receivers.

5. The Association shall establish a program of public education to better acquaint the public with the problem of maintenance and to establish more cordial relations between public and the members of the Association.

6. The Association shall establish a membership program to assure the public of the best technical service.

7. It is possible that the Association may establish recommended service charges. The public will be educated to understand the necessity for basic inspection charges. Because of the nature of such work, there *must be* a basic charge.

8. The Association shall establish a code of ethics in connection with the operations of the members of the Association.

With the definite understanding that this organization at present is purely local in scope, confining its activities to the metropolitan areas of New York City, it is more than likely that local chapters in other key cities of the nation will be formed. *John F. Rider* has temporarily accepted the office of President of the Association, *Ed Lowe* was elected temporary Vice-President, *Charles Ollstein,* temporary Treasurer and *Robert Herzog,* temporary Secretary.

A mass meeting of members of the radio and electrical appliance servicing industry has been called for November 18th.

THE *Defense Communications Board* is studying a list of 1,600 hams who are of age for military service, with the idea in mind of fitting these men into defense work. The whole scheme is in a highly nebulous form, at present, but something will break on it before long, in all likelihood. If it is decided to call upon the hams, the service will be upon a purely *voluntary* basis.

Those who follow radio developments in Washington have been surprised at the Government's failure to utilize the vast army of loyal, skilled amateurs before this time. There have been several occasions when it seemed that the hams were in a position to do the Government a real service. Army officials, for instance, were urged to use the hams in the manuevers in the Louisiana-Texas and the Carolina maneuvers, but after some thought turned down the idea. At present, it appears that the plans to use hams in the aircraft spotting units have been shelved.

WATCH for the *Defense Communications Board* to assume charge of priorities in the radio manufacturing industry . . . the army is doing more with facsimile than is generally known. Recently, James Baldwin, of *Finch Telecommunications,* became a civilian aide to the Executive Officer of the Chief of the *Signal Corps* to aid in development of facsimile for Army use . . . John F. McKernan, amiable OPM expert on radio manufacturing, has given up his $-a-year to take over direction of *Western Electric's* $100,000,000 defense radio program.

OPM's copper curtailment order of October 21, at first widely thought to sharply curb radio production, exempts all essential functioning radio parts, according to an informal but official interpretation given to RMA. The order, according to OPM officials, applies only to non-essential, non-functioning parts of radio, such as trim, escutcheons, etc., and does not apply to any electrical conduction or associated *functioning* components of radio.

Special aluminum allocations in 1942 of foil for electrolytic and fixed paper condensers, and also aluminum for tubes, have already been taken up by the *RMA Priorities Committee* with the aluminum branch of the *OPM Priorities Division.* RMA has been requested to secure statistics as a base for the prospective 1942 special allocations program for electrolytic and fixed condensers and tubes. Tentative consideration and study is being given to the special radio industry aluminum allocations for 1942, with present OPM trend toward providing limited aluminum for condensers and tubes, on a diminishing scale from January to June next year. Regarding aluminum for permanent magnets for speakers, officials feel that nickel-steel substitutes for aluminum in such magnets are now available for future civilian speaker production in 1942.

MANUFACTURERS of molded radio cabinets will continue to benefit, during October, by the terms of Amendment No. 1 to General Preference Order M-25, which a second amendment issued today by Donald M. Nelson, Director of Priorities, extends through the current month. The amendment has to do with the use of synthetic resin molding powder by manufacturers of molded radio cabinets.

ONE Government body that seems to have taken some cognizance of the usefulness of the hams is the *Nelson Rockefeller Committee* which is seeking to promote better relations with South America. In October Earl F. Lucas, W2JT, of Midland Park, N.J., was authorized by the *Federal Communications Commission* to communicate with amateurs beyond the borders of the United States.

W2JT activities in inter-American broadcasting will be on behalf of the newly formed *Inter-American Escadrille,* an organization of aviators in all the Americas. But there are hints that soon the *Rockefeller Committee* and the FCC will undertake to encourage more exchanges between hams in the United States and their Latin American brethren. Watch for this and hope for the best. 73, OR.

—30—

—AN IMPORTANT MESSAGE TO ALL SERVICEMEN—

As we explained in last month's ad we received many letters from servicemen who wanted to know why our advertisements did not appear in the various Radio Publications during the month of October, and whether we intended to continue manufacturing Test Equipment on the same "direct-to-serviceman" sales policy as in the past. We repeat the following explanation for the benefit of those servicemen who did not read our ad in the November issue of this publication....

We discontinued advertising temporarily because the increased business we received as a result of the Defense Program overtaxed our production facilities unexpectedly, and because of the increasing difficulty we have experienced in obtaining the various parts we require to complete our instruments. At the present time, however, we are in complete production at our new plant (see our new address below) and the increased space in our new quarters will enable us to continue supplying Test Equipment at the same relatively low prices as in the past. Inasmuch as our prices because of our "direct" sales policy have always reflected our actual material cost, plus labor cost plus profit, we have been compelled to revise our prices due to the increased material cost. Please note these prices are based on our present cost and in the event that the price of parts continues to rise, we will be compelled to again revise our prices. We will, however, guarantee to fill all orders at the prices quoted below providing your order is sent in *before* Jan. 31, 1942.

The New Model 1220 POCKET LABORATORY

★ WEIGHS ONLY 28 OUNCES!!
★ USES a 2% ACCURATE 0-200 MICROAMMETER—ENABLING MEASUREMENTS AT

5000 OHMS PER VOLT

SPECIFICATIONS

★ 6 D.C. Voltage Ranges: 0-3-10-50-250-500-5,000 volts.
★ 3 A.C. Voltage Ranges: 0-15-150-1500 volts.
★ 4 Resistance Ranges: 0-3000 ohms, with 15 ohm center, direct reading to 0.2 ohm; foregoing base range multiplied by 10, by 100 and by 1,000, to read up to 3 Meg. with self-contained 3 V. flashlight battery.
★ D.C. Current Ranges: 0-200 microamperes; 0-2-20-200 Milliamperes, using wirewound shunts.
★ 3 Output Meter Ranges: Same as A.C. Voltage Ranges.
★ 3 Decibel Ranges: From —2 to +58 D.B., based on .006 watt in 500 ohms.

Model 1220 comes complete with cover, self-contained battery, test leads and instructions. ONLY..... **$11.50**

The New Model 1240 TUBE TESTER

Instantaneous snap switches reduce actual testing time to absolute minimum. Tests all tubes 1.4 to 117 volts.

Sockets for all tubes— No adapters.

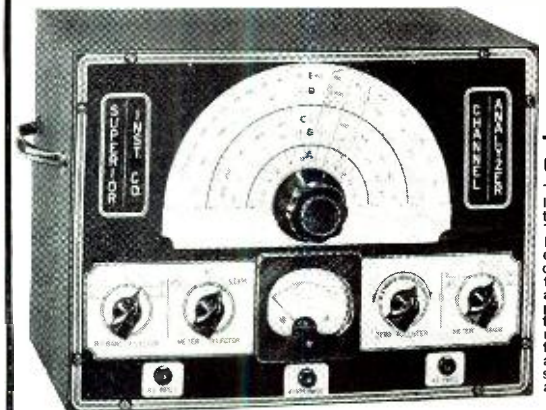
SPECIFICATIONS:

★ Tests all tubes, 1.4 to 117 volts, including 4, 5, 6, 7, 7L, octals, loctals, Bantam, Jr., Peanut, single ended, floating filament, Mercury Vapor Rectifiers, the new S series, in fact every tube designed to date.
★ Spare socket included on front panel for any future tubes.
★ Tests by the well-established emission method for tube quality, directly read on the GOOD ? BAD scale of the meter.
★ Jewel protected neon.
★ Tests shorts and leakages up to 2 megohms in all tubes.
★ Tests leakages and shorts in all elements AGAINST all elements in all tubes.
★ Tests BOTH plates in rectifiers.
★ Tests individual sections such as diodes, triodes, pentodes, etc., in multi-purpose tubes.
★ Latest type voltage regulator.
★ Features an attractive etched aluminum panel.
★ Works on 90 to 125 volts 60 cycles A.C.

Model 1240 comes complete with instructions and tabular data for every known type of receiving tube. Shipping weight 12 pounds. Size 6" x 7½" x 10¾". Our Net Price..... **$14.85**

COMPLETE WITH PORTABLE COVER

THE NEW CHANNEL-ANALYZER



FOLLOWS THE SIGNAL FROM ANTENNA TO SPEAKER OF ANY SET

The well-established and authentic SIGNAL TRACING METHOD of locating the very circuit in which there is trouble, and the very component that causes the trouble, is now for the first time available at a price any radio serviceman can afford.

THE CHANNEL-ANALYZER WILL

★ Follow the signal from antenna to speaker through all stages of any receiver ever made.
★ Instantly track down exact cause of intermittent operation.
★ Measure both Automatic-Volume-Control and Automatic-Frequency-Control, voltages and circuits without appreciably loading the circuit, using built-in highly sensitive Vacuum-Tube Voltmeter.
★ Check exact gain of every individual stage in receiver.
★ Track down and locate cause of distortion in R.F., I.F., and A.F. amplifier.
★ Check exact operating voltage of each tube.
★ Locate leaky condensers and all high-resistance shorts, also show opens.
★ Measure exact frequencies, amount of drift and comparative output of oscillators in superhets.
★ Track down exact cause of noise.

The Superior Channel-Analyzer comes housed in shielded cabinet and features an attractive etched aluminum panel. Supplied complete with tubes, three specially engineered shielded input cables, each identified as to its purpose. Also full operating instructions. Size 13" x 10" x 6". Shipping weight 19 pounds. Only... **$21.75**

MODEL 1230 SIGNAL GENERATOR

WITH FIVE STEPS OF SINE-WAVE AUDIO

SPECIFICATIONS:

1. Combination R.F. and A.F. Signal Generator. R.F.—100 K.C. to 90 Megacycles. A.F.—200 to 7500 cycles; Sine-Wave.—WITH OUTPUT OF OVER 1 VOLT. All direct reading, all by front panel switch manipulation.
2. R.F. and A.F. output independently obtainable, alone or with A.F. (any frequency) modulating R.F.
3. Latest design full-range attenuator used for controlling either the pure or modulated R.F.
4. Accuracy is within 1% on I.F. and broadcast bands; 2% on higher frequencies.
5. Giant dial etched directly on front panel, using a new mechanically perfected drive for perfect vernier control.
6. Operates on 90 to 130 V. A.C. or D.C. (any frequency).

The Model 1230 comes complete with tubes, shielded cables, molded carrying handle and instructions. Size 14" x 6" x 11". Shipping weight 15 pounds. Only..... **$14.85**

SUPERIOR INSTRUMENTS CO.

227 Fulton St., Dept. RN12
New York, N. Y.

They're Making TUBE HISTORY!

$1.00 Amateur Net
(Actual-size photo)

RCA-816 HALF-WAVE MERCURY-VAPOR RECTIFIER

"JUNIOR OF THE 866-A/866"

5000 VOLTS . 0.5 AMPERE

PEAK INVERSE VOLTAGE PEAK PLATE CURRENT

The RCA-816 is the biggest little rectifier tube value RCA has ever offered—and that means a whale of a lot to those familiar with such outstanding developments of a few years ago as the 866-A and, still later, the famous 866-A/866. Designed for medium-power transmitters, the RCA-816 gives you plenty of rectified voltage at minimum cost. It's big enough by way of performance for any rig up to, say, 400 watts input—and it is physically small enough to fit in almost anywhere. Two RCA-816's in a full-wave circuit can deliver 1600 rectified volts at 250 ma.—at a total rectifier tube cost of only $2!

The NEW UHF MIDGETS

Real ECONOMY for UHF Applications

Similar to the well-known Acorn types, but considerably lower in price, these new UHF Midgets open a wide range of design and engineering possibilities to the amateur who likes to keep up with the times. You'll find them particularly applicable for use with high-efficiency, high-gain circuits at unusually high frequencies. They have glass-button stems which provide short leads and low lead inductance. Because of their small size and convenient button-type 7-pin base, they require an absolute minimum of space—and you can count on them for long life and real dependability.

(Actual-size photos)

RCA-9001 Detector, Amplifier (Pentode) Net **$2.50**
RCA-9002 Detector, Amplifier (Triode) . Net **$2.00**
RCA-9003 Super-Control R-F Amplifier (Pentode) . Net **$2.50**

RCA

Transmitting Tubes

PROVED IN COMMUNICATION'S MOST EXACTING APPLICATIONS

RCA MANUFACTURING CO., Inc., Camden, N. J. • A Service of The Radio Corporation of America
For Canadian prices write to RCA Victor Company Limited, Montreal

RCA BROADCAST EQUIPMENT
From microphone to antenna