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I WILL TRAIN YOU TO START
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RADIO SERVICE BUSINESS
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SPARE TIME BUSINESSES

These Men Have
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Mail Now
THE mail bag continues to bring in comments regarding the article by Roger William Rits that recently appeared in "Reader's Digest." Many of these believe the article to be well-founded and accurate, while others disagree entirely with the statements made by Mr. Rits. Many pages would be required to print all of the material that has been received to date. However, one thing is certain, the serviceman must take every possible step to offset the damaging effect that the article had on his reputation.

We urge every radio serviceman to read the article on "Local Servicemen's Organizations," by Mr. Samuel Milbourne, who has spent many years within the radio service field. "Bench Notes" gives further opinions on the same subject.

Mr. Harry P. Bridge, well known advertising agency executive recently wrote a letter to "Reader's Digest" excerpts from which stated that: "You are to be congratulated for your article by Roger William Rits focusing attention on the various abuses entering into the repair of automobiles, radios, and the like. However, this is one phase of the matter I believe has been overlooked, and, in being overlooked, is likely to work a very considerable injustice on many honest members of the professions involved. "Most certainly it is wrong for a mechanic to charge for a part that was never used. It is wrong morally, and it is both wrong and downright senseless from the standpoint of good business. However, it isn't wrong for that same mechanic to make a good, substantial charge for the simple act of replacing a loosened connection in an automobile engine, or tightening a tube in a radio socket. It is no more wrong than it is for a doctor to charge a patient $2.00 fee for telling him he has only simple stomach ache and there is nothing to worry about; or for a lawyer to bill a client $25.00 for merely corroborating the latter's view on some minor point of law which might look highly important if it were not fully understood or neglected."

The aluminum shortage now troubling designers and manufacturers of radio sets is bringing off-set more and more by the introduction of high-frequency iron. Not only is this substitution essential at this time when aluminum quotas are reduced to an alarming degree, but the performance gain scored with iron core coils and permeability tuners will certainly affect the trend of radio receivers hereafter. We are still looking for some radical changes in the design of the new receivers if and when production reaches the point where the market may be supplied. The part of the designer, however, is lacking in many essential items to conduct his business.

AMATEURS are well aware, by now, of the Federal Communications Commission's recent notice of its intention to take action within the next few months that will temporarily restrict amateur operation on the frequencies from 3650-3550 kc. Mr. Rufus (Continued on page 42)
The New 1942 SKYRIDER 32

Engineered by Hallicrafters to produce superior communications performance, the new Skyrider 32 is a 13 tube, 6 band receiver covering everything on the air from 500 kc. to 40 mc. Two stages of preselection. Calibrated bandspread inertia controlled. Micrometer scale tuning inertia controlled. Tone and AC on-off. Beat frequency oscillator. AF gain—RF gain. Crystal phasing. Adjustable noise limiter. Send-receive switch—AVC-BFO switch.

80/40/20/10 meter amateur bands calibrated. Wide angle "S" meter. Push-pull high fidelity audio output. 6-step wide range variable selectivity. $149.50.

Echophone Model EC-3

Now you can buy all these communications features at moderate prices. Echophone, Model EC-3: Crystal filter (four position variable selectivity). Calibrated bandspread, automatic noise limiter. Preselection on all bands. Two stage IF amplifier, Fly-wheel tuning. Separate 6" PM speaker housed in matching cabinet. CW monitor. 10 tubes. 3 bands. Covers from 550 to 2100 kc.—2.1 to 8.1 mc—7.9 to 30 mc. Electrical bandspread. Operates on 115 volts AC/DC. Echophone (Model EC-3) $59.50

HALLICRAFTER S-29

The Sky Traveler—Take it with you or use it at home. A Hallicrafter designed to communication tolerances—Frequency coverage from 550 kc. to 30.6 mc. (545 to 9.8 meters) on 6 bands. Self-contained antenna with high gain coupling. Circuit provides truly remarkable reception throughout its tuning range. 9 tubes. Operates on either 110 volt AC or DC or from its self-contained batteries. Dimensions: 7 x 8½ x 13½. Weighs 18 lbs. Price $69.50

HALLICRAFTER S.X.23

8 bandswitch positions
Six step selectivity
Improved crystal circuit
Regular $115.00
Special $74.50

AMATEUR DIVISION, 63 Cortlandt St., N. Y., N. Y.
World's Largest Radio Dealer
LOW POWER ALL-BAND TRANSMITTER

by DAWKINS ESPY, W5CXII/6

This transmitter features a voltage-doubling circuit which lowers the cost by eliminating the usual power transformer and associated filament supply source.

Correct positions for mounting the parts are shown in the illustration below. Note the pilot lamp next to the crystal.
The universal modulation transformer provides correct impedance match, required for maximum power output.

Bottom view shows where to mount the filter choke and small parts. Toggle switches are placed on two sides.

For some reason real portability in a transmitter has always been a bugbear to the amateur. Either the set-up consists of a number of separate parts which must be connected to attain operation, or the single unit must necessarily become bulky and awkward. The following is a description of a unit which the writer believes should satisfy even the most demanding of the portable or low power enthusiasts.

To begin with, an a.c.-d.c. receiver type voltage doubling circuit is used eliminating the power transformer, and further, a Pierce type oscillator reduces the number of tuned circuits necessary. By using a coil and crystal for each band, operation is possible on all frequencies from 10 to 160 meters with approximately 8 watts input on fone and c.w. The unit is built on a 6 x 8 inch chassis. An idea of the size and layout may be had by observing the illustration.

Five controls may be seen. The a.c. and the send-receive switches are located on the left and right sides of the chassis near the front panel. The left hand dial is on the microphone gain control; the center dial the antenna tuning condenser; and the right hand dial the amplifier tuning condenser. The microphone plugs into the left jack, and the other is for the key.

The placement of the parts is clearly illustrated. The multiplier modulator transformer is mounted in the center, while just to its right is located the amplifier coil. Between the modulation transformer and the amplifier coil a small light globe, which is used to indicate the antenna current, is seen protruding through the chassis.

From left to right along the rear edge of the chassis are: the filament series resistor, 2526 voltage doubler, the 2586G amplifier tube, 6J5 oscillator, and the antenna terminals.

The underside view shows the audio section. The resistors and condensers are in the upper left hand corner. The filter choke is in the lower left hand corner, and the filter condensers are positioned along the lower and right hand edges of the chassis. In order to allow the modulation transformer connections to come through the chassis, the antenna tuning condenser is set away from the front panel. The space in the upper right hand corner is occupied by the amplifier plate tuning condenser.

The oscillator is a conventional Pierce type. A .00025 mfd. condenser is used in shunt with a 50,000 ohm resistor in the grid circuit. A series r.f. plate choke is by-passed to ground with a .006 mfd. mica condenser, while the crystal series condenser is .006 mfd. A .0001 mica condenser is used to couple to the amplifier stage.

A 25B6G, used in the amplifier circuit in conjunction with the special low minimum capacity tuning condenser makes possible smooth operation on 10 meters as well as on the lower frequency bands. A 50,000 ohm resistor is used in the control grid circuit. The screen dropping resistor is 5,000 ohms. The plate and screen-grid are by-passed with .002 mfd condensers. Six prong coils are used in the amplifier plate circuit.

The coils have, in addition to the plate winding, one which can be used to link couple to an antenna tuner. Thus by merely moving the clips provided from one to another, three types of coupling to the antenna become available, namely: direct, resonated inductive, and link. The antenna tuning condenser is 140 mfd. The 160 and 75 meter coils require 100 mfd., and the amplifier tuning condenser is 50 mfd. The 160 and 75 meter coils require 100 mfd. padding condensers which are located in the space provided for them in the coil forms.

(Continued on page 42)
LIFE BEGINS AT 4:15
by E. H. LEFTWICH

Many radio servicemen are finding new jobs in the field of aviation. They work short hours and earn good wages.

There's nothing on Earth I'd like better than to go to work for you!

I put everything I had into that statement, some four months ago when I applied for a job with a large aircraft factory in the Middle West. Anxiously, I awaited the Personnel Manager's reaction.

"Well." That was all he said, for a moment. A neat, smooth-looking young fellow, crisp and business-like, he gave me the quick once-over. He didn't smile, but there was a friendly twinkle in his eyes which encouraged me to go on. I decided to be painfully frank ... and see what happened.

"I've been a Radio serviceman for 17 years," I said. "I have a good job, and I'm not the kind of a guy who changes jobs often, but I believe I'd have a better chance here, for advancement."

"You've had my application for nearly a year. I've done all I could to get in. I've had everybody from the Mayor down to the friend who knows somebody who knows the General Manager try to get me in ... but, no soap. Finally, I decided to come out here and ask for the job, myself ... ."

This time, the Personnel Manager did smile.

"Just a moment," he said. He got up, moved over to his file and found my application. Returning to his desk, he carefully read it. "17 years Radio and Electrical. First Class Amateur Radio Operator, 12 years. Staff Sergeant Radio Instructor, 3 years, etc., etc." He paused, and looked me over again.

"Had any Aircraft experience?" He shot the question at me.

"No."

"Then, regardless of how much experience you've had, it'll take you thirty days or so to catch on."
could look the world in the face . . . and laugh. What chance had Hitler against such as these? And then, I knew that I should be very proud to become one of them!

I knew that these men had just put in a day's work and I was amazed to note the entire absence of all traces of muscular or mental fatigue. There was a springiness to their steps, which I would only, on the rare occasions when men who were on their way to work.

Lord, after I'd put in my ten hours at the garage, installing and servicing auto-radios . . . I was completely done in! I found myself able to do for the past twelve months was to crawl into bed at 7 p.m. and sleep until time to go to work again. How did they get that way? I found out later.

I had one sweet time finding another serviceman to take my place in the garage, so that I could get my release. A year before, the city was crowded with radio men, versatile ones, too.

These men, through force of circumstances, had found it necessary to learn to be able to repair refrigerators, air-conditioners, washing machines and stoves, and to install auto-heaters, small fixtures and home hot-water heaters. Some even had to lay linoleum and hang window-shades.

Even though the automobile business was on the boom, auto-radio men still had to worry with heaters, accessories, speedometers, etc. Now, it was almost impossible to find a radio man who wanted a job!

Where had the radio men gone? I also found this out . . . later.

Finally, I did find a man to take my place, and I went to work in the Aircraft Plant.

"Life," they say, "Begins at forty." I wouldn't know about that . . . yet. But I do know that life, for me, began at 4:15 p.m. on the afternoon I went to work in the Aircraft Factory.

There have been many tales about "Utopia" and the lost continent of "Atlantis," depicting the ideal conditions, the Utopian scheme for living supposedly practiced by the Ancients in those places. Always, beyond the distant hills, there have been visions of a Paradise for the working man.

Believe me, fellow so-called-iron welders, that Paradise is here, on Earth today, at the Aircraft factories, for those Radio men who are fortunate enough to land jobs there.

There has been a great deal of controversy in regard to National Defense Jobs for the Radio-serviceman. There are those old-time exponents of Radio Service, who are both better servicemen and writers, than myself, who constantly urge the serviceman to stay in his shop, remain at his bench, "because," they argue, "someone is going to be needed to repair the radios."

Okay. Someone is going to be needed to repair the radios, and if you have a shop and a good business whereby you are earning a fair living . . . then, by all means stick with it.

I have read an opinion which states that, "The 40 hour week is a lot of applesauce. Sixty hours is not too much time to put in each week, in radio service work."

But, has the man who expressed this opinion, worked 60, 70 and 80 hours per week for fifteen years? I don't think so. If he had, he'd realize that it would be pretty nice to begin living by working 40 hours per week.

The "lost Radio servicemen" whom I couldn't find in my city, were found . . . ah, you've guessed it . . . at the Aircraft Factory.

They were just a little smarter than I was. Months before, they had gone there. They had got the jobs!

One, an ex-radio serviceman, was a Foreman, another, an Amateur, with a Commercial ticket was assistant foreman, and two were Inspectors. In another department, which uses Radio men, the Lead-men on both day and night shifts were former Radio servicemen. Out of some 20 men in my present department, 8 are Amateurs and 9 former servicemen. Of these 9, 5 formerly had their own Shops.

Aircraft Production, especially the Aircraft end of it is serious business. The quality of the work we do may easily mean the difference between life and death. On an automobile, if a radio lead becomes loose, broken

---

J. K. Head, former radio-service shop owner, in charge of Sub-assemblies.

"That's okay, by me."

"Then I won't be able to start you on as much money as we pay an experienced Aircraft worker, but I will start you as an experienced Radio man.

His pencil did a quick series of loops, banks, a couple of power dives and finally made a neat landing on the pad on his desk. "We'll pay you — cents per hour, and a bonus for working at night. You'll get time and a half, for overtime, and double time on Sundays and holidays. With our present working hours, you'll make $— per week. After thirty days, we'll raise your pay. What do you say?"

What do you think I'd say? True, I had just about the best radio service job in my city. I'd held this job for five years, but I'd put in a minimum of 60 hours per week, for which I'd been paid 25% less than what he was offering. Even working 40 hours would pay me practically as much as I had been making . . . and he said he'd raise my rate after thirty days!

"I'll take it," I said. "When do I start?"

"You'll start Monday, and work from 4:15 p.m. to 12:45 p.m. But you'll have to get a release from your present employer. We don't hire workers away from other employers. Can you get a release?"

"You bet," I came back. "Thanks, a lot. I appreciate this chance . . . and you'll never regret hiring me, I promise you."

It was 3:45 p.m.

Outside the tremendous Plant, the day shift was just getting off. Trying to wedge my way through the crowd to the place where I'd parked my car, I looked at the workers.

Laughing, joking, jostling each other good-naturedly, they hurried to their cars, and to the busses. An unmistakable air of contentment radiated from them. Shoulders thrown back, eyes sparkling, real honest-to-goodness American workmen who

H. Hudgens, former serviceman, finds time to relax. Now radio inspector.
of work and knock it out as quickly as you can stick an 8 mike condenser into a ten dollar midget, or slap a push-button into a used V8.

True, we are in a hurry. We want to turn out all the work we can, so that we can help England stop Hitler, but we never forget that our work must be right. Naturally, too much hurry would result in a loss of time. So, if our work was rejected by one of the many Inspectors, and had to be done over again.

In an Aircraft Plant, you never hear the Boss yell, "Fly into it!" Slap that job out ... quick, or I'll get some body else who can slab it out quick!

"Turn out as much work as you possibly can ... but get it right!" That's the order of the day, in the Aircraft factory.

If you take pride in your work, if you like precision work, ideal surroundings and conditions, then, the Aircraft factory is the place for you, if you are lucky enough to get into one.

A great many people have an aversion to punching a time clock, but believe me, it's pretty nice, knowing you've worked hard, and quit you quit. How many times have I planned something "large" for the evening, and then have the Boss tell you, at quitting time, that he'd just sold a 32 Plymouth, and that you'd have to stay and install a radio on it before you left? Did he pay you extra to do this job? Did he even buy your dinner? Not hardly!

It's plenty nice then, to know that if you do work overtime, you'll be well paid for it. After a man has worked fifteen or twenty years, he finally begins to wonder if, after all, there isn't something else to this business of living, being. An efficient corps of Maintenance men see to that. I have seen other men, spending time with their families, fishing, shooting a little golf, or going to football games. "It would be pretty swell," he thinks, "to have enough time to do those things.

I've always had a natural desire to be with my family, and to shoot a bit of golf. I love football, but I've had to work every Saturday for the past fifteen years. This year, I can see some football games!

And if it's necessary to punch a clock ... to get these things, then, brother ... I'm glad I have a clock to punch.

For many years, I worked in dirt and grease. Often, after I'd cleaned up on Sundays, many of my friends actually didn't recognize me.

Inside the Aircraft Plant, it's spotlessly clean. An efficient corps of Maintenance men see to that. I have worn a pair of white flannel trousers for an entire week in the Plant, and they remained clean.

Owing work? I'm greeted in the Plant by many fellow-workers. There is always a friendly smile, a remarkable spirit of cooperation and helpfulness that quickly gets under your

(Continued on page 49)
Build This GRID-DIP METER

by
WILLIAM J. CONNELL

This type of instrument was very popular in past years. Up-to-date circuit provides added features. May be built with little effort.

Almost any metal cabinet will serve as a foundation unit.

PROBLEMS involving inductance calculations always confront the radio experimenter, and many hours are usually spent figuring the number of turns needed for a certain coil, its diameter, size of wire, etc. After consulting charts and formulae and the coil is completed, more computations are needed to determine the frequency range it will cover with a certain variable condenser, that is providing the maximum and minimum capacity of the condenser is known.

The instrument described will take care of these calculations in very short order. The experimenter need only approximate his values when constructing a coil, then make his corrections with the aid of this detector and his signal generator.

Also when building a set of coils for the UHF, frequency modulation or television receiver, it is always advantageous to have the coils pruned up before placing them into the receiver to avoid complications when aligning the set after the construction is completed. This job is easily handled by using the grid dip detector.

It has found numerous uses in the shop whenever problems arise requiring a sensitive resonance indicator.

The grid dip detector circuit is the old conventional grid leak-condenser detector using a 117L7GT pentode rectifier. The detector circuit sensitivity is of such extent that a tank circuit connected across the input and loosely coupled to a common battery operated 30 tube signal generator results in a comparatively large dip in the 0-1 plate milliammeter which is used to indicate resonance.

The plate current of the circuit is controlled by a variable 50,000 ohm potentiometer and a 4 megohm series resistor in the screen circuit of the detector. The purpose of the series resistor is to limit the current to about 1.5 ma. to prevent burning out the meter. The variable pot then allows the meter to be set at any convenient spot on its scale. It is generally adjusted to half scale.

A closed circuit jack is inserted in the plate circuit of the pentode section for aural monitoring of the detector.

The rectifier section of the 117L7GT provides the necessary voltage to operate the detector. It is a half wave circuit with an 8 mfd. 150 volt condenser connected across the output.

A calibrated 365 mmf. variable condenser is also included in the unit to assist in computing inductance values.

Construction

The unit was built into a 6½ x 7½ - x 4½ Triplett signal generator case, however any commercial cabinet approximating these dimensions may be used. The 3 inch Triplett 0-1 d.c. milliammeter, variable condenser dial, and screen voltage control comprise the face of the instrument.

Four binding posts are used, two for the detector input, the other two ter-

(Continued on page 45)
U.H.F. IN AVIATION

by STAFF SGT. CHARLES J. SCHAUERS

High Stability in receiver and oscillator circuits is of major concern in the design of aircraft radio equipment.

Read how "stabilized-condensers" offset frequency-drift.

Radio receivers and transmitters used for the reception and transmission of short wavelengths are somewhat different in design than those used for the reception and transmission of medium wavelengths or the lower frequencies. This is especially true of FM equipment used at the ultra high frequencies.

In the UHF receiver and transmitter, we will usually find vacuum tubes designed specifically for UHF operation. These tubes are designed so that long leads to the internal elements are eliminated, and in some circuits employing them, no sockets whatsoever are used for base contact connections. This makes for higher efficiency because very little R.F. resistance prevails at terminal connections. Inter electrode capacity between plate and grid, and plate and filament is lessened by employing smaller elements. In order to eliminate feedback most tubes are designed with input and output terminals on opposite ends of the tube base and on the glass envelope. In the transmitter, tubes that must dissipate large amounts of power are provided with fins for greater heat dissipation.

Inductances used in the UHF transmitter and receiver circuits are usually airwound, thus reducing losses. For sets designed for aircraft operation, rigidity of internal component parts is a dire necessity due to vibration, and sometimes one will find coils in UHF sets that utilize coil forms made of high quality insulating materials. Due to the very few turns of wire needed for correct inductance values at the ultra high frequencies, it is necessary to suspend these, in most cases from end connections proper. If terminal strips of unstable construction are used, especially when two coupling coils mutual to each other are attached to these, the effective coupling will either be decreased or increased with vibration. A very detrimental effect is thus produced.

In some receivers and transmitters, inductive tuning prevails, but the greater part employ capacitive tuning. The advantages of inductive tuning seem to make it preferable to capacitive tuning in that it is possible to obtain higher "Q" (sharper tuning), lesser noise, greater tuning ranges, and more compact construction. No decline in the number of capacitive tuned sets has been noticed.

Fixed resistors having high temperature rating characteristics are always employed in the construction of aircraft transmitters and receivers operating at the ultra high frequencies; these are well insulated. In some transmitters water-cooled resistors are sometimes used, owing to the amount of heat created. Resistors as used in UHF sets must have definite "pure resistance" characteristics, without a large amount, if any, of inductance. It is conceded, that if resistors having a large amount of reactance were employed in circuits affecting tuning characteristics, the added reactance to the distributed reactance would essentially create a very unsatisfactory condition. Too, the overall length of certain resistors in certain circuits would, in rare instances, affect frequency characteristics, which is undesirable. In replacing a resistor either in an UHF transmitter or receiver, be certain that it is of the same resistance, size, and made by the same manufacturer. It should be replaced in the same position as the defective.
resistor; and if connecting leads are used, they should be of the same length as those connecting the defective resistor.

Condensers having low “drift” characteristics or “negative temperature coefficients” are employed in the construction of most UHF equipment. Bimetal condensers are to be found in a number of sets. High stability in receiver and oscillator circuits is of major concern, this being the reason for using “stabilized capacity” condensers.

The methods of wiring as used in UHF set construction are more exacting than those employed in the construction of the low or medium frequency sets. Short, solid, low resistance leads must be employed for part interconnection, especially between tubes and tuned circuits. In some circuits, such as the grid input circuits of tubes, etc., a lead longer than is required will introduce losses and mistuning. This can best be understood, if it is realized that at the ultra high frequencies, the added inductance and resistance of the long lead will add to, and change input characteristics. When replacing a wire, use the same length and size as removed; sometimes it is essentially required that exact measurement of the leads with a calibrated rule be made.

The superheterodyne seems to predominate as the receiver generally employed in UHF work because of its gain and sensitivity. One will find, however, that the intermediate frequencies (IF) as used by such supers are usually much higher than those previously encountered. The IF frequency used in some FM receivers starts at 6.4 mcs, and in some UHF receivers designed for amplitude modulated signals, the frequency starts at 900 kcs. Of course, the IF bandwidth of the FM receiver is much wider than the AM receiver’s, being on the order of 150 kcs, for a 41 mc. receiver used for general FM broadcast reception.

Conventional audio frequency circuits are usually provided in the receiver, and no large problem exists in providing the necessary amount of audio amplification for either the airport or aircraft operator. High gain r.f. stages are essential at the ultra high frequencies and due to the losses always encountered, one will find more than the usual number of r.f. stages in the UHF receiver.

Many frequency multiplier stages are utilized in the UHF transmitter to obtain the correct carrier frequency.

October, 1941
or more voltage regulator tubes (or crystal) which helps to keep the voltages on the oscillator at a constant value for "on frequency" operation.

From the servicing standpoint, UHF receivers used in both the airport and modern aircraft are easy to maintain and most of the trouble encountered during a day's tour is quite easy to locate and remedy if the proper instruments are employed. The installation of the aircraft transmitter and receiver is, in reality, not a difficult job if the technician follows those instructions promulgated by the equipment manufacturer, but it should be remembered, and the thought not departed from, that no two installations present the same installation difficulties. For this reason a certain amount of discretion and "forward initiative" must be exercised by the installation technician on every installation.

The weight of the UHF receiver and transmitter is quite comparable to that of the low frequency sets, and weight distribution considerations are negligible when the equipment is to be installed aboard large aircraft, but these are of extreme importance when installed on small aircraft. Proper "installation balance" must be affected in every case, however, and the aircraft manufacturer should be consulted as to the best possible mounting positions.

If remote tuning cables are used for receiver tuning, the receiver may be mounted anywhere in the aircraft as long as it is possible to restrict the length of the antenna lead-in connections. The transmitter is usually mounted so that it is readily accessible for adjustment and service, and, in every case, as close to the lead-in connection as possible. Also, the receiver location should be as accessible to the serviceman as the transmitter location, because the attention required by the receiver parallels that given the transmitter. If the receiver utilizes "direct control tuning" it should be mounted as near the operator and/or pilot as possible, but remembering that antenna location governs, in an indirect way, its final location.

In some instances, the power supply cables must be installed for quite some distance from the receiver and transmitter power supplies; but, in keeping with low resistance requirements of cables, etc., these should be "run" as direct and straight as possible. And too, the shorter the cables the less pickup surface for radiated and conducted interference. Cables should be shielded, bonded to the aircraft about every 18 inches, taped and shellacked finally, to prevent electrostatic attraction or rubbing contact with the aircraft structure.

Blacklash in remote tuning controls should be avoided on installation by noting the manufacturer's directions and compensating for it at the receiver end of the cable. An assistant will be required to hold the cable at the tuning unit end while the adjustments and rerouting of the cable are being made by the technician.

If fuse junction boxes or terminal connection boxes are an inherent part of the aircraft's power system, connection to these should be carefully made and, in all cases, lockwashers used for holding wing nut and other retaining hardware.

In preventing conducted and radiated interference, spark plugging sheilds should be used; high tension cables must be shielded and bonded, likely radiating members should be bonded to the "main metal mass," likely radiating filters must be used in low voltage carrying circuits (generator, battery, and cutout circuits), and all clamps should be bonded to the aircraft structure and make good contact with braided shield covering the cables they are holding.

Ignition interference at the ultra high frequencies is not a large problem, but the same precautionary measures employed in the low or medium frequency installation should be used.

The installation of the airport UHF station which includes the receiver, or receivers, transmitter, antennae systems, etc., must be performed in the same thorough manner as the aircraft installation. If the installation is performed in a manner inherent of the trained technician, eventual troubles which will arise will not be attributed to installation improvisations.

Fire Underwriters regulations should be followed when installing the electrical feeder cables for both the transmitter and the receiver and the remote control equipment. Fuses of the proper size should be utilized and "metal bridges" should not be used because "no fuses are available" (which is often the case) for testing purposes.

The first step in installing the equipment in the airport station is to locate the various units in the room for uniform appearance and operational ease. The remote control units are usually installed and wired first, then the receiver and transmitter are installed and, in the meanwhile, the antenna is usually erected by a special crew, with one experienced radio man supervising the installation.

Lead-in insulators should be installed as close to the receiver and transmitter as possible, and if these are installed
NEUTRALIZING CIRCUITS

by WILLARD MOODY
Commercial Operator

It is not difficult to neutralize radio-frequency circuits if a few simple rules are followed. Read how they are applied!

PROPER neutralization of an amplifier is no more nor less than phase cancellation; energy is either fed back from the plate to the grid, or from the grid to the plate, similar to the action of negative feedback or degeneration in an audio circuit. Audio amplifiers, unless of high power, as in broadcasting, are seldom neutralized.

Because it is difficult to construct high power screen grid tubes, triodes are used for r.f. amplifiers in transmitting circuits, with a need, consequently, for neutralizing circuits. The introduction of beam power tubes, with concentrated electronic streams of current, such as the RCA 813 of 360 Watts plate input for only 1 Watt grid input, has reduced the need for triodes in low power transmitters of below 900 Watts. For high power, the triode is still required.

A typical feed-back or neutralization circuit is shown in Fig. 1. The phase shift of the tube is 180 degrees. The phase shift of the neutralizing condenser and the coil Lp is a total of 180 degrees, so that the net phase displacement is zero degrees. The parallel resonant circuit of Cg and Lp will have zero phase displacement at resonance, since the reactances (of the coil and condenser) balance out.

In effecting neutralization, the tube amplification is killed by either removing the plate voltage or the filament voltage. Usually, for reasons of safety to the operator, the d.c. plate voltage is taken off the tank circuit. Normal grid excitation is then applied to the tube by means of the preceding amplifier. Cg, the neutralizing condenser, is adjusted for maximum power output of the stage after Lp-Cg are tuned to the resonant frequency of the driver circuit. In other words, if Lp-Cg are adjustable over the limits 7000-7200 kilocycles, and the crystal oscillator is 7100 kc., Lp-Cg are tuned to 7100 kc. as shown by maximum voltage across coil and condenser. Cn is then tuned for minimum or zero voltage across coil and condenser.

In the L-C circuit of a transmitter, the external current will be zero at perfect resonance. The circulating current in the tank circuit, or in each component, may be high. An r.f. ammeter of the thermocouple type may be inserted in series with either the coil or condenser. Minimum current in the meter when Cn, the neutralizing condenser, is adjusted as desired. Reference is made to Fig. 1 and Fig. 2 with respect to this data.

Another means of securing neutralization indication is shown by Fig. 3. The first tube may be neutralized by adjusting the feed-back or neutralizing condenser, with plate voltage off the stage. The grid meter in the next stage is watched. L1-C1 are tuned to resonance and N1 is adjusted for minimum grid current. The performance is repeated for the next stage, with plate voltage on the first tube, off the second.

Also in Fig. 3 is shown a diode type rectifier circuit which supplies current to a 0-1 ma. meter. The pick-up coil, L, is brought near the plate tank (Continued on page 65)

October, 1941

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A FLEXIBLE PLUG-IN TESTER

by I. QUEEN, Service Engineer

Dozens of tests may be made with this versatile instrument.
Construction is easy. Connections are made to various jacks.

This article will fully describe the design and construction of a multi-meter test unit of wide application which has been giving excellent results for a number of months and which should prove of interest and utility to experimenters and service men. It is the especial intention of the writer to cover the ground from both theoretical and practical standpoint so that the reader will be in a position to design an instrument of his own, no matter what type of foundation meter he intends to use. The basis of the test unit specifically described herein is a 25,000 ohms-per-volt meter. Measurements of resistance, voltage and current, including all commonly used ranges, are available on insertion of a plug into the required phone jack. The finished product as built by the writer compares excellently with reliable manufactured equipment, indications on all ranges being to within one small sub-division.

A complete kit of resistors may be purchased along with a foundation meter, but it was decided, for several reasons, to use individually purchased resistors. For instance, the ready-made kit would have resulted in voltage ranges of 10-50-250-1000 volts. Since the meter scales are numbered to 10, use of the second range would have called for multiplying all indications by 5, while the third range would have necessitated multiplying by 25, etc. It was felt that such arithmetic was wholly unnecessary and would simply confuse and result in large errors. Then again, these ranges would result in great overlapping where laboratory accuracy is not needed, such as in ordinary radio service work. For the above reasons, it was decided to incorporate voltage ranges of 1-10-100-1000 volts, making for simplicity and ease in taking readings.

The different ranges desired are chosen by plugging in the end of the test cord into the corresponding phone jack. There is, therefore, no polarity to be observed at this end, and there is no rotary switch to be rotated over a number of other circuits to reach the desired one. With ordinary instruments it is usually desirable to remove cord tips each time when changing circuits to avoid meter damage, and then plugging in again when the desired range has been reached.

The Figure 1 circuit illustrates the reason for choosing a high-resistance voltmeter. Suppose we wish to measure a voltage across resistance R, which is, let us say, 10,000 ohms. The voltage is approximately 8 volts, so that the 10-volt range will apply. Using the latter scale on an ordinary 1000-ohm-per-volt meter, we have a 10,000 ohm resistance shunted across R. The resultant is now only 5000, so that we have for one thing greatly unbalanced the circuit from its normal operating condition. Then again, only half of the normal current is now passing through R, the other half being shunted through the meter, so that the voltage across R is 50% of what it normally is. The meter indication is thus greatly misleading in this case.

Now let us place a 25,000 ohms-per-volt instrument across R. The total shunting resistance is now 250,000 ohms, which is negligible. For every mil passing through the meter, 25 parts will flow through R, so that the discrepancy is only 1/26, or less than 4%, and the meter reading can now be relied upon.

The VT-voltmeter would, of course, give even more accuracy, but it was felt that the advantages of a magnetic
meter for ordinary work overbalance
the slight increase in accurate results.
The latter is relatively inexpensive,
contains no batteries or tubes to run
down and possibly give inaccurate
readings, keeps its calibration indefi-
nitely with no adjustments, is more
compact, and can be used as a current-
meter or a resistance-meter with the
addition of very simple circuits. Where
extreme accuracy might be needed in
measuring a low voltage across a high
resistance, the magnetic meter could be
used as a microammeter and cut into
the circuit in series with the re-
sistance. Current times resistance
(which could be measured) would
equal the voltage, where the resist-
ance is the total resistance of both
meter and circuit resistance R.

The resistors needed for this test in-
strument were obtained by the author
as follows: After calculation of the
desired values, a number of resistors
of approximately these values are
measured on a reliable ohmmeter un-
til the closest value is obtained. In
this way, it is possible to obtain all
values to within about 2%, which re-
results in a product of high accuracy.
For this procedure it is advisable to
secure the co-operation of a neighbor-
hood parts dealer. All resistors used
in this particular instrument are of
the half-watt midget type variety, and
with the exception of the higher val-
ues are wire-wound.

**D.C. Voltmeter**

Figure 1 shows the wiring diagram of
the voltmeter circuit. Since these
are all similar except for the series
resistor, only one will be illustrated.
It is desirable to connect all four jack
frames together to the negative end
of the circuit. The ranges obtained
are 1-10-100-1000 volts as mentioned
previously. For the low range we
must have 25,000 ohms in the circuit
(25,000 ohms per volt). The internal
resistance of the particular meter
being 5000 ohms we make R 20,000
ohms. For the second range we re-
quire 245,000 ohms at R. The next
voltage range requires 2,500,000 and
the high-voltage circuit requires 25-
000,000. This latter can best be made
up of a 5 megohm and a 20 megohm
in series, if the reader is unable to
obtain a 25 megohm resistor. No
multiplication is required on any read-
ing. If the indication is 8.3, the answer
must be 83, 8.3, 83, or 830 depending
upon the jack used. This results in
great ease of operation and highly ac-
curate results.

There is one simple trick which
should be used on the voltage ranges,
however. Using an ordinary phone
plug, it will be found that the two
sides of the circuit will be momen-
taneously shorted by the metal sleeve
of the jack during insertion. This
may prove troublesome on the voltage
measurements, so the following pro-
cedure should be followed. Note fig-
ure 3. The inner long screw is be-
moved by rotating the extremity of
the plug A. The main arm of the
plug is sawed across about half-inch
from its end (dotted lines). The in-
sulating cylinder between the long
screw and the external arm is cut in
the corresponding place.

All parts are now replaced, except
that a thin insulating washer is in-
serted between the two sawed parts
(at the dotted line). There will now
be two insulating washers in the plug,
originally there having been one be-
tween B and A. While the plug is
being inserted now, A and B are short-
circuited for an instant, but B is iso-
lated from the circuit under test. As
the plug advances further into the
jack, B and C are shorted, but again
B has no connection with A and thus
no short-circuit of the voltage takes
place. The finished plug will be simi-
lar to a microphone plug, except that
in the latter, the two insulating wash-
ers are placed too close to each other
to be used.

**D.C. Measurements**

The circuit employed for milliam-
pere readings is shown in figure 4.
For this purpose circuit-reversing
plugs are used (midget type). The
calculations are as follows. The meter
has a resistance of 5000 ohms, and
takes 0.01 amperes (1 ma.) at full-
scale. The scales desired are 1-10-100-
1000 mils. Since one milliamper is 25
times as large as 40 microamperes, we
wish 24 times as much current to be
shunted around the meter as will pass
through the latter. The shunt must
be 1/24th of 5000 ohms or 209 ohms.
In other words 25 times as much cur-
rent is passed through the entire cir-
cuit (shunt and meter) as is indicated
on the meter. For a 10 mil range the
shunt should be 1/249th of the re-
sistance of the meter, so that all read-
ings will be multiplied by 250. For
practical purposes this is 20 ohms.
The same procedure shows that a 2 ohm
shunt will multiply all readings by
2500, resulting in a full-scale of 100
mils. For the high-current scale we
must use 2 ohms, a resistance best
made up by the reader by winding
high-resistance wire on a small insul-
ating form. Note from figure 4 that
the shunt is connected before the me-
ter itself! on insertion of plug.

**Resistance Measurements**

There are two general types of ohm-
meter circuits, the series and the
shunt. In the former, the meter de-

tection decreases for higher resist-
ances on test, while in the latter, a
higher resistance being measured re-
sults in a greater positive deflection.
Both types of scales must, of course,
be present on the meter to be used.

The series type of circuit is adapted
for measurement of comparatively
high resistances. The plug-in circuit
is shown in figure 5. The unknown is
in series with the entire circuit so
that a higher value produces a smaller
indication. The constants for this di-
agram are found as follows: It is only

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necessary to know the mid-scale reading, that is the ohms indication which corresponds to 5 on the linear d.c. current or voltage scale. In this particular meter the reading is 30,000 ohms. This automatically sets the value of R as 30,000 for the following reason. The procedure is to adjust initially the meter with the two ends of the cord short-circuited, that is with zero ohms. The pointer should now come at the full-scale reading (0 on the ohms scale). Normally when we insert a resistance of 30,000 ohms between the two ends of the test cord, we expect the meter to indicate this value, which is also mid-scale. This will occur, since we have doubled the resistance in the circuit and therefore halved the current (assuming a constant EMF). This particular instrument will read up to 2 mgs with a single cell.

We must now find the value of S, the shunt across the meter. The source is 1½ volts and the total resistance (with short-circuited test cord) is 30,000 ohms. By Ohms Law the current is then .00005. Also with the above conditions we require full-scale reading, 10 microamperes must thus be shunted across the meter. If the shunt is four times as large as the meter resistance, it will shunt one-fourth as much current as passes through the meter and the problem is solved. The shunt for this case must then be 20,000 ohms. With regard to R in this circuit it is customary to replace this with a somewhat smaller resistance, let us say, 25,000 ohms, and “take up the slack” with an additional variable resistor. The purpose of this procedure is to cancel the effects of an aging battery as well as to obtain an exact full-scale reading on shorting the cord tips. In this tester, a rheostat of 7500 ohms is used in conjunction with the fixed 25,000. The control is tapered so that the resistance increases but slightly for the first 10% or 15% of rotation and then varies uniformly up to maximum.

For the measurement of medium values of resistance, that is up to 000 ohms. By Ohms Law the current is then .00005. Also with the above conditions we require full-scale reading, 10 microamperes must thus be shunted across the meter. If the shunt is four times as large as the meter resistance, it will shunt one-fourth as much current as passes through the meter and the problem is solved. The shunt for this case must then be 20,000 ohms. With regard to R in this circuit it is customary to replace this with a somewhat smaller resistance, let us say, 25,000 ohms, and “take up the slack” with an additional variable resistor. The purpose of this procedure is to cancel the effects of an aging battery as well as to obtain an exact full-scale reading on shorting the cord tips. In this tester, a rheostat of 7500 ohms is used in conjunction with the fixed 25,000. The control is tapered so that the resistance increases but slightly for the first 10% or 15% of rotation and then varies uniformly up to maximum.

For the measurement of medium values of resistance, that is up to (Continued on page 52)
THIS month, our manuscript is devoted primarily to the radio servicemen—readers who live in or near the larger cities. We have devoted a good deal of space in the past to business-building ideas which were particularly adaptable to servicemen in small communities and now we want to develop in this issue the concrete benefits a serviceman in a large community can derive from his local service organization.

"Oh, poopy!" you say. "Service organizations are a lot of malarky. You pay dues, get bored stiff at meetings and what does it get you?"

Well, friend, we won't say "yea" or "nay" regarding your own experiences with local service organizations, but you'll have to admit that the idea is a sound one if its handled right, and here's where we want to unfold for your benefit some of the activities of the P.R.S.M.A. (Philadelphia Radio Service Men's Association) as a guide to what can be done by a live-wire outfit.

Philly is a pretty large town, no matter how towns are rated, and there are a lot of servicemen trying to make an honest living within its ever expanding area. There was a time when it was every man for himself and the devil take the hindmost, but in recent years this condition has been greatly changed.

We won't go through all the details of external struggles, but to-day the P.R.S.M.A. offers service-men-members some mighty important advantages. It's these advantages that we want to present for the aid that they may offer to other local servicemen's organizations throughout the country. Many of the ideas are also in use elsewhere, but in the P.R.S.M.A. they seem to make them work with a knock that is worth the telling.

In general, what are the two main advantages which any local servicemen's organization should offer its members? To our way of thinking, they can be listed as:

1. To help each member make more money
2. To supply each member with the intangible called "fellowship" which is sought after by every serviceman.

If you've been a diligent reader of "Ringling the Bell," you will be able to answer the next question without a "bobble."

"How can any radio serviceman make more money?"

The answer, as you good students of "Bell Sales-ology" know, is threefold:

1. By finding means legitimately to raise the average repair bill to the customer. (This can be done by either charging more per unit sold, or selling more units per customer.)
2. By finding means to do repairs more quickly and thus get in more possible repairs per day.
3. By finding means to get more customers and thus to decrease the "idle" time around the shop.

These three "means" are basic. From them stem all sales and advertising ideas connected with radio servicing.

All right. Where does the local servicemen's organization fit into this picture of making more money for its members? We don't know where your local organization fits in, but here's what the P.R.S.M.A. has been doing.

Since their organization, the P.R.S.M.A. has been constantly fighting for the principle of a good radio repair job to the customer for a fair return to the serviceman. In ways that will be explained a little further along, they have helped their members become better servicemen—servicemen better able to do a first-class job of repair work on any radio chassis.

They do not offer membership to every itinerant wire-snipper and tube-changer. Every prospective member must pass a test in practical radio servicing. Some of the questions are:

1. How should a series-tuned wave trap be connected in the antenna circuit of a receiver?
2. What formula is used to determine the resultant value of two resistors connected in parallel?
3. What color pilot bead is generally used in a.c.-d.c. sets?
4. When is a phase inverter tube used?
5. A moulded bakelite condenser with red, green and orange dots is to be replaced. What value would you install?
6. The impedance of a series-tuned circuit at resonance is very high. True or false?

These are samples of the type of questions used in testing member-applicants. By using this test, the Association guards against the inclusion of the wrong type of men.

The Association guarantees the work of its individual members. If a customer has a legitimate complaint, the Association makes good and thrashes it out with the serviceman-member later. To show the brand of service work that P.R.S.M.A. members do, only two complaints have been filed in the last year!

All members follow a code of ethics which includes good work, fair prices and a guarantee. Price-cutting and the other extreme—over-charging—is minimized. Members are for the most part mature men, many of whom have been in radio servicing since the beginning. They know the value of a good reputation and do their very best to keep their individual reputation, and the reputation of the Association, unblemished.

The Association has done a good deal toward the raising of repair prices for labor and material to a proper level. It is in their feeling that if radio set owners are educated to demand the proper type of repair work, they will be willing to pay the proper price for it.

How can the local service organization help its members do repairs more quickly and thus get in more possible repairs per day? The P.R.S.M.A. arranges for the appearance at their meetings of noted radio engineers and others prominent in the radio field. These guest speakers are usually experts in some line of radio work, and it is a poor type of serviceman who couldn't get something worthwhile from listening to such men. P.R.S.M.A. members "swap" radio repair experiences before and after the meetings. Often members learn valuable service "tips" about specific makes and models of radios which they then have in their shops. These "tips" also save them time when they again

**Local Servicemen's Associations**

by SAMUEL C. MILBOURNE

This article, written by the author of "Ringling the Bell" series, presents a workable plan for the serviceman to increase his revenue.

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"Give it the works! I'm going to charge it anyhow!"
run across a similar condition of trouble in a similar receiver. There is no better way to keep "help" in radio repairing than to exchange servicing experiences with others.

Then, the P.R.S.M.A. prints a monthly magazine for the benefit of its readers. Edited by Joe Bishop, an old-timer in radio servicing, it contains plenty of good practical material for cutting down repair time by making easy ones out of hard ones. (The "Texas Broadcaster" published by the Dallas Radio Service Association is another fine organizational publication. It is also the official publication of the Texas Radio Service Association and the Radio Technicians' Guild of the Southwest.)

Now, how can the local service organization help the serviceman-member decrease his "idle" time by increasing his number of customers and repair sales? Here is where the P.R.S.M.A. really shines.

First, servicemen-members have an opportunity to be listed in the business section of the Philadelphia telephone directory under a P.R.S.M.A. heading. There is no doubt but that this pays out. The public is much more likely to phone a member of a recognized service organization than some unknown and unsung individual.

Then the P.R.S.M.A. has a "beaut" of a tie-in with a powerful local NBC station-station WFIL. This is a "mutual assistance" arrangement between the Association and the radio station. Association members boost WFIL to their customers. They display WFIL posters and show cards in their windows. They distribute WFIL program material to their customers. They see that WFIL is represented on all push-button radio receivers that they service.

In return, Radio Station WFIL gives them a show 15-minute spot (a regular radio program) on Saturday night, and two spot announcements a day throughout the week. P.R.S.M.A. is advertised along with WFIL in building plans, and on billboards throughout the Philadelphia area—all at no charge to the Association! In each radio announcement, a phone number is given to which prospects can phone for radio repairs. These calls are distributed among the members on a fair and equitable basis. The value of the tie-in has been proved beyond the shadow of a doubt, as the calls have mounted in number every month since the program started.

Just recently, the station and the Association have renewed their contract of mutual assistance after a most successful first year.

The "mutual assistance" idea extends to the members also. For instance, if you are a member, are out on a job and need some information or assistance, you merely call the nearest fellow-member. He gives you the necessary information, or the "helping hand" that you need, and sometime in the future you do the

(Continued on page 50)

### WRLC FEATURES INNOVATIONS

**ARC welded steel was used exclusively in construction of the new facility.**


The new structure incorporates Le Tourneau's standard arc welded box panel building block section. These "building blocks" are formed by pressure-stamping of 12-gage steel sheets, are welded together with interior spacers set at intervals of not more than 24 inches to form a stout structural member. These panels are welded together enabling the fabrication of the new building in one unit.

Applicable to any structure, whether it be a house or industrial plant, this building block is framework and wall member in one unit. Because of its simplicity, it reduces construction time by as much as 50%. The shielded arc process of welding with equipment supplied by The Lincoln Electric Company, Cleveland, Ohio, was employed according to Robert M. Daniels, Lincoln Field Engineer.

The main purpose of the new station is to provide the community around Toccoa, Ga., with more adequate radio facilities.

The station is set up on a regular commercial basis with a varied program of music, educational and entertainment features. Facilities include a direct wire with teletype which brings the latest news dispatches of the Associated Press 24 hours a day. The station makes news broadcasts every hour with 15-minute summaries 4 times during the broadcast period from 6 a.m. until 11 p.m.

WRLC operates on an assigned frequency of 1450 kilocycles with power of 250 watts. The license is the regular commercial type as issued by the Federal Communication Commission.

Located approximately 3 miles from the new Le Tourneau plant, station WRLC will be operated purely as a public service to the community. The nearest station is in Greenville, South Carolina, approximately 60 miles distance.

Arc welded construction enabled the prefabrication of the building in 2 months. Fabricated at the Le Tourneau plant, it was placed on a truck trailer unit and transported to the site. A view of the interior of the station can be seen in the illustration.

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A large crane was utilized to lift the structure in place.

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**Reception room of radio station WRLC at Toccoa, Ga.**
Soon to come off the production line, are a new assortment of 'national defense' type of electrolytic and paper capacitors, altered physically or electrically, as the emergency has necessitated. Some of the changes are new, and some are old in a new dress. Whatever the changes have been, though, the dual aim of conservation of materials, with little if any sacrifice of quality or efficiency, has been successfully achieved.

Waxes, paper and plastic play the leading role in this new 'face-lifting' campaign, to permit the diversion of aluminum to the needs of defense.

Among the new units developed, is a vertical type dry electrolytic, with prong base structure for twist-prong mounting. This component, with an impregnated cardboard container, is interchangeable with the presently used aluminum can type dry condenser. This interesting development is the result of considerable engineering and planning by the engineers of the leading capacitor manufacturers. It represents the first in a series of steps towards a new format of standardization that will follow along in other types of condensers and condenser practice.

The new capacitors will be made in 1" diameter style with 3 terminals and 1½" diameter with 4 terminal lugs. The lengths will vary from 2" to 4". Actually they will be slightly longer than their aluminum brethren, since additional space is required for sealing ends. This, of course, will not affect the efficiency. All capacities, now available with the aluminum can models, will be duplicated.

Aluminum foil, in either etched or fabricated style, will still be used, aluminum still being the only substance that will afford the most suitable oxide film, essential to electrolytic action. Many other metals that were tried when electrolytic design was first initiated, were again discussed and even experimented with, when the developments of this new type condenser began. These metals included tantalum, magnesium, titanium, niobium, zirconium and zinc. Although they could all be coated by electro-chemical means, all, except tantalum, were impractical for commercial use.

Tantalum provided the most effective oxide coating, but because of its prohibitive cost, it had to be set aside. It is, of course, entirely possible that some form of tantalum may be used in the future, if aluminum foil becomes absolutely impossible to get. However, this appears to be most remote, particularly with the cooperative spirit being shown by the Office of Production Management, who recently began the releasing of small but effective quantities of aluminum for capacitor manufacture. According to authoritative sources from Washington, the OPM has expressed the intent to allow between 20% to 25% of condensers manufactured for jobber use for replacement purposes, beginning around December. This is based on the actual allotment of condensers of many of the manufacturers for jobber needs, during 1940. Thus, actually, the jobber will receive as many condensers as he received in 1940. This data is based on an OPM survey among the manufacturers to determine the number of capacitors made in 1940. Thus, it is quite evident that the service man will be able to secure all the capacitors he needs for replacement. A suitable percentage, will, of course, be allotted for experimenting.

(Continued on page 55)
Learn the Code with this VERSATILE OSCILLATOR

by RICARDO MUNIZ
Radio Instructor, Brooklyn, N. Y.

Anyone handy with tools can build this latest code oscillator. It may also be used in the servicing of radio receivers for audio tests.

The student sends code copy to the instructor with standard radio key. Later they will reverse the procedure and the student will copy text.

Below: Closeup shows correct manner in which to grasp the radio key. Headphones may be plugged into the oscillator for better reception.

\[\text{\textbf{IN THESE times of National Unlimited Emergency it is fitting and proper for each Radio man to seek out the manner in which he can improve his usefulness to his country. In the times that lie ahead many of us will be called upon to serve our community and our nation. Without a working knowledge of the code you cannot really consider yourself a Radio man. The code practice oscillator described herein was designed by the author for use in his "defense" radio classes at the Brooklyn Technical High School. It was used for individual as well as class instruction. Sometimes the loudspeaker was used, with the volume turned up, for the classroom work; other times the oscillator was connected into a code net in which 15 single head phones were used.}\\]

\[\text{\textit{It was described to make the unit as flexible as possible in its operation without making its cost higher than commercial jobs now on the market. We succeeded in achieving greater than the usual flexibility at well below the cost of any comparable commercial code oscillator.}}\\

\[\text{The power output of the unit is about 55 watts. It was found necessary, in order to realize this power output without using a power transformer, to use a Permanent Magnet Dynamic Speaker instead of one with a field coil. The reason for this is that the speakers having high resistance field coils were found to cut the operating voltages down too much thus causing low volume operation. Those with low resistance field coils did not derive sufficient field excitation from the current flowing through their fields resulting also in low volume.}}\\

\[\text{Choice of the PM dynamic speaker makes possible the use of a low resistance, small filter choke in the power supply. This choke does not reduce the operating voltages appreciably yet it provides ample filtering, in connection with the dual 8 mfd electrolytic condenser, to remove all vestiges of hum from the output sound.}}\\

\[\text{In order to reduce the number of tubes to just one, and in order to avoid a heater dropping resistor either in the cord or in the cabinet a 117L7GT tube was used. The heater operates directly off the 117 volt 60 cycle a.c. mains. The "bottle" contains a diode and a beam power amplifier pentode. The diode section is used as a half wave rectifier to supply the d.c. for plate and screen potentials after filtering as described above. The beam pentode is connected as a self excited oscillator using the center-}\\}
tapped primary of the speaker output transformer as the “tank” coil.

The plate current flowing in the section of this coil in the cathode circuit feeds back inductively into the section of the coil in the grid circuit, establishing the conditions necessary for oscillation. The oscillatory frequency is determined by the coil and the fixed condensers switched across it. The larger the condenser the lower the frequency. It was found possible to produce anything from a low rumble to a high pitched shriek by proper selection of condenser values. The values specified were found to give the most useful tones. The wave form of the output was observed on an oscilloscope and was found to be sinusoidal. Changing the value of the grid resistor was found to affect the wave form. The value specified gives the musical whistle resulting from pure sine wave operation. Some students seem to prefer the harsher note which results from a higher value of grid resistor.

After much experimenting it was found that the most satisfactory volume control was a screen voltage potentiometer. Controls were tried in the grid and in the output circuits. These were not found satisfactory. In the grid circuit the control affects the feed back and thus at low volume—inability results. The fool thing simply won’t whistle every time you push the key. With the control means shown in the diagrams however—perfectly smooth control is available from a faint whisper to deafening volume.

Jacks are provided on the front panel for the key and for the phones. Plugging in the phones cuts off the speaker.

The unit as described is a very practical code practice set suitable for an individual, a club or a class. Because of the excellent wave form and the smooth control of volume—it is also useful as an audio oscillator for radio service work. If desired, a few more tuning condensers may be added and a switch having more points may be used, making it possible to extend the range of frequencies both below and above those found most useful for code practice, making the audio oscil- (Continued on page 49)
6th CORPS AREA
SIGNAL BATTALION

Located at Fort Sheridan, Illinois, the 50th Signal Battalion takes care of all forms of Army communications in the 6th Corps Area.

A code class in operation. Every student becomes proficient in copying on a typewriter. Here he is taught proper operating procedure in sending code.

THE part Radio plays in the United States Army has been written many times, although most of this material has dealt with schools and units that used Radio as one of their fundamental factors. Little has been written of the part Radio plays in the routine work of the Army. Much of the work of Radio is in taking care of details that are ordinarily passed by as commonplace, with little thought given to the organization and work necessary to maintain this vital network. Radio, as used in various forts and posts, differs considerably from that in the various schools.

One of these is Fort Sheridan, located a short distance north of Chicago on the shores of Lake Michigan. This Fort which was established in 1886 has been greatly enlarged in recent months until it is now the home of some seven thousand men. Naturally this has resulted in a marked increase in communication traffic with the resultant increase in the work of the Signal Battalion.

A complete portable transmitter-receiver which is supplied with power from a hand-driven generator. Vertical antenna mounts onto the portable cabinet.

Portable switchboard being set up for service in the field. Linemen stand by with plenty of wire. Note the removable leg supports for the assembly.
strain on communication facilities. However every effort has been made to cope with this situation by efficient planning of the work.

Fort Sheridan operates on two networks, one a small CCC net and the other a 6th Corps Area army net for communications between various posts and stations in the states of Illinois, Wisconsin, and Michigan and between posts and units on maneuvers. Messages from Washington are relayed through the 6th Corps Area headquarters in Chicago.

The post handles about 50 messages daily, and they average about 100 words each. All are official business; none, personal.

The organizations which call Fort Sheridan their home, such as the 61st, the 210th, and the 103rd Coast Artillery (Anti-Aircraft), have their own communication systems, principally for intra-battalion messages. This equipment includes telephones, switchboards, and voice and key radio sets.

The 50th Signal battalion, another Fort Sheridan organization, has been compared with the construction department of a telephone company. One of its main functions is to provide communication facilities such as permanent and semi-permanent telegraph wires for other army units to use. Its equipment includes line trucks, earth boring machines, cable splicing tools, and telephone installation materials.

This battalion is under the supervision of Major Edwin E. Hebb, Post Signal Officer, a veteran of twenty-five years of telephone work. The personnel of this battalion consists of about half selectees and half regular Army men. Many of these men have had either Radio or Telephone work in civilian life. Others are learning a trade which will fit them for much better positions in civilian life when their Army service is over. Efforts are now being made to enlarge this detachment from technically trained selectees to meet the mounting increase in communication work. Plans are also under way to construct a new building as soon as funds are available.

Radio operation is centered in the main building of Fort Sheridan and two transmitters are used, one for CCC net and the other for regular Army traffic. The long wave transmitter is a 350 watt model made by the Federal Telegraph and Telephone Co. having a frequency range of 150 to 550 kc.

The other transmitter is an RCA operating on 4300 and 4445 kcs. Receivers used are a Signal Corps BC197 with a frequency range of 100 to 1080 kc., a National HRO and a special Hammarlund Super-Pro covering from 100 kc., to 20 mc. In addition there are telegraph printers for both Western Union and Postal Telegraph connected directly to Chicago with an alternate line to Milwaukee. A TWX machine

October 1941
This portable telephone switchboard may be transported into the field and placed in operation in quick time.

Anti-aircraft gun data-computer at Fort Sheridan which is connected to the guns by cable. Note telephone sets.

The business end of the setup. The operator is seated facing an indicator dial. When two arrows match it shows that the gun is "on the target."

The permanent communications center. Large scale use of teletype is made.

The modern teletype machine saves much time in Army communications.

All photos by U. S. Army Signal Corps
Speedy trucks carry field equipment to most advantageous locations. Main trunk lines are tagged for identification.

Most field operators are former telephone men. Their vast experience enables them to furnish reliable communication.

connected directly to the Highland Park office of the Telephone Co. is also installed.

The duties of the Signal Battalion consist of the maintenance of all communication facilities within the Fort. This includes the servicing and installation of such equipment as telephones, radio receivers and transmitters, P. A. systems, and lines for Radio Broadcast. One interesting application occurred when it was desired to make the sound of the bugle heard throughout the post. This was solved by making use of a large P. A. System together with a turntable and recordings of the various bugle calls.

Aside from the conventional radio equipment, portable “Walkie-Talkies” are used for communication between units in the field. These units are similar to the popular transceivers used by hams, and are very useful for contacts within the “line of sight.” These “Walkie-Talkies” serve the same purpose as telephone lines and have the additional advantage that they may be used anywhere without the laying of lines with their chance of disruption.

A very interesting use of communications principles is in connection with anti-aircraft guns to connect the height finders, data computers, and sound locators. The data computers are almost human in their operation, it only being necessary to set the dials to known factors, with the computers doing all the work of calculating, and operating an indicator on the anti-aircraft gun. It is then only necessary for the gunner to line up a mark on the gun with this indicator and the gun is ready to fire.

Naturally maintenance of this complicated equipment requires the highest skill, and “ham” operators have been found most useful for this work. Likely prospects are picked from selectees and enlisted men and then given basic training in the particular branch in which they are to be used.

October, 1941
The Good Old Summertime (See You)

By ROBERT KENDALL
Service Manager, Indianapolis, Indiana

ALL in all, the past month has been a trying one for your conductor, who finds himself in a more pessimistic mood than usual, and the best we can do is to warn those readers, who might be looking for light, frivolous entertainment, to skip quickly over these pages to Ham Chatter, whose carefree contributors apparently do not have to worry about making a living out of radio.

First of all, we are in the midst of one of those usual Corn Belt midsummer hot spells, which afflict this writer with a tendency to snap at his associates, and to throw something at those dear little toots next door that shriek so merrily outside our windows. As for the radio business, while the high temperatures fried out quite a number of crystals in phonographs and recording microphones, the financial returns were negligible, as most owners were apathetic about the whole thing, and merely muttered something about “waiting until it is cooler.”

Things like these, and such minor matters as freehanded slaughter in Europe and Asia tend to give us a growing conviction that the human race is composed largely of nogoons, which conviction is increased by the recent inquiries into the manners and morals of the service trades, conducted by a periodical of some standing.

To be brief we are in a nasty mood, and inclined to speak a few plain words —so if you choose to read past this point, don’t say we didn’t warn you.

Two Out of Three

BY the time these lines appear in print, the radio service man has no doubt come to loathe all conversation that begins “Say, didja read—,” so we will not bother to ask you if you read the recent article in Reader’s Digest, with the inspiring caption “The Radio Man Will Gyp You”, and spare your feelings to that extent at least. Ordinarily we can find some amusement in most of the situations encountered in daily life, but this one can’t be laughed off, and those who advocate just ignoring the whole thing are indulging in wishful thinking at best.

The radio service man has been the astonished recipient of a good kick in the pants, and he is going to feel it for some time to come, regardless of his attitude or opinion toward the survey in question.

While we regret the publication of such a report as heartily as any radio man, at the same time we are not greatly surprised at the averages arrived at by the investigators, as the figures coincide rather closely with our own previous estimates of the service business. Since it seems permissible for other columnists of wider circulation to hasten to print with “I told you so” when events bear out previous statements, we feel well within the scribbler’s rights to quote from Bench Notes in the April issue:

“We feel certain that the amount of price-cutting . . . is grossly overstated . . . In fact, our experience has been quite to the contrary, in that most of evidence obtained . . . indicates strongly that the majority of service men are more inclined to overcharge for mediocre service.”

Therefore, since the Reader’s Digest report merely corroborates an opinion of some years’ standing, we cannot logically agree with those men that attempt to minimize the effect of the article by questioning the accuracy of averages obtained from a comparatively small cross-section of the radio service men. Neither do we feel that the result would have been radically changed even if the survey had included a much greater number of cases.

These attempts to soothe the ruffled sensibilities of the service men accomplish nothing of value, as there is nothing to be gained by haggling over the accuracy of the published conclusions as applied to the service business as a whole. It cannot be denied that the 304 cases investigated represent something more than a hasty snap-judgment, and as far as the average consumer is concerned the figure is large enough to be fairly convincing.

While we do not question the accuracy of Mr. Riss’ facts and figures, we do find much to dispute in the statement of his star witnesses, the service men and those who probably did more to create lasting damage to the radio service business than Mr. Riss’ mathematical conclusions. In this respect we believe the service men have a legitimate complaint against the presentation of Mr. Riss’ case. His chief witness, the “frank repair man in Chicago,” not content with being exposed as a cheap gyp, apparently could not resist the opportunity to play the “wise guy” as well, and speaking without warrant for the whole service business brayed forth a series of misrepresentations with little or no foundation on facts.

Said Chicago Frank, in part: “we have to do that sort of thing. Everybody else in the radio business does it.” Everybody does not do it, according to Mr. Riss’ own figures, which show that at least one out of three men is honest. As the feeblest of excuses, “Frank” advances the following: “Suppose we charged 50 cents, the customer would think we didn’t really fix it.” It is doubtful if Frank himself is deceived by this piece of bunk. Our customers may be rather difficult at times about matters pertaining to radio, but a dead receiver restored to normal operation, generally inclines the dullest to feel that his set is “fixed.”

While the conclusions reached by Mr. Riss, that only one man out of three is honest, are unfavorable enough, in the long run we do not feel that the honest service men would be seriously affected financially on this account, as the consumer will still require a certain amount of service, and the average man generally has sufficient confidence in his ability to “size up” the other fellow, to enable him to pick the “one out of three” that is honest.

As we see it, the most damaging clout to the service man’s pocketbook was given by our gabby little pal in Chicago, who was so anxious to “tell all” that he proceeded to brand himself and others as habitual petty larcenists by stating, without qualification: “Most of the time there’s nothing (Continued on page 51).”

“Quick, Adolph—have Z3 decode dot secret message!”
GERMAN MESSERSCHMITT
RADIO OBSOLETE

Aircraft radio equipment manufactured in the U. S. A. is far more efficient than that now being used by the Nazi Luftwaffe.

Complete data is given on the equipment.

Evidence of obsolescence and ersatz in German aircraft radio equipment removed from a Messerschmitt 109 fighter plane was disclosed by William P. Lear, designer and builder of aircraft radio for the United States air services and the Allies, following completion of exhaustive test of the radio apparatus found in the Nazi pursuit now being displayed in this country by Bundles for Britain, Inc.

The equipment tested was installed in a German Messerschmitt 109 shot down over the Thames estuary. The plane was shipped to the United States through arrangements made by Mrs. Winston Churchill, honorary sponsor of Bundles for Britain. Upon its arrival in this country, Lear engineers removed the radio apparatus, and the equipment was thoroughly tested by Mr. Lear in his laboratories at Lear Avia, Inc., Piqua, Ohio.

Mr. Lear’s report on the German radio equipment stressed four points:

1. The Germans have apparently “froze” their military radio design since 1933, and standardized their tubes and components for ease of mass production in radio servicing.

2. Shortages of war materials are indicated by the use of ceramics instead of plastics, fibre instead of rubber and special alloys instead of aluminum.

3. The extremely limited range of the transmitter (around 5 miles), and the provision for higher power output, indicate that most German warplanes in a given squadron can talk only to one another, while the leader only can communicate with his base.

4. German aircraft radio apparatus found in the Messerschmitt cannot pass U.S. Government test for even commercial radio equipment, and weighs more than comparable American apparatus.

Examination of the radio equipment from the Messerschmitt indicates very definitely that it is intended primarily for communication over very limited ranges. The equipment is comprised of a low-power transmitter sufficient for interplane communication; a receiver, and a power supply unit. The receiver is relatively insensitive, and the transmitter output is so limited that it cannot be picked up by the enemy at a distant location. The frequency range of the equipment is from 2500 to 3700 kilocycles which in itself represents a very narrow band for communication purposes. Both the receiver and the transmitter are tunable in this range of frequencies.

The equipment weighs in the neighborhood of sixty pounds and the approximate dimensions for the various units are as follows:

<table>
<thead>
<tr>
<th>Unit</th>
<th>Dimensions</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receiver</td>
<td>13 1/4” x 3 1/2” x 3 1/2”</td>
<td>13 lb.</td>
</tr>
<tr>
<td>Transmitter</td>
<td>11 1/4” x 2 1/2” x 2 1/2”</td>
<td>24 lb.</td>
</tr>
<tr>
<td>Transmitter &amp; Filter</td>
<td>9 1/2” x 3 1/2” x 3 1/2”</td>
<td>13 lb.</td>
</tr>
<tr>
<td>Junction Box &amp; Cables</td>
<td>4 1/2” x 1/2” x 1/2”</td>
<td>13 lb.</td>
</tr>
<tr>
<td>Resistive Units</td>
<td>1 1/2” x 4 1/2” x 4 1/2”</td>
<td>2 lb.</td>
</tr>
</tbody>
</table>

As far as the size and weight of the Messerschmitt radio equipment is concerned, it should be mentioned that it is possible to obtain commercial equipment in this country which will give much better performance and yet be considerably lighter and take up much less space. Specifically, Lear Avia, Inc., manufactures a transmitter and a receiver, complete with a shielded loop for aural communication.

(Continued on page 59)

The bulky German radio equipment shown alongside of modern units. Note the loop for direction-finding.
M y partner and I both have soft spots in our hearts for Joe Krog, the plumber, because he started his shop about the same time we opened ours. Before I met him, I had looked upon plumbing as a dull, prosaic business; but no one imaginative enough to think of the motto he uses could possibly have a dull business. On his show window he boasts *Every Job's a Pipe.*

We like him anyway. He drops in at *Salutary Sales & Service* now and then in the evening, for he closes earlier than we do. He usually sits in our customers' chair (placed far from the workbench, to discourage set owners who come in with midgets, and expect to watch us give cafeteria service) and we sort of knock off work to chew the fat with him.

"I see the allies are trying to win the war with the letter V," he remarked one night last week. "It says here that the four opening notes of Beethoven's *Fifth Symphony* have a rhythm like the Morse V. Do you suppose the old boy had a code in the head when he composed it?"

"Joe," I said, "sometimes I look at you and wonder. You know, there might be more logic than you think in the idea of winning the war with classical music. Its effect on the common mind has always been akin to horror. Personally, I'd rather take my chances against a Panzer division than listen to Siegfried's lines."

"You're prejudiced," Al replied. "Remember that Josh Billings once said that Wagner's music isn't as bad as it sounds."

"You can kid about it," Joe said, dropping his paper into his lap, "but music is a wonderful thing. So is radio, for that matter. I often envy you repairmen for getting into such an easy business."

Al and I both groaned.

"I'm not kidding," Joe persisted. "Every call you answer makes someone's life fuller, every set you repair makes somebody happier."

"Yeh," I said, "after we put in ten years' experience and the best replacements, the set owner uses it only to play soap operas so loud the neighbors sue him. Not all our calls are pleasant."

"They should be," Joe insisted. "When you come into a swimming pool to repair a record-changer, you increase its entertainment value. When you go to a cabaret, you help the singers, musicians, and even the waiters to earn a living. Every person you meet in your day's work should be glad to see you, and it's a factor you can turn to your advantage as you do business. I wish I had the same advantage in plumbing."

"Don't tell me," I said, "that your customers aren't glad to see you arrive when their basement is being flooded."

"Yes, in a way," Joe admitted, "but still they're flustered, and more likely to ask me why I didn't come sooner than they are to thank me. With you it's different—you guys are lucky."

"You're right," Al declared. "Lee, here, doesn't see the natural advantages our profession offers. You ought to hear some of the lame excuses he brings back to the store after he loses a job. Some of his customers must welcome him like a plague!"

I knew that sooner or later Al would join Joe against me, and so I paid no attention.

"If you're so sure about this happiness angle," I demanded, "prove it. Just why do you think radio repairing brings more happiness than plumbing?"

"Well," he said, crossing his knees, "when I'm called out to repair a leaky faucet, I have to do it within ten minutes after I get there. Usually I work with the customer watching me. If I finish quickly, I have a tough time getting more than a half a buck because the job looks so simple; if I take my time, the customer thinks I'm incompetent. It's a commonplace task."

"But when you get a job that corresponds to replacing a leaky gasket, it's hidden, mysterious, and therefore it follows, in your customer's mind, that it requires great skill. You make clucking noises, shake your head, and take the set to the shop. When you deliver the set three days later, the customer is financially and psychologically prepared to fork over twelve-fifty, chiefly because he doesn't understand what you've done."

"Now, listen here, fellow—" I began, indignantly. But Joe went right ahead.

"One might say my work was negative, and yours positive. Radio gives the customer something, while plumbing takes it away. When you enter a customer's house, he trusts you with the most important fixture in his home—except one. I grant—and he is glad to see you because he knows you will bring joy to all the members of the family. In your toolbag are the instruments of amusement, news, education, and happiness."

"We don't bring those things," I pointed out. "They are provided by the broadcasters. The repairman only turns on the faucet, and lets the benefits come through, just as you do in your profession. It's certain you don't know the whole picture. My customers are just as hard to work with as yours. I don't bring happiness to all of them!"

"What a confession!" Al laughed.

"Name once when you didn't," Joe demanded.

"Well, er," I stammered, caught unprepared, "just now I can't remember any one particular—"

"I thought so," Joe said, rising from the chair. "If you ever come across such a case, let me know," he tauted. "By the way—here's a call: my mother's set is on the blink. Twenty-three forty Borden Avenue. Take a run over there, will you? I'll settle for it tomorrow night."

Mrs. Krog lived with Joe's sister, Gladys, and her husband. The old lady had a small room on the second floor. As I entered, she stopped rocking and knitting, smiled hello, and went back to her work. I examined the set, an a-c-d-e gidget.

The resistor cord was okay, but the juice didn't get through the chassis. We usually don't pick up a set unless we give a definite price, but since Joe was paying for it, and because it would be easier to work in the shop than in the small room, I wrapped the wires around the box and announced:

"I'm going to check it at the shop. You'll have to listen to the big set downstairs for a while."

She sat there rocking, without looking up from her knitting. I cleared my throat, and spoke more loudly:

(Continued on page 65)
PART 2

In the first installment of this new series on recording which appeared last month we explained the action of the magnetic type of record cutter. This month we examine the structure and technical aspects of the crystal units. In order to clarify on certain points which will help in understanding how these devices work, we shall begin with an analysis of the elements that are used, not only in cutters, but those finding application in speakers and headphones as well. The following paragraphs, appearing in “Technical Bulletin No. 310” of the Brush Development Co., give full explanation as to the function of the crystal cutter.

“To the layman, the operation of crystal sound devices has been shrouded in mystery only because non-technical information on the subject has not been made available. The few basic properties involved are comparatively simple; complexities exist only in the advanced utilization of these crystals.

“Certain crystalline substances exhibit the phenomenon of piezo—(pressure) electricity, i.e., when they are stressed mechanically an electric charge is produced, and conversely, when a voltage is applied, mechanical deformation of the crystal takes place.

“In the first case, the piezo-electric crystal may be likened to a generator, since it converts mechanical motion into electricity. Crystal microphones and phonograph pickups are common examples of piezo-electric generators. In the second case, the piezo-electric crystal may be likened to a motor, since it converts electricity into mechanical motion. Crystal headphones and record cutters are good examples of piezo-electric motors.

“Piezo-electric crystals as used in sound and other devices, such as those manufactured by the Brush Development Company are of the common

Theory and Practice of DISC RECORDING

by OLIVER READ

Crystal cutters are used widely in both professional and home recorders. They are analyzed in this month's article on recording.
crystalline form of rochelle salt (sodium potassium tartrate). These crystals possess piezoelectric properties to a greater extent than any other known material, being approximately 1,000 times more active than quartz crystals.

"The crystals are first grown in large clear homogenous bars about two feet long. For convenience, the crystal plants produce only one-half the natural rochelle salt crystal bar along the diagonals applied voltage.

### Bender Bimorph

(see Figure 2A). They are grown by very closely controlled and advanced methods of the ordinary "crystallization from solution" process. By means of unique methods developed by Brush engineers, these large bars are first cut into slabs (see Figure 2B) and then into the small plates used in the final crystal elements.

### Twister Bimorph

"The two commonly used crystal plates are usually referred to as 'expander' and 'shear' plates, as shown in Figures 2C and 2D.

"The properties of these crystal plates may be expressed in terms of three axes (a-a) (b-b) and (c-c) as shown. These are known as the electrical, mechanical, and optical axes respectively. It will be noted that the 'expander' plate is cut at a 45° angle to the optical and mechanical axes and the 'shear' plate is cut with edges parallel to the mechanical and optical axes.

"When a voltage of given polarity is applied to the two faces of each plate, the mechanical motions developed will be at 45° from the mechanical and optical axes. This means that the 'expander' plate of Fig. 2C will increase its length and simultaneously decrease its width; these two actions reverse on change of polarity of the applied voltage. The cut of the 'shear' plate of Fig. 2D shows that a similar action occurs, but that expansions and contractions occur approximately along the diagonals of the plate in-

### Exchanging Ideas

**THIS column is being written with the sole purpose in mind of enabling police radio men throughout the country to read what the other fellow is doing in his department in his own way to better his own communication system.

Perhaps some of the problems that he has solved are now one of yours and you have not as yet found a solution in overcoming them. By exchanging views with police radio men and discussing the latest trends with the manufacturers of our equipment, we are attempting to be of some assistance in enabling you to increase the efficiency of your department.

Your letters relating your own ideas concerning police radio and the results you have achieved in your department are requested. By receiving your reports we are able to pass on your results to the rest of the field.

**Motorcycle Radio**

**Motorcycle patrolling** is still very popular with police departments, especially so in Metropolitan areas where the only practical method of controlling parking and traffic is with the use of a motorcycle.

Back in the early thirties when police radio was still in its infancy, many departments were beginning to equip their motorcycles with a receiver that was installed on the carrier above the back wheel. The receiver was bulky, drawing many complaints from the police officers due to the difficulty in controlling the machine. Also many technical problems were still unsolved, and the receivers gave no end of trouble to the radio servicemen. Due to the unusual mounting position, the sets were literally shaken to pieces.

In 1938 the saddle type of construction was adopted and is now used universally. The receiver is split, the power supply straddling one side of the wheel, and the receiver on the other. A magnetic type speaker unit is mounted in a weather proof housing on the handlebar. The antenna consists of a rather oval shaped grid mounted on two insulators directly behind the carrier. In some cases the telescopic type antenna is used in preference to the grid type. Volume is controlled by a flexible shaft running from the volume control in the receiver to a position midway between the seat and speedometer housing.

As would be expected, motor noise presented the chief problem in motorcycle reception. Suppressors were tried, resulting in noise reduction in some cases but increased mechanical problems in others. Many of the wheels were difficult to start because of the decreased spark caused by the suppressors, and a quick get-away is essential for efficient motorcycle pa-

(Continued on page 44)
THE radio amateur has been called upon to sacrifice a few of his frequencies in the interest of national defense preparations. On July 22nd, the Federal Communications Commission announced the temporary shifting of the 300-kec. slice of 80-meter ham frequencies between 3650 and 3950 kilocycles to military use. It is aimed to transfer these frequencies by degrees between December 1941 and March 1942 in order to occasion the least inconvenience to amateur activities.

The arrangement will still leave 150 kc. for c.w. at the low end of the 80-meter band and 50 kc. for phone at the high end. However, the Commission intends to allocate additional frequencies for phone operation within the remaining amateur bands.

Military use of the relinquished frequencies in defense preparations is aimed toward more adequate protection of military pilots undergoing training to serve in the nation's augmented air force. It is therefore the patriotic duty of every ham to see to it that no interference is occasioned the military use of the frequencies.

In this article, we are directing attention once more to the various types of interference which might result from amateur operation on adjacent or harmonically-related frequencies and discussing methods for eliminating such a real obstruction to the national defense program.

**Direct Operation**

The sub-band, 3650-3950 kc., will not be authorized operation in that territory will render the perpetrator a bottleneck in the national program. The Commission will notify all amateurs of the frequency shift, and has already expressed in a press release a crystal or variable-frequency oscillator on one of the shifted frequencies, an eventuality which can be forestalled at the outset by immediately regrading all crystals now ground to the forbidden frequencies or storing them safely out of reach "for the duration." And all variable-frequency oscillators may easily be made totally inoperative on the forbidden frequencies. To have no equipment operable between 3650 and 2000 kc. is the surest guarantee against direct operation on those frequencies.

It is a simple matter to adapt a variable-frequency oscillator (electron-coupled or otherwise) for automatic cut-off when tuning accidentally through the shifted frequencies. There are numerous schemes for so throwing these oscillators out of operation over a portion of their tuning range. The scientifically-minded ham might prefer a complicated system of some kind, but most of us will choose one of the simpler methods of automatically shorting out the tuning condenser over the 3650-3950 kc. (or 1925-1975 kc. in the case of 160-meter fundamental) portion of its tuning range.

The simplest and most economical scheme for accomplishing this action consists in bending in a portion of one of the outside rotor plates so that the bent portion makes a sliding contact with the adjacent stator plate throughout the forbidden tuning range, thus shorting out the tuned circuit. The job is made somewhat less laborious if the tuning condenser is of the slotted-rotor construction employed in broadcast receivers.

**Frequency Measurement**

It is, of course, essential that every ham know the forbidden frequencies definitely and precisely when he encounters them. Adequate frequency measuring equipment having no connection with the transmitter frequency-control apparatus is already required by the Regulations and is assumed already to be in operation at every station.

One of the most satisfactory instruments for rapid and accurate frequency measurements in the ham shack is the 100-kec. oscillator—10-kec. multivibrator standard frequency combination. This device will spot the end frequencies, 3650 and 3950 kc. "on the nose," as well as providing twenty-nine accurate spot frequencies at 10-kec. intervals between the end frequencies. Secondary standards of this type have been described in Radio News constructional articles.

In lieu of a good frequency standard, such as just mentioned, a good electron-coupled frequency meter-monitor will suffice, provided it can be calibrated frequently against some known standard frequency. (A broadcast station carrier will suffice for the calibration if no other standard is available.) Such a standard was described in Oct. 1939 Radio News.—Editor.

Any variable-frequency oscillator signal should be frequency-monitored continuously during all transmissions during this emergency if the operator is interested in maximum safety.

Every amateur knows how transmitter harmonics can raise pot with (Continued on page 48)
OUR Seattle Marine Reporter tells us "there is a definite shortage of experienced qualified ops at this port as at all others. A number of the more experienced men have taken jobs in the Alaskan salmon canneries for the season. This created a number of vacancies in the Alaska SSCO and the Northland Transco which were filled by permit members as first and second assistants. The AMI's new boats are really sumpin' with RMCA equipment installed by Don Newman and HD Underwood, former chief at KPE. And best of all, radiop quartermasters that make for morale and efficiency. The designers really knew something, eh.

チャールス・ボルヴィン advis us from Akron, Ohio, that tis four ack emma and not a thing has happened all night ... except a couple holdups, a hit skip and a homicide by a 'culled' boy with a razor . . . 'Red' Dawson missed Uncle Sam's Navy by a 12 year old record which showed a touch of TB. 'S tough on Red . . . the Navy don't want him and the Army can't get him . . . One of the gang from the East Coast writes bemoaning GY's anti-ACA attitude, but even he admits there is a lot of clean-up work to be done . . . Here's an idea to have hundreds of qualified ops with six months experience. The government should get busy on this lake op problem which once upon a time was the school for the salt-water radiop. There would be plenty of chance for a green man to get that first six months without as much danger to the ship's crew. A green man out in the middle of the Pacific or the Atlantic may mean no radio for two or three weeks but on the lakes only a day or two." (not bad . . . Ed).

We hear that Stan McKnight left TWA and is now holding down a pretty hot spot . . . that of Airways Traffic Control at Burbank, Calif. This job is nobody's ice-cream pie, what with every lil word you say going on a phone where only a few people could have played back at you . . . split second decisions to make on which may depend the safety of a plane-load of passengers where one little slip may mean a terrible crack-up . . . and all the time the recorder is grinding merrily away so that alibis are out. As can readily be seen only top grade men ever handle these jobs. They usually go to the "cream" of the airlines ops and they are the ones who deserve the credit for the safety records of such crowded airports as New York, Chicago and Burbank. So FS rates a bouquet or would a horseshoe of four leaf clovers be more appropriate?

Brother A. B. ANDERSON, CTU-Mardiv representative on the West Coast, took over a sea-side billet after being on the beach for the past few years 'rounding up the lost brethren and gathering them together under the banner of the Radio Officers' Union. Although Andy felt that his organizing services were of paramount importance on the Pacific side, a contract with a shipper was of even greater importance. So, unable to procure a radiop to take the ship out, he hopped aboard himself and took the vessel out. Everybody was happy, including Andy, who will for the first time since he became a union official, have a couple of bucks in his jeans at the end of each month. Oh, for the life of a CTU-Mardiv union official! Say, what would happen if the officials struck for higher pay and regular working hours? What an idea, eh?

Brother Fred M. Howe, CTU-Mardiv official, writes in a recent issue of the "Journal" an article entitled "The Six Months' Law," which is so check full of "common sense talk" that we present it here verbatim for the benefit of our readers, former ship radiops who may now be employed in one of the defense industries, radiops with tickets but no experience and/or radiops who have their tickets and experience who are semi-retired and, also, those Congressmen and the FCC whose letters have shown that they are interested in this column . . . Quote . . . There is at the present time a serious shortage of Radio Officers, both experienced and inexperienced. This shortage which was at first observed in the making of a few months ago has rapidly become more acute in recent weeks. This is due primarily to high remunerative inducements offered for work afloat. The rapidly expanding industries directly related to National Defense, as well as some governmental agencies, have taken a great number, comparatively speaking, of experienced.

(Continued on page 64)
Dear Sir:

In accordance with your request, I am setting forth a summary of the information concerning the new allocation of amateur frequencies.

The purpose behind this move is to provide much needed frequencies by our military forces for use in training pilots. The plan for building large numbers of airplanes has been given wide publicity, but it is not so generally appreciated that there is also under way a program for training a very large number of pilots to fly those planes. This program is a part of the national defense effort and it requires communication between students and instructors which must be handled via radio. Government needs having already necessitated the use of a large number of commercial frequencies, this further need for space could be extended only by temporary invasion of the amateur bands.

Although losing some of their previously enjoyed territory, amateurs should feel gratified that the sacrifice is being made for a worthwhile and very necessary cause. A further reason for gratification lies in the manner in which the subject was handled. Rather than remove us from the air without warning by Executive Order, which easily could have been done, the matter was handled as a civil proposition with collaboration between the interested parties, amateurs being represented by the ARRL.

The procedure actually used shows every evidence of a desire on the part of the federal authorities to inconvenience the amateur as little as possible. Further, we are assured that the use of these frequencies by others will be made only for the duration of the emergency and that they will be returned to us immediately when the emergency is over. Actually the amateurs will not, according to present information, be entirely removed from the frequencies; their operation will merely be restricted to hours and location. This means that they are still amateur frequencies and for those inclined to cry "wolf" this should be carefully noted.

Now, as to the actual action taken, up to this writing, to the best of our knowledge and belief the Federal Communications Commission has issued no "orders" but has given notice of what action is contemplated. It is expected, however, that an order will be issued to become effective about December 20th, 1941, which will require and permit the following:

1. Removal of all amateur operation from the 1600 to 1900 kc. band except that A1 emission will be allowed during the day from two hours after sun-up to two hours before sun-down in certain territories which can be roughly designated as the northern part of the country.

2. Removal all A3 operation from the 1500 to 1600 kc. band. (This has the effect of extending the present 1500 to 1600 c.w. band to read 1750 to 1800 kc. thus providing more territory for c.w. to compensate for the loss of c.w. frequencies in the meter band.)

3. Permit the use of A3 operation in the 7250 to 7300 kc. band. (This helps make up for the loss of some of the 1600 meter and 15 meter phone frequencies. The 15 meter change is expected to come later.)

This December 20th change will be the first of three steps. Under it 1800 kc. (2000 to 3900) will be restricted as to amateur use. Sometime later this 1800 kc. band will be widened to 200 kc. by the extension of the frequencies fifty kilocycles each way making the restricted area read 3750 to 3950 kc. The third step, anticipated during the spring, will widen the restricted band still another 100 kc. by extending the limits down from 3750 to 3650 kc.

Amateurs will be informed of the actual issuance of the A1 and A3 orders by the ARRL and from the numerous official broadcast stations. Every amateur is strongly urged to listen to these broadcasts regularly for such information as this in which he is vitally interested.

In the meantime, let us remember that this service which we are called upon to make in the interest of National Defense may be a very serious one. When compared with the contributions being made by so many of our citizens in the Selective Service Act. We should not only be willing but anxious to do it so fully and so effectively as the need is present. Also keep in mind that these restrictions are temporary at the last, effective as of July 2nd.

H. W. Hamilton, W9MRQ, Assistant Director, Central Division, ARRL

The Heart of America Radio Club is planning to hold its annual Convention to be held October 11th and 12th at the Hotel Midway in Kansas City, Mo. A full program is promised with entertainment, games and plenty of prizes, topped off with a banquet. Full details must be found by writing J. N. Blair at Box 7082 Kansas City, Mo.

Ham Chatter from West 11th:

W9DIV, Bob Of Woburn, Mass runs 24 watts to 40 meters on 66 ft. Antenna is a 66 ft. 200 p. Revi is a Super Skyrider. QRH is 1111 kc.

(Continued on page 65)
NYA Installs Centralized

The National Youth Administration has been teaching radio to many of its students. An entire high school installation was one project.

A COMPLETE centralized sound system has recently been installed in the Roaring Spring High School at Roaring Spring, Pa. by the Altoona Radio Workshop of the NYA and is one of the first projects completed under NYA’s expanded national defense work.

This expansion has been made possible through a special Congressional appropriation made upon the recommendation of the National Defense Commission and industrialists in an effort to give as many young men and women as possible the opportunity to test and develop their skills so that they can take an active part in the national defense program.

Pennsylvania has joined its sister states throughout the nation in making it possible to provide young people with the opportunity to obtain practical work experience in various types of radio work. It is the hope of the NYA and the Defense Commission that through this work experience and the supplementary training they receive through the school system, they will be, among other things, able to qualify for an FCC amateur license. With these operators, a nationwide NYA net-work of short-wave radio stations will be set up which will be invaluable in any emergency.

The Sound Service System at Roaring Spring was constructed from component parts and installed in the school by NYA youth. The installation covers three buildings with a total of 21 rooms and over a mile of wire was used. Some of the special problems included the placing of underground cable connecting the three buildings which were located across a street from one another.

The main unit and controls are located in the principal’s office. This unit consists of five sections, a public address amplifier, a radio tuner, an intercommunicating amplifier, a tran-

(Continued on page 63)
This group of girl students are assembling the parts for the speakers that will be used in the classrooms of the school.

Sound System

The completed unit was subjected to final test and found to be perfect.

The control console as it appears after being installed in the Administration office of the high school. The radio tuner is on the top panel.

Wall-type speakers installed by students in one of the classrooms.

Every joint is carefully checked to assure the best performance.
New 10-Watt Bell Amplifier

Among a number of units of equipment attracting special comment is a newly designed, streamlined 10-watt amplifier, shown by the Bell Sound Systems, Inc. of Columbus, Ohio. It was one of a completely new line presented by this company.

Several valuable features are claimed for this popular sized unit. It has individually controlled electronic base and treble boost which permits unlimited tone selection. Supplemented by inverse feedback and beam power output tubes, it eliminates feedback difficulties to a remarkable degree. The inverse feedback also stabilizes the amplifier and brings improved wave-form at low frequencies.

Three microphone channels and a phono pickup channel have separate volume controls, permitting any combination of volume. A tap type impedance switch is built into the amplifier chassis. Plug-ins are provided for using and matching as many as six speakers.

The streamlined housing is of hammered metal construction, which gives a rich two-tone effect to the "dust-proof" gray finish. The unit is trimmed in dark red plastic. Pointer dials are mounted on an inclined panel and are indirectly illuminated. Dials have remote knob control.

Airline 25-Watt Amplifier

Shown below is a rugged, dependable low cost 25-Watt Airline Amplifier, symbolized of the new Standard line of Montgomery Ward Sound Systems. The entire group comprises an 8, 15, 25, 35 and 50 watt size for use on 110 volt, 60 cycle a.c. and 14 and 20 watt mobile type for use on a.c. and 6 volt battery as well. No frills, no useless gadgets to get out of order—but a reliable P.A. System unit to withstand any kind of operating conditions. Six high efficiency tubes are used with Beam power push pull output.

A wide selection of speakers, projectors, haffle cases and other accessories is available. Also in many instances a choice of as many as six popular microphones is available at one common price. On the 35 and 50 watt size a simple speaker impedance matching device is built in. This provides the following outputs: 2, 4, 8, 16, 250 and 500-ohms. In addition the usual two speaker sockets are standard equipment. Montgomery Ward & Co., 618 W. Chicago Avenue, Chicago, Illinois.

Knight 20 Watt "Bantam" P.A.

Allied Radio Corporation, Chicago, introduces a revolutionary 20-watt compact Sound System that is exceptionally light weight and ingeniously portable. Scientific Sound Research has at last produced a "Bantam" unit with perfectly distributed weight-balance, simplicity of design and operation, and elimination of speaker case rattling.

It is easy to carry, easy to set up and use—with all the power needed for most performance. Schools, Orchestras, Carnivals, Lecturers, and Demonstrators will readily appreciate the remarkable and practical flexibility contained in a unit no larger than an average suitcase.

The complete "Bantam" portable includes: 1—Knight 20-Watt Amplifier with tubes and built-in phone; 1—Shure Crystal PA Mike with 25-foot cables and plugs attached; complete instructions. It’s housed in the most compact case available today—finished in brown air-luggage cloth: size: 24”x10½” x10½”; weighs only 40 lbs.

The rugged amplifier with phone top is housed in the center section of the case. It has 20 watts usable power output (20 watts peak); hum is negligible (55 db. below rate of output). Output impedance, 4 and 8 ohms; supplies field excitation for two 2500-ohm speakers. Has three input channels, one for high-gain mike with individual control. Gain on mike is 127 db.; on phono, 70 db. Frequency response is 50-15,000 CPS. Tubes used are 1—6S17, 1—6SC7, 1—574, 2—6L6. Line drain is 160 watts. Fully fused for operation from 110-120 volts, 60 cycles a.c. E.R.P.I. licensed.

Thordarson Filament Transformer

Thordarson announces the addition of a new "19" Series Filament transformer. This transformer, T-19FTS, is especially recommended for use with the new RCA 816 rectifier tube. Characteristics of the tube make its application particularly suitable for amateur radio work, and Thordarson, realizing the inevitable popularity of the tube, designed the T-19FTS to match it.

The T-19FTS is an open frame type with a 115 volt 50-60 cycle primary. Its secondary rating is 2½ volts at 1amp. The type is given in Catalog No. 400-F, available free from any Thordarson distributor, or direct from the factory: Thordarson Electric Mfg. Co., 300 W. Huron Street, Chicago, Illinois.

New Speaker Works in Water

An unusual feature of a recent National Defense sub-contract accepted by Cinadograph Speakers, Inc., 921 W. Van Buren St., Chicago, was the fact that the speakers had to be tested under water to meet stringent U. S. Navy requirements.

This problem, difficult at first, was solved by the use of entirely waterproof materials throughout. The cone and spikes were made of components which were water-resistant, and non-soluble cement was used in putting them together. All metal parts of the unit were first plated and then treated with a water-repellent coating.

Normally, speakers are somewhat sensitive to moisture and heat conditions, but those built by Cinadograph under the sub-contract in question were to be used on one of Uncle Sam's new battleships under construction, and hence had to withstand all kinds of weather to insure continuous operation. The Navy wants no failure in communication when the going gets "wet and heavy." Of interest to engineers is the fact that the speakers actually seemed to work as well under water as in air except for the greatly reduced power required to activate the unit. The cone action was the same in either medium, but the voice coil withstand 300% more watt-
The portable systems incorporate a full length microphone stand.

**New Record Disc**

Rainbo Record Co., Los Angeles, now comes on the market through trade channels with a new instantaneous recording disc that can be cold pressed. Base is of flexible thermostized board base and surface coating of cold pressed nitrocellulose. Primarily deals will be for ballasts and diodes. Initial tryout was midst at army camps for personal messages. Music and stock announcements can be cold pressed on the discs, and blank space left for personal messages to be dubbed in. Printed matter and illustrations on the surface of disc do not interfere with the recording.

**New Geared Vernier Dial**

A precision-built gear driven dial has just been announced by宝 Radio Inc. of Cleveland, Ohio. This dial is designed for use on such equipment as electron-coupled oscillators, frequency meters, receivers, and other instruments, where extreme accuracy of calibration is essential.

This dial is driven with spring-loaded gears to insure freedom from backlash. It is calibrated in 500 divisions over the 180 degree scale. The dial is easily panel mounted and furnished with complete instructions. The gear drive unit is mounted behind the panel, and the dial scale is mounted on the front of the panel. This scale may be removed for calibration without removing the dial drive. Mounting area is 5 1/2 by 5 1/2. The gear ratio between the knob shaft and pointer shaft is 10 to 1. All friction clutch on the knob shaft prevents damage to the gears when maximum or minimum rotation is reached.

**70-Watt Audionog Cable Amplifier**

A 70-watt amplifier, for use in hall parks, stadiums, church towers, and other large installations requiring high power without distortion, is announced by John Meek Industries, 1313 W. Randolph St., Chicago. Listing at a price under a hundred dollars, this Model B-70C offers "stadium" power at low cost.

Four independently controlled microphone input channels and one phono input channel allow handling of large stage set-ups. The unit embodies two separate power transformers and rectifiers to assure good regulation. Output impedances of 2, 4, 8, 166, 250, and 500 ohms are provided for connecting as many speakers as desired. A monitor speaker and monitor volume control may be supplied.

**Linear Time-Base Generator**

A low-frequency linear time-base generator, to be known as Type 215, has been developed by the engineers of Allen B. Du Mont Laboratories, Inc., Passaic, N. J., for release this fall. This instrument will be especially valuable in facilitating studies of low-frequency phenomena, such as found in vibration studies, strain analyses, physiological applications and similar usages.

(Continued on page 62)

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**New Phono Amplifier**

Webster-Rauland's new phono amplifier is designed to give better reproduction from phonograph records. Automatic volume expansion permits true fidelity expression of voice and music as recorded, particularly in bringing out the crescendos of the fuller passages and the diminuendo of the softer tones. Unit is designed with vertical front panel and within specified dimensions to permit rack mounting if so desired. Incorporates such features as: automatic volume expander up to 10 db; Dafel fader-phono unit, permitting mixing and fading of two phono's; two separate tone controls, each increases or decreases treble and bass respectively; master volume control with A.C. switch. Webster-Rauland, 4125 W. Armitage Ave., Chicago.

**New Erwood Products**

Erwood Sound Equipment Company, 227 West Erie St., Chicago, Illinois, have just announced a new series of portable and fixed public address systems, having power of 30 watts.

The amplifier has provision for using four microphones. Also it is said that a new method of tone equalization has been developed in connection with this amplifier, giving greatly increased tone range control.

The amplifier is housed in a modernistic cabinet with an attractive indirect lighting scheme. Microphones are of the Unidirectional type to facilitate reduction of feedback.

Speakers are of the Permanent Magnet type, and are available in either portable cases or in permanent type walnut finish.
New IRC Control Manual Lists 1/3 More Models

FULLY revised up to the last minute, listing almost one third more replacements for radio receiver models than ever before, and giving complete control information at a glance, the new IRC Volume Control Replacement Manual is now available to members of the radio service profession. Copies may be obtained through authorized IRC Control Jobbers, or will be sent direct from International Resistance Company, 401 North Broad St., Philadelphia, Pa., to servicemen whose jobbers are unable to supply it.

Greatly enlarged in contents, printed in new, easy-to-read 8½" x 11" size, the IRC Manual contains 136 pages including much helpful and detailed control information never before published in a handbook of this type. Utmost accuracy is assured by the fact that replacement control recommendation charts have been checked and double-checked against manufacturers' original drawings, revised specifications or latest engineering data. All needed information from manufacturers' original part numbers to Rider's Manual reference, price, resistance value, switch data, etc., is obtainable at a glance.

Supplement to Sylvania Technical Manual Lists Recent Tube Types

RINGING the Fifth Edition, second printing, of the Sylvania Radio Tube Technical Manual up to date is a six page, parallel fold supplement which lists all types announced in the interim. It is strip gummed on the back page permitting easy mounting to the inside back cover of the Technical Manual.

These supplements are being offered free to all holders of the Sylvania Technical Manual. They can be secured either through Sylvania jobbers or by writing direct to Hygrade Sylvania Corporation, Exeterium, Penna. The current Technical Manual is being shipped to purchasers with the new supplement fastened in place. The price remains unchanged, 35c.

Hygrade Sylvania Corporation, 500 Fifth Ave., N. Y. C.

Allied Is Out with 1942 Radio Catalog

ALLIED RADIO CORPORATION, 433 W. Jackson Blvd., Chicago, Illinois, is one of the first to announce the release of a new 1942 catalog. A large publication, comprising 212 pages, it represents months of preparation, research and market-combing in tabulating complete stocks of Everything in Radio. All merchandise is carefully arranged in clearly defined sections and precisely indexed for speedy reference.

Allied's new catalog is printed with attractive covers in color. Dramatic interest is especially heightened on the front cover by a control-tower view of an Army Air Corps photographic furnished by the War Department. It emphasizes the essential role modern radio communication fulfills in our National Defense Program.

Fifty new 1942 Knight radio models embodying the latest styling and new features are presented in a handsome 32-page rotogravure section. Introduced are latest FM models, luxuri-

(Continued on page 63)
Now as Always...

YOU CAN DEPEND ON "ALLIED"

FOR EVERYTHING IN RADIO

AT LOWEST PRICES!

FOR SERVICEMEN • DEALERS • SOUND MEN • AMATEURS • BUILDERS

Today, more than ever, ALLIED is the one name that means Everything in Radio. Today, more than ever, you can always depend on ALLIED for fast, complete stocks of the leading makes of diversified equipment in every field of radio and electronics. You can always depend on ALLIED for quality merchandise that's "tops," for rush-service direct to you on all orders, for those extra values you'll not find equalled anywhere in radio today. There's never been so complete, so value-packed a catalog as the new 1942 ALLIED book— the FREE 212-page Catalog you'll need to keep up with radio. Servicemen, Dealers, Amateurs, Sound Men, Experimenters—send for your copy of Radio's Greatest Catalog with the lowest prices in the entire field.

50 New Set Models

You'll want to see the 1942 KNIGHT "Radio III" models—more than 50 of them—featuring the newest styling, latest developments, low prices that can't be challenged. There's a radio for every room—New FM-AM models; Insulated Photo-Radio Period Models; new continental-style plastics; Table Models; portable, recorders—radios; farm sets; auto radios—radios for every purse and purpose!

Knight Sets PA Pace

There's a big new section devoted 100% to PA. New Systems—7 to 60 watts; new hi-fidelity power amplifiers; new type "Bantam" Portable Systems; Everything in microphones, speaker and phone accessories; valuable data and charts on how to select the right sound system. Get the facts about our 15-Day Trial Offer and the Easiest Time Payment Plan in PA! Write for FREE complete advice regarding your PA problems.

Big Service Section

The most complete catalog in radio's history—nothing like it ever before.Pages after pages of the very latest quality Test Equipment—all the leading makes—all the latest gadgets, tools, books, to make service work easier, faster, and far more profitable. And more than 50 pages devoted exclusively to replacement parts for repairing any make and model radio. It's the Serviceman's Buying Guide!

Fluorescent Lighting

For those extra profits, and extra savings, see our completely new Fluorescent Lighting rotogravure section. Here's a wide variety of low priced easy-to-install new fixtures and accessories for commercial, industrial and home lighting applications—at new low prices that will amaze you! It will pay your large dividends to investigate this profitable new field! Clip the coupon below for the most reliable fluorescent guide to complete stocks available now.

ALLIED RADIO CORP.

833 W. Jackson Blvd., Dept. 1-K-1
Chicago, Ill.

Clip the coupon below for the most reliable fluorescent guide to complete stocks available now.

ALLIED RADIO

833 W. JACKSON BLVD.
CHICAGO

October, 1942
Turner in his article, this month, gives practical solutions in overcoming any difficulty in the operation of amateur equipment in keeping the desired transmission from falling within the "foamed" frequency spectrum. Every ham should read this article as it is most timely. 

A VERY excellent, low-power, all-band transmitter is featured this month which uses a minimum number of parts and which may be built at an extremely low cost. 

OUR mail frequently brings in requests from readers, particularly servicemen, for information on obtaining jobs in industries that are making use of radio equipment. Many servicemen have already found their way into the aviation field. How they did this is told in the article, "Life Begins at 4:15," written by Mr. E. H. Leftwich. This article will answer many questions the serviceman may have on his mind. 

THE enthusiastic interest which radio holds for the amateur equals, if not transcends, that of any other hobby. Unlike some pursuits, there is no pecuniary motive for the radio amateur; he functions solely for his own entertainment and enlightenment. His ardor has built up an exemplary fraternal spirit which has contributed much to the advancement of radio in general. In flood, hurricane, or other localized emergency the "ham" can be depended upon to establish communication when wire service is temporarily disrupted. And from the patriotic amateur ranks Uncle Sam is now obtaining many operators and other technicians urgently needed for the national defense. In the theatrical profession the term "ham" is more or less derogatory, but among radio amateurs it is a coveted honor. Amateur licenses are eagerly sought, and proudly cherished. It is a personal distinction to be a "ham." Therefore, there was nothing singular that Leo Sadowny, 482 Ashford St., a Brooklyn, N. Y. youth, was among the many who of late applied to the Commission for an amateur radio operator's license. But remarkable is the fact that this particular applicant is deaf, dumb, and blind! Stranger still is the fact that he qualified. Despite his handicap, the young applicant had passed the prescribed written examination at the Commission's nearest office field. To 10 pages of questions and problems, he submitted 30 pages of answers written by himself on a Braille typewriter. In the practical tests the candidate demonstrated that he could "hear" radio-telegraph signals through vibrations produced by special devices. The result is that this aspiring 21-year-old is, according to Commission records, the first deaf, dumb and blind licensed amateur radio operator. 

THE FCC listening posts, set up to analyze foreign propaganda, have scored two notable successes in the work of attempting to predict military and political moves of the Axis. 

The first was to predict, days ahead of time, the German invasion of Russia. This the FCC agency was able to do by noting the change in tonor and technique of Nazi short wave broadcasts. The second was to call the turn on the Japanese push to the south, by analyzing Jap broadcasts carefully. The listening posts are coming more and more under the wing of Gen. "Wild Bill" Donovan, chief of Government Information and mystery man of Washington. No one seems to quite know what Gen. Donovan is doing, but the general suspicion is that he's directing our foreign intelligence and espionage activities. The listening posts are turning their dope over to him directly. 

METALS required for the manufacture of replacement tubes and condensers needed to keep in operation the bulk of 50,000,000 radio sets in the United States are allocated to that use, in a program just announced by Leon Henderson, Administrator, Office of Price Administration and Civilian Supply. . . . The program stipulates that during the period of from August 20 to November 30, 1941, the highest civilian rating shall be given to specific amounts of metals required to make tubes and electrolytic condensers for replacement. Some of the metals are . . . nickel, steel, aluminum, copper, chromium, tin, brass, etc. Appropriation among the various manufacturers of the metals allocated is keyed to the program through the ratio of each makers dollars sales of tubes and condensers to the aggregate industry dollar value sales of the same respective items in that year. This confers the findings of Mr. Lew Winner. Read his article on "Priorities" in this issue. 

TWO more suspensions have been announced by the FCC for communicating with foreign countries. A number of such offenses has fallen off sharply and it is like most of the boys have learned that the man with the whiskeys isn't fooling about this. 

Those suspended recently were Robert F. Avrutik, W2VNO, Yankee, N. Y., for communicating with Honduras, and Charles S. Lewis, W1ANR, Jamaica Plains, N. Y., for communicating with Brazil. At the same time, the FCC announced suspension of two Texas radiotelephone operators. It was charged that W. C. Dove, of Orange, Texas, impersonated Homer Bowman, a fellow townsmen, in taking an examination for a restricted radio telephone permit. Dove passed the examination all right, but the FCC alleged that he did so for his friend and picked up both of the men's tickets. 

AT this writing we are looking back on the "Jamboree" which was sponsored by the Hamusters and took place here in Chicago over the Labor Day weekend. We saw a great many old friends and acquaintances, not a few of whom were wearing the uniforms of Uncle Sam's various services. Nice looking lot of fellows, those Truly the "cream of the crop" and deserving of every ounce of our respect! 73, OR.

Low Power All-Band Xmt. 

(Continued from page 7)

It was found that the 66 to 150 meter coil would resonate at 160 meters; the 33 to 75 meter coil on 75 meters; the 17 to 41 on 40 meters; and the 10 to 20 meters on 20 meters. The 150 meter coil consists of three turns of number 14 wire, 1 1/4 inches in diameter spaced 3/4 of an inch between turns with the antenna part of the coil being three turns of number 18 rubber-covered flexible wire arranged so that it may be meshed with the rigid portion of the coil. The windings are made in air, and are mounted on the coil form of which all but a quarter of an inch of the form is sawed off. Both the plate and the screen are modulated.

Audio Section

With a high-level crystal, microphone, several watts of audio energy may be realized from the output of the 25B6G modulator tube. A five megohm input resistor is used to the 6S7, and the cathode is biased with a 500 ohm resistor, and by-passed with a 25 mfd. 25 volt condenser. A 50,000 ohm resistor is used in series with the plate resistor which is 100,000 ohms, and the screen resistor, which is 300-
000 ohms. The decoupling is accomplished through the use of two .1 mfd condensers. The suppressor grid is externally connected to the cathode.

A .01 mfd. paper condenser is used to couple the speech amplifier to the modulator. Microphone gain is controlled by a 500,000 ohm potentiometer. The 250 ohm cathode resistor for the modulator is by-passed by a 25 volt .001 mfd condenser. A speaker connected to the modulator will convert this unit into an excellent low power public address system.

Voltage doubling is accomplished by a 25V6 connected in the conventional manner, that is, such that two condensers are charged on alternate cycles, and the output is taken from these two condensers which are connected in series. These two condensers as well as the output condenser are 16 mfd, and are rated at 350 volts d.c. The filter choke has an inductance of 8 henries. On fone operation with a load of about 100 mills this power supply delivers approximately 135 volts. If much c.w. operation is contemplated it would be advisable to make arrangement for disconnecting the plate of the audio section so that an increase of plate voltage may be had for the r.f. section. In this case the plate voltage will be in the neighborhood of 200 volts.

The adjustments at high frequencies may be somewhat more critical than at lower frequencies, but if the apparatus is constructed with reasonable care one need not expect too much difficulty. The formula for getting upward modulation is to have a very active crystal, to keep the amplifier slightly detuned on the lower side, and not to couple too tightly to the antenna. The modulation capability of this transmitter is about 80% to 90%.

The chassis cannot be directly grounded because of the type of rectifier circuit used. After one is familiar with the transmitter it is possible to change bands in about half a minute.

The Favorite Quality Line
COSTS YOU LESS!

RCP-661 ELECTRONIC MULTITESTER
Vacuum Tube AC and DC Volt Meter, Capacity and Ohmmeter

DEALER NET $36.95

Make complete checking tests on AM, FM and television receivers under actual operating conditions, without disturbing the circuit constants! Model 661 has all the newest, needed ranges, including capacity measurements from .00003 mfd. to 1000 mfd. Vacuum tube DC volt-meter impedance 160 megohms on high ranges, 16 megohms on low. Vacuum tube AC voltmeter input capacity only .00005 mfd. Look at all the useful ranges of this great test instrument value!

DC Volts-0/15/100/500/1500/6000
AC Volts-0/1/5/10/50/500/1000/6000
Ohm-0/100/1000/10000/10 meg./100 meg./1000 meg./10000 meg.
Capacity-0/.001/.01/.1/1/10/100/1000 mfd.

You Get All-Quality test equipment when you specify Radio City Products. That means long test instrument life at peak operating performance, advanced features throughout and obsolescence minimized. You enjoy all this at lowest prices, moreover. That's why it pays to use and recommend RCP. See for yourself. Send for new FREE catalog describing the entire line of RCP dependable test equipment. Prices subject to change without further notice. Buy now and save!

Radio City Products Co., Inc.
85 Park Place, New York, N.Y.
Book Review
(Continued from page 34)

NEW GHIRARDI REVISED SERVICING HANDBOOK READY


All of the features which made the old edition so popular have been retained, but every page has been completely revised and brought up to date. In addition, over 200 pages of new receiver "Case Histories," Charts and Tabulated data never before published have been added—increasing the size of the book by 40%.

Now featured among the 710 manual-sized pages of useful data in the new Ghirardi Handbook are 386 pages of trouble "Case Histories" for over 4,800 models of receivers and automatic record changers (the largest "Case History" compilation ever published), a 50-page tabulation of the receiver "I-F Peaks" and alignment data for practically every known superhet receiver, 64-pages of tabulated data and charts compiled particularly 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.

The new Ghirardi Handbook is an imposing volume of 710 pages, 8½ x 11 inch (manual size), bound in handsome gold-lettered Fabrikoid with a stiff cover meant to stand many months of rough handling in the shop. To really appreciate its completeness and merit, every service man should examine a copy for himself—page by page.

Copies may be obtained through your regular jobber, or direct from the publisher, Radio & Technical Publishing Co. of 45 Astor Place, New York City. It is priced at only $3.50 in the U.S.A. ($4.00 Foreign).

Police Radio
(Continued from page 32)

Trolling. In some cases the noise peaks were of such an amplitude to allow the AVC of the receiver to decrease the sensitivity in short pulses resulting in very erratic reception. Under these conditions it was almost impossible to copy a signal with the motor running.

All sorts of combinations of chokes and condensers in the power supply and battery lead were tried with little success.

Further experimentation proved that motor noise could almost be eliminated by completely enclosing the entire ignition system including the coil, ignition wiring and spark plugs. The ignition wires running from the spark plugs to the distributor coil are enclosed braiding and grounded to the frame. This braiding connects to a metal cap which surrounds the spark plugs.

Experience with motorcycle receivers shows the following components to give the most trouble.

The magnetic speaker seems to be the greatest trouble maker. Vibration apparently is a little too much for the armature, which gradually wanders off center toward one of the pole pieces causing severe distortion. Vibrators also cause their share of trouble, especially the cheaper grades. In these units the leads from the vibrator itself to the prongs in the base actually break open under the extreme conditions which they must work. Only the best vibrators available are recommended for this service.

Another cause of grief to radio servicemen is the speaker cord running from the receiver to the housing on the handlebar. It is a single conductor shielded lead terminating in a bayonet plug at the receiver end. Vibration of the machine again rips the braiding from the bayonet plug, causing an open speaker circuit.

Tube failures occur at about the same rate as in any other mobile unit, however the converter (6AB) seems to be the weak link in the tube lineup. We notice in the later models this tube is now being replaced by a 6K8.

With the exception of these difficulties, motorcycle radio reception is excellent despite the punishment delivered to the receiver.

The Indian Motorcycle company medium high frequency receiver built by RCA is designed to operate on either the 1600-1720 kc or the 2300-2500 kc band. This is accomplished by shorting out a portion of the antenna, RP, and oscillator coil when operating in the latter band.

The circuit is the usual super-heterodyne. Metal tubes are used except the power output stage, where a type 38 tube is utilized. The unit is very compact and extremely rugged.

Since the recent popularity of the ultra high frequencies for police radio, Indian is now marketing an ultra high receiver made by General Electric covering a frequency range of 30-42 megacycles. The receiver is placed into the same type of housing as the medium high receiver. It is a simple super-regenerative circuit containing only four tubes. Both receivers use a synchronous vibrator power supply and drain about 2.8 amperes from the 6 volt storage battery.

Personalities

FRED H. SCHNELL, chief engineer for the Chicago Police radio system has reported for active duty as lieutenant commander at the post of communications officer for the ninth Naval district. Frank McLoughlin will take
over the reins of the department.

Fred is well known in the police radio field, being one of the first engineers to experiment and adopt FM for his department. He has been given an indefinite leave of absence from his police post.

A feminine voice is being heard on the ultra-high radio police band at Altoona, Pa., in the form of Mary G. Ferry, secretary to chief of police Arthur V. Yoh of the Altoona police department.

Miss Ferry recently received her restricted radio telephone license and is now actively engaged in operating the station WQZJ on 37.1 meg. She is the first feminine resident of Altoona to hold a radio operator’s license. After accepting the position of secretary to Chief Yoh, she became interested in the radio system and passed her examination last May.

Delaware Turns FM

M. LINK & CO. has been awarded the contract to install FM equipment for the Delaware State Police.

Connecticut incidentally has increased their number of mobile installations to over 300. It looks as if the eastern states are really satisfied with FM for their state communication systems.

Recently we have been hearing many reports of the greater distances being covered by police departments installing FM equipment, but Stanley Mattison, chief op at WSTF La Crosse, Wisconsin, sends in the following interesting report on his LaCrosse County radio system.

The system uses Motorola AM equipment and covers completely the entire county of 481 square miles. The terrain changes from 700 to 1500 feet approximately six times. The area is all hill-and-dale and the radio area is on a bluff or hill down in the valley. Communication from car to station has been achieved at distances of from 60 to 90 miles airplane.

Just recently WSTF has been serving two mobile units of adjacent Jackson county having an area of 990 square miles. This means a working range of 60 miles must be maintained. The coverage into this county is approximately 75%.

Mattison has a 250 watt transmitter on 31.5 meg, feeding a coaxial antenna on a 175 foot self supporting tower. All receivers are also out at the transmitting location about 5 miles out of LaCrosse on top of a 1500 foot elevation.

Communication is always maintained with WBDX at Wausau, Wisconsin, which is an airline distance of 110 miles.

This report only proves that a well designed AM system can still give very satisfactory service despite the fact that it is being termed old fashioned since the advent of frequency modulation.

Grid Dip Meter

(Continued from page 11)

minating the calibrated variable condenser. Each set of two is mounted on a 4 x ¼ inch piece of bakelite. The holes are drilled in the case large enough to prevent the metal binding posts from touching the chassis. The two bakelite strips are then mounted on the front and rear of the case. Insulated binding posts mounted directly to the case could also have been used for this purpose.

The grid condenser is connected through a 3½ inch grommet, one side of the line connected directly to the case, the other side going to the switch on the back of the screen voltage control. This switch was added later and is not shown in the illustration.

A closed circuit jack insulated from the case is mounted directly below the line cord entrance. This jack of course is wired in such manner that it provides a closed circuit to the plate current when not in use, but as soon as the phone plug is inserted, the current passes through the phones.

The tube socket is mounted on a 2 x 2 inch piece of sheet steel and secured to the back of the front panel. The tube is mounted horizontally next to the meter. The grid leak and condenser is mounted between a tie lug and one of the detector input binding posts. The other input post connects to the chassis.

The variable condenser and pot. are also mounted on the back of the front panel, the condenser terminals wired to the condenser input posts with number 14 busbar. The condenser is not insulated from the case so one of the posts will be grounded. It may be calibrated against a known standard calibrated condenser by the substitution method, or more simply, by utilizing one of the many condenser testers on the market. The former method is more accurate, but for all practical purposes the latter method can be used. A curve is then plotted of dial reading vs. capacity and the accuracy of these values will depend on the accuracy of the condenser tester used.

Using the Detector

In making use of the instrument for measuring inductance of coils, the unknown coil is placed across the detector input posts, with the calibrated condenser posts wired in parallel. A short test lead with alligator clips is used for this purpose. Since one terminal of each input is grounded, only one lead is used to connect the two opposite terminals together. The signal generator is then coupled to the coil by making a loop of several turns of wire placed around the coil, and the condenser is set to some even numerical capacity to simplify calculations. The signal generator is turned to the band which resonance is believed to occur with the coil and con-
CHASSIS CABINETS RACKS PANELS

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For Quality and Beauty

Whether you want a "standard" job or a De Luxe job—you’ll find that every Par-Metal part has been accurately machined for easy assembly and smartly designed to give the finished job the look of commercially produced equipment.

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Moisture, visible or invisible, will cause trouble if it can penetrate the protective surface of a resistor. A microscopic examination of the surface of a Vitrohm Resistor will show freedom from even minute enamel crazes or cracks. The resistance wire is sealed in Vitrohm, a glass-like enclosure, excluding moisture and assuring complete protection.

WARD LEONARD ELECTRIC COMPANY
47 South Street Mount Vernon, N. Y.
A MONTH after television's commercial debut found CBS requesting a thirty-day extension of the original month's program test period for its New York eye-and-ear station, WCBW.

A chief blame for the delay was placed on insufficient equipment for commercial operation.

The CBS announcement tersely concluded with the statement, "The portable equipment necessary to release the CBS television studio for commercial operation was ordered by CBS two years ago. It has not yet been delivered."

BIG technical improvements will be completed at WNBC, the General Electric station in Schenectady, New York, when the station resumes operation at an early date. Power will be increased from 3 to 70 kilowatts for sound and from 10 to 40 kilowatts for images. When completed, the transmitter and studio set-up will be one of the best in the country and will serve upper New York State with local programs in addition to rebroadcasts of WNBC's offerings in New York City.

The Video Reporter had a recent chat with Sterling Fisher, CBS director of education, who has great faith in television's future as a classroom aid. Mr. Fisher did not see present types of schoolroom visual aids threatened by television. He thinks they will have their place all the more when lessons "by television" are received in the schools. He pointed out that the image on the receiver screen is a fleeting and vanishing complex of moving visual lessons are over. Hence, he said, television will not replace the blackboards, maps, globes and charts that have been pedagogical stand-bys for many generations.

When Radio City was built in New York several years ago, a cluster of studios in the clover leaf formation was "set aside" for television. Guides taking paying customers on studio tours always pointed to the clover-leaf unit with pride and told of its eventual television usage.

However, when television did come along it was relegated to a single third floor studio and the NBC video staff was divided on two other floors. Now, the personnel at long last is grouped together in the adjoining Sixth Avenue Building. Passageways connecting the third and fourth floors of that structure with the NBC section of the RCA Building were built to permit the video staff to go from office to studio without using elevators.

But what's become of the clover-leaf studios? It seems as if television could make mighty good use of a clover leaf right now!

DISCUSSING the commercial call letters of the NBC video station, a company spokesman pointed out that WNET could apply for merchandised under the slogan of "Why Not Buy Time?" And we couldn't help mentioning the possible response of: "We're Not Bothered Terribly."

And we could have added much initial pointers as "Why Not Boost Television?" and "We Need Better Television."

However, we don't doubt that television time will be salable in big units once the programs improve and there are real merchandising efforts for video receivers at reasonable prices.

The first handful of sponsors has already taken a crack at television and some of the efforts to present visual advertising blurs have been interesting. The chief handicap seems to be the formula of radio commercials built up to tremendous proportions by sound broadcasting. Many commercials seemed overdone in sound radio alone: now, with the eye as well as the ear getting the ballyhoo, everyone concerned should proceed carefully lest the attempt be overdone.

But, for a sample, let us quote from a recent NBC announcement regarding the signing of the television program of the Miami of the Clovers as a sponsor: "The programs, which will begin soon, will consist of an unique presentation each evening of the weather report for the following day, together with a visual exposition of one or more of the floray products which include wrinkleproof ties, robes, men's and women's wear fabrics, yarns, and Lanolin beauty aids."

The home television receiver, some look-and-listener's comment, is not a show window for sound broadcasting. As in radio broadcasting, the listener is willing to receive a limited commercial along with the entertainment the advertiser pays for. But the temptation for advertisers to go overboard on the idea of parading their wares before the studio camera will result in many darkened home television screens.

DuMont deluxe television receiver.

The home television receiver, some look-and-listener's comment, is not a show window for sound broadcasting. As in radio broadcasting, the listener is willing to receive a limited commercial along with the entertainment the advertiser pays for. But the temptation for advertisers to go overboard on the idea of parading their wares before the studio camera will result in many darkened home television screens.

DuMont 20" Teletron video tube.

Incidentally, television station operators and agency executives are alert to the fact that a brand new technique for presenting commercial spics must be perfected in order to reach mass television audiences.

And here's a tip for creative writers: The market for television scripts—particularly commercial ones—is growing, and the station and agency desks are in a mood to consider the worth of all ideas presented.

The manufacturing future of television is none too bright at the time of this writing. While the industry is being allotted materials for "essential" radio services, the status of television as "essential" in a period of national emergency is problematical. However, word from laboratories and manufacturers imply that television production plans are progressing along, as yet, there is no intensive effort at merchandising.
radio communication. One hundred and sixty-meter waveband which will place harmonics within the 80-meter military band will lie between 1825 and 1975 kc. Hams operating 160-meter rigs in that spectrum must take every precaution to eliminate all harmonic radiation. A high-fil amplifier should be employed wherever practicable. In addition, loose antenna coupling and Faraday shields should be used in the antenna circuit.

Antenna circuits must be carefully tuned, and coupling critically adjusted. Matching networks which give rise to harmonic radiation must be thrown out. Wires or metal pipes which might be parasitically excited must be removed from the antenna field. In short, any condition of operation which gives rise to harmonic radiation in 1825-1975 kc. transmitters is to be regarded as a bottleneck in our country's defense program and is not to be tolerated.

"Superhet" Interference

We assume that superheterodyne receivers will be employed in military use of our relinquished frequencies. If this is the case, then the peculiar unintentional type of interference due to images and other phantom signals may result from operation of nearby 80-meter transmitters. The presence of this sort of interference will depend in large part upon the design of the receivers. And since the radio amateur can certainly do nothing to alter the design of the military receivers in the field, it will be far better that he suspend operation on those 80-meter frequencies which will create "superhet" interference.

The probability of superhet (image) interference depends also upon the intermediate frequency of the receiver. If the i.f. is chosen properly, there will be no likelihood at all of image interference from 80-meter ham signals. For example: if the receiver i.f. is 175 kc., its high-frequency oscillator is operated on either 3825 or 3475 kc. when the receiver is tuned to 3650 kc. If this receiver is not provided with efficient r.f. amplification, or if a nearby signal is strong enough, any undesired signal lying twice the intermediate frequency on either side of the desired signal will also ride through the i.f. channel, although quite unintentionally. This undesired signal is the image.

Now, in the case of our 175-ki. i.f., interfering signal may be at 350 kc. (twice the intermediate frequency) above and below the desired signal. And these signals will be 3300 kc., which is not a ham frequency, and 4000 kc., which is a ham frequency.

Since, obviously, we do not know which intermediate frequency will be employed by the Government, we can only point to the possibilities with each of the potential intermediates. We are therefore printing a chart on these pages showing the images for each of the intermediates that might be used. Where we have made no listings, the frequencies are not ham frequencies and therefore need not be of concern to 80-meter operators.

Perhaps, later on, the Government will see fit to tell us just which intermediates they will employ. Then, by referring to the chart, a ham will know at once which frequencies to avoid for maximum safety when military operations are on foot within interference range of his rig.

From the chart it may be seen that a 3500-ki. ham signal will be capable of image interference with a 3900-ki. military signal if the military receiver employs a 175- or 200-ki. intermediate. But this same amateur signal would create no interference if the intermediate were one of the higher values. Note that the only 75-meter phone signal capable of image interference is 4000 kc. which will ride in on a 3500-ki. military carrier into a 175-ki. i.f. channel.

It is gratifying to note that the only ham image interference might be expected in military superhet receivers with 175- or 200-ki. intermediates. Neither of these frequencies is in very wide present use in communication receivers, and we suspect hopefully that the amateur may be spared this trouble.

Interference from military operators, however, hams may apply the same line of reasoning and figuring to other, higher-frequency bands (should portions of these bands be later requisitioned by the Government) where even the higher intermediates might be susceptible to ham images.

Cross-talk or cross-modulation, of either the external or internal variety will in most every case be the result of conditions over which we have no control and most likely can do nothing to remedy. So that when this variety of interference is created with the Government communications, we have no way of knowing what it will be for the ham to vacate the frequency, or frequencies causing the trouble. There must be no balking or unnecessary lip service in such an event. "Tis far better to regrind a crystal or to shift the e. c. o. dial than to give all of amateur radio a black eye.

Overmodulation

Overmodulation of 75- and 160-meter ham phone signals must positively be eradicated if we are to keep out of trouble with the authorities. All of the rules of good practice must be applied at this time in quarters where previously they have been disregarded for reasons we cannot understand.

Automatic modulation control, efficient matching up of modulator and amplifier stages, and a well-designed power supply and continuous monitoring of modulation percentage are requisites.
Learn the Code
(Continued from page 23)

Instructor more practical for general work.
It is suggested that the following frequencies would cover the audio range adequately for service work: 30, 60, 100, 500, 2,000, 5,000 and 10,000 cycles per second. This would require a seven point switch. These are readily available from the same maker as the one specified. Use of an output transformer having a tapped secondary is also indicated if the unit is to be used as an audio signal source of merit for servicing. The various taps would then be brought out to a binding post strip on the panel.
The author wishes to acknowledge the valued assistance of two of his pupils: Frank Scudner who did the original construction work and Robert Vuno who cooperated in the final experiment on this versatile oscillator.

This unit has been in use for one year at Brooklyn Tech and has performed well under hard use for this period. It is still in use and is likely to continue in use for a long time to come. You won’t go wrong constructing this proven and tested unit.

Life Begins at 4:15
(Continued from page 10)

The bird who fixed my radio two years ago? I haven’t had time to call you, but the radio hasn’t been right ever since you worked on it. What are you going to do about it?”

And you, the poor, tired, overworked and under-paid serviceman, rather than argue with the customer, say, “All right, Mr. Jones. Bring it in, and I’ll take another crack at it.”

There are three departments in the Aircraft factory for the experienced Radio serviceman: Radio and Electrical Sub-assembly. Final Assembly and Final Test. The first-named Department is the largest, and is the one in which I work. Here, all of the Radio and Electrical wiring and assembly is done. There are so many different units to wire and assemble that the work never becomes uninteresting.

In Final Assembly, the work is mostly installation of assemblies and wiring on the ships. Final Test, requires only a few men who make tests and adjustments before the ships are given their first test flight.

Ordinarily, in any large organization, there are always one or more Foremen, Supervisors, or Officials, who gained their jobs through “pull,” politics, or what have you. This type of executive not only “knows nothing,” but is usually unreasonable, demanding or sarcastic to the men.

Unsmooth view shows parts’ placement.
under him. During the time I have been at the Aircraft factory, I can sincerely say that I haven’t yet met such an executive, for the simple reason that there aren’t any to be found there.

Officials are, without exception, old-time Aircraft men who know their jobs thoroughly, and know how to treat men like fellow-humans. Instinctively, they realize that to be well-liked by the workers pays big dividends; that a man who knows his Boss is a regular fellow, a square-shooter, will put everything he has into his job. None of these officials are “unapproachable.” At any time, a worker is free to discuss personal or business problems with them, knowing that they will be sympathetic.

Suggestions from employees are not only welcome, but actually have been “stepped-up” to assure constant improvements in products and processes; in addition to needed developments in new fields.

Today’s demands are important, but the needs of tomorrow cannot be slighted—and are anticipated in never flagging engineering and research developments. You have assurance that in the months and years to come, new Triplett products will serve expanded fields, where they will merit values and savings for every dollar spent in their purchase.

**THE TRIPLETT ELECTRICAL INSTRUMENT CO.**
Bluffton, Ohio

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For nearly two months after I started, I went around in a sort of daze. Although I had had as good a job as is ordinarily found anywhere, I couldn’t realize that there were jobs like these. I expected to awaken at any moment to find that it was all a pleasant dream. I actually waited for this awakening. There just couldn’t be a job like this. It was entirely too good to be true.

But it was true!

After four months I have awakened. I have come out of my daze. I know that such jobs can be, and I’m thankful that I have one of them.

After the War is over . . . what then?

True, the Aircraft industry cannot absorb all of these workers, but there will at least be a place there for part of them, a great many of them.

My fondest hope is that I may be one of those fortunate ones who will stay on. If not, I can always go back to “fixing radios.” After all, a peek at Paradise is better than no look at all. So, I have a very strong feeling that all this is going to teach other employers a few much-needed lessons; that this shortage of Radio servicemen is going to make conditions a great deal better for all of us.

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**Servicemen’s Organizations**
(Continued from page 20)

same for him. Shades of cut-throat competition! What better illustration could we give of the high level to which radio servicemen have risen in Philadelphia?

There are two other benefits which accrue from membership in a live-wire local servicemen’s association. They are sometimes hard to value in actual returns, but they’re there just the same.

First, as a member of a local radio service organization, you gain a certain prestige among your customers. If the organization has a good reputation, this reputation extends to you, so long as you are worthy of it.

Second, since the association offers you their many means for gaining additional radio knowledge (and if you take advantage of the means) you will become a better radio serviceman. If you become a better radio serviceman, you will be able consistently to do a better radio repair job. If you turn out better radio repair jobs, you will have less “return” calls and less dissatisfaction with the brand you offer. With unfailingly correct job, you will gain more “repeat” customers and have more time for new customers. Hence, you will build up your business and make more money.

We don’t deserve as much space in the “fellowship” side of the local servicemen’s organization as we would like to. There is a powerful inspiration for a man to “do better” when he
travels with the "right" crowd. Besides the good times which come with any get together of radio servicemen, there are the lasting friendships which occur and which sometimes shape a man's destiny to his everlasting advantage. It is important to know other local servicemen, jobbers, manufacturers' representatives and engineers, and other men who are prominent in the radio field and who are important to know.

Above all, membership in any organization which is formed for the good of fellow beings has a broadening and leavening influence on each member which is most necessary to the end that they become better men.

Are local radio servicemen's organizations worthwhile? When they are run like the Philadelphia Radio Service Men's Association, we think that they are definitely worthwhile.

We invite our service readers to send in their opinions and comments. Editor.

U.H.F. in Aviation
(Continued from page 15)

type of test equipment available, and the type of equipment needing attention. Many methods of testing radio equipment have been promulgated by various experts, but regardless of the efficiency of these, every technician seems to have methods of his own. Component by component elimination with the "sweeping tracing method" running a close second, are methods both efficient and speedy; the latter being the fastest. If the technician knows how to use available test equipment, he can test any and all UHF installations, both aircraft and airport.

Futuristic Perception

The field of "aviation UHF radio" is an expanding one, and those who qualify themselves early will find positions of good financial return, both in civilian life and in the Military Services. But, needless to say, every aspect of the situation must be examined thoroughly and as much practical experience accumulated as possible for proper qualification. Those who do not possess the proper class of Government license as issued by the FCC should obtain one in order to be able, legally, to tune and adjust equipment as the need arises.

The many applications of UHF have been given, and from present indications, there will be many more—not only in the aviation field, but in the various industries.

Ultra high frequency, ten years from today, will be as commonplace as is the low frequency spectrum utilized for general broadcasting today. Those who will build knowledge now on a foundation of the first advancements, will be ready for the more complicated applications to come. UHF has definitely established itself as an up and coming mode of communication and its advantages are available to those who are desirous of utilizing them, NOW!

Bench Notes
(Continued from page 28)

ing much more wrong with radios than there was with yours . . . I fixed his (a customer's) set with 10c worth of wire, charged him $3.50." It is most regrettable that this man did not have a sensible partner on hand to beam him with an old Majestic power-pack before his tongue-wagging reached this point. However, the damage is done, and it is from this outrageous misstatement that the service man will probably suffer the most. As any service man knows this is practically the reverse of the actual facts, as not one set in ten is brought in for service with a defect so simple. By the time most set-owners reluctantly conclude they must call in the radio man, the receiver is usually in such condition that more than a minor repair is needed. Off-hand we should say that at least one-fourth of the household receivers that finally get to the service man require something along the lines of new filter condensers, a volume control and one or more tubes; and it requires little imagination to picture the cold stare that will be the service man's reward when he presents an estimate of eight or ten dollars to a customer.

There is a complaint on the part of some men that the methods employed by the investigators in obtaining their evidence was not quite "fair," but this is a viewpoint that receives no sympathy from this department. As far as we are concerned the test was as fair as could be devised, inasmuch as no tricks were employed, since the disconnected wire or lose tube must have been plainly evident to any man who did not choose to ignore it. In this connection we feel that the radio men should be thankful the investigation was not conducted by representatives of the Better Business Bureau, with authority to bring charges for obtaining money under false pretenses, as has been done before. In view of the wide-spread publicity on the subject, it is not unreasonable to suspect that such steps may be taken in some communities in the near future, and it might be well for the service man to give his business methods a thorough going over.

In the meantime, what is the service man going to do about clearing up his besmirched status as a business man? This writer has been the busy little bee, interviewing any and all that had any views on the subject, but as yet no definite practical plans have been presented to view. Some men were disposed to be content with expressing their indignation against the Digest and its investigators, with varying degrees of abuse and profanity, which is merely mis-directed energy.

A business that cannot stand investigation, deserves to be exposed, and the man that feels he must give vent to his feelings would do better to direct his resentment against the conditions in the trade that made such a
report possible. A few vague proposals have been made that the service men combine in some sort of a cooperative advertising campaign, which does not appeal to this department in the light of past experience with such schemes.

However, assuming that a sufficient number of men are willing to contribute for this purpose, it is doubtful if sufficient funds could be raised to pay for more than a single advertisement, which would be of negligible value in counteracting the effect of an article of national circulation. Paid advertising to be effective must be carried on continuously, year after year, and we do not think there are a sufficient number of radio service men that are willing and able to undertake such a campaign.

What may or may not be done is, of course, largely a matter of conjecture, but we are disposed to feel that the most effective results will be obtained by the service man's individual efforts with his own clientele, and to do this he is going to have to create a definite business-like policy that will bear public inspection. The old slap-dash methods of conducting a service business have been on the wane for several years, and it may be that Digest's article is just the final shovel-pat needed to bury them for keeps, to form a foundation for radio service as a bona-fide business, and not a handyman's racket.

"Mr. Kendall has been a top service man for many years. His conclusions are based entirely upon his own knowledge of the subject. Some may disagree. We invite our readers to send in their reactions." — Editor.

Plug-in Tester
(Continued from page 18)

about 100,000 ohms, a circuit similar to the above is used. The same scales as before are used but all readings are mentally divided by 10, that is, we drop the last two pairs of digits. The mid-scale reading is therefore 3000 ohms and this is the series value required at all times. The variable rheostat takes care of this function on this range also, so that no fixed series resistor is required here. The 1½ volts of the battery, divided by 3000 ohms gives a current of 500 microamperes which must correspond to full-scale. This means that 460 microamps pass through the shunt and 40 through the meter, or the shunt must be in the ratio of 4/46 to that of the meter, a result of 435 ohms. It should be remembered that if the indicator points to the correct result it is 10,000 ohms using this circuit. This can be done conveniently. In handling the medium and high resistance ranges, it should be kept in mind that if it is necessary to test the two ends of the cord, the resistance of the body which is of the order of several hundred thousand ohms or less will come into play giving lower than actual readings, so that only insulated parts should be touched.

The shunt type of ohmmeter which, in this particular case gives easy readings up to about 200 ohms, is slightly more complicated. For the sake of the story, it is noted that a push-button (spring type) is used. This button on depression makes one circuit and breaks another. On release, the first circuit is broken and the second is made. Of course, a double-throw, single-pole toggle switch could be used just as well. In this circuit, current may flow whether a resistance is on measurement or not if the circuit is otherwise complete, so that the button is a precaution. Also, it makes for simplification of this particular circuit.

The calculations for the shunt type of resistance meter is as follows. We note from the meter's indication of just under 16 ohms corresponding to mid-scale. The shunt S must, therefore, be of this value. Now when we attempt to measure a presumably high resistance of this same value (approximately 15.9 ohms) we expect the pointer to come to rest at 15.9. This will, of course happen, since the shunt is across an effective resistance of 15.9 ohms also, and therefore the current through the meter drops to mid-scale. With no resistance under measurement test the pointer should come to rest at full-scale (infinity). The necessary series resistance does not have to be calculated since the same variable rheostat as before is simply varied until full-scale does appear with open test cords. From considerations noted under current measurements, it will be seen that approximately 13 miles flow through the circuit under this condition. In connection with this low-ohms range, the push-button must be depressed to get a reading. This circuit is used to obtain a more accurate reading since the test cords may be connected to the circuit with clips. This is important where low values of under an ohm or two are under consideration.

As before, we may consider all scale readings multiplied or divided by a constant such as 10. In other words, the reader may treat the mid-scale indication of 15.9 ohms as 1.59 ohms and by using a shunt of this value at S, will obtain a circuit which will measure extremely low values. By treating the value as 159 ohms, another circuit may be designed which will measure higher resistances, etc., although this was not done in this particular instrument because it was felt that such overlapping was not required.

A.C. Measurements
All d.c. voltage and current ranges and ohmmeter ranges should be wired up first, using the basic diagrams shown as guides and the values of calculated resistances, etc., for the a.c. ranges are tackled. As a matter of fact, the above voltage and current circuits are also a component
part of the a.c. ranges as we shall see.

First of all, connections which were made to the positive terminal of the 25,000 ohms-per-volt meter are soldered together so as to form one connection, and this connection is separated from its meter terminal. This combination of leads (as shown in figure 7) is wired into a double-throw, double pole switch, which can be a toggle switch for convenience. It can be seen that when the switch is thrown to "d.c." connection A is wired directly to the positive terminal of the meter so that the previous d.c. and ohmmeter circuits are the same as described in the previous paragraphs.

A copper-oxide rectifier is utilized to rectify a.c. and audio frequency voltages and currents so that they can be measured by the d.c. meter. The type used by the writer in this particular instrument is one made by Radio City Products Co., although any similar type may be used, of course. It will be seen that the rectifier is composed of round discs, held together by a screw. The particular rectifier used also comes with a mounting bracket so that the complete assembly can be fastened right into one of the meter terminals, which makes for simplicity and convenience. Leads coming from the rectifier are wired as in the diagram. The three colors of the leads are black, red, and yellow.

When this circuit has been wired as shown, and the switch thrown to a.c., it will be seen that with the test leads connected to any a.c. source of voltage, a reading will be obtained. It will be noticed further that the ratio of actual a.c. voltage to indicated d.c. voltage is practically one of 10,000 ohms per volt.

Conclusion

The reader who builds and uses the above test instrument with whatever ranges and whichever meter he chooses, will be amply repaid for his trouble. As the accompanying photo shows, the entire equipment may be placed in a very small box. The writer built the instrument on a panel 6 ½" by 5 ½" and used it to replace an older type Triplett analyzer-oscillator combination. The ease of operation and the accuracy of readings are remarkable. The illustration shows how the 12 jacks are arranged on the panel. The four voltage jacks are shown on the left, the lower values being at the top. At the right of the meter are the three ohms scales and one labeled "meter" which is simply a direct connection to the meter itself. The reading is thus only 40 microamps and may be employed for any use requiring a sensitive galvanometer. Below the meter, arranged horizontally, are the four current jacks, the lower ones at the left. Directly below the meter is the push-button, which is depressed only for the low ohms scale, and immediately below this button is the a.c.-d.c. toggle switch.

The case into which this panel was put is composed of the meter section at the right, the oscillator at the left and a small battery compartment in the center. For this particular installation, it was found convenient to place the variable rheostat (controlling the zero position for resistance measurements) on the panel of this battery compartment rather than the meter panel so that connections are more direct and the meter panel is not so crowded.

A few words about the meter itself may be in order. This meter is unusually sensitive and should naturally be handled with great care. Excessive temperatures and hard knocks may well take a few points off the percentage of accuracy of indications. When unknown currents or voltages are to be measured, it is well to use a lower range at first. When adjusting for zero position to read ohms, remember that it is always better to retard the rheostat at first and then come up to the desired setting than to take a chance of having the setting too high and having the needle hang up against the stop. Make sure that the jack you use is the one you choose.

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M. J. Doherty, President

How a crystal cutter is assembled.

Crystal element used in microphone.

lead connections are made to the electrodes
the, and plates are, with proper orienta-
tion, are welded together with a ce-
mant. The electrodes are connected either in parallel or in series depend-
ing on the application for which the final element is constructed. The para-
allel load arrangement, however, is standard and for this reason only this is
shown in Fig. 3.

Operation of crystal headphones.

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piezo-electric properties permanently. The voltage developed by the crystal elements for a given stress remains
constant over the temperature range, provided that the load impedance for all conditions is much higher than
the crystal impedance. This generated voltage is practically proportional to the applied stress. Conversely, the
amplitude of motion produced when the crystal is used as a motor is also practically proportional to the
applied voltage."

Next month we will continue our series with an analysis of various feed mechanisms.

RADIO NEWS
Priorities and Capacitors

(Continued from page 21)

and 'at-home' building.

The aluminum used in these capacitors, will be as close to the 99.99% purity, as conditions will permit. Thus far, it appears as if this will be possible, although it may drop to 99.5% if the mill action is too accelerated. The anode plate, will, as heretofore, vary from 0.0015" to .0025" in thickness and in a variety of widths, dependent on the capacity. It will be dead soft, fully annealed, with a smooth bright mirror-like finish. The cathode plate will also be dead soft aluminum, varying from .0015" to .0025", and matching the anode in width. Its purity can be less than that of the anode. Engineers of the various manufacturers have under advisement, the use of even thinner anode and cathode foils than are now being used, to afford additional conservatism. At the present, such developments have not reached the stage where such production is feasible, because of the difficulty of making suitable contact to the too-thin tabs on the foil. All the capacitors will be made in the polarized and non-polarized style. The polarized type uses anode and cathode foils with a separator between, while the non-polarized type has a single anode foil with a separator between. The non-polarized type is mostly used in ac circuits. Incidentally, heretofore, it has been common practice to specify an etched cathode in multiple section units, where the circuit application required the use of etched cathodes for less than all the sections. It is simple to see that this constitutes a waste of aluminum, and thus this practice will be probably avoided, with a separate section or sections being used.

Because of the non-liquid state of the waxes, used in the dry electrolytics, it is naturally possible to use the cardboard containers, with various types of waxes to effectively seal the container. Heretofore, it has been possible to use a spun metal casing over the condenser, over which in some instances was placed the cardboard. Now, however, the metal casing will be absent, and thus the cardboard and particularly the wax used, must be of an unusual nature. In this respect, a variety of suitable waxes have been developed. There are two essential types of waxes; one, suitable, and the other highly flexible. The hard waxes are used for sealing, while the flexible waxes are used for impregnation, as in paper and mica condensers. In considering waxes for these capacitors, it is essential that they be exceedingly resistant to moisture and oxidation, such as the micro-crystalline or amorphous types.

These waxes come from the western fields, and are the product of petroleum crudes in this area. The crystal-
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radio news

wire leads out of each end, the wire to
be 10 strands of No. 30 tinned copper
with a minimum length of 2½".
The dual sections will have bare wire
leads with two anode leads out of one
end and the cathode lead out of
the opposite end. The wire will be
the same as for the single, with the
same lengths. This specified wire
length will reduce the number of types
of capacitors, which now differ only
by lead lengths, thus simplifying and
increasing the flexibility of inventories.
It will be noted that copper is specified
for the bare wire leads. This is
imported in paper, and is used in r.f.
Bypass circuits. Steel or soft iron,
which cannot be used in this type of
 capacitor, can, however, be used as the
leads in filter condensers, and will thus
be incorporated, where it is essential
to provide extensions.
The plastic tube dry electrolytic,
which will be available shortly,
introduces a new form of capacitor that
should become quite popular with
the service man and experimenter.
Color coded and moderately small, with
a variety of capacities and voltages
to choose from, with a completely sealed
plastic container, the efficiency af-
forded closely parallels that of a
metal-Clad unit.
The plastic materials used, include
Cellulose acetate or cellulose acetate
butyrate. Both have effective electrical
and physical properties. Cellulose
acetates are, of course, thermoplastic,
which means that they are softened by
the application of heat and hardened
again by cooling. This cycle of soften-
ing and hardening may be repeated
without any chemical change taking
place in the material. The electrical
properties of the cellulose acetate
material is such that it has been used
as a direct winding over bare and
eamed wire.

Microphoto of paraffin wax crystals.

developed by two brothers in the Caro-
linas. This paper is similar to a cer-
tain extent to the cigarette paper,
except that it is super-calendered, much
like magazine paper. The paper used
in the electrolytic is, of course, highly
absorbent. Originally, this paper or
separator consisted of a cheese cloth
or bag type material, with thick-
ness varied by calendering. Today, cel-
lulose or paper type is used, however.
These have the necessary high absorb-
ent property and yet simplicity of han-
dling. Some forms of separators are
made from selected cotton rag stock,
as well as kapok, jute, hemp, etc.

The paper tubes, made of Kraft
stock, and the cardboard containers of
coated chip board, used in these new
type capacitors, have undergone little
basic changes in physical or electrical
characteristics, except that chemical
treatments have been improved upon
to increase resistance to moisture and
air. In addition, they provide a better
adhering surface for the sealing com-

pounds, and are of a purer state, so as
to not affect the chemical action en-
countered in dry electrolytics.

A shortage of aluminum rivets and
copper wire has prompted a change in
design, that is quite evident in the new
 capacitors. Lugs are used instead of
flexible leads and riser rods, eyeleted
directly to foils, make direct contact
with the lugs. It is important that all
riser rods, rivets, eyelets be of the
same metal, to afford most effective
point to point contact and prevent in-
ternal or external corrosion. Lugs
will undoubtedly be used in practically
every type of condenser, according
to the present status of affairs.
Should, however, wire be made more gen-
erally available, standardization of
length and type of wire, will be in-
voked. For instance, single section,
tubular type capacitors will have bare

Microphoto of amorphous wax crystals.

The high breakdown voltage and in-
sulation resistance of cellulose acetate
also permits its use as very thin foils.
And for slot insulation, it is laminated
to insulation paper for me-
chanical strength. As an insulation over
wires, it is inert to transformer
oils, is not corrosive to copper wire,
and has marked resistance to humid-
ity. Cellulose acetate butyrate com-
positions also have excellent weather-
ing resistance, due in part to the relatively low moisture absorption. It also affords a high degree of resistance to distortion under varying degrees of heat and humidity. Therefore, these plastics have been used to form molded duck pins, outlet wood, molded shoe heels, which cannot scuff; automobile tail light emblems, refrigerator parts, artificial bait, in addition to the purposes mentioned before for wire. Now, it enters a new and interesting phase of its career, which should be quite successful, offering as it does an effective new product and lending a hand too, to the needs of our national defense.

In paper tubulars, it is planned to adopt soon the use of lead alloy foil, to afford additional conservation of materials. Drawbacks now are that such condensers would be too large, and as such, too costly to produce for present consumption.

It has also been learned that one of our largest chemical organizations is developing a paper base, such as kraft .00035", on which it will be possible to spray aluminum pigments. Sprayed tinfoil on cellophane has also been tried. As yet, this is not available, for the cellophane has too many impurities to permit its use in radio. Incidentally, some 25 years ago, a Mr. Mansbridge of England, patented a method of spraying foil. It was used for a time by a telephone company in Chicago, but not very successfully, because the paper suffered from poor conductivity. However, much has been learned in the ensuing years, and it is entirely possible that now the successful solution shall be found. Certainly, this development will prove of the utmost importance to radio, not only in this moment of emergency, but later on, in the course of peaceful procedure.

Sprayed metals are also being experimented with, as housings for electrolytics. Thus far, the results have not been successful, because the area afforded by the spraying process is insufficient and in addition, not penetrating enough. Accordingly, there isn't sufficient metal available on these surfaces to deflect the heat that may accumulate. In addition, the spray does not add sufficient resistance to the paper body to avoid absorption of moisture or air, to warrant the expense at the present time. It should be said, though, that the process is entirely feasible and will certainly be practical soon.

There is no denying that the metal housed capacitors offer the most perfect form of hermetrical sealing, and thus assure the utmost in freedom from loss of electrolyte, or contamination from atmosphere, permitting, too, operation at higher a.c. currents, because of the better heat dissipating abilities of the can. Nevertheless, although the new capacitors, cannot boast of these identical properties, because of the natural restrictive properties of the materials used, their characteristics are such that parallel-
Aviation Radio

(Continued from page 18)

is not available, it would be wise then to utilize a one tube affair rigged up as a rectifier (diode) and noting the amount of noise present in the coupled filter and shielded vibrator. By testing the unit without a load and comparing the form and output characteristics of the test made with load, a fair idea of its "workability" may be had. If it still seems to be dressed down unless and then, with caution. It is preferable to obtain a new set of parts rather than an attempt to dress them down; and in cases where the expense involved in purchasing new parts would be prohibitive, a new vibrator unit should be purchased.

Special tools are needed to perform vibrator maintenance and if the proper tools the finished job would compare to a job performed on the floor with a monkey wrench and screw-driver.

In replacing the high voltage condenser usually found in most units, a condenser having the same value and rating should be used. Where, upon inspection it is found that the condenser has been leaking wax or "filler" due to heat, it would be wise to replace that condenser because trouble will inevitably develop.

When a unit used in an aircraft radio set specifically designed for high altitude work exhibits intermittent characteristics, it should be replaced. These are scaled and should not be passed off as serviceable.

Where noise is present in the R.F. circuits of the receiver, do not place the circuit to the vibrator, check all shielding, bonding, and the adjustment of the vibrator itself. If the noise persists, check the tube and the vibrator; and checking the above, check the filter and rectifier circuits. A faulty tube will cause noise in many cases, and defective condensers will also contribute to the difficulty.

In adjusting a transmitter never adjust it while the aircraft is in the hangar or close to steel buildings. By shutting the input of the receiver in the aircraft installation with a small piece of wire, the transmitter can be checked for approximate frequency setting, and proper modulation. The relay found in most installations should be set before the test is made so that the receiver and transmitter will not operate spontaneously. The 5 & 10 stores now sell a "variable wattage bulb" that can be twisted with a twist of the wrist for three wattage settings. The bulb can be used for indicating output capacity of the auxiliary aircraft transmitter up to 75 watts.

To Our Readers

All letters not containing a self-addressed stamped envelope are given second priority. In case your letter has already been answered, please be patient. Due to the influx of correspondence which is expected, it will be sometime until all letters are answered. But you'll receive your answer! In case the answers are not coming directly to their questions pertinent to aviation radio material that they would like to see presented, kindly drop a line to the editor.

Washington Communication

(Continued from page 10)

ke spectrum according to latest information. The men who run Station WAR (from the Washington, Department, Washington, are proud of the record they have maintained—four months—1,600 contacts with hams. This has been the result of many requests for the AARS. Schedules will continue as at present, with the exception of these changes in the schedule.

Daily, except Sundays, from 9 to 10 p.m. EST, WAR, on 6990 kc, will work the 7000-7100 kc band; on Saturdays from 2:15 to 4 p.m. EST, WAR, on 4920 will work 3500-3600 kc amateur band; on Saturdays from 7:15 to 8 p.m. EST, WAR, on 6210 kc will work 1750-2050 kc amateur band.

The Treasury Department revealed recently that it had broken up the operations of a strange "Japanese "fishing fleet" in Hawaiian waters. Some of 19 to 20 boats were seized and it was found that they were equipped with expensive radio equipment. It was said that each of the boats, which had been providing around the coast of Japan, was included in its crew at least one member of the Japanese Naval Reserve.

The Defense Communications Board took steps to safeguard communication centers and plants manufacturing radio equipment. The AARS has invited the H.B. to employ agents to export these changes to employees, Government officials and others who had been hindered in any way. It was explained privately, was purely precautionary and need not raise any fears that saboteurs or spies were a threat.

The Army is taking interest in a patent just issued to one Adolph H. Rosenthal, of England, for a television code system by which images can be transmitted without the danger of interception. The sending set scrambles the image to be transmitted, so that only those receivers operating under precise conditions can form a comprehensive picture from the impulses received.

Dr. Lawrence J. Dunn, WCLM, WLMD of Garden City, N.Y., has been appointed Chief Radio Aide of the AARS. This is a traditional position and a post which in the past has been more honorary than anything else. But Dr. Dunn may find himself with quite a bit of work when the emergency brings the hams ever more into the defense effort.

Dr. Dunn is a veteran of the last war and a real old timer in radio. He got his first license in 1913 and has been in service. He established a station with the call letters 2CA. Ready for any emergency now is the elaborate file of 40,000 American amateurs. This punch card file has been filled out in duplicate on the basis of the questionnaires distributed some months ago by the Army. Within a few minutes, the War Department can run off the cards and locate as many hams with special qualifications as it might need in any part of the country.

Major General Joseph O. Mac
been in the Army, is on retirement from the service, as of September 30 and the Signal Corps take one of the most outstanding of hams, and every branch of the service will benefit from his advice. "The War Department spent 38 years in the Army, during the last four of which he commanded the Signal Corps."

You can write in your letter, however, that Gen. Macbourn, though he is leaving the Army, is not going out of Government service. A man of his great ability is sorely needed now and he will be drafted for the Defense Department. Best bet: Gen. Macbourn will be named to fill the vacancy on the FCC, where he will work for the "Defense Commissioner." Brief, Gen. Dawson Devonsteed, who has been commanding the vast Signal Corps establishment at Fort Monmouth, N.J., took over as Acting Chief Signal Officer and began a "streamlining" of the organization.
null direction finding, which weighs less than one half that of the Messerschmitt equipment, and the combined equipment does not take up any more room than either the German receiver or transmitter. The American equipment has much less sensitivity, and the output of the transmitter is about four times as great as that of the German equipment. From this comparison it is obvious that we in this country have progressed further with the development of lightweight aircraft equipment in commercial fields than the Germans have with their military equipment.

This is amply demonstrated in the accompanying photographs which shows both the equipments mentioned.

In general, the equipment is built very rugged and the chassis of both the transmitter and the receiver are lightweight cases. The material used is Elektro, which is a special aluminum alloy having a high per-
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BLILEY ELECTRIC CO., ERIE, PA.

Bottom view of transmitter unit.

As far as the various features which have been mentioned above are concerned, it is apparent that this equipment is at least seven years behind commercial practices in this country. It is also evident that the Germans have "frozen" on this design a good many years ago and have concentrated making a large number of these units available for application in the Messerschmitt 109's. The general use of die casting and the method of construction employed are indicative of large quantity production. It may be added that this same general type of construction is used in some of the Germans' later designs. It has been noticed that the same plugs and sub-assemblies are used in various applications, indicating the tendency to standardize on components for a large number of applications.

The receiver has a single band, tunable over the frequency range of 2500-3700 kilocycles. It employs a superheterodyne circuit and contains five shielded Telefunken RENS 1264 tubes used as follows: first r.f., detector oscillator, first IF, second detector, and audio output. The filament voltage on these tubes is 4 volts, and the plate lead is brought out at the top of the tube. These tubes are the equivalent of our Nos. 24 or 35; their design is at least ten years old. They have been obsolete for more than 5 years and are no longer used in this country. The r.f. detector uses an old type autodyne circuit which is not at all suitable for high frequency operation and has been radically revised through the use of newer types of tubes.

Ceramics are used extensively in the equipment for terminal boards, coil forms and tube sockets. The coils in every case are air-tuned and no iron-core coils are used except in the second IF transformer. This is significant because Germany pioneered in the development and application of iron core coils. The receiver output circuit is designed for an 8,000-milliwatt load, and the maximum power output is approximately 70 milliwatts. The receiver sensitivity is approximately 10 microvolts at the high frequency end of the band, and 50 microvolts at the low end of the band. The IF frequency of the receiver is 520 kilocycles, and the first IF transformer is double-tuned, whereas the second IF transformer has only one tuned circuit.

Ceramic resistors and condensers are used extensively in the receiver and these are color-coded for case in wiring. In every case these are mounted on ceramic terminal boards. The various leads used in the wiring of the receiver are covered with varnished cambric tubing and then laced into place. A very hard solder is used, apparently containing a high percentage of tin, thus facilitating the necessary connections. When special sub-assemblies are fastened by screws, cement is used to lock these in place; current practice in this country is to use an approved type of lock washer for this purpose.

The transmitter consists of four tubes arranged as follows: a Telefunken REM-904 tube used as a straight feedback oscillator; the frequency of this oscillator is controlled...
by a tuning condenser in the plate circuit and is indicated on a dial on the front panel of the set. The output of this oscillator is fed to two Telefunken RES-1664-D tubes in parallel, which function as grid modulated r.f. amplifiers.

The modulated equipment consists of one Telefunken REM-904 tube. Provision is made for another REM-904 tube to be used in conjunction with the present one so that more audio voltage can be applied to the grid of the power amplifier tube when they are subjected to high plate voltage.

The antenna system is connected with the set through a "fixed-trailing" antenna selector switch and variometer. This antenna system consists of a short fixed antenna and a conventional trailing wire type. The circuit is so arranged that when on fixed antenna position the ship serves as a counterpoise; when on trailing antenna position both the fixed antenna and the ship serve as a counterpoise.

The filter for the power supply and rectifier for the bias voltage are contained in the transmitter unit itself. Power output for this unit is approximately 1200 watts.

In general, construction of the transmitter is somewhat along the same lines as the receiver and employs the same ceramic terminal boards and resistor assembly. Likewise, ceramic tube socket bases are used in the transmitter. It is noticed that in the equipment all phenolic materials including bakelite, plastics, etc., are kept to an absolute minimum; wherever it would be desirable to use this type of material, ceramics are employed.

The chassis of the transmitter is also a casting made of the same material as the receiver.

The power supply for the Messerschmitt 109 transmitter and receiver combination consists of motor-generator unit and filter combination for both the output and input voltages; these are combined in one unit. The voltages supplied by this unit are: 12 volts d.c. for lighting the filament of the tubes; 400 volts d.c. to supply the plate and screen voltages for the tubes; 275 volts 90 cycles a.c., rectified at the transmitter, to supply the bias voltages for the oscillator and speech amplifier tubes.

The motor generator unit itself is designed to operate from a 24 volt d.c. source. Fuses for the high and low voltages filter network are used only in the primary side of the motor generator. The high voltage filter networks are for the receiver only, the transmitter filter being contained in the transmitter chassis itself.

Editor's Note: The above paragraphs indicate, conclusively, that our American aircraft equipment is far superior to that being used at the present time by the German air corps. Once again, the initiative and skill of American radio engineers is shown in the type of equipment now being made for our own air services.
What’s New in Radio
(Continued from page 39)

This generator has a frequency range from .2 to 125 cycles per second, with negligible deviation from absolute linearity. It offers both single and continuous sweeps controlled manually or by positive signal. The maximum undistorted output is 500 v. D.C. Signal blanking facilities are provided. Type 715 generator is particularly recommended for use with Du Mont Types 175 and 175A oscillographs which are provided with long persistence screens in teletrons operated at high accelerating potential, and which are essential to satisfactory trace at low sweep frequencies. This instrument is housed in the standard Du Mont portable metal case, with leather carrying handle, and measures 14 x 8 x 17½ inches. It weighs 35 lbs.

Special Wall Rack
A new style wall rack for radio service shops has been brought out by the Walter L. Scott Co., makers of Walter radio products. It holds an assortment of Walter Unbeltts (new adjustable dial belts), a spool holding several kinds of dial cords and cables, and a bottle each of the following—Waltero radio cement, cemen solvent, contact cleaning fluid (containing a new oxidation preventing chemical), and dial oil all in one assembly.

This new style wall rack lays on the wall and makes it far easier for the service man to keep his work bench clean. It is free with the purchase of the Waltero products it holds, and is now available at all jobbers carrying the Waltero line.

New Sapphire Needle
Duotone, Inc., 799 Broadway, New York City, manufacturers of a complete line of cutting and playback needles, have just brought out a new durumahodium shaft sapphire playback needle, curved to meet the record straight on, with smooth drag. The sapphire used is small, perfect, not easily broken. The effect of this carefully engineered product is to reduce surface noise to the vanishing point. It is beautifully packed, and is designed for the most critical professional use, as well as for homes.

Atlas “Two-Way” Baffle
New “Two-Way” Baffle for 8” speaker is especially designed for paging systems and inter-communication systems in national defense factories, army barracks, and other locations requiring extensive sound coverage.

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The Classified Columns of RADIO NEWS will help you to sell your old equipment in a practical way to make a quick sale. The rate is only 15c per word, prepaid.

New Phono-Radio-Recorder
This 9-Tube Phono-Radio-Recorder is the newest contribution of Sonora Radio & Tele- vision Corporation, Chicago, to complete home entertainment. Housed in a case of painted mahogany woods, 30” high, 36” wide, 16½” deep, is a 2-Band radio capable of both standard Broadcast and Foreign reception; an Automatic Phonograph that plays back twelve 10” or ten 12” records at a single loading; a Recorder for making home recordings; a Public Address System. Cabinet has adequate and practical storage space for albums, recording discs and micro-
ous Phono-Radio and Radio-Recorder models in Period styling, Table Models, Portables, Auto Sets, Farm Radios, Record-Players, and an unusually complete selection of phonograph and recording accessories.

Thirty 1942 Knight Sound Systems are listed in the big rotogravure Public Address Section. For the Serviceman there are over 100 pages devoted to all the latest test equipment and over 15,000 quality parts from the country's leading manufacturers. Of outstanding interest is the big Bargain Merchandise sections and the pages of tools and supplies, also books and manuals of every subject in radio and electronics.

Fluorescent lighting comes of age with a large special rotogravure section of its own. A wide variety of fixtures and lamps for the home, store, and industrial application is presented. A big Amateur Section, including eight pages of rotogravure, covers a gigantic selection of Communication Receivers and Transmitters, tubes, Klystrons, transformers, and complete parts and accessories for every Amateur purpose. A special time-payment arrangement has been made available to the Amateur.

The Builder and Experimenter will find a wide variety of kits using from one to five tubes, accessories, diagrams, and all necessary builders' tools and supplies. A number of kits and projects have especially been planned for use in the radio training classes organized throughout the country in connection with the National Defense Program. This new 212-page 1942 Radio Catalog may be had free of charge from Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, Illinois.

cription turntable and a master control panel.

The seven tube public address amplifier operates as a class A amplifier with two 6N7G tubes providing 15 watts of audio. Two microphone input channels are provided as well as input from the transcription turntable.

The radio tuner is an all wave high fidelity superhetronyde which feeds into the public address amplifier for program distribution to the various rooms.

The transcription turntable is equipped with a dual speed motor which allows playing of either 33½ or 78 r.p.m. transcriptions. A sixteen inch crystal pick-up is used which feeds through the public address amplifier to the various rooms.

The master control panel permits the instant distribution of programs from the radio tuner, the transcription turntable or a local microphone to any room or any group of rooms. It also provides for two way communication from the main office to any room. One of the outstanding features of this control panel is the special emergency switch. By the use of a single switch, every room in the three buildings may be connected to the main amplifier to the purpose of special announcements, fire drills, etc.

The successful completion of this installation has dispelled any possible doubt as to the ability of the NYA radio shops to construct and install this type of equipment. The high school authorities have expressed their complete satisfaction with the installation. Since the system has been placed in operation it has never been necessary to place one man on regular adjustments. Service calls have been conspicuous by their absence.

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**MILITARY TYPE HAND-MIKE**

marine Radio Officers. These same agencies are now also absorbing the inexperienced men as soon as they obtain their licenses.

The shortage has become so acute that numerous vessels have been delayed in their departure solely due to the lack of an available Radio Officer. Several steamship companies have hired inexperienced men and placed them on one-man ships in violation of the Communications Act of 1934, as Amended, and thus placed themselves in jeopardy of being heavily fined. This was necessary, however, to sail the ships.

The merchant marine needs its experienced Radio Officers. It needs them during the present emergency more than at any other time. No shipping concern desires to send one of its costly vessels, with a valuable cargo, on any lengthy voyage manned by an inexperienced, untried, and possibly very incompetent Radio Officer in charge of the radio department.

It is now a well-known fact in both shipping and governmental circles—and we old-timers who have been through the mill, know it well—that inexperienced marine Radio Officers are, in a majority of cases, of no appreciable value insofar as radio service is concerned on their first voyage to sea. Beginners who make their first trips to sea on one-man ships without first having had previous marine operating experience know of their utter incompetency better than anyone. The highly technical nature of modern radio apparatus, and the involved technique of radio communication procedure are such that actual operating experience under the guidance of experienced men is necessary before one may be considered competent to meet any emergency at sea, or to render that degree of efficiency in radio service which modern shipping demands.

Hundreds of experienced marine Radio Officers have left their ships during recent months. The problem before the shipping industry now is to prevent any further exodus of experienced men from their chosen profession at sea. The shipping industry must meet the requirements which this necessitates.

What are these requirements? The shipping industry must pay in wages as much, or more, than these men can earn ashore. It must meet its competitors in the open market and pay as much, or more than they are willing to pay. This is not all. The shipping industry must make sure that discrimination on board ship in which they seemingly always forget the Radio Officer. First of all comes the question of living quarters. The living quarters, and the radio operating rooms on the vast majority of vessels are intolerable. These rooms are often placed in the hottest part of the vessel, barring the engineroom or galley. There are frequently no ventilation. The quarters are often too small and cramped. There is no running water. There are no convenient bathing facilities. Let us take a vessel such as the—one upon which I once was employed.

The radio operating room on the ___ is, first of all, much too small. The deck on the port side of the operating room is so hot when the ship is in motion that one is unable to lay his bare hand on it and hold it there for any length of time without extreme discomfort. This deck is directly over some steam pipes and heat which comes from the engineroom and the galley. There is no ventilation from that side of the room. In the tropics—and nearly all ships go to the tropics—it is almost impossible to work or live in such a room for four hours which may constitute the Radio Officer's watch. This room could be improved by an extra ventilator, or by insulating the deck. This was brought officially to the attention of the U.S. Maritime Commission more than three years ago when it owned and operated this vessel. A remedy was promised. The officers said they would "look into it." They never did. Nothing was ever done to remedy an unbearable situation.

Next, let us take the bath room of the ____. Let us assume that it is a cold night and the Radio Officer desires to bathe. If it is very cold, this is what he must do to take a bath:

First of all, he must put on his overcoat, hat, and gloves. He must place his towels and soap in a pail and walk along the deck for at least a hundred feet. He must then walk down a stairway which may be exposed to snow, rain, hail, sleet, a strong wind, and heavy seas a wash over the deck. He then has two choices of direction. He may walk across No. 3 hatch and up another flight of stairs to the mates' bath room which is unusually small and in which there is no place to hang his
overcoat, his hat, or his towels; besides, he may find one of the Mates using the bath room, in which case he would be obliged to return to his quarters. If the bath room is not in use, he may lay his overcoat down on the lower extremity of the first stairway and walk about fifty feet to a bath room used by dirty cooks and messboys. Being rated as an officer of the vessel, he doesn’t feel like associating so intimately with his brothers, the ship’s company originally hired because they could be obtained for lower wages than those for which a white man would work. As it is often difficult to go to room, and his voice was heard in the bath room without simultaneously sharing the glories of the bath with one or more of his brothers, the sophisticated Radio Officer usually shuns this bath room, using it only after midnight or in an emergency. Unquote.

Worse (To be continued).

With the above for a thought we say... 73... GY.

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**Ham Chatter**

(Continued from page 35)

W1AFN, Walter of Pittsfield Mass is 25 years old. Works 72 watts PEP to a 45 final. Revert is a Sky Buddy. He has W. A. X. on the air.

W1AGS, George of Danbury, Conn is active on 1560, 2000, 1200 and 4000 watts to a 512 final. Antenna is a half wave end fed Zepp. Great DX on 1200 this past summer.

W2MNJ, Bill of Coney Island, N Y is active on 7020, 2500 with new 2500 watts to a TW2 final. Revert is a SX 24.

W2XNP, Don is active on 1750. He is a friend of the author. He runs 45 watts to a 460 final. Antenna is a full wave Zepp. Big DX on 1750.

W2XNO, Joe of X Y C has a 50 bat 45 QSL. Has a proper antenna for 45 Final. Antenna is a Hertz Half Wave. Revert is a Liberty 60. Pro 4-A.

W2XNF, Steve of Paterson N J has a 50 bat to a 914 final. Revert is a F 417. Ant is a half wave Zepp.

W2XBB, Bob of Bethouen Mt runs 75 watts to a 450 final. QSL is 7200. Revert is a Sky Buddy. Age is 1yr 12m old.

W1AJA, 16, Cal of Boulder City, Nev. is active on 40 kW. He is my pride as my rig runs 36 watts to a 1221 final. Revert is a SX 24.

WSTN, Carl of Canton Ohio runs 157 watts to a 750 final. Revert is a SX 17. He has a pictorial card showing N 35 kW spot trade.

WSTVQ, Pete of Dunkirk N Y runs 450 watts to a 1750 final. Revert is a 510D. He has W A. G, W A. X. and W. A. Z belongs to A. L. A.

W3VLY, Jack of Cleveland Ohio has a T in final. Antenna is a Zepp. Lives in Saratoga Springs, N Y. He and I have had a sales talk every day, hi.

W1HQL, of Charles City, Iowa runs 100 watts to a 750 final. Revert is a N 250. Antenna is a 100 Meter Antenna. He got his license on July 2 in case he wants to go if 75 final. (Navigator) It is.

W2VYF, Bill of Kewaunee Wis runs 35 watts to a 615 final. Revert is a SX 39 Sky Champion.

W4HXS, Henry of Pine Camp NY operates 100 watts to a 512 final. He is in the Army Camp. QTH there are 7200, 7217, etc 7217.

W1HFP, Ed of Louisville Ky runs 250 watts to 1700. Revert is a Sky Buddy. He is active on 45 kW. He believe he belongs to A. L. A.

AH8LW, Leslie of Mt. Prospect, Ill has bought himself a NC 209. Rig runs 35 watts to 2120. Earns a Sig Sluffer.

**Serviceman’s Experiences**

(Continued from page 30)

"I'm going to take—" I began. Gladys appeared at the door.

"Mrs. Kroger is completely deaf," she explained. "Take it to the shop if you wish!"

I wrote, "I'll bring the set back tomorrow on a piece of paper and handed it to her. She thanked me pleasantly, and said goodbye.

On the way to the store, I realized that this was the only way I could use to win my argument with Joe. How could a repairman bring happiness by fixing a set for a person who was stone deaf? There were exceptions, after all!

When Joe came in later that evening, Al charged him a buck for parts.

Joe picked up the set and started for the door. Thanks a lot," he said, "I'll deliver it myself."

"Just a minute, there," I called. "This call you sent me was the very one that didn't bring happiness into anyone's life. If your mother can't hear anything, how can her life be 'made fuller' by a receiver that plays? How can there possibly be any difference to her between a set that gives out and one that doesn't?"

Joe stopped at the door to answer. I expected more argument, but his spirit was gone. Joe was no longer taunting. I felt good, knowing I had proved my point.

"This set," Joe explained, "was my father's last-remaining gift to Mom before he died. She can't hear the set, but it makes her feel good to see the light on the tuning dial, as it was when they used to listen to it together. Sis says she stops knitting sometimes and sates at the pilot light for hour after hour. Good night."

I felt a bit ashamed as he walked out to the car.

"So even that job brought happiness," Al remarked. "I know, Lee—it should help you in your work to remember the things Joe told you last night."

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**Neutralizing Circuits**

(Continued from page 15)

to secure an indication. Minimum reading of the meter shows proper neutralization. The condenser in the rectifier tank is adjusted first for resonance in order to attain maximum sensitivity. The more sensitive and more resistant the rectifier circuit, the less circuit loading due to power absorption. It is really nothing more than an unilateral inverter. In the push-pull circuit of Fig. 4, the neutralizing plate and grid tank condensers should be adjusted step by step in unison. Adjustment of a neutralizing condenser in any one stage produces the push-pull, or single ended, may affect the grid or plate tank circuits which, if so-
fected, must be returned. Zero plate a.c. voltage is desired, as in the single ended stage circuits. The d.c. voltage is off while making adjustments. Either the rectifier type wavemeter or a neon bulb soldered to a pick-up coil or wire can be used, as for the single stage circuits, to get minimum field from the final tank.

In conclusion, while the adjustments appear to be quite simple, I have met quite a few amateurs who were hazy about the exact procedure; hence this little dissertation. One fellow even tried to neutralize by using the dubious indication of a d.c. voltmeter across the final tank coil.

Servicemen's Case Histories (Continued from page 40)

CROSBY 118 "Rondo" (Home Facsimile Recorder)
Not printing ... 1) power off
2) "loose" or "open" connection between receiver and printer
3) stylus stuck
Variations in ... 1) receiver may not have suitable arc circuit capable of keeping the output constant against wide variations of incoming signal strength
2) receiver may not have sufficient output
3) stylus may be stuck in bake-lit bridge
4) stylus may be worn
5) print head may have slight deposits of carbon on it. Clean
Wobbly print... 1) receiver not tuned properly (printer not synchronized with transmitter)
2) bent or loose stylus pin
CROSBY 521
Weak reception ... 1) replace 10,000-ohm resistor No. 10 with a 12,000-ohm 1/2-watt unit. Replace 300,000-ohm 72 tube plate filter resistor with a 250,000-ohm 1/2-watt unit (connecting plate end of high-voltage end of Condensior voltage divider resistor No. 41-13)
DEBUTA 610
Hum ......... 1) if receiver employs a Condenser resistor enclosed in a perforated can, check to see if it has slid down and is "shorted" on one end to its metal casing. The connection is cooled to the chassis, which is grounded
EMERSON 310—(Chassis 6G, 16)
Inoperative ... 1) "shorted" 0.1-mfd. by-pass condenser C-25, causing burn-out of 0.9-mfd. R-4 portion of metal-filmed wire-wound tapped resistor. Replace condenser with 0.1-mfd. unit and connect a 7,000-ohm 10-watt resistor across burned-out portion of tapped resistor.
2) check 1-mfd. 200-volt condenser C-9 for "short." Replace with 400-volt unit
3) "open" 100,000-ohm R-2 portion of wire-wound tapped voltage divider resistor. Replace with 10,000-ohm 10-watt resistor connected across burned portion.
EMERSON Q-157—(Chassis Q)
Whistling ... 1) connect 0.1-mfd. condenser from electrolytic condenser to ground

EMERSON 397 (Automatic Record Changer)
Time arm ... 1) check automatic record selecting lever (the lever that is struck by 127 records when they drop). Directly below this lever (on the underside of the panel) is a bronze spring that often drops from the panel, causing this trouble. Replace with new type Emerson replacement spring that can not fall off
FAIA 5000
Howling ... 1) move 25.16 tube plate lead intermittently away from the 600-ohm resistor. Shield lead if necessary
2) check for "open" by-pass condenser in 25.16 plate circuit
Howling ... 1) faulty filter condenser section

FARNWORTH BT-57, BT-53, BT-51, BT-53, BT-56
Circuit change ... 1) remove 100-ohm resistor now connected in the primary circuit of the 2nd i-f transformer. Connect it instead in the 12SA7 (two-mfd.) plate and screen circuit combined return lead to B plus. The 600-ohm by-pass condenser in the tank should be connected between ground and the plate end of this transformer
FARNWORTH BK-77, BK-58
Circuit change ... 1) change 8,200-ohm resistor in the shading network for improved performance
2) connect 150-000-ohm resistor No. 11 in the negative leg of the power supply circuit to 320,000-ohms. Ground it instead of connecting it to the mid-point of resistors No. 8 and No. 12
3) change 10,000-ohm oscillator plate resistor No. 5 to 22,000-ohms.

GENERAL ELECTRIC 4-75
Inoperative ... 1) check for "shorted" 0.1-mfd. Weak rectification—400-ohm, 1/2-watt by-pass condenser C-37. Replace with 600-ohm unit. Also check for overheated 1,000-ohm 6X7 plate resistor R-6. Replace with 1/2-watt unit. Pulling out ... 1) check 0.1-mfd. condenser in after playing new lead if amplifier O.K. for short time

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