RADIO NEWS

OCTOBER
1941
25c
In Canada 30c

BEGINNERS ALL-BAND TRANSMITTER

★

CONSTRUCTING A CODE OSCILLATOR

The RCA Electronic Microscope.

3 YEARS IN THE MAKING!

The New

P. R. MALLORY & CO. Inc.

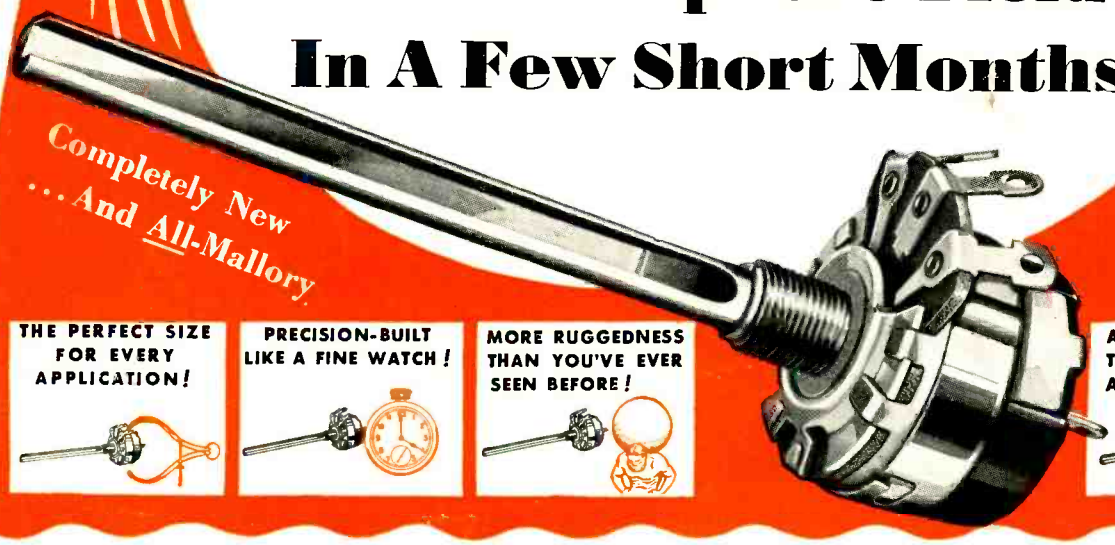
MALLORY

Replacement

VOLUME CONTROL

Has Swept the Field In A Few Short Months!

Completely New ... And All-Mallory



THE PERFECT SIZE FOR EVERY APPLICATION!

PRECISION-BUILT LIKE A FINE WATCH!

MORE RUGGEDNESS THAN YOU'VE EVER SEEN BEFORE!

AN A-C SWITCH THAT SNAPS ON AND STAYS ON!

The new Mallory Replacement Volume Control is *not* just an improved control. It's brand-new in every detail and principle . . . mechanical and electrical.

It licks the volume-control problems you've always been up against. You get quiet operation . . . gradual increase or decrease of volume . . . smooth attenuation . . . easy installation. And it has a simple, snap-on A-C switch. What's more—only 16 controls fill 85% of your replacement needs!

No wonder it's a hit with service engineers in only a few short months. See it at your Mallory distributor's *today*.

P. R. MALLORY & CO., INC.
INDIANAPOLIS INDIANA
Cable Address—PELMALLO

The New MYE Is Going Fast!

Order Yours Now!

Get It From Your Distributor Today!

More Mallory Replacement Condensers Being Sold Than Ever!

Complete coverage . . . color-coding for instant voltage-identification of paper tubular condensers . . . mounting features that others have tried to copy . . . long-life construction. These are some of the reasons Mallory Replacement Condensers are selling faster than ever. They fill every requirement—simplify your service calls—do a job you know is right!

Save your old Aluminum parts. It is patriotic to give them to National Defense.

More than ever —INSIST ON

P. R. MALLORY & CO. Inc.
MALLORY
APPROVED PRECISION PRODUCTS

VIBRATORS • VIBRAPACKS • CONDENSERS • VOLUME CONTROLS • ROTARY SWITCHES • SINGLE AND MULTIPLE PUSH BUTTON SWITCHES • RESISTORS • RADIO HARDWARE

I WILL TRAIN YOU TO START

A SPARE TIME OR FULL TIME

RADIO SERVICE BUSINESS WITHOUT CAPITAL

J. E. Smith, Pres.
National Radio Institute
Est. 25 Years

I Trained These Men

These Men Have SPARE TIME BUSINESSES

"I repaired many Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half, and I have made an average of $10—just spare time."
JOHN JERRY
1729 Penn St.
Denver, Colo.

"I do Radio Service work in my spare time only, operating from my home, and I net about $40 a month. I was able to start servicing Radios 3 months after enrolling with N.R.I."
WM. J. CHERMAK
R. No. 1—Box 287
Hopkins, Minn.

"I am doing spare time Radio work, and I am averaging around $500 a year. Those extra dollars mean so much—the difference between just barely getting by and living comfortably."
JOHN WASHKO
97 New Cranberry
Hazleton, Penna.

I Trained These Men

These Men Have FULL TIME BUSINESSES

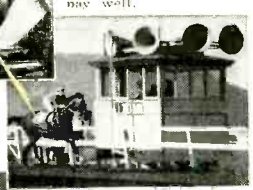
"For several years I have been in business for myself making around $200 a month. Business has steadily increased. I have N.R.I. to thank for my start in this field."
ARLIE J. FROEHNER
300 W. Texas Ave.
Goose Creek, Texas

"I went into business for myself 6 months after enrolling. In my Radio repair shop I do about $300 worth of business a month. I can't tell you how valuable your Course has been to me."
A. J. BATEN
Box 1168
Gladewater, Texas

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

N.R.I. MEN WORK IN THESE BRANCHES, TOO

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



(Above) **Radio Jobbers and Dealers** employ installation and servicemen at good pay.

(Above) **Loud Speaker System** is another field for Radio Technicians. (Left) **Police, Aviation and Commercial Radio** are newer fields for which we give the required knowledge of Radio.

The tremendous increase in the use of Radio in recent years has opened many opportunities for you to have a spare time or full time Radio service and sales business of your own. More than 50,000,000 home and auto sets are in use today—many millions more than there are telephones. Every year millions of these sets get out of date and are replaced. Millions more need new tubes, repairs, other forms of service. U. S. Radio owners spend $60,000,000 a year for servicing their Receivers. I will train you at home in your spare time to be a Radio Technician—to repair, sell, install all types of Radio sets—to start your own Radio business and to build it up on money you make in your spare time while learning. I will also train you to hold a good job in many of Radio's profitable branches. And best of all, you don't need to give up your present job or go away to school and spend a lot of money to train to be a Radio Technician or Operator. I train you right at home in your spare time.

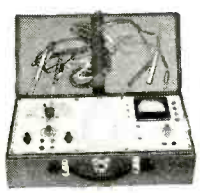
MANY RADIO TECHNICIANS I TRAINED AT HOME MAKE $30, $40, $50 A WEEK

Many N.R.I. trained Radio Technicians have taken advantage of opportunities to open a full time or spare time Radio business selling, servicing, installing, repairing home and auto Radio sets. Many others hold good jobs doing this kind of work for Radio manufacturers, dealers, jobbers, service organizations. Radio Operators I trained have good jobs in Broadcasting, Commercial, Aviation, Police, Ship, Radio Stations. Some make good money in Public Address work and other branches of the Radio industry.

My Course is thorough and practical. I give you basic training in Radio Theory and Engineering Practice which enables you to understand the operation and design of practically every type of Radio apparatus. You understand your work—know just what to do—instead of merely relying on your mechanical ability to fix a few common faults and make a few simple adjustments. That's why many men who have been in Radio before enrolling report that my Course helped them make more money, win success. I train you too, for Television, a promising field of future opportunity.

BEGINNERS QUICKLY LEARN TO EARN $5 TO $10 A WEEK EXTRA IN SPARE TIME

Nearly every neighborhood offers opportunities for a good part-time Radio Technician to make extra money fixing Radio sets. I give you special training to show you how to start cashing in on these opportunities early. You get Radio parts and instructions for building test equipment, for conducting experiments that give you valuable practical experience. My 50-50 method of training—half with Radio parts I send you, half studying my lesson texts—makes learning Radio at home interesting, fascinating, practical.



YOU ALSO GET THIS PROFESSIONAL SERVICING INSTRUMENT

as part of my Course to help you make more money, do better Radio work. For full details mail the Coupon.

MAIL THE COUPON—get my FREE Lesson and 64-page Book "Rich Rewards in Radio" at once. See what Radio offers you as a skilled Radio Technician. Learn how practical my Course really is. Read letters from more than 100 men I have trained telling what they are doing and earning. Mail the Coupon NOW—in an envelope or paste it on a penny postal.

J. E. SMITH, President
National Radio Institute, Dept. IKR
Washington, D. C.

EXTRA PAY IN ARMY, NAVY, TOO

Every man likely to go into military service, every soldier, sailor, marine, should mail the Coupon Now! Learning Radio helps men get extra rank, extra prestige, more interesting duty at pay up to 6 times a private's base pay. Also prepares for good Radio jobs after service ends. IT'S SMART TO TRAIN FOR RADIO NOW!

SAMPLE LESSON FREE

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

Mail Now

GOOD FOR BOTH 64 PAGE BOOK SAMPLE LESSON FREE

J. E. SMITH, President, Dept. IKR
National Radio Institute, Washington, D. C.

Without obligating me, mail your Sample Lesson and 64-page Book FREE. I am particularly interested in the branch of Radio checked below. (No salesman will call. Write plainly.)

- ☐ Radio Service Business of My Own
- ☐ Service Technician for Radio Stores and Factories
- ☐ Spare Time Radio Servicing
- ☐ Auto Radio Technician
- ☐ Aviation Radio
- ☐ Operating Broadcasting Stations
- ☐ Army, Navy Radio Jobs
- ☐ Operating Police Radio Stations
- ☐ Operating Ship and Harbor Radio

(If you have not decided which branch you prefer—mail coupon for facts to help you decide.)

Age .....

Name .....

Address .....

City ..... State 14x1

by THE EDITOR

THE mail bag continues to bring in comments regarding the article by *Roger William Riis* that recently appeared in "Reader's Digest." Many of these believe the article to be well-founded and accurate, while others disagreed entirely with the statements made by *Mr. Riis.* 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 off-set 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 articles by *Roger William Riis* focusing attention on the various abuses entering into the repair of automobiles, radios. and the like. *However,* there 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 take a patient's $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 loom highly important if it were not fully understood or neglected. . . ."

* * *

THE aluminum shortage now troubling designers and manufacturers of radio sets is being 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 parts jobber, 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 3650-3950 kcs. Mr. *Rufus*

(*Continued on page* 42)

RADIO NEWS

Trade-Mark Registered

Including Articles on POPULAR TELEVISION

The Magazine for the radio amateur experimenter, serviceman and dealer

Vol. 26, No. 4

Contents for October, 1941

FEATURES

Cover Picture: James Hillier and Dr. V. K. Zworykin (standing), with RCA electron microscope.

DEPARTMENTS

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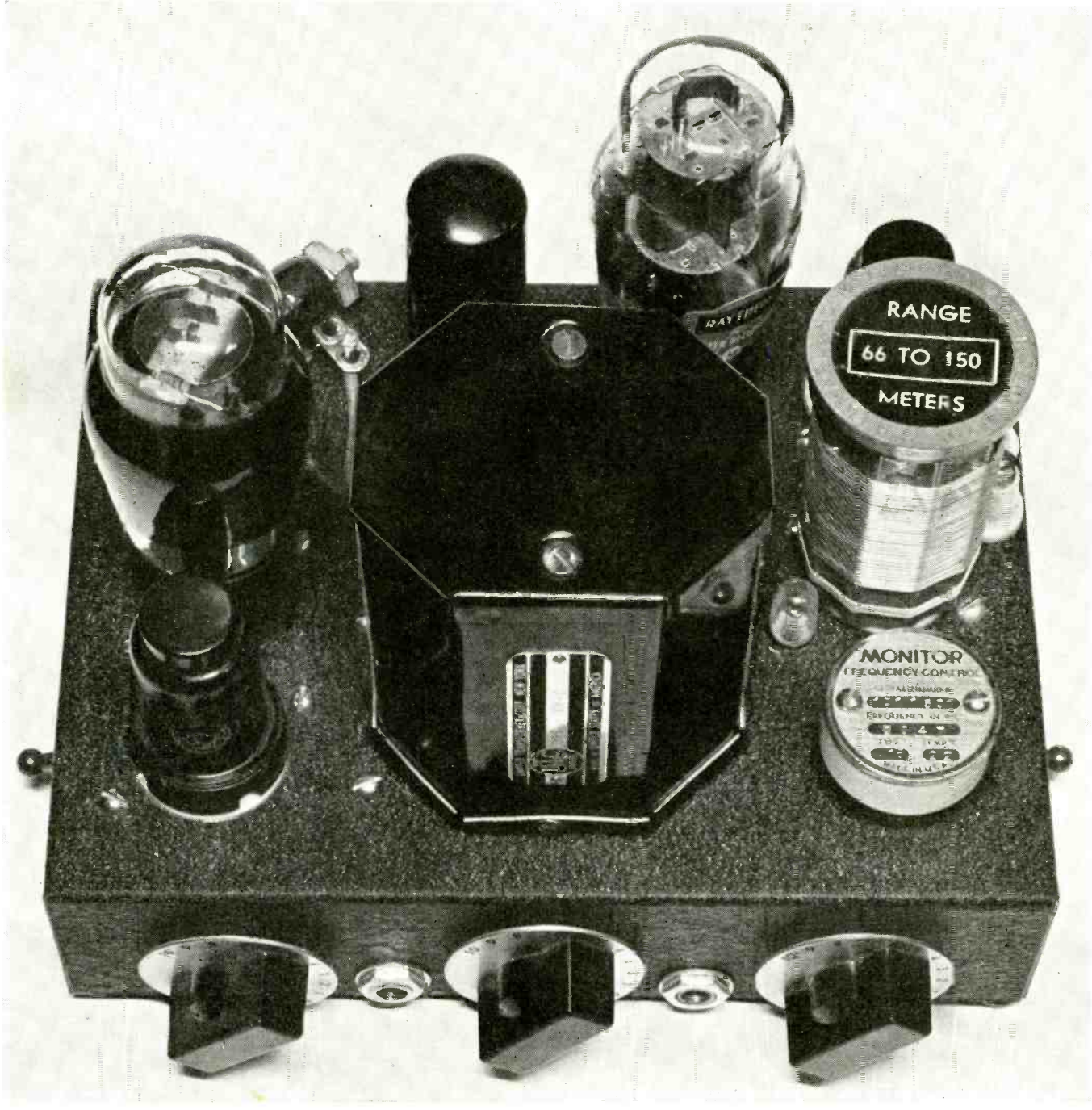
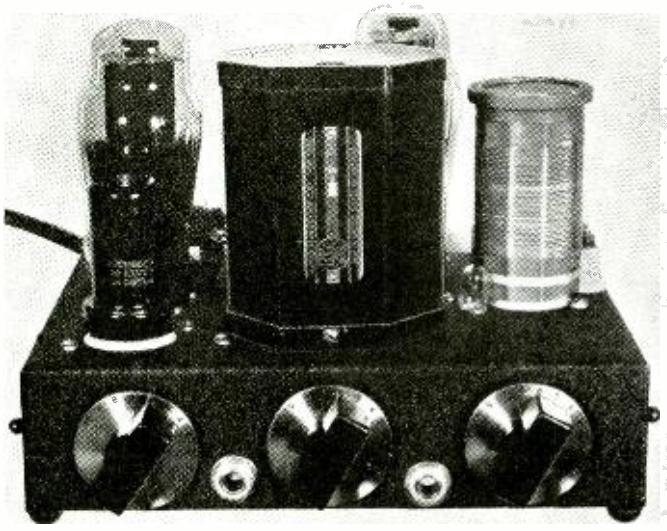
LOW POWER ALL-BAND TRANSMITTER

by DAWKINS ESPY, W5CXH/6

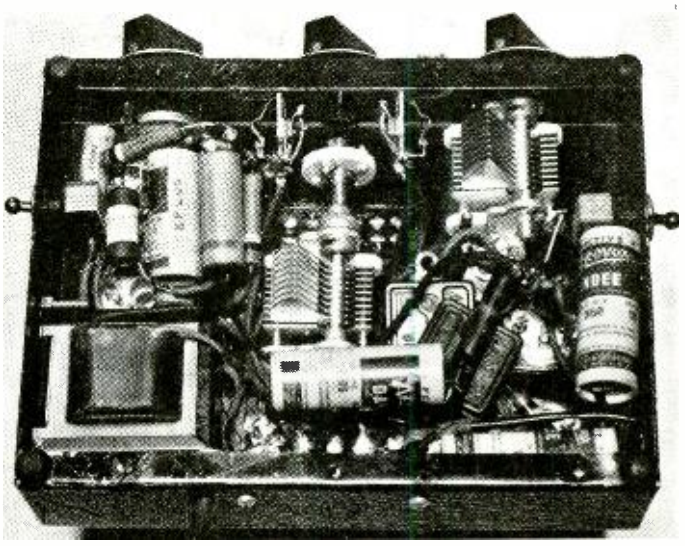
This transmitter features a voltage-doubling circuit which lowers the cost by eliminating the usual power transformer and associated filament supply source.

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 bugaboo 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 multi-match 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 chasis are: the filament series resistor, 25Z6 voltage doubler, the 25B6G amplifier tube, 6J5 oscillator, and the antenna terminals.

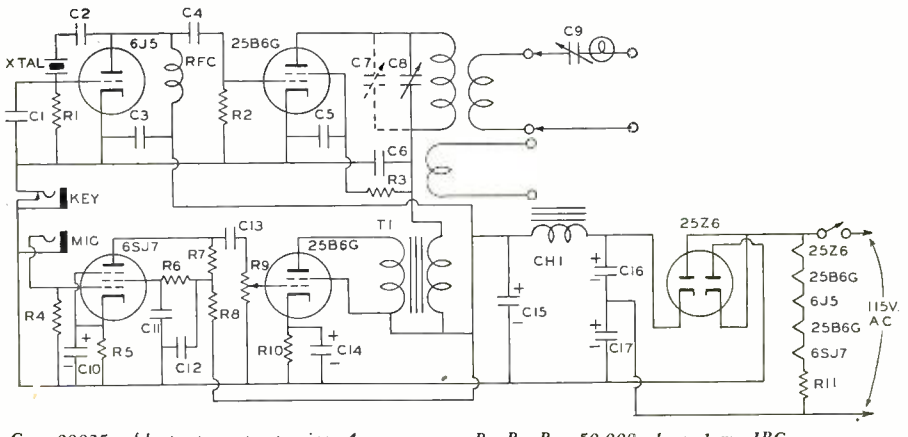
The underside view shows the audio section. The resistors and condensers are in the upper left hand corner. The filter choke is in the lower left hand corner, and the filter condensers are positioned along the lower and right hand edges of the chassis. In order to allow the modulation transformer connections 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.

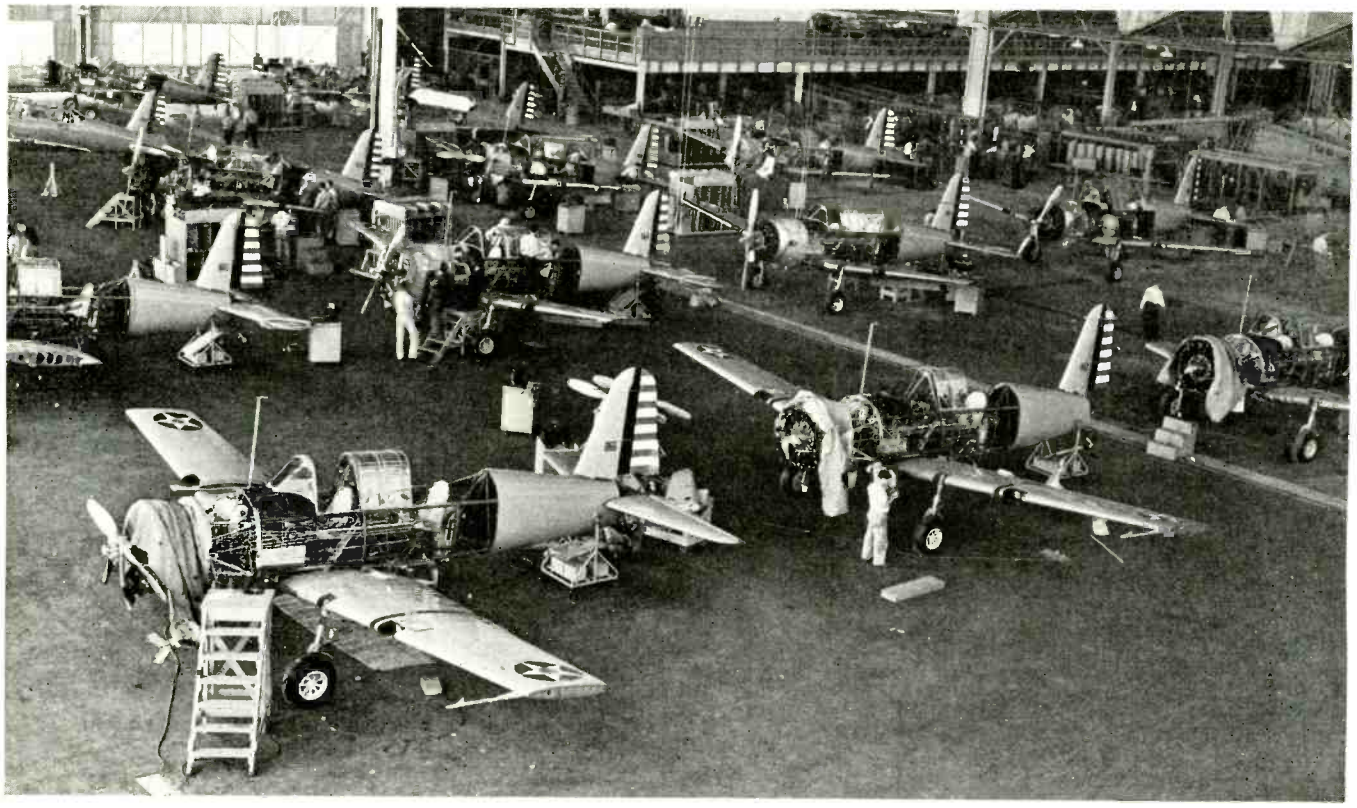
The coils have, in addition to the plate winding, one which can be used to link couple to an antenna tuner. Thus, by merely moving the clips provided from one to another, three types of coupling to the antenna become available, namely: direct, resonated inductive, and link. The antenna tuning condenser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

(Continued on page 42)



C_1—.00025 mfd., postage stamp mica, Aerovox
C_2, C_3—.006 mfd., mica, Aerovox
C_4—.0001 mfd., postage stamp mica, Aerovox
C_5, C_6—.001 mfd., mica, Aerovox
C_7—100 mmf. padder, Hammarlund APC 100
C_8—50 mmf. variable, Hammarlund HF50
C_9—140 mmf. variable, Hammarlund MC140M
C_{10}, C_{14}—25 mfd., 25 v. electro, Aerovox
C_{11}, C_{12}—.1 mfd., 400 v. paper, Aerovox
C_{13}—.01 mfd., 400 v. paper, Aerovox
C_{15}, C_{16}, C_{17}—16 mfd., 350 v. electro, Aerovox

R_1, R_2, R_5—50,000 ohms, 1 w., IRC
R_3—5,000 ohms, 1 w., IRC
R_4—5 meg., ½ w., IRC
R_5—500 ohms, 1 w., IRC
R_6—300,000 ohms, ½ w., IRC
R_7—100,000 ohms, ½ w., IRC
R_9—500,000 ohms, pot., Centralab
R_{10}—250 oms, 10 w., Ohmite
R_{11}—100 ohms, line cord, Ohmite
T_1—Universal modulation transformer, UTC VM-0
Ch_1—150 MA filter choke, Thordarson T-13C30



Final-assembly line in a large aircraft factory. Radio equipment must be installed by specially-trained men.

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.

The author punches "time-out."

"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 . . . "

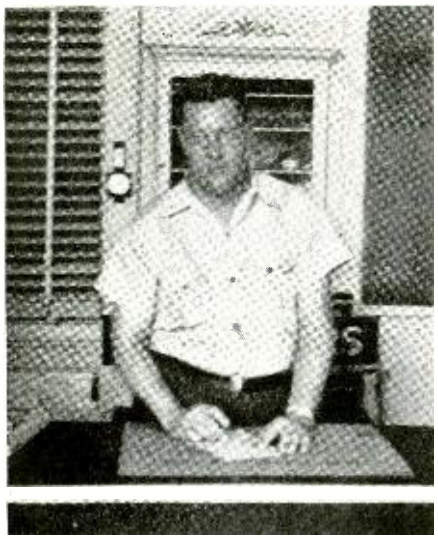
This time, the Personnel Manager *did* smile.

"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."



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 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 expect to see in 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! All I'd been 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, accessories 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 flawless 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 soldering-iron wielders, 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 service-man 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 Radio 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

H. Hudgens, former serviceman, finds time to relax. Now radio inspector.

or shorted, the owner can wait a week, a month, or even a year, and then drive into a Shop to have the set repaired.

In a plane, *one* mistake can mean a crack-up, through "no-reading," or false reading of navigation instruments, poor or faulty operation of receiver or transmitter, or radio-beacon receiver. The work not only has to be *right* . . . it has to be as nearly *perfect* as human hands can make it!

This means constant attention and full concentration on the job at hand. It's impossible to fly into this type

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 set onto 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, 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 somebody else who *can* slap 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 when you start work and when you quit. How many times have you 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 besides working and sleeping. He sees 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.

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

(*Continued on page* 49)

***by* ALFRED TOOMBS**

AMERICAN radiomen have justly earned a remarkable reputation for courage, unselfishness, ingenuity and perseverance. Their exploits have won them world-wide fame. But reports are trickling into Washington of daring and unbelievable feats undertaken by radiomen in the occupied countries of Europe beside which the notable accomplishments of the Americans necessarily are pale.

For as the people of Europe grown restive under the Nazi tyrant, it seems to be the radioman who first comes forth to risk his life in the good cause. From the northern tip of Norway to the heart of Vichy-Africa, from all the countries over-run, there are pulsing every day the signals sent forth from hidden transmitters—set up and operated by those who hate the Nazis. Some of these transmitters are run by veteran amateur and professional radiomen, while others are operated by men and women who have learned to be radio operators since the Germans came.

Consider that the mere possession of radio transmitting equipment warrants the death penalty and you will understand the risk that the European operators are running. The Germans are stern with those who are caught—they exact the full penalty. But this has not stopped transmission. Frantically, the Nazis patrol the air and dash from place to place in search of the illegal stations.

Our FCC monitoring stations and listening posts pick them up sometimes. And, more than once, American listeners have heard this fatal drama enacted: the illegal broadcaster will be in the middle of a sentence when suddenly the words will choke in his throat and there will be complete silence.

"You can almost see the Gestapo agents creep up behind the operator and seize him by the throat," one official said sadly.

That station will not be heard from again, but soon there will be another one. That the Germans realize the damage that can be done via radio is plain. They are even afraid to allow the people of the occupied countries to have receiving sets. When, a short time after the invasion of Russia started, the British threat to invade Norway first developed, the Nazis demanded surrender of all receiving equipment. Reich Commissioner Josef Terboven decreed that all residents of coastal areas which face Great Britain, must turn in their equipment. The Nazis wanted to make sure that the Norwegians wouldn't get orders from the British by radio.

Recently, the Germans announced that three Norwegians had faced a firing squad—the first capital punishment carried out in Norway in recent times. They had been sending military information to the British over transmitting equipment smuggled into the country.

The reports that reach Washington are not all grim, however. To the Russians goes credit for the happiest radio foray. For several weeks, radio listeners in Germany were puzzled by the sound of mumbling which seemed to break in during pauses in official news broadcasts. They could not make out the words distinctly until one night late in August. Then, when the official propaganda spiel had ended, they heard a voice say quiet clearly: "You don't expect us to believe those fairy tales, do you?" Later, when an announcer paused for breath in the midst of a particularly fanciful collection of claims, a second voice blended in—as if from the announcer's side—to explain confidentially "This is all a lot of lies, of course." For a couple of days, the heckling continued. The Nazi blood pressure was rising and the people were beginning to snicker—a bad thing in Germany.

Then the Germans countered. They put their announcers on in shifts, talking as fast as they could. When one would get out of breath, the next would take over, with never a pause. They started and ended every program with blaring music. There wasn't a blank second. Of course, the announcers were talking so fast that no one could understand what they were saying. But the Nazis were pretty happy as they got through the day without an interruption. That is, until the last news broadcast. The announcer finished reading his script and stepped back with a triumphant expression. "This is the end of the news for the day," he intoned. Then every listener heard the heckler after waiting for hours break in, to say: "But the lies will continue tomorrow."

NOTHING has been said about it publicly, but insiders will tell you privately that the reallocation of amateur bands, decreed during the summer by the FCC, approached very nearly to being a fiasco.

The Army came to the FCC to demand room on the air for student fliers who would be training in the Fall. The Army demands were whittled down some and the FCC issued its order of July 22, chasing hams off the bands between 3650 and 3950. It was planned to take over part of this for the Army on September 1.

But as the date approached, the Army began to re-examine the situation. It suddenly discovered that it didn't have as many student pilots in the air as it expected. So the 3800-3900 kilocycle band, which was to have been taken over immediately, was not needed. The FCC then decided that on or before October 1, the Army would start using the 3800-3900 kc band jointly with the hams—if it needed it. It is not expected that hams will have to cease activities on this band before December 20. Some believe that the Army will not even need the band exclusively by then and it appears that it will be some months before there will be enough student pilots for the Army to demand exclusive use of the entire 3650-3950 kc portion of the amateur band. So rest a little easier.

The Army's miscalculation caused some at the FCC to get a little hot under the collar, but the hams took the whole procedure with good grace. Not a single protest against the action was registered, the hams demonstrating quite clearly that they understood that defense comes first. But there was a protest—loud and long—against the FCC order that Class A privileges should be suspended at the same time. K. B. Warner, testifying at the hearing on the proposed order, said:

"There are about 20,000 Class A licensees who have the right to work on two restricted bands as a sort of reward for special qualifications. The very delicate balance of occupancy in the crowded amateur bands would be substantially upset by the removal of the Class A franchise and the opening of all of the phone frequencies to all amateurs."

Result: The FCC decided not to suspend Class A, after all.

The Army Amateur Radio System is going to have to do some moving around as a result of the reallocation. AARS officials working with Corps Area Signal Officers and with the ARRL Communications Manager, are now preparing a revised directory of AARS nets. It is planned to use the 1750-1900 kc band for new nets, as well as for a number which had been operating on the 3500-3900

(*Continued on page* 58)

Build This GRID-DIP METER

by

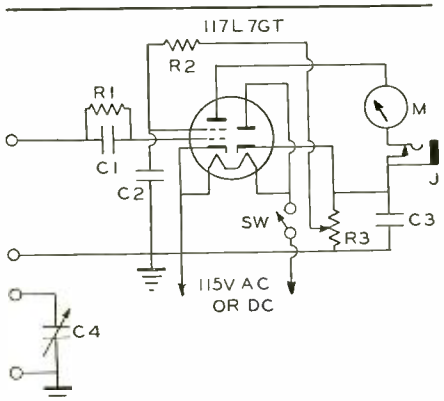
WILLIAM J. CONNELL

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.



C_1—.0005 mfd., mica
C_2—.01 mfd., paper
C_3—8 mfd., 450 v. electro
C_4—375 mmf. variable Cardwell XR150PS
R_1—1 meg., ½ w., Aerovox
R_2—4 meg., ½ w., Aerovox
R_3—50,000 ohms, pot. with switch, Yaxley
M—0-1MA meter, Triplett No. 321
J—Closed circuit jack
SW—SPST on R_3

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.

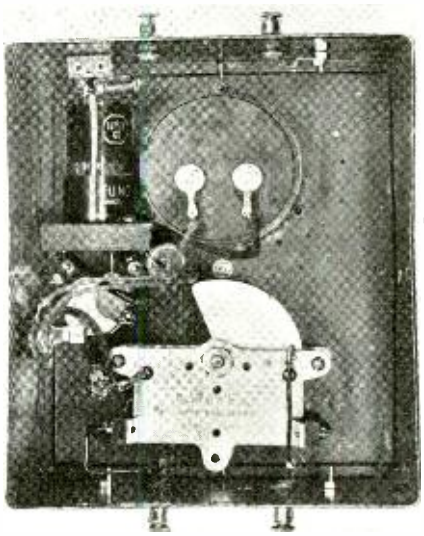
It has found numerous uses in the shop whenever problems arise requiring a sensitive resonance indicator.

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 milliameter 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



The input and output terminals may be mounted wherever most convenient.

circuit with an 8 mfd. 150 volt condenser connected across the output.

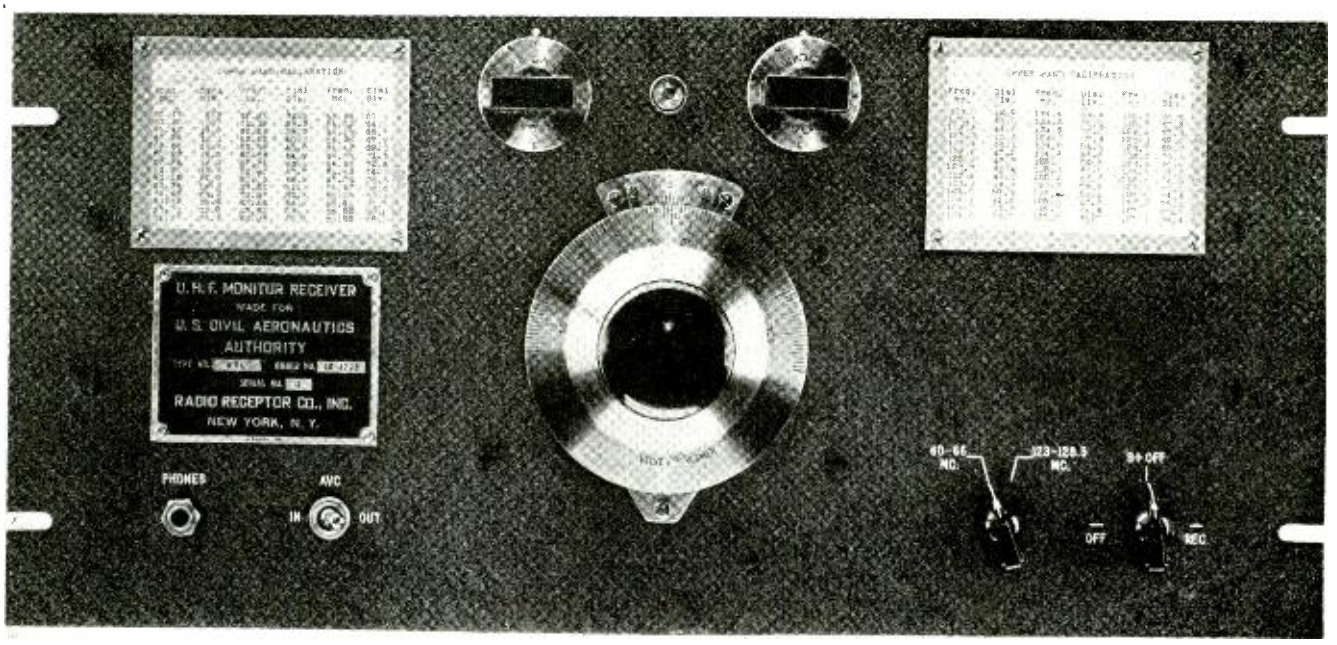
A calibrated 365 mmf. variable condenser is also included in the unit to assist in computing inductance values.

Construction

The unit was built into a 6½ x 7¾ - x 4¾ *Triplett* signal generator case, however any commercial cabinet approximating these dimensions may be used. The 3 inch *Triplett* 0-1 d.c. milliameter, 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)



Commercial Ultra-High Frequency Receiver. It covers both the 60-66 mc. and 123-127.1 mc. frequency bands.

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.

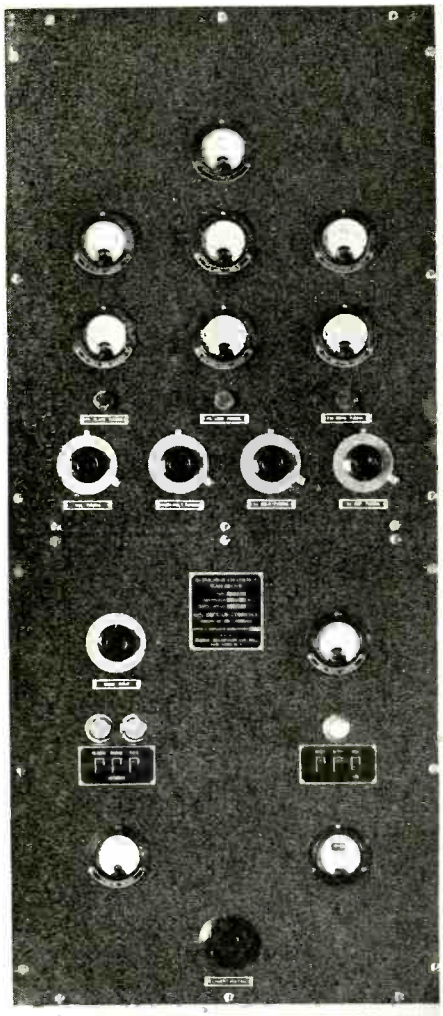
RADIO receivers and transmitters used for the reception and transmission of short wavelengths are somewhat different in design than those used for the reception and transmission of medium wavelengths or the lower frequencies. This is especially true of FM equipment used at the ultra high frequencies.

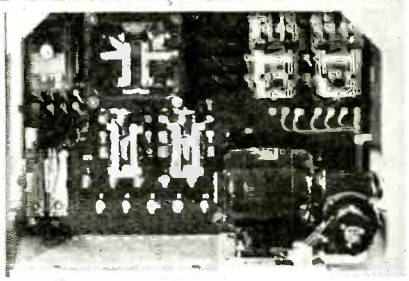
In the UHF receiver and transmitter, we will usually find vacuum tubes designed specifically for UHF operation. These tubes are designed so that long leads to the internal elements are eliminated, and in some circuits employing them, no sockets whatsoever are used for base contact connections. This makes for higher efficiency because very little r.f. resistance prevails at terminal connections. Interelectrode 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.

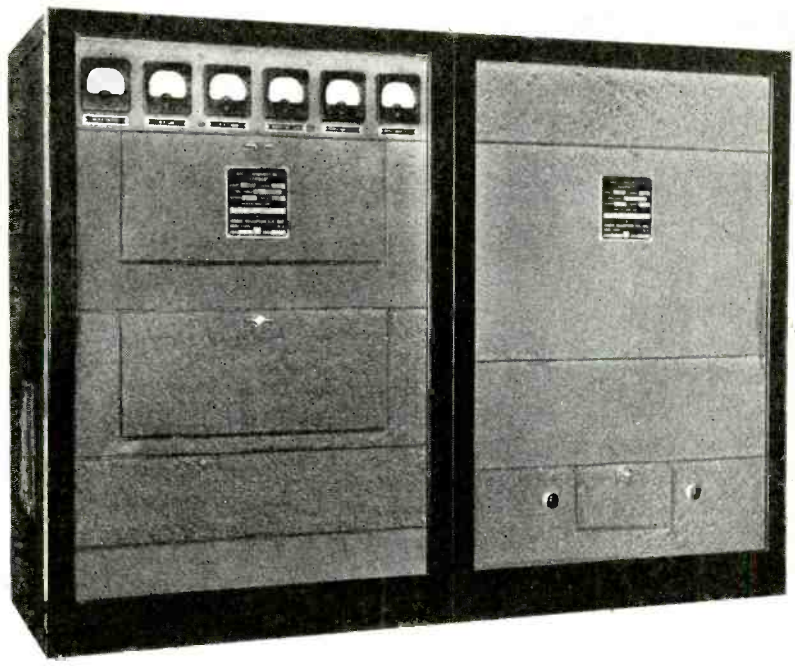
In some receivers and transmitters, inductive tuning prevails, but the greater part employ capacitive tuning. The advantages of inductive tuning seem to make it preferable to capacitive tuning in that it is possible to obtain higher "Q" (sharper tuning), lesser noise, greater tuning ranges, and more 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



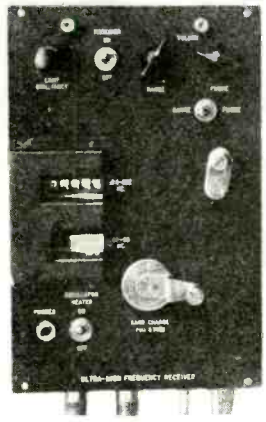


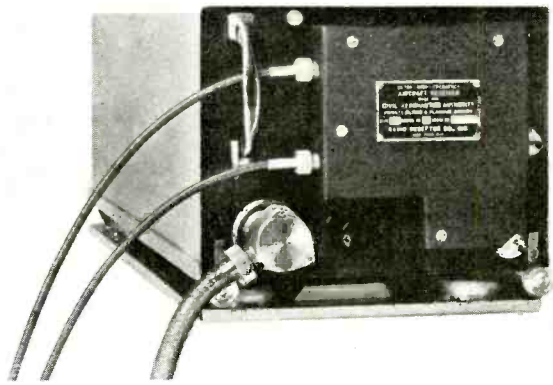
Ultra-High-Frequency Marker radio transmitter. Note relays at bottom.



Commercial 100 watt Airport Traffic Control radio transmitter made by the Radio Receptor Company. Tuning and other controls are back of the metal doors. Only the pilot lamps and necessary indicating meters are visible.

★ ★





A modern aircraft receiver that operates on the ultra-high channels is shown above. All connectors must pass a rigid test before they may be used in planes.

resistor; and if connecting leads are used, they should be of the same length as those connecting the defective resistor.

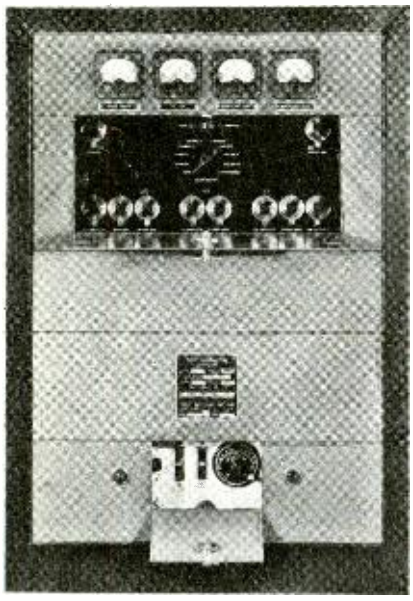
Condensers having low "drift" characteristics or "negative temperature coefficients" are employed in the construction of most UHF equipment. Bimetal condensers are to be found in a number of sets. High stability in receiver and oscillator circuits is of major concern, this being the reason for using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

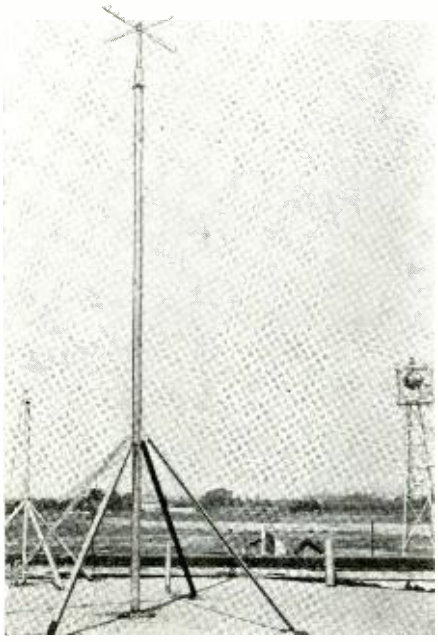
The superheterodyne seems to predominate as the receiver generally employed in UHF work because of its gain and sensitivity. One will find, however, that the intermediate frequencies (IF) as used by such supers are usually much higher than those previously encountered. The IF frequency used in some FM 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 band width 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.



Airport Traffic Control transmitter of 50 watts output. Tuning knobs lock.



U.H.F. Traffic Control antenna installed at Philadelphia, Pennsylvania.

A basic crystal control circuit is usually used in the airport transmitter, but in the aircraft transmitter m.o.p.a. will be found in addition to crystal control. The main reason for m.o.p.a. seems to lie in the fact that sometimes it is necessary that the transmitter have a variable frequency range.

Power supplies for the aircraft transmitter and receiver usually consist of the plane's battery for low voltage supply and for energizing a dynamotor used for supplying the high plate voltages necessary. The conventional 110 volt a.c. line usually furnishes the power for the airport receiver and transmitter in conjunction with a specially designed power supply and rectifier system.

The receiver usually contains two 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 deviated 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 noises due to vibration or rubbing contact with the aircraft structure.

Blacklash in remote tuning controls should be avoided on installation by noting the amount 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 nuts and other retaining hardware.

In preventing conducted and radiated interference, spark plug shields should be used, high tension cables must be shielded and bonded, likely radiating members should be bonded to the "main metal mass," reactive filters must be used in low voltage circuits having the correct current carrying capacity (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.

New York-Chicago U.H.F. Antenna site.

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 improprieties.

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 radioman supervising the installation.

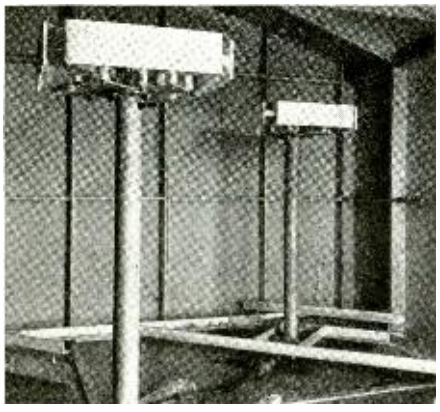
Lead-in insulators should be installed as close to the receiver and transmitter as possible, and if these are installed

upon glass panels or windows, care should be taken in tightening them. Small, compact, tightening wrenches having a calibrated pound scale are available and should be used where the exact tension is critical.

The finished station installation should appear "workmanlike," because the external appearance of the installed equipment and associated components is a "mark" that travels with the technician wherever he goes.

Maintenance and Testing

The first requirement of proper UHF testing and maintenance (and installation) is that the technician possess proper equipment. In addition to the usual testing equipment found in the aviation radio shop, an UHF frequency meter or a calibrated oscillator with stable frequency characteristics is needed. Although the Lecher wire wavelength measuring system, or the absorption method may be used for measuring frequencies in the microwave and the UHF spectrums, a manufactured meter seems to be more accurate. In addition to the meter, a



Inside of the U.H.F. antenna "house."

dependable "UHF tube tester" should be available; these are scarce at the present time.

The aircraft radio installation should be inspected thoroughly every thirty-five hours and all components tested on the bench. A daily pre-flight test is always made and consists of a visual examination of all components and the operating test made with and without the engine operating and the generator charging. The station installation should be inspected monthly. All dust and dirt accumulation should be removed, relays checked for adjustment, fuse values noticed, meter readings examined, operating log consulted for "equipment failures," etc. Depending upon the policy of the operating agency, more frequent inspections may be required, but the monthly examination should suffice.

Thirty-five hour inspections performed carelessly will in time show up on the operating agency's ledger in red! This means, that new equipment may have to be purchased or components replaced before their "life expiration" period is due, resulting in needless expense.

Testing procedure varies with the

(*Continued on page* 51)

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 feed-back 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 500 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 Ln is a total of 180 degrees, so that the net phase displacement is zero degrees. The parallel resonant circuit of Cp 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. Cn, the neutralizing condenser, is adjusted for minimum power output of the stage after Lp-Cp are tuned to the resonant frequency of the driver circuit. In other words, if Lp-Cp are adjustable over the limits 7000-7300 kilocycles, and the crystal oscillator is 7100 kc., Lp-Cp 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.

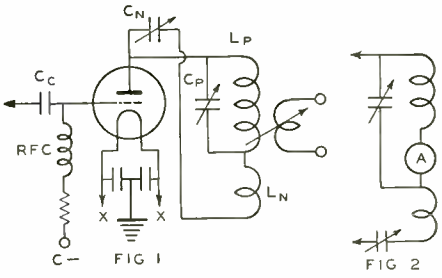


FIG 1 FIG 2

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)

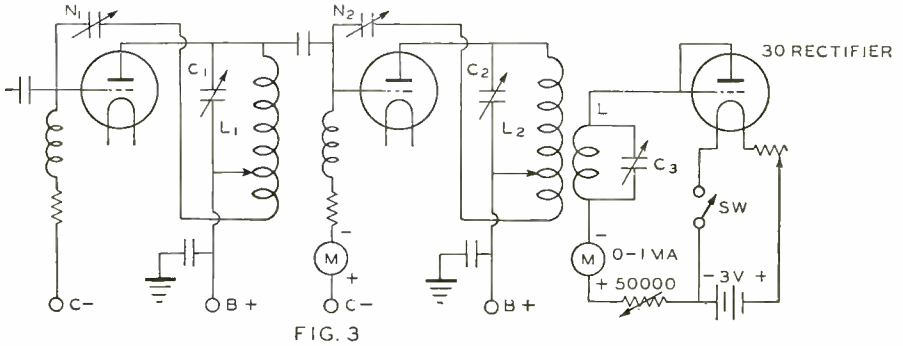
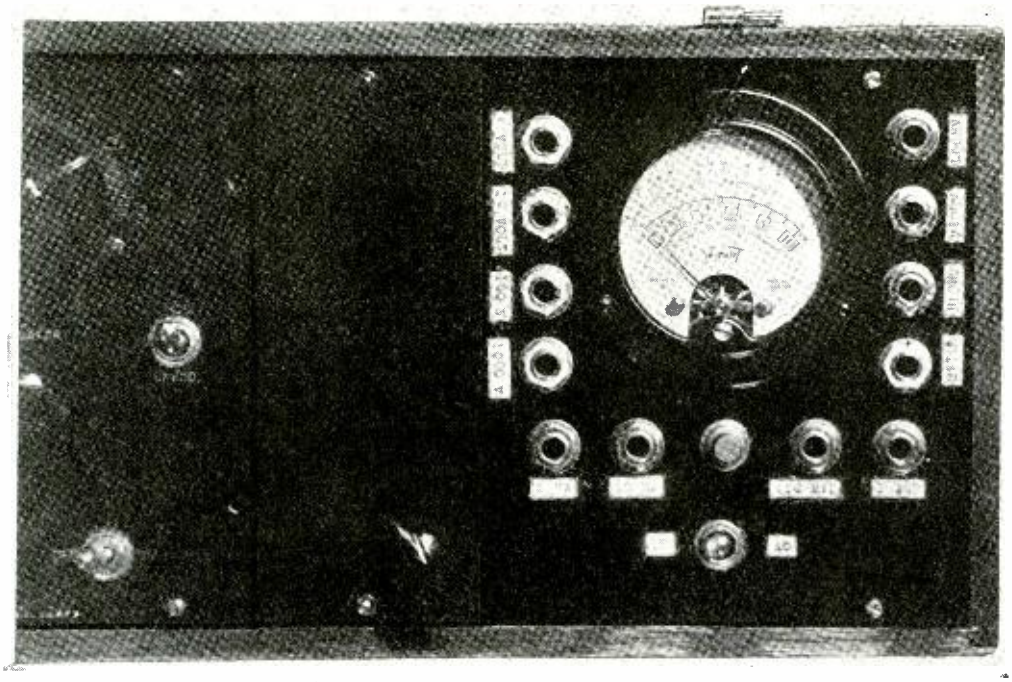


FIG. 3



This efficient tester may be constructed from parts on hand or from standards kits.

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 standpoints 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

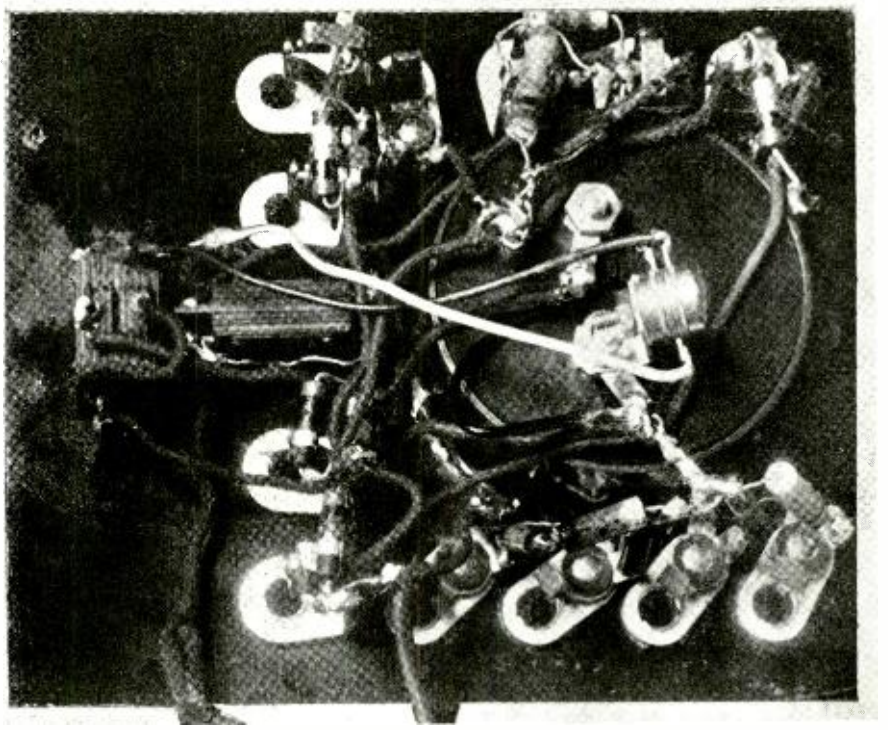
meter for ordinary work overbalance the slight increase in accurate results. The latter is relatively inexpensive, contains no batteries or tubes to run down and possibly give inaccurate readings, keeps its calibration indefinitely with no adjustments, is more compact, and can be used as a current-meter 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 resistance. Current times resistance (which could be measured) would equal the voltage, where the resistance is the *total* resistance of both meter and circuit resistance R.

The resistors needed for this test instrument 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 until the closest value is obtained. In this way, it is possible to obtain all values to within about 2%, which results in a product of high accuracy. For this procedure it is advisable to secure the co-operation of a neighborhood parts dealer. All resistors used in this particular instrument are of the half-watt midget type variety, and with the exception of the higher values are wire-wound.

D.C. Voltmeter

Figure 2 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 this particular meter being 5000 ohms we make R 20,000 ohms. For the second range we require 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 reading. 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 accurate 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 momentarily shorted by the metal sleeve of the jack during insertion. This may prove troublesome on the voltage measurements, so the following procedure should be followed. Note figure 3. The interior long screw is removed 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 insulating cylinder between the long screw and the exterior arm is cut in the corresponding place.



Rear view of the Plug-In tester. The jacks must be turned at an angle in order that they fit into a compact assembly. Note rectifier on the meter.

All parts are now replaced, except that a thin insulating washer is inserted between the two sawed parts (at the dotted line). There will now be two insulating washers in the plug, originally there having been one between B and A. While the plug is being inserted now, A and B are short-circuited for an instant, but B is isolated 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 similar to a microphone plug, except that in the latter, the two insulating washers are placed too close to each other to be used.

D.C. Measurements

The circuit employed for milliampere 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 .001 amperes (1 ma.) at full-scale. The scales desired are 1-10-100-1000 mils. Since one milliampere 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 5,000 ohms or 209 ohms. In other words 25 times as much current is passed through the entire circuit (shunt and meter) as is indicated on the meter. For a 10 mil range the shunt should be 1/249th of the resistance of the meter, so that all readings 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 insulating form. Note from figure 4 that the *shunt is connected before the meter itself!* on insertion of plug.

Resistance Measurements

There are two general types of ohmmeter circuits, the series and the shunt. In the former, the meter deflection decreases for higher resistances on test, while in the latter, a higher resistance being measured results 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 diagram are found as follows: It is only

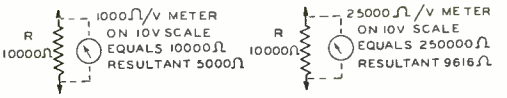
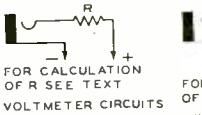


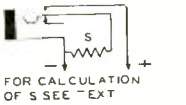
FIG 1A

FIG 1B



VOLTMETER CIRCUITS

FIG 2



MILLIAMETER CIRCUITS

FIG 4

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 to rest at the full-scale reading (0 on the ohms scale). Naturally when we insert a resistance of 30,000 ohms between the two ends of the test cord, we expect the meter to

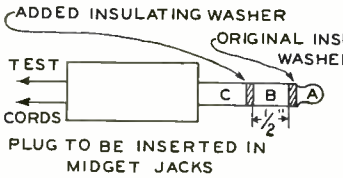


FIG. 3

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 megs 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,-

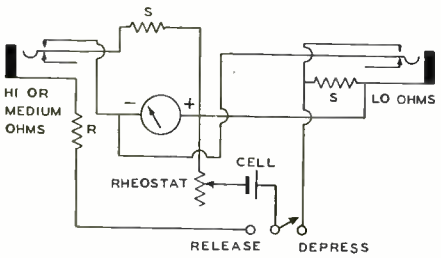


FIG.5 FIG.6

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)

by CHARLES J. SCHAUERS

From Drafting Table to Aircraft

AT one time or another who hasn't heard the question, "Why didn't they incorporate this or that, in that new receiver just released for sale?" And who hasn't heard this one, "I could have done a better job myself; they're selling something, half of which, we could do without!" And how many times were those who asked the question and made the statement quite inaccurate? The answer is, frequently!

The many factors that enter into the design, manufacture and sale of aviation radio equipment are numerous; as are those factors which must be necessarily considered when making a survey of the demand and acceptance of a certain unit.

Usually, those who purchase aviation radio equipment are not acquainted with all the factors that must be considered before the finished product is shipped to them.

The radio serviceman who installs the equipment or who maintains it should have an insight into the workings of the *average* aviation radio manufacturing concern, not only for his knowledge, but also because he should be the intermediate contact between customer and factory.

Before a piece of equipment is released to the public it is generally known that it is thoroughly tested, but it is not generally known that before the testing begins that a large part of the work in putting the finished product on the market is consummated outside of factory doors.

Tracing the steps of survey, design, production and sale, we find that each has a definite purpose and is closely related to the other three.

Depending upon current practices, word is received by the manufacturer that such and such a unit is needed by the airlines. The surveying personnel is immediately sent out and they determine the following: type of units needed, service to be rendered, size of units, overall specifications, other demands, and the "roughage price." After this information is returned to the factory, the engineering department acts upon it and their finished information, design, initial testing, etc., is acted upon by the production department.

Then in turn, the sales manager and his staff consult with the other three departments and consideration is given to price and likely markets. Production hasn't started yet. Another survey is then made of competitors' equipment manufactured on similar lines and all defects are ironed out in a final testing process, using their own design plus the design considerations of their competitors. One wouldn't necessarily call this "spying research" but it is done, and to the advantage of the purchaser.

After production starts on a mass scale those who placed orders first after receiving all pertinent information concerning the unit, are given priority and then the sales campaign starts.

The public relations department, not idle while production is moving assists the sales department by advertising and demonstrating the unit with the assistance of a technically qualified demonstrator.

The procedure outlined above varies slightly in various concerns, but on the whole, is accepted by most as the best.

Now here is where the serviceman comes in or the installation technician: while all this "redtape" is being run through the "mill" he is patiently sitting back waiting for the finished product and is wondering the meanwhile what service considerations have been given the unit. After the unit floods the market he receives his chance to examine the contents of his package . . . and then without much "ado" he says, "Now what did they put that thing in there for? Can't see where it's necessary!" If the designing engineer could only hear him! Then if he's the type of serviceman who desires to render the best possible service he inquires into the technical design features of the unit and studies the "high points." When his time comes to service the unit he knows what to do.

Some manufacturers have "traveling schools" who render all possible aid to the serviceman in teaching him how to service, install, and sell their equipment. In explaining the unit to a customer he is not at a disadvantage and usually makes a sale if the customer is in need of such a unit. On the other hand the serviceman who doesn't understand why a certain circuit was incorporated in the set, or why the set did this or did that, will usually find the customer walking away because he feels that if the serviceman cannot explain the set to him it is not worth considering because the manufacturer is unreliable in that he did not educate his "agent"; and if he neglects to do this he surely must have neglected to put something in the set that it really needed. The writer has seen customers take the above attitude time after time, and if the serviceman had only educated himself instead of waiting for the manufacturer to do this for him, he would have made a sale.

The servicemen should have those factors in mind at all times which directly concern the design, production and sale of equipment, and he should understand these thoroughly not only because it adds to salesmanship but because it helps him to understand the technical features of the equipment much better. The customer not only appreciates his interest but knows that he can be depended upon as well as the manufacturer.

Vibrator Maintenance

Those vibrators usually found in aircraft radio equipment need little attention if the correct input voltage is maintained at all times. However being an electro-mechanical device they will give up the "ghost" if not periodically checked. Some units are sealed at the factory and consequently cannot be inspected; these are replaced when they become defective. In some installations, however, one will find a vibrator that has been so constructed so as to allow inspection, adjustment and repair. In all cases the unit should be removed to the service bench for cleaning, etc., because if the proper procedure is to be followed, it cannot be in the cramped quarters found in the ordinary aircraft. There are some aircraft radio service agencies who employ "mobile service" units which greatly facilitate the service of any part of the radio installation, but it will be seldom found where these units contain the requisite apparatus for testing properly and overhauling a vibrator.

A defective vibrator will cause no end of trouble and because of their "temperamental" nature after they are once out of adjustment it is wise to replace them if they are of standard design rather than attempt repair.

If a cathode ray oscilloscope is obtainable, it should be used for final adjustment and test of the vibrator. If, however, the scope

(*Continued on page* 58)

Local Servicemen's Associations

by SAMUEL C. MILBOURNE

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

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, pooey!" 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 hindermost, but in recent years this condition has been greatly changed.

We won't go through all the details of early organizational struggles, but to-day the P.R.S.M.A. offers servicemen-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 knack that is worth the telling.

In the first place, 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 man.

If you've been a diligent reader of "Ringing 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 itinerate 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, untarnished.

The Association has done a good deal toward the raising of repair prices for labor and material to a proper level. It is 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

"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 "hep" 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.

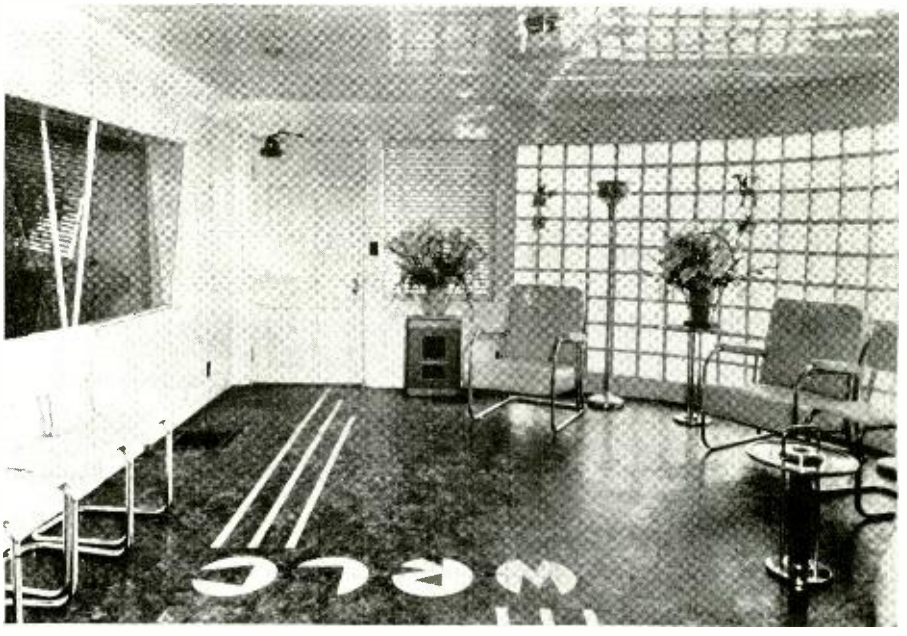
In return, Radio Station WFIL gives them a choice 15-minute spot (a regular radio program) on Saturday night, and two spot announcements a day throughout the week. P.R.S.M.A. is advertised along with WFIL in buses, streetcars, and on billboards throughout the Philadelphia area—all at no charge to the 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

★ ★



Reception room of radio station WRLC at Toccoa, Ga.

ARC welded steel was used exclusively in construction of the new radio station WRLC of *R. G. Le Tourneau, Inc.* at Toccoa, Ga.

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-gauge steel sheets, arc welded together with interior spacers set at intervals of not more than 24 inches to form a stout structural member. These panels arc welded together enabled 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.

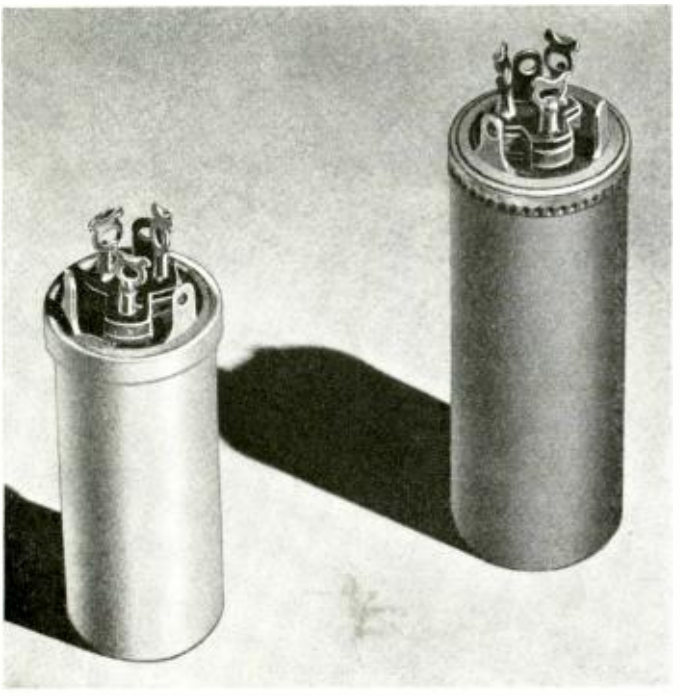
WRLC operates on an assigned frequency of 1450 kilocycles with power of 250 watts. The license is the regular commercial type as issued by the *Federal Communication Commission.*

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.

—30—

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



Above: Aluminum (old), and Cardboard (new) capacitors.

PRIORITIES and their Effect on CAPACITORS

by LEWIS WINNER
Market Research Eng., N.Y.C.

A recent survey among sources of raw materials and capacitor manufacturers revealed many important vital facts.

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 lugs and 1⅜″ diameter with 4 terminal lugs. The lengths will vary from 2″ to 4″. Actually they will be slightly longer than their aluminum bretheren, 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 ozide 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 quanitities 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)

View in paper section winding dept. of modern plant shows latest trends.

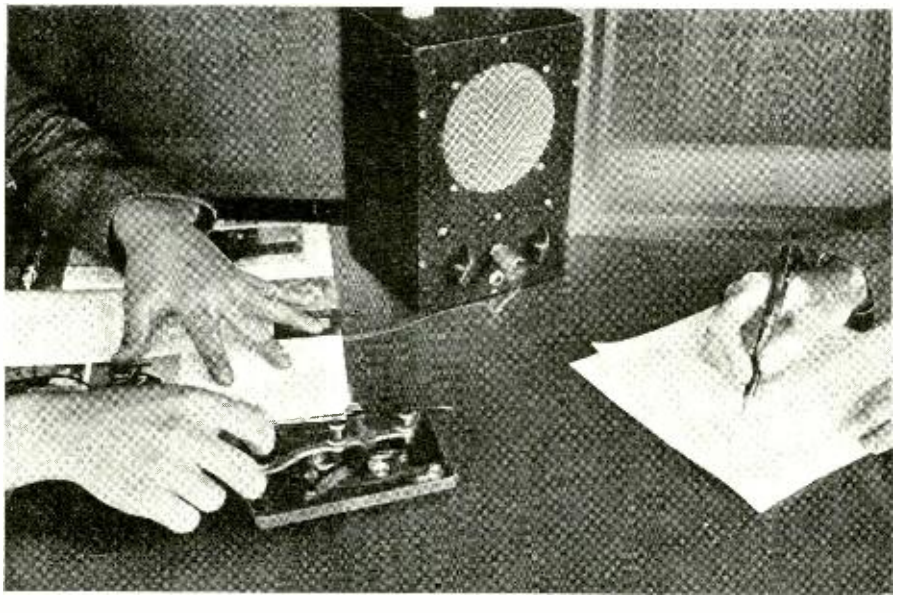
Learn the Code with this VERSATILE OSCILLATOR

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.



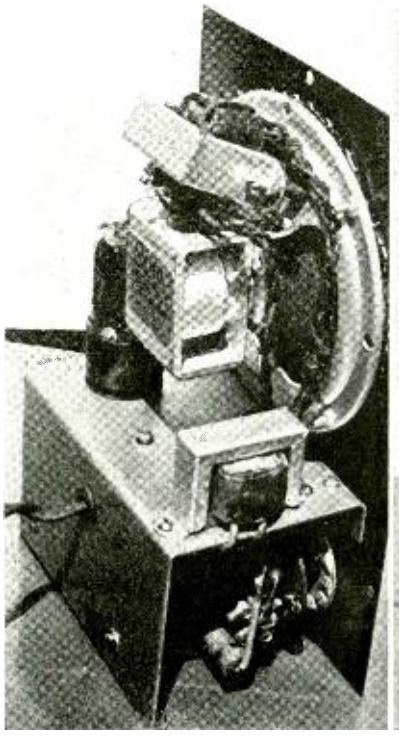
IN THESE times of National Unlimited Emergency it is fitting and proper for each Radio man to seek out the manner in which he can improve his usefulness to his country. In the times that lie ahead many of us will be called upon to serve our community and our nation. Without a working knowledge of the 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.

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.

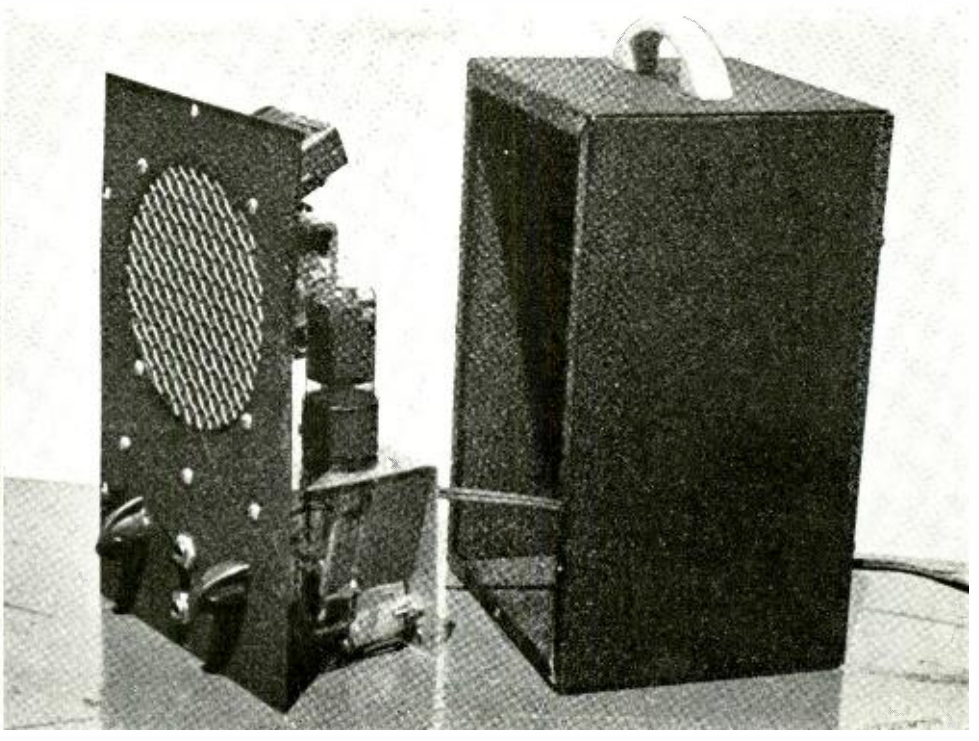
The power output of the unit is about .55 watts. It was found necessary, in order to realize this power output without using a power transformer, to use a Permanent Magnet Dynamic Speaker instead of one with a field coil. The reason for this is that the speakers having high resistance field coils were 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.

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.

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-



Speaker and choke are mounted on the small sub-chassis above.



Two jacks are mounted on the front of the panel—one for the key, and the other for external headphones. Tone is varied by adjusting the left hand knob on the panel.

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.

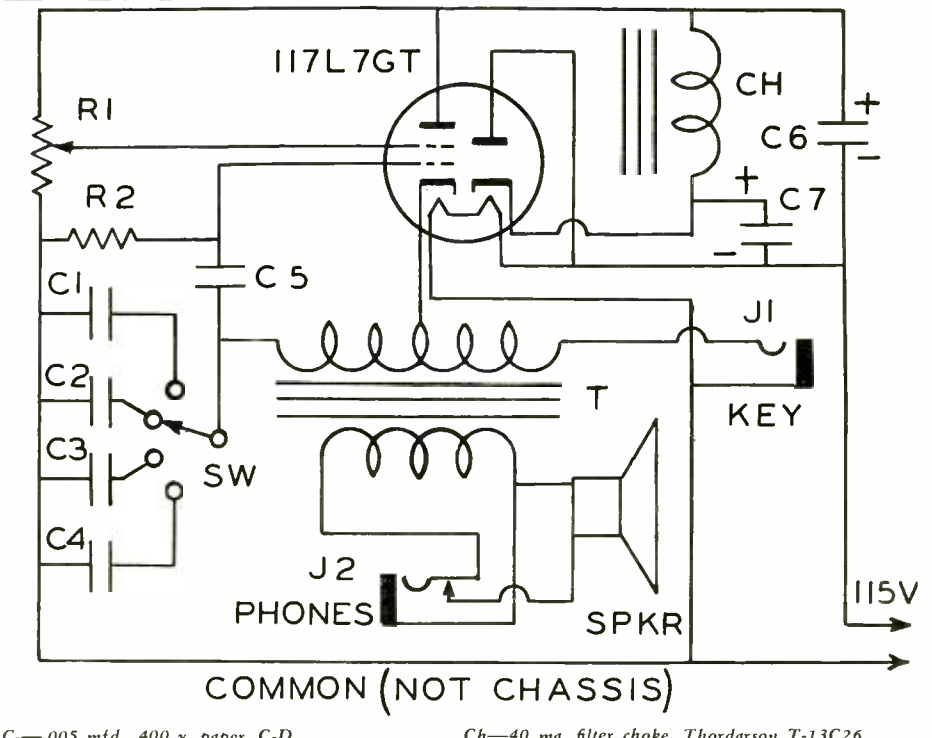
After much experimenting it was found that the most satisfactory volume control was a screen voltage potentiometer. Controls were tried in the grid and in the output circuits. These were not found satisfactory. In the grid circuit the control affects the feed back and thus at low volume —instability 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.

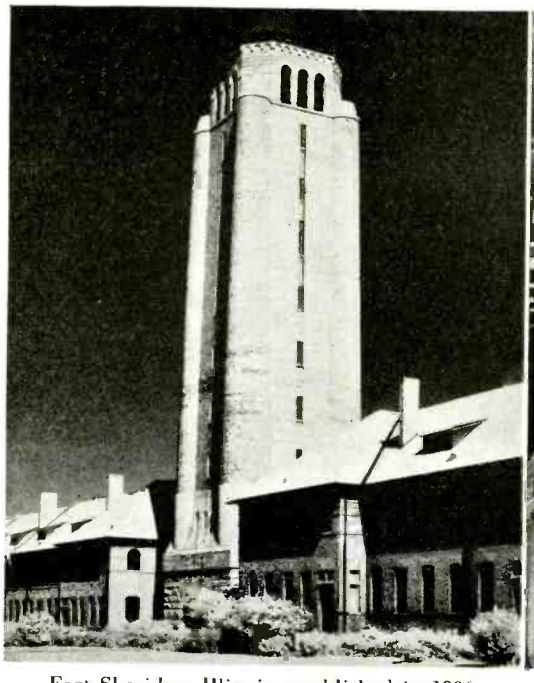
The unit as described is a very practical code practice set suitable for an individual, a club or a class.

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-

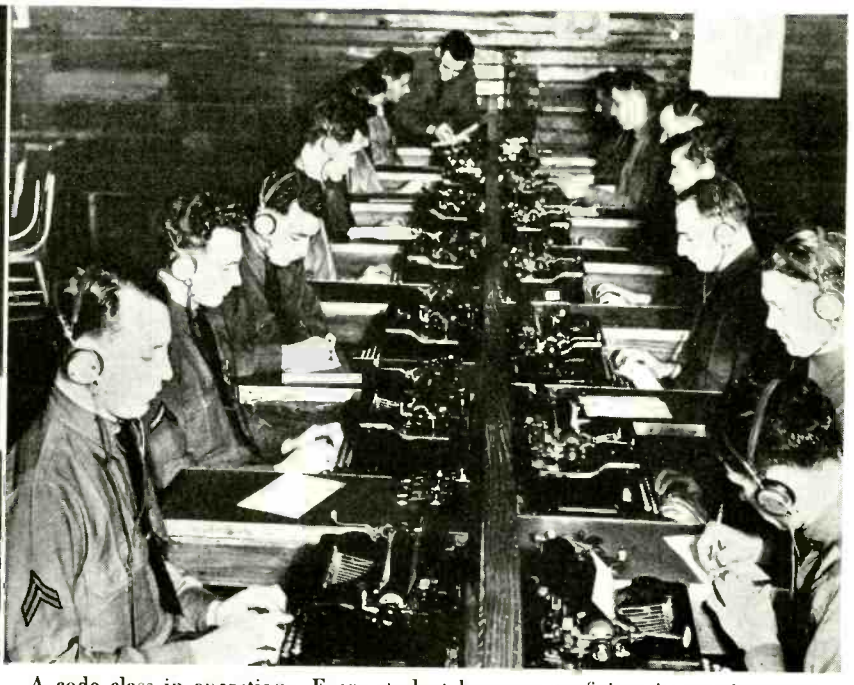
(*Continued on page* 49)



C_1—.005 mfd., 400 v. paper, C-D
C_2—.01 mfd., 400 v. paper, C-D
C_3—.02 mfd., 400 v. paper, C-D
C_4, C_5—.05 mfd., 400 v. paper, C-D
C_6, C_7—8 mfd., 250 v. electro, C-D
R_1—50,000 ohms, pot., Yaxley
R_2—25,000 ohms, 1 w., IRC
Ch—40 ma. filter choke, Thordarson T-13C26
SW—1 circuit 4 position switch, Yaxley 1316L
J_1—Open circuit jack, Mallory
J_2—Closed circuit jack, Mallory
T—PP output transformer on spkr.
Spkr—5" PM, Rola
Socket—Amphenol



Fort Sheridan, Illinois, established in 1886, is situated on the shores of Lake Michigan.



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

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.

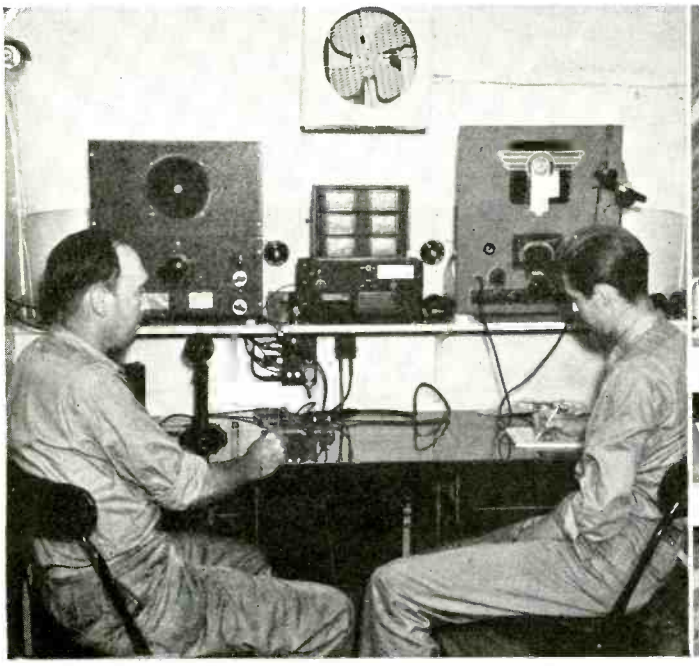
THE part Radio plays in the *United States Army* has been written many times, although most of this material has dealt with schools and units that used Radio as one of their fundamental factors. Little has been written of the part Radio plays in the routine work of the Army. Much of the work of Radio 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

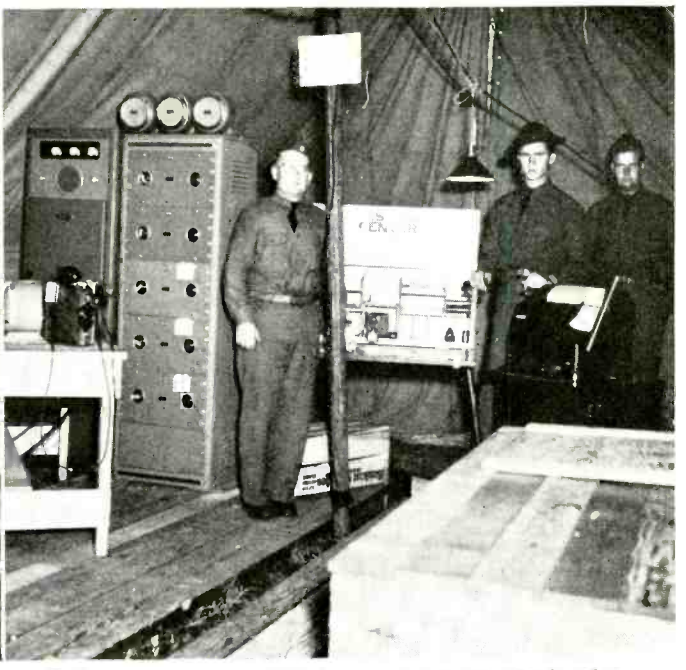
A complete portable transmitter-receiver which is supplied with power from a hand-driven generator. Vertical antenna mounts onto the portable cabinet.

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.

All Photos by U. S. Army Signal Corps.



Complete mobile radio station built into a trailer. All of the equipment must be tied down. Note ventilating fan.



Field message center. This heavy equipment was placed in an Army tent during maneuvers at Camp McCoy, Wisconsin.

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.

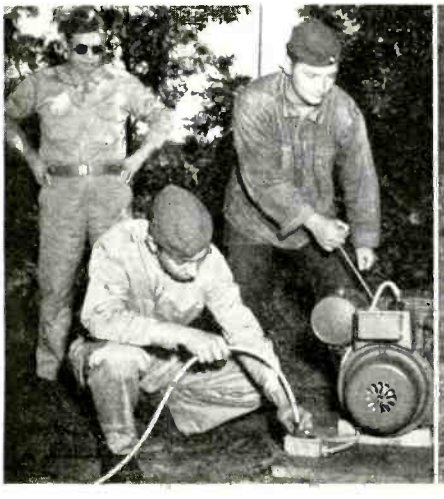
The 50th Signal battalion, another *Fort Sheridan* organization, has been compared with the construction department of a telephone company. One of its main functions is to provide communication facilities such as permanent and semi-permanent telegraph wires for other army units to use. Its equipment 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

Portable gasoline-driven generator furnishes power for high-powered radio transmitters. Many of these are used.



Radio-op in background is cranking generator which will furnish portable radio unit with all power requirements.

Communications crew shown laying telephone wires through woods during maneuvers. These men are specially trained.

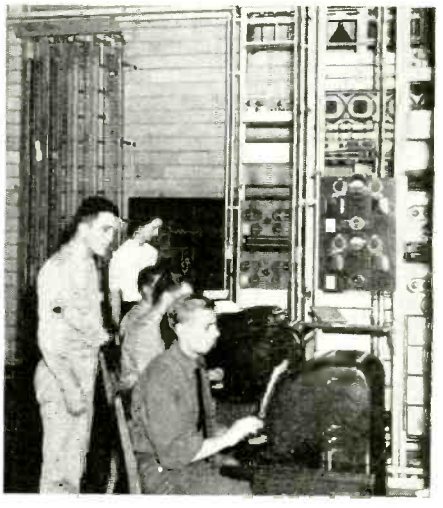
All Photos by U. S. Army Signal Corps.

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

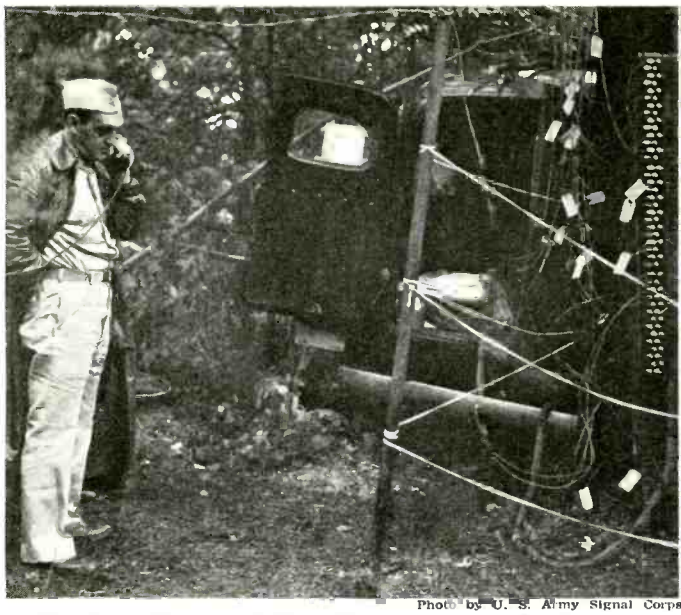


Photo by U. S. Army Signal Corps

Speedy trucks carry field equipment to most advantageous locations. Main trunk lines are tagged for identification.

Photo by U. S. Army Signal Corps

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

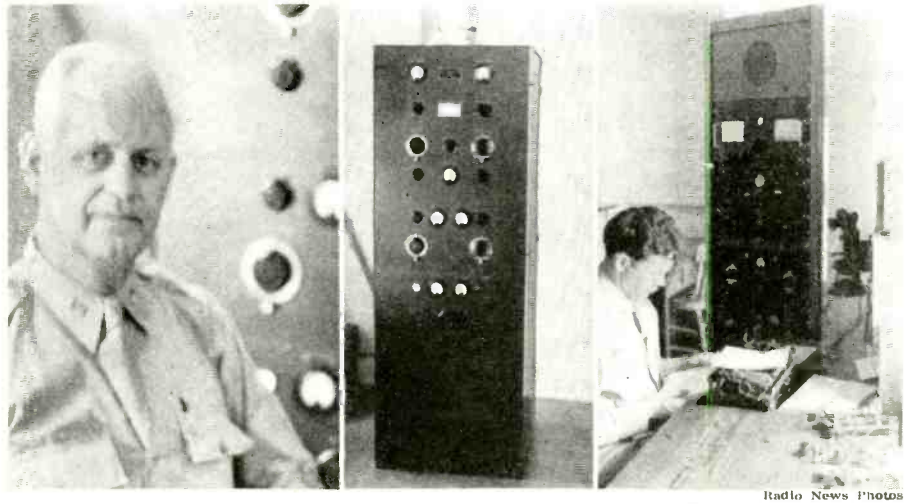
connected directly to the Highland Park office of the Telephone Co. is also installed.

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. —30—

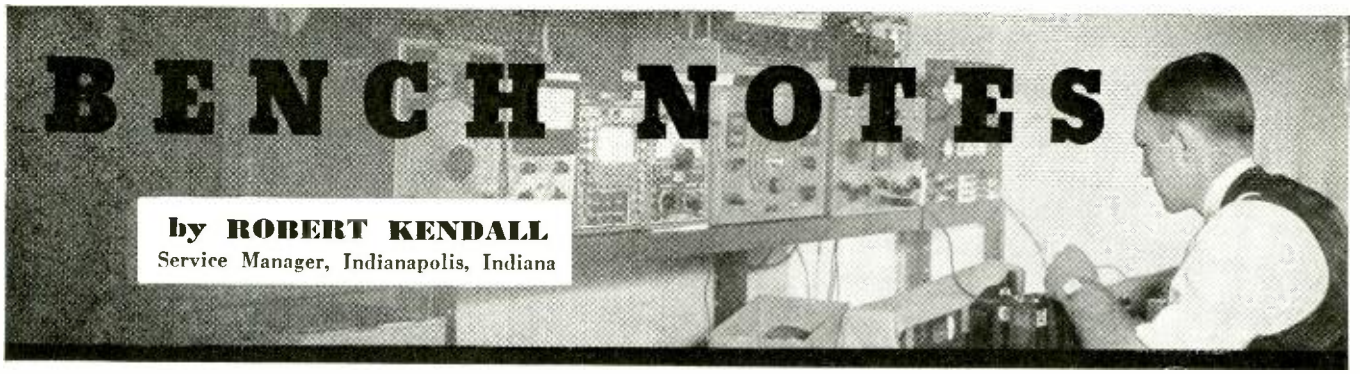


Radio News Photos

Upper left: Major Edwin E. Hebb, post signal officer at Ft. Sheridan. Center: *Federal* 350 watt transmitter. Right: Radio receivers at operating position.

Regulation Army tent serves to protect valuable radio equipment from rain. Improvised wooden floors must be sturdy to carry the tremendous weight.

Photo by U. S. Army Signal Corps



BENCH NOTES

by ROBERT KENDALL
Service Manager, Indianapolis, Indiana

The Good Old Summertime (Sez You)

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 tots 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 no-goods, 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 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 overestimated . . . 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.

"Qvick, Adolph — have Z-3 decode dot zecret message!"

While we do not question the accuracy of Mr. Riis' facts and figures, we do find much to dispute in the statement of his star witnesses, the service men themselves, who probably did more to create lasting damage to the radio service business than Mr. Riis' mathematical conclusions. In this respect we believe the service men have a legitimate complaint against the presentation of Mr. Riis' 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 mis-representations 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. Riis' 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. Riis, that only one man out of three is honest, are unpalatable 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 radio 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 noth-

(*Continued on page* 51)

William P. Lear, aviation engineer.

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 "frozen" 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.

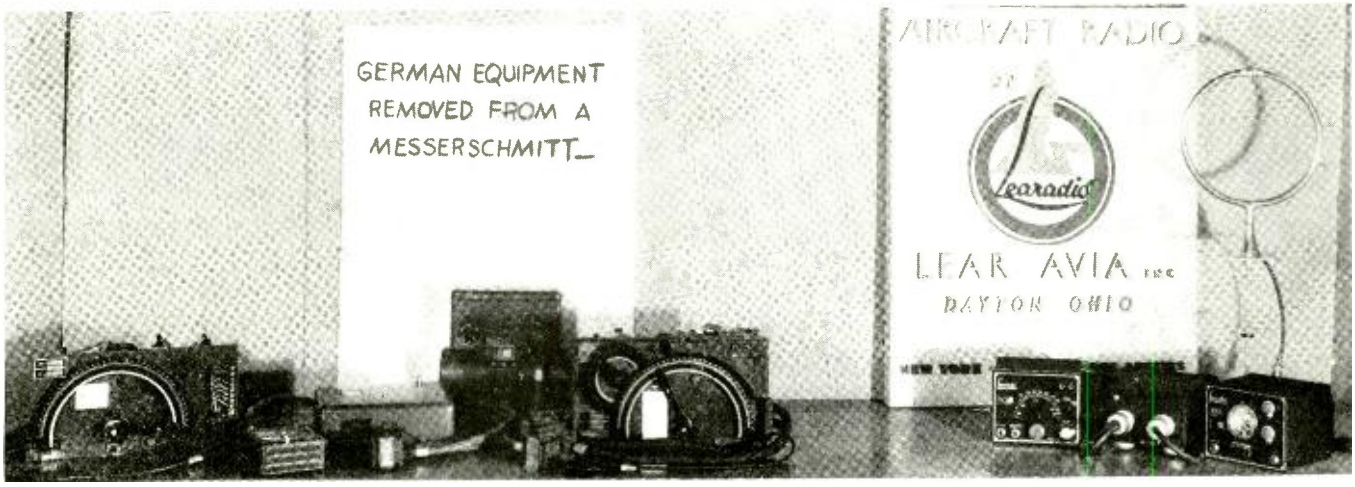
The equipment weighs in the neighborhood of sixty pounds and the approximate dimensions for the various units are as follows:

Unit	Dimensions	Weight
Receiver	13¼"x 9⅞"x6⅞" high	13 lb.
Transmitter	8¼"x13½"x7½" high	20 lb.
Dynamotor & Filter	9½"x 4¾"x9" high	13 lb.
Junction Box & Cables	4⅝"x 9¼"x3⅛" high	13 lb.
Resistance Units	4½"x 5¼"x2" high	2 lb.

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

(*Continued on page* 59)

The bulky German radio equipment shown alongside of modern units. Note the loop for direction-finding.



SERVICEMAN'S EXPERIENCES

by LEE SHELDON

MY partner and I both have soft spots in our hearts for Joe Kroger, 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."

"The parts are all here. I tried fixing it myself!"

"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. Kroger 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-c midget.

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, I'm afraid."

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

(*Continued on page* 65)

PART 2

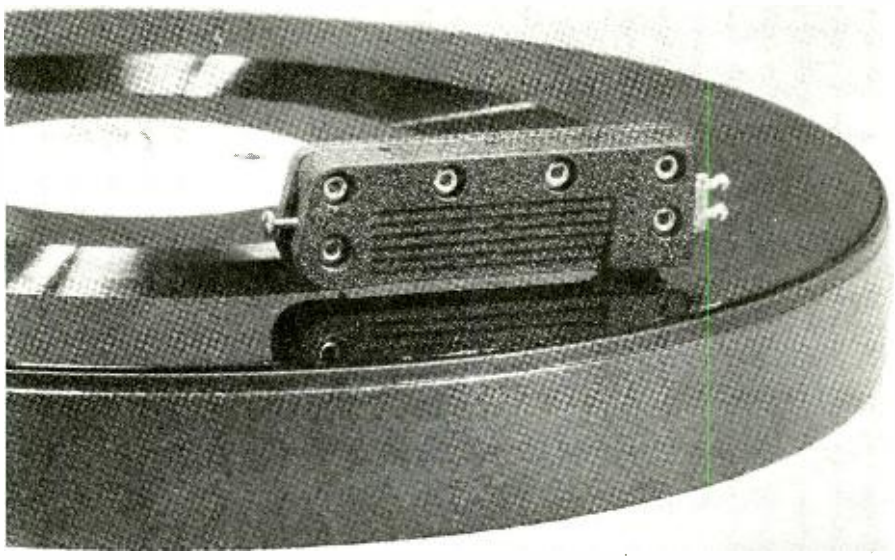
IN the first installment of this new series on recording which appeared last month we explained the action of the *magnetic* type of record cutter. This month we examine the structure and technical aspects of the *crystal* units. In order to clarify on certain points which will help in understanding 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 nontechnical 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



Crystal cutter, capable of high quality cutting when used properly.

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.

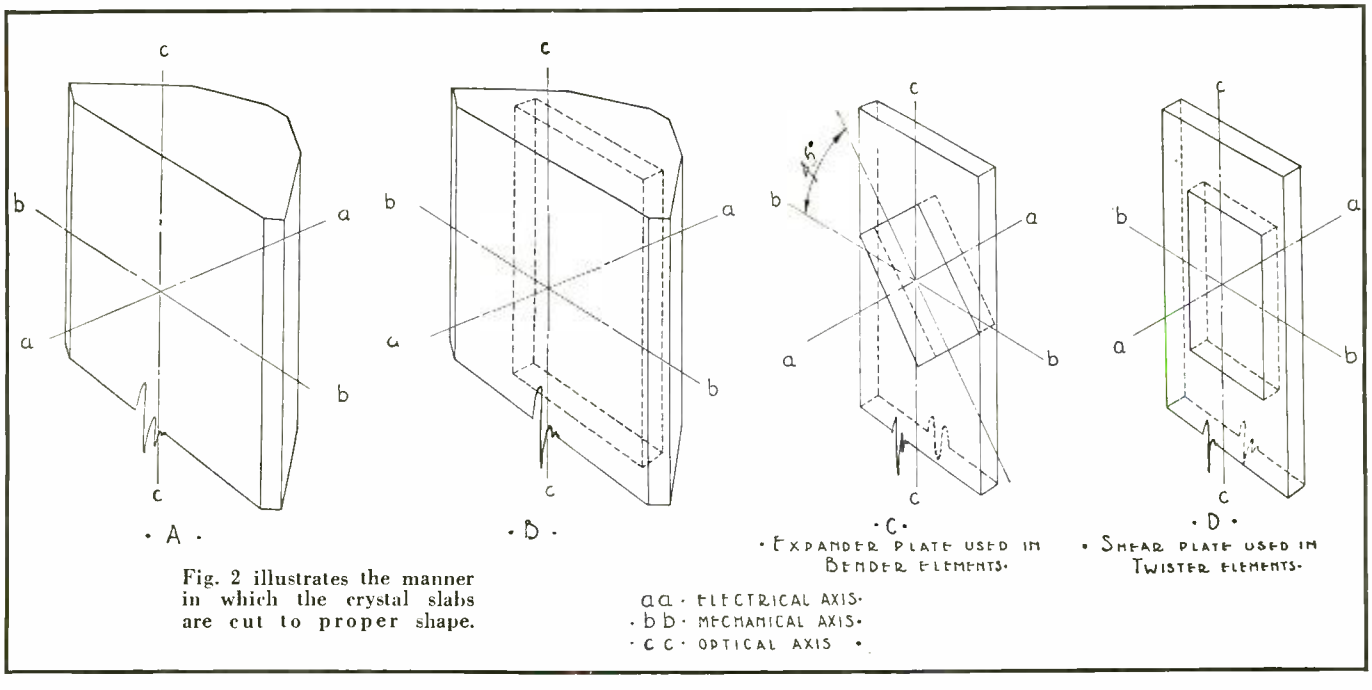
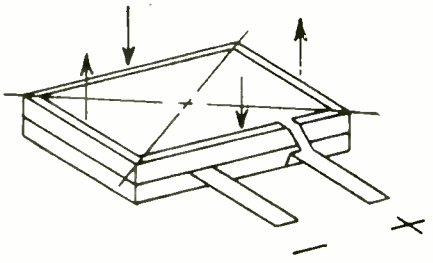


Fig. 2 illustrates the manner in which the crystal slabs are cut to proper shape.

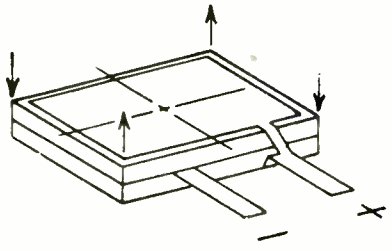
crystalline form of rochelle salt (sodium potassium tartrate). These crystals possess piezo-electric properties to a greater extent than any other known material, being approximately 1,000 times more active than quartz crystals.

"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



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-

(*Continued on page* 54)

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

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

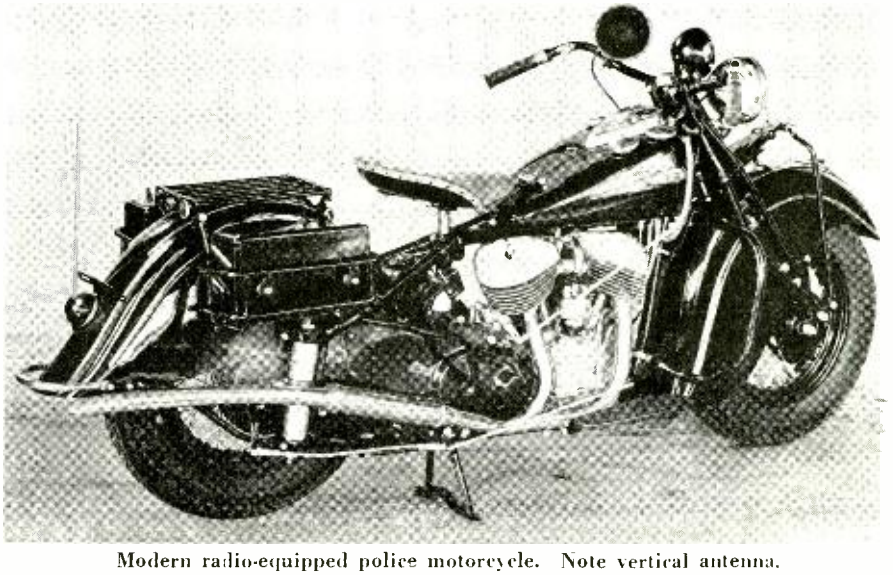
MOTORCYCLE patrolling is still very popular with police departments, especially so in Metropolitan areas where the only practical method of controlling parking and traffic is with the use of a motorcycle.

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)



Modern radio-equipped police motorcycle. Note vertical antenna.

3650-3950 Kcs. Requisition

by RUFUS P. TURNER, W1AY

Means for preventing operation on the "borrowed" Ham channels are explained in this specially-prepared article.

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-kc. 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.

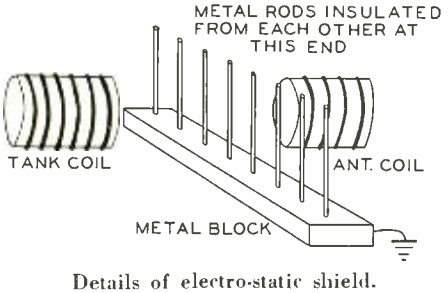
The arrangement will still leave 150 kc. for c.w. at the low end of the 80-meter band and 50 kc. for phone at the high end. However, the Commission intends to allocate additional frequencies for phone operation within the remaining amateur bands.

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 amateur property until further notice. In plain language, then, any unauthorized 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



Details of electro-static shield.

"high appreciation of the amateurs and counts upon their long manifest patriotism for effective cooperation with the Government in this situation."

In view of the Commission's notification, there will be no excuse for ham operation directly upon the shifted frequencies. Nor do we expect that our American amateurs will knowingly be guilty of any such deliberate misdemeanor. But they may, if they are not more than ordinarily cautious, trespass unintentionally upon the relinquished frequencies.

This accidental direct operation might result from inadvertently using a crystal or variable-frequency oscillator on one of the shifted frequencies, an eventuality which can be forestalled at the outset by immediately regrinding 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 3950 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 1825-1975-kc. in the case of 160-meter fundamentals) 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

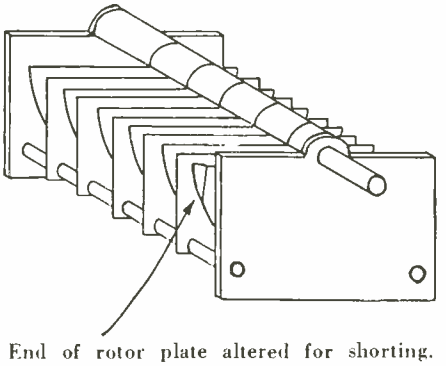
It is, of course, essential that every ham *know* the forbidden frequencies definitely and precisely when he encounters them. Adequate frequency measuring equipment having no connection with the transmitter frequency-control apparatus is already required by the Regulations and is assumed already to be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

One of the most satisfactory instruments for rapid and accurate frequency measurements in the ham shack is the 100-kc. oscillator—10-kc. 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-kc. intervals between the end frequencies. Secondary standards of this

Military Signal (kc.)	AMATEUR IMAGE SIGNAL (kc.)							
	175-kc. I.F.		200-kc. I.F.		455-kc. I.F.		465-kc. I.F.	
3650		4000						
3700								
3750								
3800								
3850	3500							
3900	3500		3500					
3950	3600		3550					

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



End of rotor plate altered for shorting.

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)

TECHNICAL BOOK & BULLETIN REVIEW

"AEROSPHERE, 1941," edited by Glenn D. Angle, M. E., A.F.I., Ae.S. Consulting Engineer, formerly professor of Mechanical Engineering, Lawrence Institute of Technology, published by *Aircraft Publications,* 370 Lexington Avenue, New York City, U. S. A., price $10.00.

AEROSPHERE is a serious and successful attempt to serve those who wish to obtain a broad perspective of the Aviation Industry.

The table of contents includes sections devoted to: Modern Aircraft, including all known current types of aircraft produced throughout the world, described and illustrated in alphabetical order; Modern Aircraft Engines, that includes, in condensed form, all of the available information on all aircraft engines produced currently throughout the world, as well as that obtainable on new designs and experimental types; Statistics of Various Sorts, to which one frequently desires to refer; Buyers Guide that has been arranged especially for the convenience of the user. The countries represented are arranged in alphabetical order and each country has two divisions; the first being an alphabetical list of forms and individuals, with addresses, plus the names of officers and executives, branch offices and their products, the second division lists the firm name under each article which it is known to produce.

Many readers of RADIO NEWS are now engaged in the study of military and commercial aviation. This book will be a valuable aid in keeping them abreast of all of the latest developments that are taking place so rapidly. It will greatly aid the radio serviceman to understand some of the problems that he will encounter in this fascinating field.

"MOST-OFTEN-NEEDED 1941 RADIO DIAGRAMS, and Servicing Information," compiled by M. N. Beitman, published by *Supreme Publications,* 3727 W. 13th Street, Chicago, Illinois, U. S. A. Complete radio diagrams are needed to repair sets quickly and properly. In this one manual you will find most of the popular 1941 diagrams you really need. All sets, which have been sold in large quantities during the 1941 radio season, are included. The most often-needed diagrams are presented here in this one handy manual. This latest addition to the radio diagram manuals follows Volume I, which included the most popular diagrams for 1926-1938 receivers, Volume II, which covers 1939 receivers, and Volume III, which includes over 80% of the 1940 circuits you will ever need. Prices and other information on this manual may be had by writing to *Supreme Publications.*

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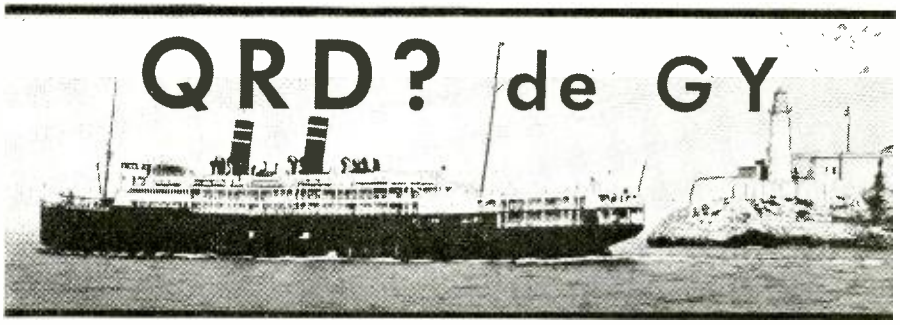


by JERRY COLBY

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 AML'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 quarters that make for morale and efficiency. The designers really knew something, eh.

CHARLEY BOLVIN advises 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 'cullud' 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 phono record which can be 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 five 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 idee, eh!

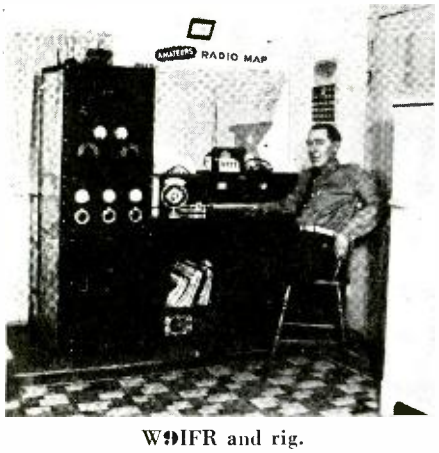
BROTHER FRED M. HOWE, CTU-Mardiv official, writes in a recent issue of the "Journal" an article entitled "The Six Months' Law," which is so chock full of "common sense talk" that we present it here verbatim for the benefit of our readers, former ship radiops who may now be employed in one of the defense 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 a few months ago has rapidly become more acute in recent weeks. This is due primarily to high remunerative inducements offered for work ashore.

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)

Layout of W3ARM.

Martha W8VFL of the YLRL.



W9IFR and rig.

Ham Chatter

SINCE the announced change in amateur regulations there has been much grumbling and groaning among the ham fraternity. While it is perfectly natural for any normal person to chafe at new restrictions, we believe most of the grumbling would be eliminated or greatly reduced if the entire story were known. Many letters have been received recently accusing the ARRL of almost everything, including a cash sale of the Amateur privileges. In order to obtain the whole story in an accurate form we have contracted Mr. H. W. Hamilton, W9MRQ, assistant director of the Central Division, and asked him to explain the situation fully. His letter follows.

For last minute information on F. C. C. action read *"Washington Communications"*

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 satisfied 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 amatur as little as possible. Further, we are assured that the use of these frequencies by others is to last 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 as 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. Remove all amateur operation from the 3800 to 3900 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. Remove all A3 operation from the 1800 to 1900 kc. band. (This has the effect of extending the present 1750 to 1800 kc. c. w. band to read 1750 to 1900 kc. thus providing more territory for c. w. to compensate for the loss of of c. w. frequencies in the 80 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 160 meter and 75 meter phone frequencies. The 75 meter change is expected to come later.)

This December 20th change will be the first of three steps. Under it 100 kc. (3800 to 3900) will be restricted as to amateur use. Sometime later this 100 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 orders through the ARRL which is attempting to disseminate the information as widely as possible. Up-to-the-minute news can be obtained by listening to the official broadcasts from W1AW 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 sacrifice which we are called upon to make in the interest of National Defense is really a very small and unimportant one when compared with the contributions being made by so many of our young men under the Selective Service Act. We should not only be willing but anxious to do it so long as the need is present. Also keep in mind that these restrictions are temporary—full use of the frequencies will be returned to us when the emergency is over, we are assured.

H. W. Hamilton, W9MRQ,
Assistant Director, Central Division,
A R R L.

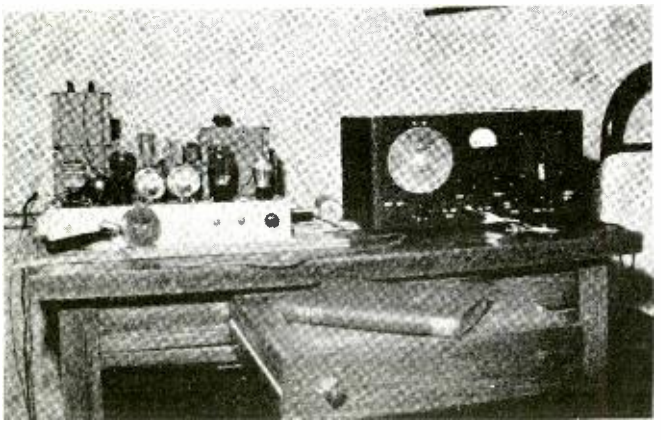
THE Heart of America Radio Club is sponsoring the 1941 Mid-West Division to be held October 11th and 12th at the Hotel Muehlebach in Kansas City, Mo. A full program is promised with entertainment galore and plenty of prizes, topped off with a banquet. Full details may be obtained by writing to J. N. Blair at Box 7092 Kansas City, Mo.

CHATTER from W3JGJ:

W1DPV, Bob Of Woburn Mass runs 75 watts to pp 6L6Gs on 40 cw. Antenna is a 66 ft. zepp. Rcvr is a Super Skyrider. QRG is 7154 kc.

(Continued on page 65)

Rig of RR op W9ERW/9.

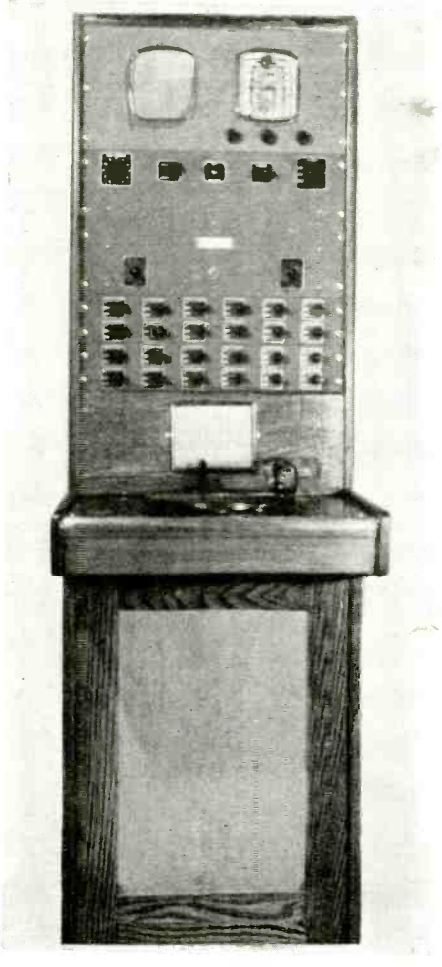


"Prairie Dog Special" of W9KYK.

Mr. Cornet demonstrates the equipment to Mr. Garber of Roaring Spring High School.

Careful checking and supervision resulted in outstanding workmanship on the finished public address units built by the NYA student body.

NYA Installs Centralized



Left: Completed control panel with every switch marked for identification.

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-

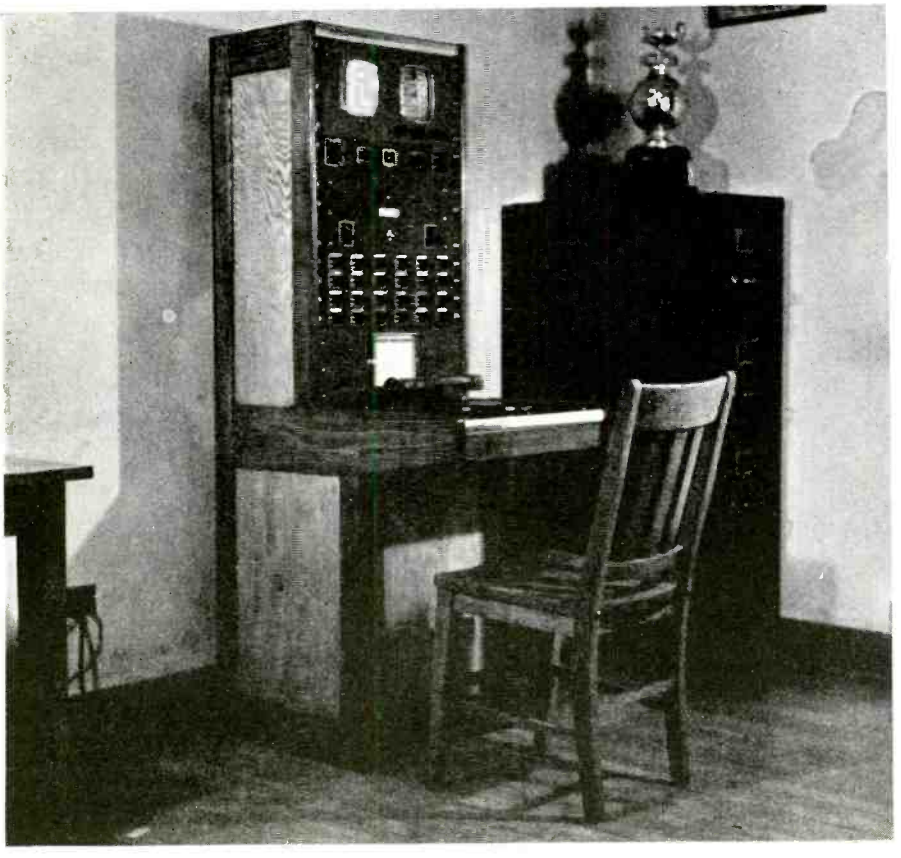
(*Continued on page* 63)

This group of girl students are assembling the parts for the speakers that will be used in the classrooms of the school.

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

Sound System

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.

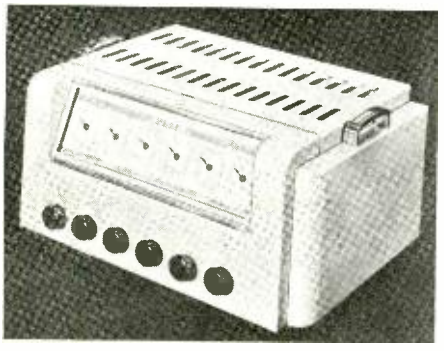
Every joint is carefully checked to assure the best performance.

WHAT'S NEW IN RADIO

Presenting the latest equipment now available on the market.

New 48-Watt Bell Amplifier

Among a number of units of equipment attracting special comment is a newly designed, streamlined 48-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, symbolical

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 built to stand up under any kind of operating conditions. Six high efficiency tubes are used with Beam power push pull output.

A wide selection of speakers, projectors, baffle 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, 166, 250 and 500-ohms. In addition the usual two speaker sockets are standard equipment. *Montgomery Ward & Co.*, 618 W. Chicago Avenue, Chicago, Illinois.

Thordarson Filament Transformer

Thordarson announces the addition of a new "19" Series filament transformer. This transformer, T-19F75, 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-19F75 to match it.

The T-19F75 is an open frame type with a 115 volt 50-60 cycle primary. Its secondary rating is 2½ volts at amps. ct. The types is given in Catalog No. 400-F, available *free* from any *Thordarson* distributor or direct from the factory: *Thordarson Electric Mfg. Co.*, 500 W. Huron Street, 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 phono; 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"x10¾" x10¾"; weighs only 40 lbs.

The rugged amplifier with phono top is housed in the center section of the case. It has 20 watts usable power output (26 watts peak); hum is inaudible (55 db. below rated 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 50-10,000 CPS. Tubes used are: 1—6SJ7, 1—6SC7, 1—5T4, 2—61.6. Line drain is 160 watts. Fully fused for operation from 110-120 volts, 60 cycles a.c. E.R.P.I. licensed.

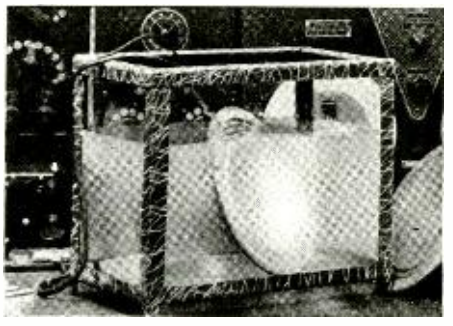
A product of *Allied Radio Corporation*, 833 West Jackson Boulevard, Chicago, Illinois.

New Speaker Works in Water

An unusual feature of a recent National Defense sub-contract accepted by *Cinaudagraph Speakers, Inc.*, 921 W. Van Buren St., Chicago, was the fact that the speaker 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 spider 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 *Cinaudagraph* under the subcontract 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 com-



munications 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 greater power required to activate the unit. The cone action was the same in either medium, but the voice coil withstood 300% more watt-

age while completely immersed. This was due to the weight of the water pressing against the assembly, and the ahility of the liquid to act as a coolant in dissipating any heat which might have resulted from the tremendous overload. It was found, for instance that the wire safely carried the increased current under water; but burned through when the same power was applied and the speaker operated in air.

Having successfully designed this original waterproof speaker, *Cinaudagraph* plans to offer similar units to the general public under the trade name of "THE MALLARD." These are of the permanent magnet variety, and range in size from 3½ to 12 inches. For marine and out-of-door installations they are especially suited.

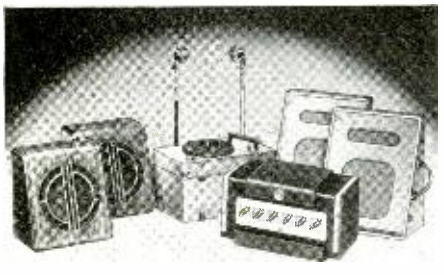
New Phono Amplifier

Webster-Rauland's new phono amplifier is designed to give better reproduction from phonograph records. Automatic volume ex-

pansion permits true fidelity expression of voice and music as recorded, particularly in bringing out the crescendo 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: Dual fader-phono unit, (permitting mixing and fading of two phonos): two separate tone controls, each increases or decreases treble and bass respectively; master volume control with A.C. switch. *Webster-Rauland*, 3825 W. Armitage Ave., Chicago.

New Erwood Products

Erwood Sound Equipment Company of 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 Uni-directional 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 baffles.

The portable systems incorporate a full length microphone stand.

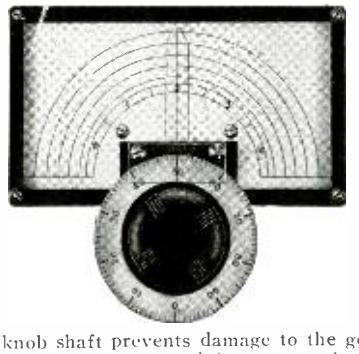
New Record Disc

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 fiberized board base and surface coating of cold pressed nitrocellulose. Primarily deals will be for bulk sales. Initial tryout was made at army camps for personal messages. Music and stock announcements can be cold pressed on the discs, and blank space left for personal mmesages 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 *Bud 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 back-lash. It is calibrated in 500 divisions over the 180 degree scale. The dial is easily panel mounted and is 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 5¼" by 5¾". 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 Audiograph Amplifier

A 70-watt amplifier, for use in ball parks, stadiums, church towers, and other large installations requiring high power without distortion, is announced by *John Meck Industries*, 1313 W. Randolph Ct., 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 phonograph 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)

by Samuel Kaufman

A FULL month after the start of commercial television found little video interest on the part of New York radio listeners. Despite the sincere attempts by metropolitan telecasters to do their parts in moulding television into a formidable industry, the average New Yorker still considers television as somewhat of a peep-hole novelty "that hasn't yet arrived."

The public just isn't being stirred. And, in a program sense, there is little to be stirred about. The eye-and-ear airings continue along virtually identical lines to the long, long period of experimental television. What is more, public demonstrations are limited and about the best place to view a nighttime program outside of one's own home is in a bar or tavern.

We've spoken before of the fallacy of the pioneer televioncers in believing that they can build a sizable audience by too much catering to the tavern crowds. But we must bring the matter up again inasmuch as commercial television seems to be designing more and more features for the television-equipped wining and dining establishments, the attention seeming entirely out of proportion with the care given to programs for home audiences.

Of course, attention must be given the NBC claim that there are 800 television set owners in taverns, cafes and restaurants in the New York area. This represents a sizable audience when you consider that about twenty persons — sometimes more — crowd around each of these semi-public demonstrations.

The network recently recognized this type of audience to the extent of distributing a window and mirror poster for them to bal-

Monitoring "movie" programs at Du Mont television station W2XWV.

lyhoo the first of a sponsored series of prize fights from Ebbets Field, Brooklyn. This poster was described by NBC as the "first piece of major television consumer promotion."

It may be true that the tavern promotion tied up well with the products being advertised on the televised fight program—men's hats. But we do not think that the kind of "major television consumer promotion" greatly needed at this time is the kind that reaches into homes—the greatest potential market for video receivers.

DAVID SARNOFF, RCA president, may or may not agree with our view that the initial commercial programs are no better than the past offerings of the experimental variety.

"Now," Mr. Sarnoff writes in the July issue of RCA Review, "although it invites

(*Continued on page* 46)

SERVICEMEN'S CASE HISTORIES

by

ALFRED A. GHIRARDI

PHILCO 655

Inoperative ....1) "shorted" section in condenser **No. 58** (indicated by overheated rectifier tube)
2) "shorted" condenser **No. 8** (indicated by **wide** tuning meter shadow)
3) "inter-winding short" in r-f transformer **No. 10** (indicated by **wide** tuning meter shadow)
4) "open" tuning meter **No. 73** (indicated by **narrow** tuning meter shadow)
5) "grounded" resistor **No. 56**

Distortion .....1) check i-f transformer **No. 30** for "shorted" secondary
at resonance peak of station)2 realign second i-f stage

Hum .....1) "open" section in condenser **No. 58**
2) "shorted" condenser **No. 59**

RCA 1911 Receivers

Excessive .....1) it may be found necessary in certain localities to reduce the sensitivity of these receivers in order to reduce the effect of noise pickup in between stations. This can be done by adding larger resistors in the i-f cathode circuit (connected between the existing 100-ohms and ground, with a 1/10-mfd. condenser shunt with the added resistor). On the receivers which do not use a 100-ohm resistor in the i-f cathode, the resistor and capacity combination should be added between the cathode and ground. The value of the resistor could be anything between 500 and 3,000 ohms, depending upon the reduction in sensitivity required
Noise pickup between stations

RCA 95X6

Distortion .....1) reverse power line plug
when large antenna is used 2) shunt two 1-mfd. condensers (in series with each other) across power line, and connect their common junction to ground

RCA 97Y, 98EY

Hum, ...1) locate shield of cable which interconnects 6J7 grid to the volume control. Change it from the tone control terminal to terminal No. 3 (one nearest end of chassis) of the volume control
Audio whistling or howling

RCA K-105

High-frequency mechanical buzz.1) inspect to see if "diffuser" mounted across front of the loudspeaker is striking the cone or the cabinet baffle. If so, remove diffuser entirely. It is not used on later production receivers

Hum .....1) check for broken lead to A and B primary loop
(tunable)

AIRLINE 62-160

Distortion .....1) locate the 2-megohn bias resistor connected between the control grid and the "positive" filament terminal of the 34 second detector tube. Replace it with a 750,000-ohm resistor
(especially when B-battery is run down)

AIRLINE 62-316

Inoperative on broadcast band, but O.K. on short waves.1) connect a 0.003-mfd. condenser **across** the C-6 condenser (one of the pair of units next to the front of the chassis)

ARVIN 618 Auto Radio

Hum .....1) high-resistance contact (which may check O.K.) between chassis and ground lug riveted to 6Q7G tube socket. Bend this lug over and solder it securely to the chassis
(steady or intermittent)

BELMONT 101

Distortion ....1) check leakage of the 0.05-mfd. condenser in avc lead of r-f stage
Two-spot tuning
2) check leakage of 0.05-mfd. cathode-to-ground condenser in same stage

(*Continued on page* 66)

MANUFACTURER'S LITERATURE

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

New 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 recommendations 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.

All trade and brand names are listed alphabetically so that they can be quickly located. Auto radios are listed by make of car, rather than under the name of the actual manufacturer of the radios thus avoiding any danger of confusion. Chassis and model numbers of receivers are conveniently cross-indexed.

An interesting feature of the Manual is the fact that, except for the comparatively few necessary "specials," listings are based entirely on the use of Type D Controls with Tap-in Shafts—*IRC's* famous small-size controls that have been finding widespread favor in all parts of the country as fully dependable, universal replacements. This feature not only simplifies the servicemen's work, but enables him to handle the big majority of all replacements from a small, inexpensive stock of controls.

In addition to much helpful information on the installation, use and construction of volume controls, the Manual includes complete control and resistor catalogs as well as a handy information section, charts, etc.

Supplement to Sylvania Technical Manual Lists Recent Tube Types

BRINGING 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,* Emporium, Penna.

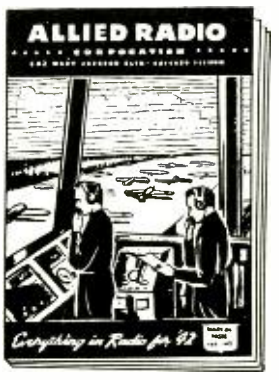
The current Technical Manual is being shipped to purchasers with the new supplement fastened in place. The price remains unchanged, 35c.

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

Allied Is Out with 1942 Radio Catalog

ALLIED RADIO CORPORATION, 833 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 Airport from a photograph 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 PM models, luxuri-

(*Continued on page* 63)

For the Record

(*Continued from page 4*)

Turner in his article, this month, gives practical solutions in overcoming any difficulty in the operation of amateur equipment in keeping the omitted transmission from falling within the "loaned" 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 Sadowsky*, 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 handicaps, the youth took the prescribed written examination at the Commission's nearest field office. 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 tenor 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. Nobody 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. Apportionment among the various manufacturers of the metals allocated is keyed in the program to the ratio of each makers dollars sales of tubes and condensers in 1940 to the aggregate industry dollar value sales of the same respective items in that year." This confirms 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. The number of such offenses has fallen off sharply and it looks like most of the boys have learned that the man with the whiskers isn't fooling about this.

Those suspended recently were Robert F. Avrutik, W2NVO, Yonkers, N. Y., for communicating with Honduras, and Charles S. Lewis, W1ANR, Jamaica Plains, N. Y., for comunicating with Brazil.

At the same time, the *FCC* announced suspension of two Texas radiotelephone operators. It was charged that Woodrow W. Dove, of Orange, Texas, impersonated Homer Bowman, a fellow townsman, in taking an examination for a restricted radiotelephone 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 *Hamfesters* 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 uniform of Uncle Sam's various services. Nice loking lot of fellows, those. Truly the "cream of the crop" and deserving of every ounce of our respect!

73, OR

Low Power All-Band Xmtr.

(*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 10 meter coil consists of three turns of number 14 wire, 1¼ inches in diameter spaced ¼" 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 6SJ7, 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 25 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 25Z6 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.

—30—

Book Review

(*Continued from page* 34)

NEW GHIRARDI REVISED SERVICING HANDOOK READY

The popularity of Ghirardi's Radio Trouble-Shooter's Handbook among service men has made it necessary to bring out a new revised edition—the *second*—of this valuable reference data book.

All of the features which made the old edition so popular have been retained, but every page has been completely revised and brought 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 4,600 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, 60-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)

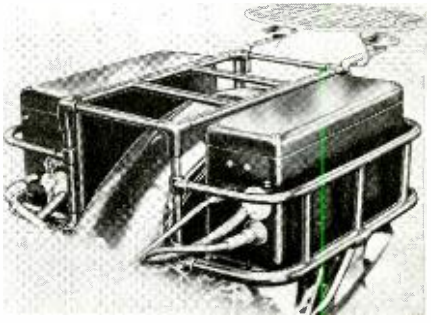
trolling. In some cases the noise peaks were of such an amplitude to allow the AVC of the receiver to decrease the sensitivity in short pulses resulting in very erratic reception. Under these conditions it was almost impossible to copy a signal with the motor running. All sorts of combinations of chokes 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 distributer coil are enclosed in 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.



Close-up of motorcycle equipment.

Tube failures occur at about the same rate as in any other mobile unit, however the converter (6A8) 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, RF, 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 McLaughlin 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 police band at Allentown, Pa., in the form of Mary G. Ferry, secretary to chief of police Arthur V. Yohe of the *Allentown* police department.

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

Delaware Turns FM

F. 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 LaCrosse, 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 roads are either on top of a bluff or down in the valley. Communication from car to station has been achieved at distances of from 60 to 90 miles airline!

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.

-30-

Grid Dip Meter

(*Continued from page* 11)

minating the calibrated variable condenser. Each set of two is mounted on a 4 x ½ 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 line cord is inserted through a ⅜ 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 in 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 much simpler, 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-

denser. After resonance is found by the dip in the meter, the frequency of the signal generator is noted. We then have two known variables, the frequency and the capacity.

By using the formula

$$L = \frac{25{,}330}{f^2 C}$$

where f=frequency in megacycles
C=capacity in mmf.

We can solve for the inductance, L=inductance in microhenries.

This formula is a simplified derivation of the common formula for the determination of resonant frequency in a series tank circuit.

$$f = \frac{1}{2\pi\sqrt{LC}}$$

For determining the frequency range of tank circuits, the instrument is priceless. The tank coil and condenser is placed across the detector input posts and the condenser set at *maximum*. By again coupling the signal generator to the coil, the resonance dip is located and the frequency read on the signal generator. By setting the tank condenser to minimum and repeating the procedure, the frequency band of the tank is found in a hurry.

The instrument can also be used as a field strength meter, an emergency receiver, phone monitor or a frequency monitor by placing a tank circuit resonated to the station desired across the detector input. Relative field strength can then be determined by the meter. By plugging phones into the closed circuit jack, the desired station can also be heard.

In tracking superheterodynes the various trimmers can be aligned without turning on the receiver. The primaries of the oscillator, r.f. and detector coils are individually connected across the output of the signal generator. Beginning with the RF coil, the condenser gang of the receiver is set to 1400 kc. (assuming the B.C. band is being aligned) with the signal generator also set to this frequency. The r.f. trimmer is now adjusted until a dip is noted on the meter. The detector coil and trimmer is adjusted in the same manner.

Now since the oscillator should be tuned to 1400 kc *plus* the IF of the receiver, the signal generator is reset on this new frequency. The gang condenser of the receiver remains the same during this operation. The oscillator trimmer is now adjusted for maximum dip of the meter. Setting the signal generator to 600 kc. plus the IF, and the gang condenser to 600 kc., the oscillator padder is adjusted for maximum dip. While the gang is set at this position the r.f. and detector coils can be rechecked for resonance at this frequency. The higher frequency operation should now be repeated again for accurate alignment.

The IF transformers may also be adjusted to resonance with the receiver dead. One of the windings is used to couple to the signal generator while the other is tuned for maximum dip. The signal generator must be set at the IF value given by the manufacturer of the transformer.

The grid dip detector can also be used for determining the frequency range of permeability tuned coils used in conjunction with a specified fixed capacitor. The coil and capacitor is again placed across the detector input and coupled to the signal generator in the manner previously described. The two frequency limits are then read on the signal generator as the inductance is varied by the permalloy core.

The matching of coils is easily accomplished by using the calibrated capacitor in parallel with the detector input. The coils to be matched are then placed across the detector input and resonated to the signal generator. Whether the coils are high or low in inductance in comparison with the coil used as standard can be determined by the amount of capacity added or subtracted to bring back the point of resonance.

These are only a few of the uses for this little instrument. The small expense involved in constructing it will certainly be compensated for by its usefulness in the shop. —30—

Video Reporter

(*Continued from page* 39)

the support of sponsors who advertise, technically television has not relinquished its experimental status. Like the unlimited radio realm in which it has been nurtured, television, if it is to survive and thrive commercially, will forever be experimental. As long as it is a subject of experiment it will progress. The word 'experimental' signifies that, as a science and art, it is alive and seeking opportunities to advance in order to take every advantage of the unlimited possibilities for expansion."

It seems, though, that Mr. Sarnoff was more concerned with the technical side of television.

While the program producing side, of course, has technical limitations, the field is ready for new and original presentations. There's no reason why a new art should be a dull one. And there's no reason why the newness of an entertainment medium should "entitle" it to be cumbersome and erratic.

TELEVISION networking on a nation-wide scale is a long way off. Just *how* far is a thing that noboby knows. Getting programs to the entire nation is a thing that will have to be accomplished before television can grow to the status of a really great industry. Just equipping big cities with transmitters is not enough. The small towns must be reached. Just imagine what sound broadcasting would be like, if the small towns and rural districts weren't serviced with programs! Radio receiver sales would be just a very small fraction of those actually achieved and the roster of program sponsors would be the faintest shadow of its present form.

Hence, it was with interest that we observed the statement by Niles Trammell, NBC president, before the Senate's Interstate Commerce Committee.

"Television in the national sense," he declared, "must begin with a network. It will require investment and enterprise to which that of sound broadcasting is like a drop in the bucket.

"NBC has been doing everything in its power, subject to priorities of men and materials, to establish local television in Wash-

ington as well as in New York. But it is mere moonshine to say, as has been stated to your committee, that by limiting television licenses to three stations for any one licensee, the go-ahead signal has been given and—presto chango!—a national service of television is made possible."

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.

DuMont deluxe television receiver.

The CBS announcement tersely concluded with: "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."

And there were no such delaying things as OPM priorities back in those order-placing days!

BIG technical improvements will be completed at W2XB, the General Electric video station in Schenectady, New York, when the station resumes operation at an early date. Power will be increased from 3 to 20 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 WNBT'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 one and vanishes completely once the television 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 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 WNBT could aptly be merchandised under the slogan of "Why Not Buy Time?" And we couldn't help mentioning the possible response of: "We're Not Bothered Terribly."

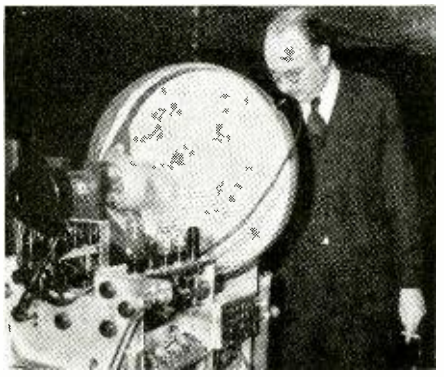
And we could have added such initial pointers as "Why Not Boost Television?" and "We Need Better Television."

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 blurbs 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 Botany Worsted Mills 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 Botany 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-listeners may comment, is not a show window for merchandise. 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 advertising agencies are alert to the fact that a brand new technique for presenting commercial spiels 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 lads 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 problematic. However, word from laboratories and manufacturers imply that television production plans are progressing. But, as yet, there is no intensive effort at merchandising.

—30—

3650-3950 Kcs. Requisitioned

(*Continued from page 33*)

radio communication. One hundred and sixty meter signals 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 push-pull final 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 the 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 military receivers in the field, it would 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-kc. i.f., interfering signals will lie 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 images 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 3550-kc. ham signal will be capable of image interference with a 3900-kc. military signal if the military receiver employs a 175- or 200-kc. 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 with a 3650-kc. military carrier into a 175-kc. i.f. channel.

It is gratifying to note that the only ham image interference might be expected in military superhets with 175- or 200-kc. 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 troublesome interference problem. 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 the amateur has no control and most likely can do nothing to remedy. So that when this variety of interference is created with the Government communications, the most sensible course of action 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 they previously have been disregarded for reasons we cannot understand.

Automatic modulation control, efficient matching up of modulator and final amplifier stages with respect to capability and power balance, and continuous monitoring of modulation percentage are *requisites*.

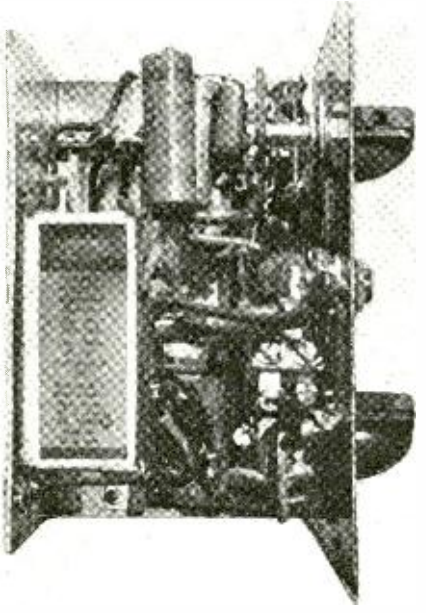
—30—

Learn the Code

(*Continued from page 23*)

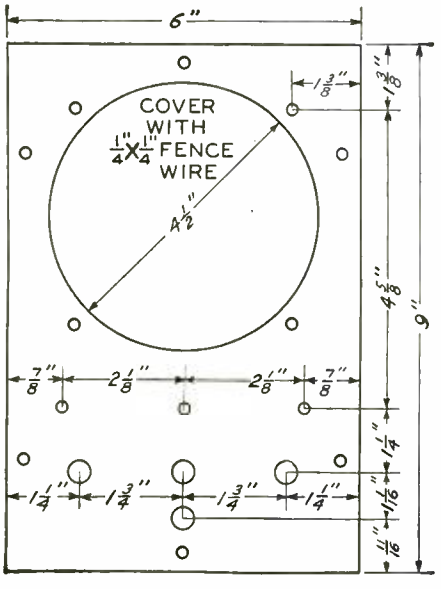
lator more practical for general work.

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



Underside view of the oscillator.

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

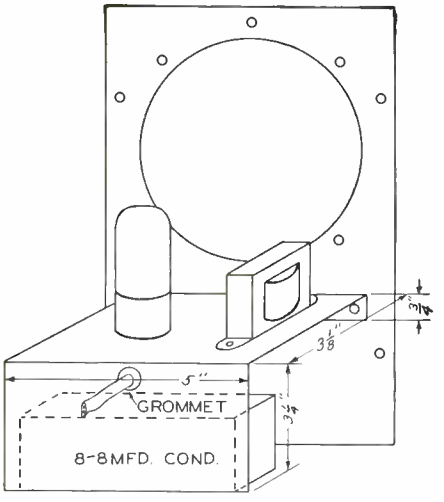


Panel layout dimensions.

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 Vuono who cooperated in the final experiments 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



Rear view shows parts' placement.

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.

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Life Begins at 1:15

(*Continued from page 10*)

skin and becomes part of you. What a relief it is not to have to slink through alleys and cross streets to avoid whining, complaining and unreasonable radio-service customers who greet you with, "Ain't you 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

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 sought after by the Company. Employees are rewarded with cash, for practical suggestions. A First-Aid-Hospital, attended by efficient personnel is always ready to care for injuries, and we are urged to use this service, even if we so much as get a scratch. Clean, modern wash-rooms and a Cafeteria for workers are provided. Nothing has been overlooked which could provide or add to the comfort or safety of employees.

The Plant is exceptionally well-lighted and because Radio and Electrical work is close, and must be careful and accurate, seats are provided for the men so that they may get close to their work. Each employee is given an opportunity to participate in sports; tennis, golf, baseball, etc. There are also Rifle Teams and Flying Clubs. These activities are all sponsored by the Company.

Careful and complete records of the progress and efficiency of each worker are kept, and promotions made to the better jobs from *the men on the benches.* In short, if you've got what it takes, you'll go places with an Aircraft factory.

In order to add credence to this tale of almost unbelievably ideal working conditions, I quote, herewith, part of the Company's Policy:

"1. To provide safe, harmonious and healthful working conditions.

"2. To assist employees in time of need.

"3. To treat all employees fairly and without discrimination.

"4. To maintain a fair and equitable rate of pay for services rendered.

"5. To afford each employee the opportunity to advance with the Company.

"6. To fill vacancies by promotions, wherever present employees are qualified.

"7. To assure each employee the right to discuss freely with executives any matter concerning either his own or the Company's welfare."

It would, I am sure, be impossible to find a better policy in any industry, anywhere.

That's why I'm proud of my job!

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, and besides, 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.

—30—

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 of work you offer. With unprofitable repair calls cut to a minimum, 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 shan't devote as such space to 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's 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 *decidedly* worthwhile.

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

—30—

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 "signal 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 Perspection

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 also 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 build their 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! —30—

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 bean 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 over a fairly long period of time, 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 formulate 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* 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 serviceman 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.

—30—

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 zero on all indications. 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 100,000, the correct result 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 the hands hold 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. Figure 6 gives 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 on the meter scale an 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 unknown 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 mils 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 enables the user 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

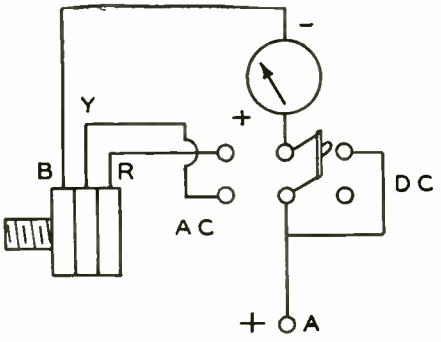
All d.c. voltage and current ranges and ohmmeter ranges should be wired up first, using the basic diagrams shown as guides and the values of parts as calculated in the text before the a.c. ranges are tackled. As a matter of fact, the above voltage and current circuits are also a component

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 (shown as A in figure 7) is wired to 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 on one of the meter terminals, which makes for simplicity and convenience. Three 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 in 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



AC CIRCUITS

FIG. 7

a constant throughout the meter range. It was found in the particular instrument built by the writer that this ratio was 2.5 practically throughout the entire range of the meter. In other words an a.c. voltage of 10 (from a transformer) was indicated as a voltage of 4 (on the a.c. scale of the meter, which is the lowest scale and which has red numerals). A voltage of 20 was indicated on the meter as 8, etc. This ratio is practically exact, but due to the characteristics of all copper-oxide rectifiers, will vary slightly depending upon which part of the scale is being read. In other words, the 2% accuracy of the d.c. readings will not be obtained. Instead, the accuracy will be nearer to 5% for a.c. and audio frequencies.

The above also applies to a.c. currents, of course, as is to be expected. An a.c. current of 200 ma. will be indicated as 80, etc. The ohmmeter scales are not to be used when the switch is thrown to the a.c. side. These lower than actual readings need cause no confusion and are due to the low efficiency of this type of rectifier which is not perfect, allowing some current to be passed in the reverse direction. The meter on a.c. scales is thus 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 6½" by 5½" 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 bang up against the stop. Make sure that the jack you use is the one you

want. A moment of carelessness may leave you with a ruined expensive meter on your hands.

For those who notice that the meter seems to act sluggishly on certain ranges, it may be pointed out that when the needle moves across the scale, the small coil which rotates between the magnet poles is generating a current. The reaction is such as to slow any movement of this coil. When the shunt across the meter is rather low, as it is for several of the ranges, a large current will be generated, so that on these ranges, the meter will seem to be sluggish.

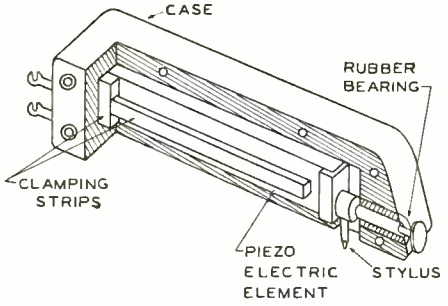
GENERAL PARTS
Panel (to be determined by reader)
25,000 ohms per volt meter (Triplett 3")
Phone plug, to be treated as described in text
2-wire test cord (about 5" long)
2 tip plugs, insulated—one black and one red, so that polarity can be observed
VOLTAGE CIRCUITS (figure 2)
4 open circuit jacks such as Yaxley A-1 midgets
Resistors—20,000, 245,000, 2,500,000, 25,000,000 ohms
CURRENT CIRCUITS (figure 4)
4 circuit-reversing jacks such as Yaxley A3-A midgets
Resistors—209, 20, 2, .2 (latter wound by hand)
1 open circuit jack for 40 microamp reading
OHMMETER CIRCUITS (figures 5 and 6)
30,000, 20,000, 435, 15.9 ohms resistors
Variable rheostat, 7500 ohms
Small battery cell, 1½ volt
3 circuit-reversing jacks
AC CIRCUITS (figure 7)
Copper-oxide rectifier
DPDT toggle switch

Disc Recording

(Continued from page 32)

stead of in directions parallel to the edges as in the case of the 'expander' plate.

"In crystal elements two or more crystal plates, properly oriented with respect to each other, are cemented together to provide more efficient utilization of the piezo-electric properties of the crystal. Two or more 'expander' plates when cemented together form a 'bender' element and two or more

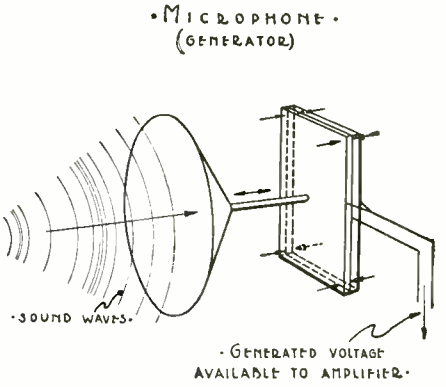


How a crystal cutter is assembled.

'shear' plates when cemented together form a 'twister' element. These names 'bender' and 'twister' have been selected since they indicate the resulting motion of the final element when an electrical potential is applied.

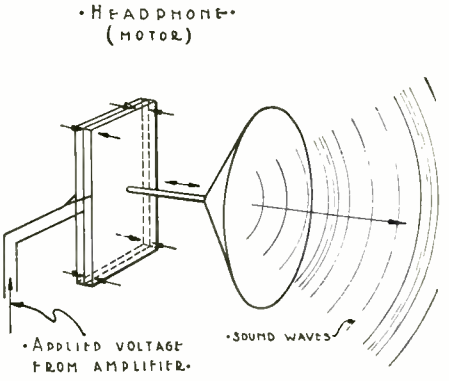
"Both 'bender' and 'twister' elements because of their multiple plate construction are further classified as 'Bimorphs.' This type of construction has the advantage over the single plate crystal of practically eliminating the generally undesirable effects of saturation and hysterisis and of greatly reducing the effects of temperature on sensitivity and impedance.

"Figure 3 shows the method of construction of 'bender' and 'twister' 'Bimorph' elements. Prior to the final assembly the two faces of each crystal plate are milled smooth and graphite or foil electrodes are applied. Metal



Crystal element used in microphone.

leads are connected to the electrodes and the plates, after proper orientation, are bonded together with a cement. The electrodes are connected either in parallel or in series depending on the application for which the final element is constructed. The parallel lead arrangement, however, is standard and for this reason only this is shown in Fig. 3.



Operation of crystal headphones.

"The assembled crystal element is finally coated with an especially prepared moisture-proofing material for protection against deterioration in unusually dry or damp conditions of use.

"Rochelle salt crystals operate safely from −40° to +130° F. and have their greatest piezo-electric activity at normal room temperature (72° F.). On exposure to temperatures higher than 130° F. the crystals lose their 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. —30—

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 .0015" to .005" 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 conservation. 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.

As in the past, these 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 uses two anode foils 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 electrolytic, 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, stone-hard, 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 crystalline types, which are not used, come from the fields of Pennsylvania, where the yield is paraffine. The micro-crystalline waxes are composed of a series of tiny globules, closely woven, and as such prevent moisture or air from entering. The crystalline waxes are needle-like in structure with open spaces between them, thus permitting moisture to seep through. Paraffine waxes, which were originally used and discarded when the smaller sets came into vogue, oxidizes when in contact with air over a period of time, whereas the other waxes, simply change color, and are otherwise not affected.

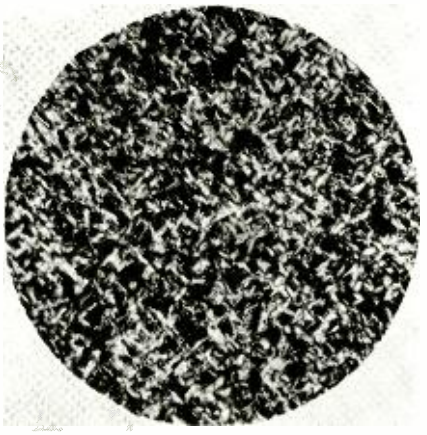
Melting points and cold flow points are two other important features of waxes, that directly affect the method of design and construction of the new type of capacitors. It is possible to produce waxes with high melting points and cold flows very close to this point. Then, again, some waxes are rated as having a high melting point, but due to their construction have a low cold flow, offering poor resistance to heat. It is easy to see that unless this product is properly specified, seepage and complete loss of capacitor action will result. Thus, with the proper wax, it will be possible to produce a capacitor that will closely resemble a hermetically sealed unit. In the latest type capacitors to appear soon, some waxes used will have a low power factor or high Q and with melting temperatures within the vicinity of 200° Fahrenheit (boiling water temperature).

Fortunately we have a plentiful supply of all the waxes, having even found a suitable substitute for the previously imported montan wax, that was extracted from lignite (coal) deposits in Austria and Czecho-Slovakia, and then distilled to form the wax. This material was used as a potting compound to provide moisture proofing. One wax, however, that has had wide acceptance, and may not be available soon, is asphaltic wax. This is used for internal sealing. The base for this compound comes from the Dutch East Indies, and is essential in defense production. However, even though this product has such virtues as high melting point, good adhesion to the walls for an effective seal, it will be possible to provide suitable duplicates, made in this country, with similar virtues.

Because of the outstanding virtues of the available waxes, paper capacitors, practically molded in wax compounds, will be found to be used widely in the newer type of receivers. Their sizes and shapes will be varied, and in some instance, will be fairly large, similar to the old style papers, to provide increased capacity and voltage properties. Whereas in the old types breakdowns due to molten wax were quite frequent, these newer types will tolerate exceedingly more voltage and current, and thus be adaptable for filter circuits.

Paper, both as a thin tissue, and as a heavy tube, constitute another of the important ingredients in the new ca-

pacitors. It is recognized that, either of these materials were used in capacitors before, but, because of European conflict and present emergency, they did not take on different characteristics. Before the warring conditions existed, we used linen paper made from linen cloth produced from flax found in European countries. Today, the papers are made directly from a flax, in accordance with a method



Microphoto of paraffin wax crystals.

developed by two brothers in the Carolinas. This paper is similar to a certain 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 bandage type material, with thickness varied by calendering. Today, cellulose or paper type is used, however. These have the necessary high absorbent property and yet simplicity of handling. 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 compounds, and are of a purer state, so as not to affect the chemical action encountered 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, eyeletted 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 internal 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 generally available, standardization of lengths and type of wire, will be invoked. For instance, single section, tubular type capacitors will have bare 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 important in paper tubulars 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 afforded 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 softening 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 previously it has been used as a direct winding over bare and enameled wire.

Microphoto of amorphous wax crystals.

The high break-down voltage and insulation resistance of cellulose acetate also permits its use as very thin foils. And for slot insulation, the foil is laminated to insulation paper for mechanical strength. As an insulation over wires, it is inert to transformer oils, is not corrosive to copper wire, and has marked resistance to humidity. Cellulose acetate butyrate compositions 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. Heretofore, these plastics have been used to form molded duck pins, which outlast 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 hermetical 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-

ing efficiency can be obtained, provided suitable care is taken in their use in the receiver or instrument. This means that in replacement work or in new designs, working voltages should be chosen carefully to avoid overheating, with a consequent depreciation in capacity value. It also means that whatever limitations there are should be respected, and designs or replacements applied with corresponding care. Following this simple practice will pay big dividends in permitting the successful applications of these new "defense" capacitors and aiding the cause of national defense too.

—30—

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 output of the coupled filter and shielded vibrator. By testing the unit without a load and comparing the form and output characteristics with the tests made with load, a fair idea of its "workability" may be had. Points should never be dressed down unless it is absolutely necessary and then, with caution. It is preferable to obtain a new set of reeds rather than attempting to dress them down; and in cases where the expense involved in purchasing new reeds would be prohibitive, a new vibrator unit should be purchased.

Special tools are needed to perform vibrator maintenance and without the proper tools the finished job would compare to a job performed on a piano 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 sealed and should not be tampered with.

Where noise is present in the R.F. circuits of the receiver and can be traced to the vibrator, check all shielding, bonding, and the adjustment of the vibrator itself. If the noise persists after changing 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 shunting 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 function simultaneously. The 5 & 10 stores now sell a "variable wattage bulb" that can be adjusted with a twist of the wrist for three wattage settings. The bulb can be used for indicating output capability of the ordinary 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 not been answered, please be patient. Due to the influx of correspondence, which is gratifying, it will be sometime until all letters are answered. But you'll receive your answer! In case the readers of this column have suggestions pertinent to aviation radio material that they would like to see presented, kindly drop a line to the editor.

—30—

Washington Communication

(*Continued from page* 10)

kc spectrum according to latest information.

The men who run Station WAR from the War Department, Washington, are proud of the record they have compiled in recent months—1,600 contacts with hams. This has resulted in many new members for the AARS. Schedules will continue as at present, with the exception of these changes in the 1750-2050 kc band:

Daily, except Sundays, from 9 to 10 p. m. EST, WAR, on 6990 kc, will work the 7000-7300 kc ham band; on Saturdays, 7 to 7:45 p. m. EST, WAR on 4020 will work 3500-3800 amateur band; on Saturdays from 7:45 p. m. to 8 p. m. EST, WAR on 4020 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 19 of the 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 prowling around the base for months, included in its crew at least one member of the *Japanese Naval Reserve.*

Ashore, the *Defense Communications Board* took steps to safeguard communications centers and plants manufacturing radio equipment. The DCB requested that all foreigners be excluded from plants and that access to communication centers or factories making radio and other equipment be restricted to employes, Government officials and those who had business in the plants. This step, it was explained privately, was purely precautionary and need not raise any fears that saboteurs or spies have been at work.

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

DR. *LAWRENCE J. DUNN,* W2CLA/WLMD of Garden City, N. Y., has been appointed Chief Radio Aide of the AARS. This is a traditional high honor and a post which in the past has been more honorary than anything else. But Dr. Dunn may find himself with quite a job on his hands as the emergency brings the hams ever more into the defense picture.

Dr. Dunn is a veteran of the last war and a real old timer in radio. He got his first license in 1913 and after the war he established a station with the call letters 2CLA.

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 questionaires 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. MAUBORGNE, Chief Signal Officer of the Army, applied for retirement from the Army, as of September 30 and the *Signal Corps* loses thus one of the most outstanding officers ever to command this branch of the service. Gen. Mauborgne spent 38 years in the Army, during the last four of which he commanded the *Signal Corps.*

You can write it in your book, however, that Gen. Mauborgne, though he is leaving the Army, is not going out of Government service. A man of his knowledge and ability is sorely needed now and he will be "drafted" for the duration of the emergency. Best bet: Gen. Mauborgne will be named to fill the vacancy on the FCC, where he will work with *Defense Communications Board.*

Brig. Gen. Dawson Olmstead, 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.

AS was forecast here last month, the *Office of Price Administration and Civilian Supply* and the OPM have taken steps to free a sufficient supply of strategic metals to keep up the stocks of replacement parts for radio and to permit a limited amount of manufacturing of new equipment.

Under the OPACS program, specific amounts of nickel, steel, aluminum, copper, chromium, tin, brass and other metals were allocated to radio parts manufacturers to permit them to turn out all the tubes and condensers that the country will require through December. The metals are being apportioned among manufacturers on the basis of their respective sales during that period last year. Tubes made with metal provided under this program must be marked for replacement only—and cannot be used in new sets.

The idea behind this being that the country's 50 million receiving sets must be kept in order during the emergency. At the same time, OPM is making available to radio manufacturers a sufficient quantity of metal to keep them going on Army orders and on a limited number of civilian orders.

The civilian orders are to keep the industry—particularly the small manufacturers—going until defense orders take up the slack. For the shortage of materials is going to bring the manufacture of radios for civilian use to a virtual halt. This will not make much difference to the big companies, who are loaded with Army orders. But it leaves the little manufacturers high and dry.

Some months ago, we forecast that there would be a drive to force the big radio makers to sub-contract some of their Army orders. This is now under way.

The bulk of the millions spent for Army radio has gone to five companies—*General Electric, R.C.A., Bendix, Westinghouse* and *Western Electric*. At the behest of OPM, these companies are acting as "prime contractors"—letting out the work to smaller companies, but being responsible for it. For instance, *Western Electric* has farmed out $16,000,000 in purchase orders on the $37,000,000 in defense orders it now has on production. Hundreds of suppliers are working on these orders.

As the contracts are signed for the latest $350,000,000 the Army has to spend on radio, more and more sub-contracting will be done. Sufficient supplies of aluminum, nickel, etc., for this work has been assured by OPM. It is interesting to note that the Army has approved recent development of substitutes for metals which are scarce. As a result, radio manufacturers are using only one per cent of the amount of virgin aluminum they required in 1940. —30—

German Messerschmitt

(*Continued from page 29*)

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 better 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 photograph which shows both the equipments mentioned.

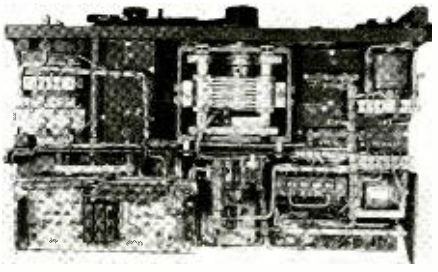
In general, the equipment is built very rugged and the chassis of both the transmitter and the receiver are lightweight castings. The material used is Elektron, which is a special aluminum alloy having a high per-

A portable recording amplifier will be described in next month's issue of RADIO NEWS—on the newsstands October 24th.

centage of magnesium, and yet at the same time will not burn when subjected to intense heat. The casting and the rest of the equipment was painted a dark gray which is the standard color for German military equipment.

The various units are interconnected with cables which are complete with coupling plugs. These plugs are waterproof and include a ceramic terminal board for the various connections. The practice in this country is to provide cable connectors at the receiver or transmitter proper thus eliminating the disadvantage of having a piece of cable attached to the equipment permanently. Shielded rubber covered cables are used in this country for maximum dependability under humidity and abrasion, whereas German equipment uses fiber covered cables.

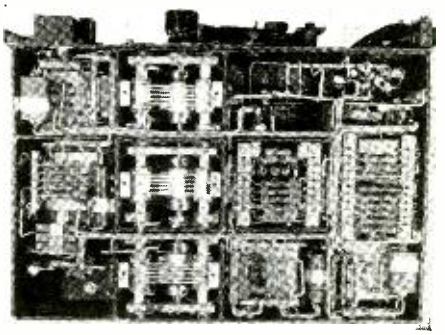
The workmanship included in the German equipment is very good. However, the equipment as a whole will not meet the requirements which we impose even on our commercial equipment, with respect to performance under temperature and humidity variations. The German equipment will not pass our test with respect to operation over a temperature range from −40 to + 150°F. Furthermore it would not pass our humidity test since the various metallic surfaces are not protected against corrosion through the use of suitable platings. None of the coils are impregnated with a protective coating of wax, so it is doubtful whether the equipment would even operate after being subjected to a humidity test.



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



Underside of German receiver.

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 five 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 ohm 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 varies up to 60 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 ease 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 2 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 filaments 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 seen in the type of equipment now being made for our own air services.*

—30—

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 215 generator is particularly recommended for use with *Du Mont* Types 175 and 175A oscillographs which are provided with long-persistence screen 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 17¼ inches. It weighs 35 lbs.

Special Wall Rack

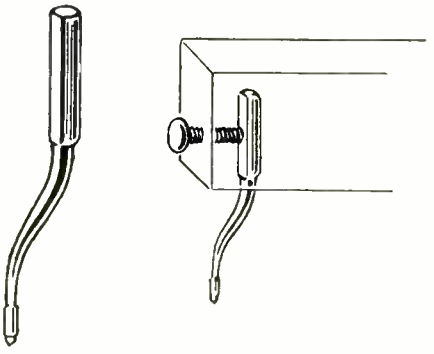
A new style wall rack for radio service shops has been brought out by the *Walter L. Schott Co.*, makers of *Walsco* products.

It holds an assortment of *Walsco* Unibelts (new adjustable dial belts), a spool holding several kinds of dial cords and cables, and a bottle each of the following—*Walsco* radio cement, cement 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 *Walsco* products it holds, and is now available at all jobbers carrying the *Walsco* line.

New Sapphire Needle

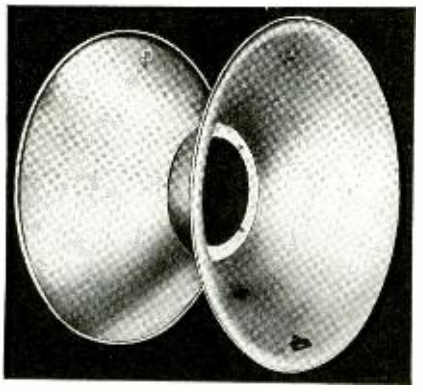
Duotone Co., Inc., 799 Broadway, New York City, manufacturers of a complete line of cutting and playback needles, have just brought out a new duraluminum shaft sapphire playback needle, curved to meet the record straight on, without drag. The sapphire used is small, perfect, not easily



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.



Sound can be projected in two directions with a single 8" cone unit mounted between the two bell sections. The two separate heavy-gauge flares are of pressed steel, finished in brilliant silver. Bell diameters, 21½", total length, 14". Hanging loops and speaker hardware supplied. *Atlas Sound Corporation*, 1449 39th St., Brooklyn, N. Y.

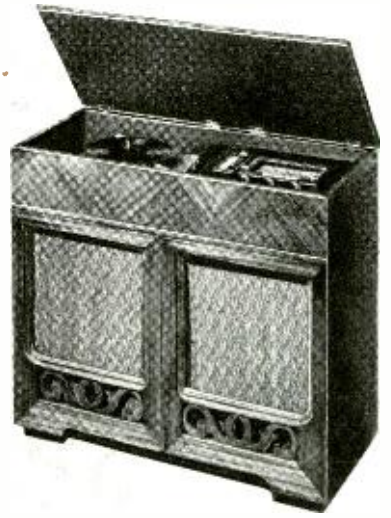
Dual Speed Recorder

Talk-A-Phone Manufacturing Co., 1217 West Van Buren Street, Chicago, announces a new Dual-Speed Home Recorder. It is actually three instruments in one: (1) a Dual-Speed Recorder; (2) an efficient Record Player; (3) a complete Public Address System, including amplifier, Crystal microphone, and special heavy-duty 6½-inch Dynamic Speaker. Cuts records at both 33⅓ and 78 RPM up to ten-inch size. Has new crystal cutting head and low-pressure crystal playback pickup. Plays back all records, 10-inch or 12-inch, with cabinet lid closed. When used as a PA system, develops full three watts power output. Circuit uses five tubes, including rectifier and Electric Eye Volume Indicator. This new *Talk-A-Phone* Dual-

Speed Recorder, Model R-82, is housed in a durable, attractive carrying case finished in striped luggage-cloth. Size: 16 in. long, 16 in. deep, 14 in. high.

Phono-Radio-Recorder

This 9-Tube Phono-Radio-Recorder is the newest contribution of *Sonora Radio & Television Corporation*, Chicago, to complete home entertainment. Housed in a console of matched mahogany woods, 32" high, 36" wide, 16¼" 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-



phone. The radio contains built-in "Sonorascope" loop, eliminating the necessity for ground or aerial; giant 7"x3¾" Slide-Rule Dial; Automatic Push-Button Tuning for 6 stations; 12" Concert Dynamic Speaker; 4 Watts Output; Tone Control; AVC. The Automatic Record Changer-Recorder has crystal recording head and new feather-weight playback crystal pickup and lifetime needle. The beautifully constructed mahogany console is a luxurious complement to the finest home.

—30—

Manufacturers' Literature

(*Continued from page* 40)

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, keys, 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.

NYA Sound System

(*Continued from page* 36)

scription 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 superheterodyne 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 33⅓ 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 make any further adjustments. Service calls have been conspicuous by their absence. —30—

QRD? de Gy

(*Continued from page* 34)

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 efficient 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 leaving 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. But this is not all. The shipping industry must eliminate 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 is frequently no ventilation. The quarters are often much too small and cramped. There is no running water. There are no convenient bathing facilities. Let us take a vessel such as the—upon which I once was employer.

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 certain steampipes 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 officials 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 awash 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 deck of the darkened passageway and trust in heaven that someone doesn't fall over it and get injured.

If he decides to use the Stewards' bath room, he may turn to his left at 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 whom the steamship 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 take a bath in the Stewards' 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. (To be continued).

With the above for a thought we say ge....73....GY. —30—

Ham Chatter

(*Continued from page* 35)

W1EFN, Walter of Pittsfield Mass is vy active on 7250 kcs. Rig runs 75 watts to a 10 final. Rcvr is a Sky Buddy. He has W. A. S. es belongs to the RCC.

W1GAS, George of Danbury, Conn is active on 7150 kcs running 120 watts to a 812 final. Antenna is a half wave end fed Zepp. Rcvr is a Sky Buddy.

W2MNJ, Bill of Coney Island, N Y is active on 7032 kcs running 250 watts to a TW75 final. Rcvr is a SX 24.

W2NMF, Don is active on 7150 kcs. He is located at Troy N Y. Rig runs 60 watts to a 6L6G final. Ant is a full wave Zepp. Rcvr is a Sky Champion.

W2NNB, Joe, of N Y C has a vy fb QSL. Rig there runs 40 watts to a RK 49 Final. Antenna is a Hertz Half Wave. Rcvr is a Lafayette "Pro 9."

W2NQF, Steve of Paterson N J has a vy fb QSL also. Rig runs 10 watts to a 6L6 xtal osc. Rcvr is a FB7. Ant is a half wave.

W3JBB, Bob of Bethesda, Md runs 75 watts to a 6L6G final. QRG is 7230. Rcvr is a Sky Buddy. Age is 17 yrs old.

W6IAJ, 16, Cal of Boulder City, Nev. is active on 40 CW. He is my pride es joy. Rig runs 300 watts to a pr of 812 pp. Rcvr is a SX 24.

W8TNI, Cliff of Canton Ohio runs 175 watts to a T55 final. Rcvr is a SX 17. He has a pictorial card showing a 3 kw spark rig.

W8TVQ, Pete, of Dunkirk N Y runs 450 watts to pr of 812 s. Rcvr is a HRO. He has W. A. S. es W. A. C. es belongs to ARRL.

W8VLX, Jackm of Cleveland Ohio has a T 40 final. Rcvr is a Sky Champion.

W8VOS, Bill, Of Dayton Ohio, *150* watts to a pr of 6L6s in pp in a *OSC!* Whew, I betcha he buys xtals every day, hi.

W9HQY, of Charles City, Iowa runs 100 watts to a T55 final. Rcvr is a NC 200. Antenna is a 160 Meter Antenna. He got his Class A license on July 3 es expects to go on 20 fone, (sucker) HI.

W9FQW, Bill, of Kenosha Wis. runs 35 watts to a 6L6 final. Rcvr is a S 20 Sky Champion.

W9RXS, Henry, of Pine Camp NY operates this station fixed portable. It is in a Army Camp. QRG there are 7030, 7127, es 7131. Age is 25 yrs old.

W9BPE, Ed of Louisville Ky runs 250 watts to PP 804's. Rcvr is a Sky Buddy. He is active on 40 cw. He belongs to ARRL.

W9RLW, Leslie of Mt. Prospect, Ill has bought himself a NC 200. Rig running 35 watts to pp 42s. He uses a Sig Shifter.

—30—

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 call was the one 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 on 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, and his voice was no longer taunting. I felt good, knowing I had proved my point.

"This set," Joe explained, "was my father's last anniversary 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 stares 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 hapiness," Al remarked. "You know, Lee—it should help you in your work to remember the things Joe told you last night." —30—

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 up-to-date wavemeter.

In the push-pull circuit of Fig. 4, the neutralizing plate and grid tank condensers should be adjusted step step by step in unison. Adjustment of a neutralizing condenser in any compensated circuit, push-pull or single ended, may affect the grid or plate tank circuits which, if so af-

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.

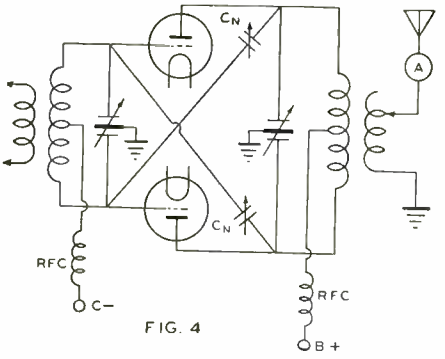


FIG. 4

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.

—30—

Servicemen's Case Histories

(*Continued from page* 40)

CROSLEY 118 "Readio" (Home Facsimile Recorder)

Not printing	1)	power off
	2)	"loose" or "open" connection between receiver and printer
	3)	stylus stuck
Variations in density or blackness of printing	1)	receiver may not have suitable ave circuit capable of keeping the output constant over wide variations of incoming signal strength
	2)	receiver may not have sufficient output
	3)	stylus may be stuck in bakelite bracket
	4)	stylus may be worn
	5)	platen track may have small deposits of carbon on it. Clean
Wobbly printing	1)	receiver not tuned properly (printer not synchronized with transmitter)
	2)	bent or loose stylus pin

CROSLEY 531

Weak reception	1)	replace 10,000-ohm resistor **No. 10** with a 13,000-ohm ½-watt unit. Replace 300,000-ohm 75 tube plate filter resistor with a 250,000-ohm ½-watt unit (connecting plate supply end of high-voltage end of Candohm voltage divider resistor **No. 41-42**)

DETROLA 310

Hum	1)	if receiver employs a Candohm resistor enclosed in a perforated can, check to see if it has slid down and is "shorting" on one end to its metal casing. The casing is connected to the chassis, which is **not** grounded

EMERSON 31C—(Chassis 6C, D6)

Inoperative	1)	"shorted" 0.1-mfd. by-pass condenser **C-25**, causing burnout of 6,600-ohm **R-1** portion of metal-clad wire-wound tapped resistor. Replace condenser with 600-volt 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" 10,400-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 a 0.1-mfd. condenser from electrolytic condenser to ground
Improving volume and bass response	1)	shunt a 5 to 25-mfd. 35-volt electrolytic condenser across the 25L6G cathode resistor (a small rectangular **black** unit mounted directly underneath the 25L6G socket). Connect condenser **positive** to cathode and **negative** to chassis

EMERSON 397 (Automatic Record Changer)

Tone arm lands only on 10" records	1)	check automatic record setting lever (the lever that is struck by 12" records when they drop). Directly below this lever (on the underside of the panel) is a bronze spring about ¾" long that often drops from the panel, causing this trouble. Replace with new type Emerson replacement spring that cannot fall off

FADA 5F60

Howling intermittently	1)	move 25L6 tube plate lead away from the 6C6 grid lead. Shield lead if necessary
	2)	check for "open" by-pass condenser in 25L6 plate circuit
Howling Hum, Distortion	1)	faulty filter condenser section

FARNSWORTH BT-52, BT-53, BT-54, BT-55, BT-56

Circuit change for improved performance	1)	remove 100-ohm resistor now connected in the primary circuit of the 2nd i-f transformer. Connect it instead in the 12SA7 (osc.-mod.) plate and screen circuit **combined** return lead to B plus. The 0.05-mfd. by-pass condenser in this circuit should be connected between ground and the **plate** end of this resistor

FARNSWORTH BK-77, BK-78

Circuit changes to make in early-run receivers for improved performance	1)	change 8,200-ohm resistor **No. 6** supplying the screens of the r-f converter and i-f tubes to 12,000-ohms
	2)	change 150,000-ohm resistor **No. 13** in the negative leg of the power supply circuit to 220,000-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 A-75

Inoperative Weak reception	1)	check for "shorted" 0.1-mfd. 400-volt i-f plate by-pass condenser **C-37**. Replace with 600-volt unit. Also check for overheated 1,000-ohm 6K7 plate resistor **R-9**. Replace with ½-watt unit
Fading out after playing O.K. for short time	1)	check 0.1-mfd. condenser in ave lead of i-f amplifier

(To be Continued)

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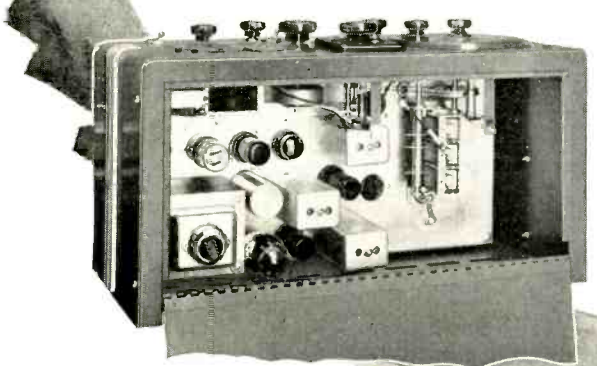

Tube line-up, 6SK7 RF amplifier, 6K8 first detector—mixer H.F. Oscillator, 6SK7 first IF amplifier, 6SK7 second IF amplifier, 6SQ7 second detector, AVC first stage of audio, 6F6G second audio output stage, 6H6 automatic noise limiter, 6J5GT beat frequency oscillator, 80 rectifier.

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