NTRODUCTION TO TELEV S ON SEE PAGE

RADIO NEWS

FEBRUARY
25c

★

VISUAL DEVIATION MONITOR

★

AKE YOUR OWN RECORDS

★

RAISE THE XMTR FFICIENCY

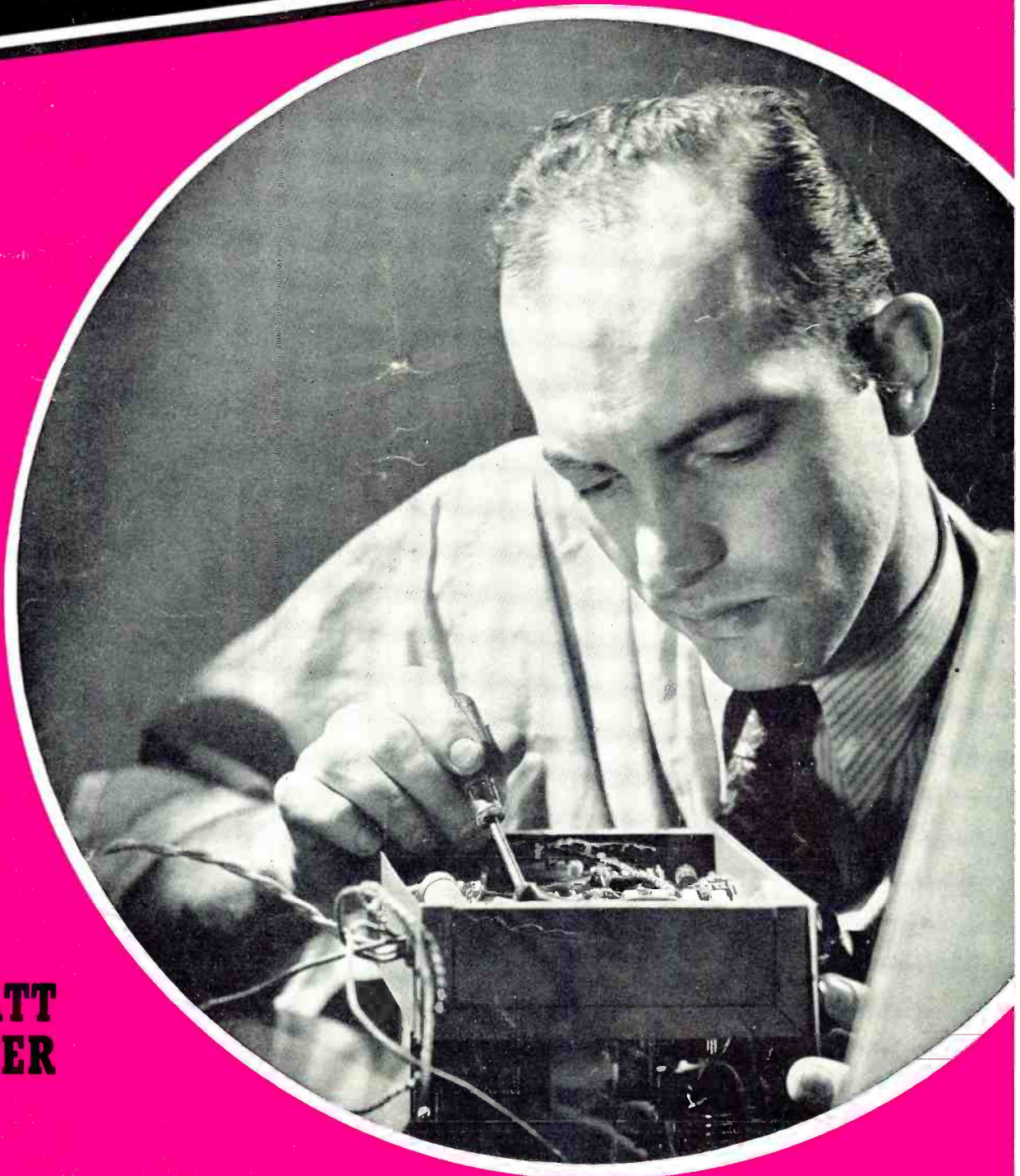
★

BUILD YOUR TELEVISION RECEIVER

★

EW 00 WATT TRANSMITTER

★



RAD O CONTROLLED AIRPLANE MODEL

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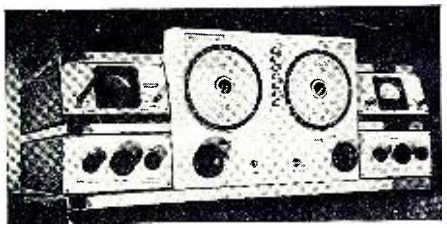
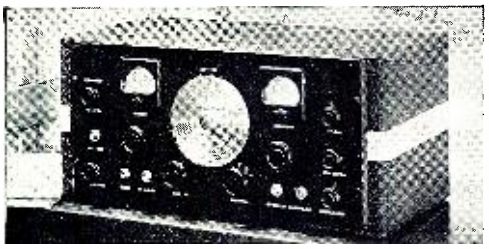
WORLD'S LARGEST RETAIL RADIO DEALER

• Finest and Largest Display of Amateur Receivers and Transmitters in New York

DAVEGA is New York's Pioneer dealer in HALLICRAFTER



HALLICRAFTER DIVERSITY: 6 Bands covering from 545 KC. to 44 MC. and there are 25 tubes in the complete system • Separate "Diversity Action" meters • Average sensitivity of better than 1 microvolt • Audio amplifier output of 10 watts (Tuner only 50 milliwatts) • Infinite adjacent channel rejector.



SKY CHALLENGER 11: 9 Tubes • Infinite Image Rejector • Recessed Main Tuning Dial • 1000 Spiral Band Spread • 38 MC. to 540 KC. (7.9 to 557 Meters) • Iron Core I.F.'s • Crystal Filter Circuit. Model S-18.....$77.00

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Including the following:

- Skyriders
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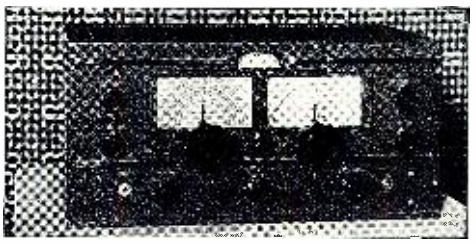
- Special 5-10
- Marine Models
- Sky Buddy
- Hallicrafter Transmitters

DAVEGA has the most complete Stock of R.M.E. in New York



R.M.E. 70. Latest development of R.M.E. laboratories. One of the finest receivers manufactured today by a company known for its rigid standards of quality. Now on demonstration at Davega. Ready for delivery.

R.M.E. 69. A receiver that is praised by engineers, amateurs and B.C.L.'s throughout the world. One of today's communication standbys.

DB 20 by R.M.E. Signal Amplifier, image rejector guaranteed to improve any set enormously or money refunded.

510 X Frequency Expander. Expands your present receiver into 5 meter reception. Utilizes all present power and adds sensitivity.

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ACR-111 COMMUNICATION RECEIVER

The ACR-111 employs a single-signal, 16-tube Superheterodyne circuit with two tuned rf. stages, constant-percentage electrical band-spread, individual carefully isolated oscillators, two I.F. amplifier stages, crystal filter, calibrated input-signal strength indicator (electron-ray tube), noise limiter, noise suppressor, audio driver stages, push-pull power-output stage, and an integral power supply.

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Established 1914

The man who has directed the home study training of more men for the Radio Industry than any other man in America.

I will send you a Lesson Free

to show how I train you at home in spare time for Good Jobs in Radio

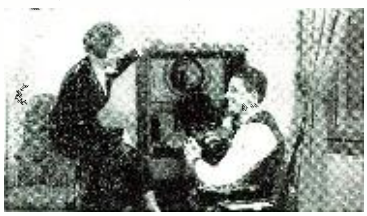
Clip the coupon and mail it. I will prove I can train you at home in your spare time to be a RADIO EXPERT. I will send you my first lesson FREE. Examine it, read it, see how easy it is to understand—how practical I make learning Radio at home. Men without Radio or electrical knowledge become Radio Experts, earn more money than ever as a result of my Training.

Get Ready Now for Jobs Like These

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Fixing Radio sets in spare time pays many $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as $30, $50, $75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, and pay up to $6,000 a year. Automobile, police, aviation, commercial Radio, loud speaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

Broadcasting Stations

Employ managers, engineers, operators, installation and maintenance men for fascinating jobs and pay up to $5,000 a year



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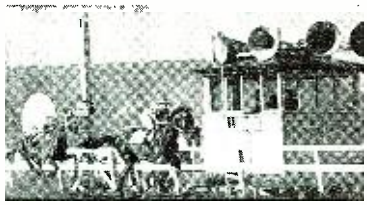
Spare time set repair work pays many $5, $10, $15 a week extra while learning. Full time servicing pays as much as $30, $50, $75 a week.



Loud Speaker Systems

Building, installing, servicing and operating public address systems is another growing field for men well trained in Radio.

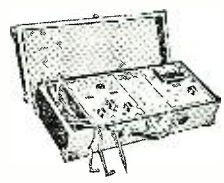
Why Many Radio Experts Make $30, $50, $75 a Week

Radio is young—yet it's one of our large industries. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios get out of date and are replaced. Millions more need new tubes, repairs. Over $50,000,000 are spent every year for Radio repairs alone. Over 5,000,000 auto Radios are in use; more are being sold every day, offering more profit-making opportunities for Radio experts. And RADIO IS STILL YOUNG, GROWING, expanding into new fields. The few hundred $30, $50, $75 a week jobs of 20 years ago have grown to thousands. Yes, Radio offers opportunities—now and for the future!

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

The day you enroll, in addition to our regular Course, I start sending Extra Money Job Sheets, show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money $200 to $500—for hundreds, while learning. I send you special Radio equipment—to conduct experiments, build circuits. This 50-50 method of training makes learning at home easy, fascinating, practical.

I Also Give You This Professional Servicing Instrument



Here is the instrument every Radio expert needs and wants—an All-Wave All-Purpose, Set Servicing Instrument. It contains everything necessary to measure A.C. and D.C. voltages and current; to test tubes, resistance, adjust and align any set, old or new. It satisfies your needs for professional servicing after you graduate can help you make extra money fixing sets while training.

Get Sample Lesson and 64 Page Book — Mail Coupon

Act Today. Mail the coupon now for sample lesson and 64-page book. They're free to any fellow over 16 years old. They point out Radio's spare time and full time opportunities and those coming in Television: tell about my training in Radio and Television; show you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. SMITH, President
Dept. 9BR
NATIONAL RADIO INSTITUTE
WASHINGTON, D. C.

HERE'S PROOF

$10 Week in Spare Time

"My work has consisted of Radio set servicing, with some Public Address Systems work — all in my spare time. My earnings in Radio amount to about $10 a week."—WILLIAM MEYER, 705 Ridge Road, Hobart, Ind.

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I'll prove my Training gives practical, money-making information, is easy to understand—just 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. A cross reference 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 and testing. You can get this lesson Free. No obligation.

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The Tested Way to BETTER PAY

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J. E. SMITH, President
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Dear Mr. Smith: Without obligation send me free the Sample Lesson and your 64-Page Book "Rich Rewards in Radio," telling about spare time and full time Radio opportunities, and how I can train for them at home in spare time. (Please write plainly.)

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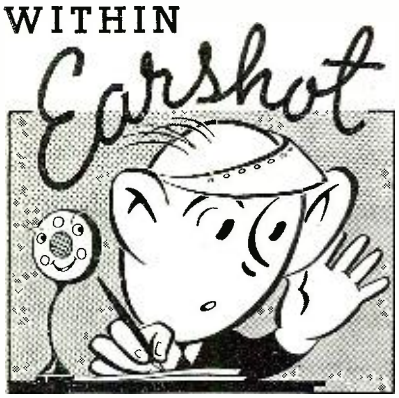


OF THE EDITOR

WE are firmly convinced that television is on the way. We believe that the ham should do something in this newest field. To that end we offer to publish (at our usual rates) all pictures and articles dealing with amateur television apparatus and experiences, provided only that the picture is interesting and the article suitable for publication. Well, fellows, what say? Are you "going to town" on television? Which amateur will be the first to develop a television transmitter which will send out "live" programs? We predict his name will go down in contemporary ham history.

* * *

FOR the thrill of thrills cast over the short waves for transatlantic phone conversations. Almost always they will be "scrambled." But once in a great while for one reason or another they won't be, and that is when you hear persons around the world discussing home affairs with the nonchalance of the old party wire.

* * *

NEXT to that, hearing the pilots report from their airplanes as they fly the airlanes is a sensation that will live in your memory. Generally you can hear the roar of the motors, and knowing that the pilot is somewheres above the earth, a great distance away, never fails to provide a "kick" which is hard to beat.

* * *

NOW is the time to write that newly elected Senator or Congressman of yours, and find out where he stands on the ham band situation. Don't take "No" for an answer either.

* * *

WATCHING the action of the *Philco Mystery Control,* the thought came to us that here was a "super-super" manner of controlling that new bandswitch transmitter of which we have been thinking. Unfortunately, we have only been doing some thinking—not building—and undoubtedly before we ever put a soldering iron to wire, someone else will have built up the same idea.

* * *

OUR Friday evening get-togethers continue to be a marked success.

(*More earshot on page* 57)

RADIO NEWS

Including Articles on POPULAR TELEVISION

The Magazine for the radio amateur experimenter, serviceman & dealer

VOL. 21 NO. 2

Contents for February, 1939

FEATURES

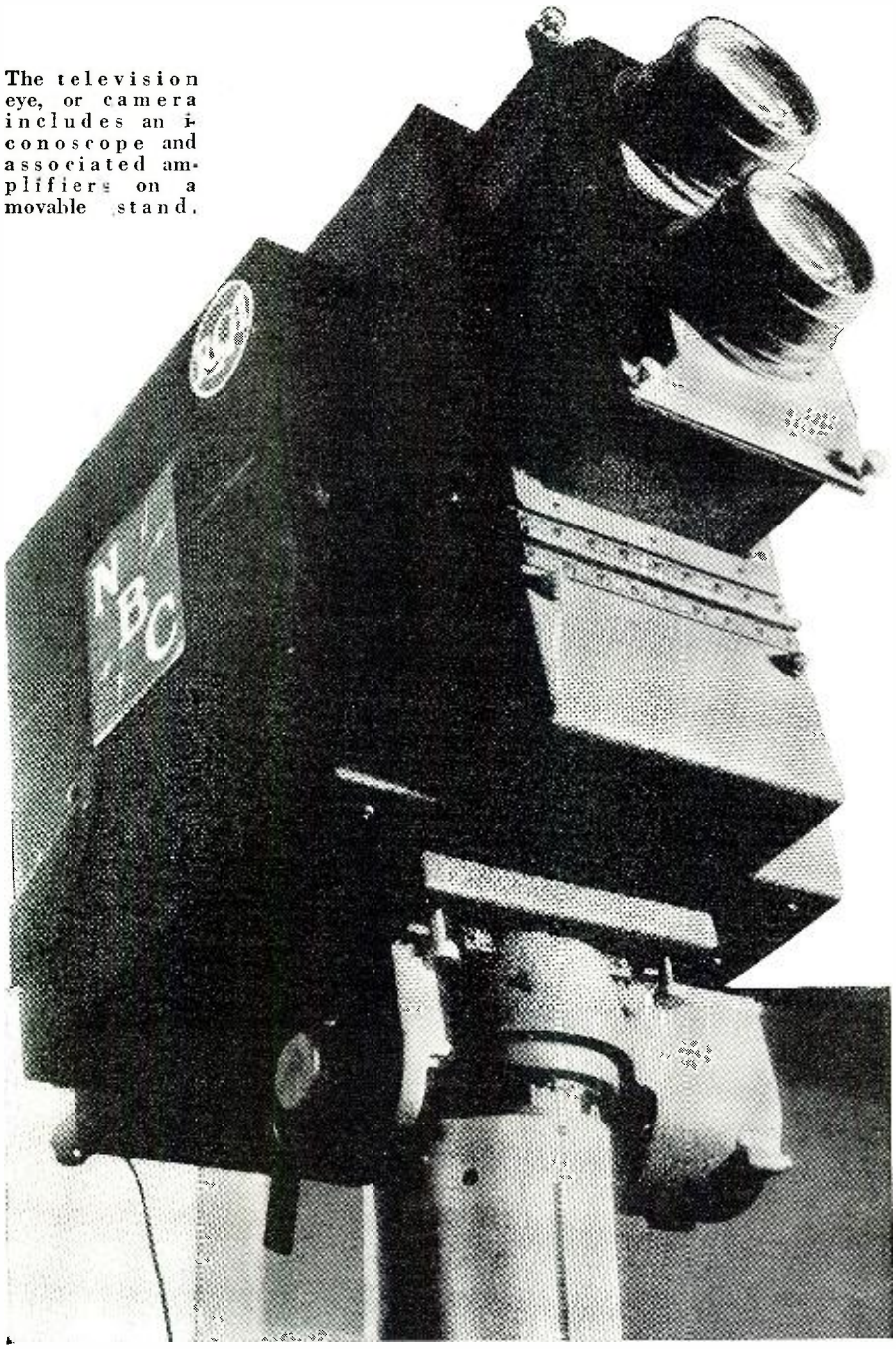
DEPARTMENTS

RADIO NEWS is published monthly by the Ziff-Davis Publishing Company at 608 S. Dearborn St., Chicago, Ill. William B. Ziff, Publisher; B. G. Davis, Editor; Karl A. Kopetzky, W9QEA, Managing Editor; Oliver Read, W9ETI, Technical Associate; E. Stanton Brown, Associate Editor; Herman R. Bollin, Art Director; John H. Reardon, Circulation Director; S. L. Cahn, Advertising Manager. New York Office, 381 Fourth Ave. Subscription $2.50 per year; single copies, 25 cents; foreign postage $1.00 per year additional, except Canada. Entered as second class matter, March 9, 1938, at the Post Office, Chicago, Illinois, under the Act of March 3, 1879. Contributors should retain a copy of contributions. All submitted material must contain return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Accepted material is subject to whatever revisions necessary to meet requirements. Payment will be made at our current rates upon acceptance and, unless otherwise specified by the contributor, all photographs and drawings will be considered as constituting a part of the manuscript in making payment.

INTRODUCTION TO MODERN TELEVISION

By M. W. THOMPSON
Television Engineer, Chicago, Illinois

Here is your introductory course to television written so that all the difficulties are made understandable and very easy.



The television eye, or camera includes an iconoscope and associated amplifiers on a movable stand.

YOU gentlemen with more than the average broadcast listener's interest in radio, who intend getting acquainted with *Miss Television* during her "coming out" parties of the next few months, will find this fascinating newcomer speaks a new and strange language. Her sense of time is not that of seconds, minutes and hours, but is in terms of "H" and "V"—3H, 0.15H, 0.10V and 0.07V—in which "H" is 1/13230th-second and "V" is 220½ H's.

For this new miracle of the air waves is a matter of timing far finer than ever was achieved by Rockne's immortal *Four Horsemen,* the bat of the Yankee's *Babe* or a Bobby Jones iron shot. The successful maneuvers worked out for the triumph of the electrons, by coaches Zworykin, Maloff, Farnsworth, DuMont, Preisman. etc., are timed in micro-seconds, and consist of "blanking," "pulses," "interlace," "keystoning" and many others.

The long-debated matter of "when should television be released" was brought to a head and settled last June when the RMA Television Committee voted approval of a set of *Television Transmission Standards* for this country. As the RMA and the FCC have been in constant touch on this subject, it seems a certainty that the recommendations will be accepted by government authorities.

One thing should be made clear at this point. The system of television to which this series will give the greater space is most certainly not the only way in which this modern miracle can be accomplished; it is, however. the result of many months of work by the Television Committee of R.M.A. and represents the standards for transmission and reception that will, apparently, be general practice in this country.

There is much of merit in the developments of Marconi, Telefunken, Fernseh, Mihaly-Traub, Scophony, Dumont, Farnsworth and many others. While it apears that American practice will be developed around electron optical scanning systems, based on the cathode ray tube, equally good results have been achieved with mechanical optical systems. Research into the work done both here and abroad during the past ten years, brings to light an almost unbelievable number of combinations of lenses, apertures, prisms and mirrors mounted on drums, spirals and discs. As this is being written, an-

nouncement has been made by Scophony, Ltd. (British) that a $10,000,000 American affiliate will be formed to market receivers utilizing mechanical optical designs.

Allen Dumont has an excellent system of television which involves no sychronizing signals, has 4-to-1 instead of 2-to-1 interlace, and utilizes two carriers. Over in England they use "negative" modulation which means that highest amplitude is white rather than the sychronizing pulse level in blackest black, and the sync pulse level is zero radiated power where our standards of "positive" modulation result in white. Should one care to make a careful study of the work of many very brilliant minds and form his own opinion of the relative merit of each one's methods, it will be interesting, and definitely instructive; the fact will remain, however, that the electron optical systems are going to dominate commercial television just as gasoline motors outnumber diesels, there will be synchronizing signals transmitted, 441 will be the generally-used line frequency, and sync signals will be above blackest black.

In this first article, I will present briefly the many features, new to radio men, that are essential to commercially practical television, then in the second article explain with circuits and charts how they are accomplished, in both transmission and reception, then, with later articles, bring everyone up to the point where he can intelligently plan and construct his receiver. While few of us will attempt the construction of a television transmitter, it is essential to the building, altering or servicing of a receiver, that one know all the whys and wherefores of the complete system, as it is about to be handed to a more-than-expectant public.

First of all, television broadcasting is to be done in the ultra high frequency spectrum, and, to start, seven channels have been assigned for this service between 44 and 108 megacycles, and another twelve between 156 and 294 megacycles (see Figure 1). This is necessary as it was only in this division of the useful frequencies that enough frequencies were available to permit a few channels with the relatively wide sidebands required (a television channel is six megacycles in width). Here also, reflections from the "heaviside" layer occur but seldom. Reflections would be disastrous, as the difference in time between the arrival of the ground wave and that of the reflected wave would produce images in offset pairs or "ghosts."

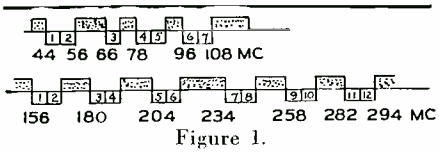


Figure 1.

Each channel is complete in itself, that is it will include both the video (picture) and the audio (sound) transmission, and these will, in every channel, be a definite distance apart. Thus they can be tuned-in simultaneously, heterodyned by one oscillator, and each diverted into its own intermediate amplifiers. How this works out is illustrated in Figure 2. For this example, the channel in use at the Empire State Building (N.B.C.) transmitter is chosen—the channel from 44 to 50 megacycles (mc.).

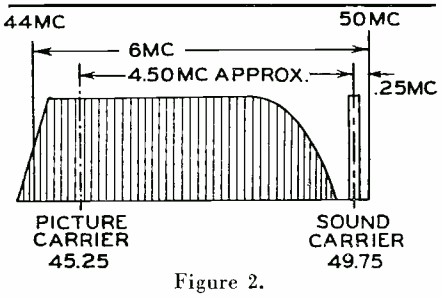
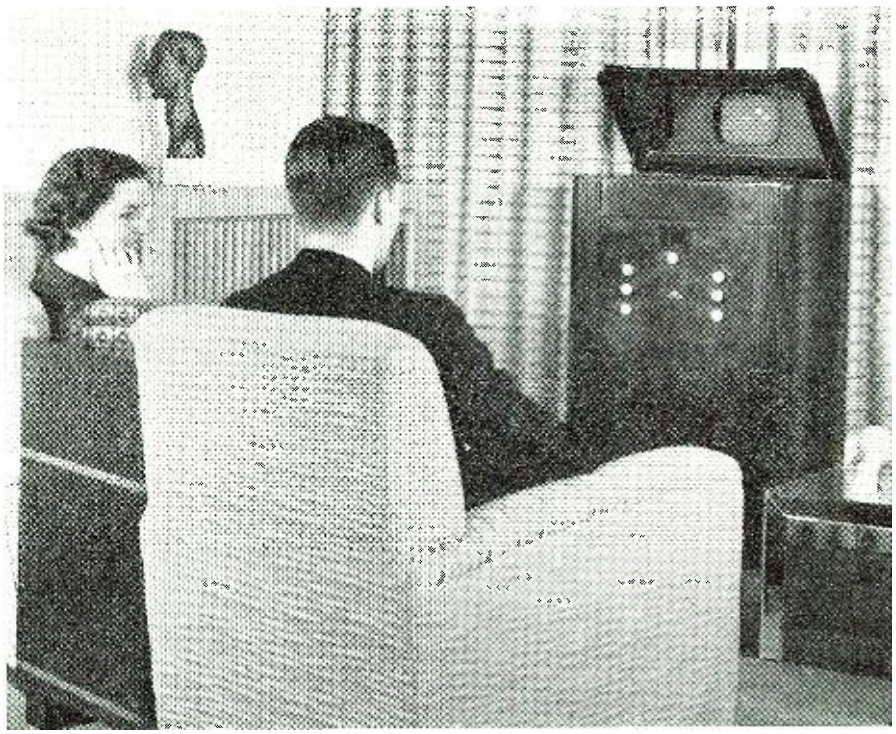
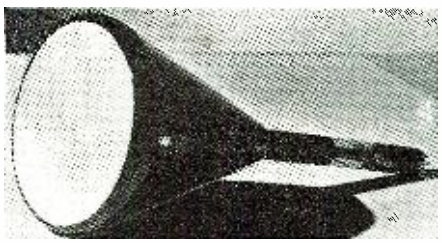


Figure 2.

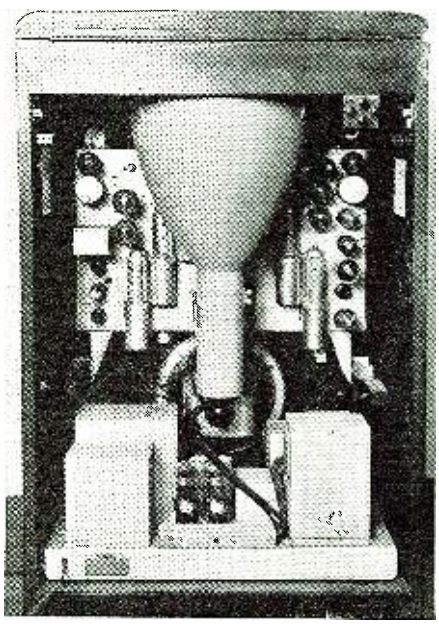
It has been found that the wider the video sidebands, the better the detail and entertainment value, so, rather than transmit both sidebands (video) and have each be 2.5 mc. deep, it will be the practice to utilize but one sideband and have it, roughly, 4.0 mc. deep. The other will be suppressed. In Figure 2, the video carrier is shown as 45.25 mc. and placed 1.25 mc. from the 44 mc. (lower frequency) edge of the channel. Its sideband is about 4.0 mc. deep. The sound carrier is at 49.75 mc., placing it 4.5 megacycles above the video carrier and 0.25 mc. from the 50 mc. (higher frequency) edge of the band. This 4.5 mc. separation, and the 0.25 mc. placing of the sound carrier, are in the recommended standards.

If, at the receiver, we tune an oscillator to 58 mc., and have it heterodyne the 45.25 and 49.75 mc. carriers, we automatically secure the RMA standard sound intermediate fre-


The newest television receiver will be so made that more than one person will be able to enjoy the broadcasts.


The Kinescope which makes the reception of television signals possible.

The modern television receiver is a bit more complicated than the BC set.



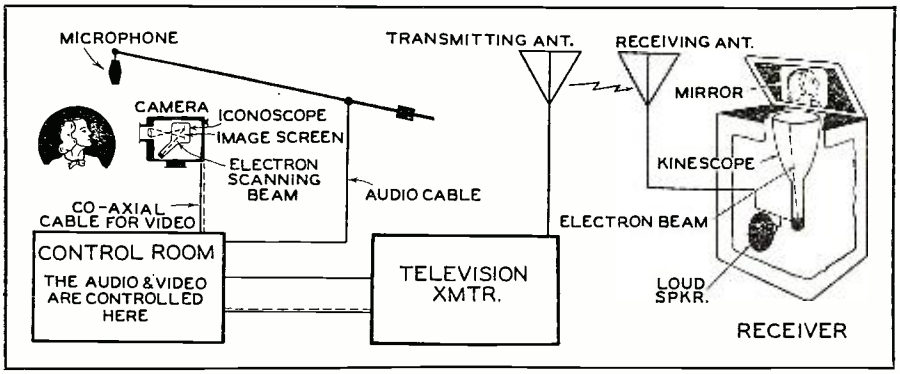
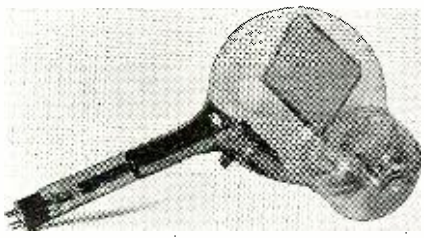


Diagram showing the various stages of the television and audio broadcast.



The heart of the television transmitter.

quency of 8.25 mc. and the video intermediate frequency of 12.74 mc. Whether one tunes to the 44-50, the 50-56 or the 78-84 mc. channel, the two carriers will tune correctly and heterodyne to their proper i.f. passbands.

Probably the easiest way to visualize the "pickup" and re-creation of television transmission of a scene is to imagine that you have before you, as a photoprint, the scene to be transmitted, as it would be at any given 1/30th-second. You have a current-generating pencil, from which a wire leads to the transmitter—you draw a straight line across the top edge of the picture, and, as you go over a black spot the current generated increases, while a gray spot produces less current, and a white area would result in no current flowing. Obviously, using a photograph, the current would constantly be changing.

Now you draw another line as close to the first as possible, so that a total of 441 lines will cover the picture completely. When you have finished, every point of the picture will have been represented by a current, either strong or medium or weak, flowing from your pencil. In television, a tiny stream (or beam) of electrons is caused to travel, just as you did it, over the image picked up by a lens and a complex variety of cathode-ray tube called an *Iconoscope*. This is called "scanning" and it results in a constantly-varying current, modulated onto a high frequency carrier, which, when received, can be re-created into an identical picture by another beam on the end of another type of cathode-ray tube termed a *Kinescope*.

While cathode-ray tubes, as used in television, will be analyzed and explained in detail in the next article, I present in Figure 3 a simplified sketch of the *Iconoscope* and *Kinescope*, to make the current discussion more readily understandable. The pickup of a scene is, in principle, not difficult to understand when an illustration is available. The left wall of the *Iconoscope*, as shown in Figure 3, is of exceptionally clear, highly-polished glass, with a lens of the order of f2.8 or f3.5 mounted at correct focal distance so the scene to be transmitted is reduced to proper size on the *Signal Plate* within the tube. As the electron beam

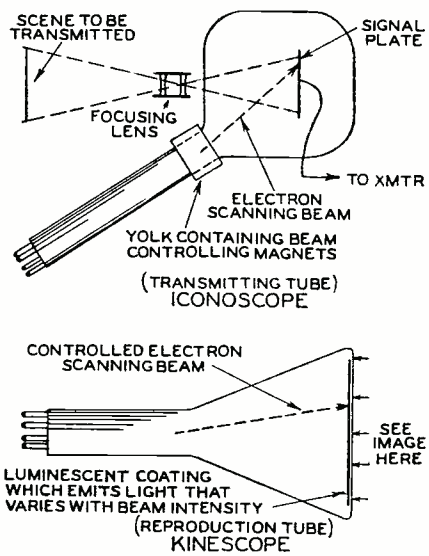
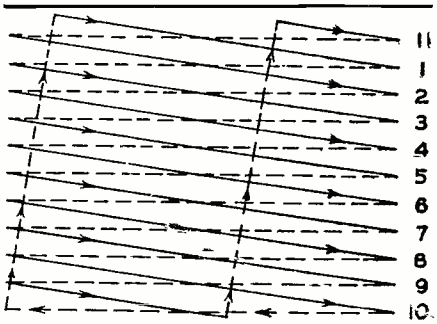


Figure 3.

systematically covers the image on the *Signal Plate*, a constantly-varying current is caused to flow to amplifiers and the transmitter.

At the receiving end, this varying current, which is stronger as the picture is darker and weaker as the picture tends toward white, varies the intensity of the electron stream in the *Kinescope* as the beam scans the inner surface of the glass end of the tube. As this inner wall of the tube is coated with a preparation (may be either a



VISUALIZATION OF INTERLACING
Figure 4.

sulfide or a silicate of zinc) which is highly luminescent, the original scene is re-created in approximately 225,000 pin points of light with surprising fidelity. The negatively-charged particles that compose the beam are moving with velocities of the order of 30,000 miles per second.

Thus, what one will really see is a rapid sequence of pictures as "scanned" by a lightning-fast electron pencil. To avoid flicker, it was known that 24 complete pictures (movie standards) or better, would have to be created per second on the end of the *Kinescope*. The number 30 was chosen, because, being a multiple of the 60-cycle supply frequency, hum difficulties could more readily be avoided. Hum would, in this case, show itself as a dim pattern moving across the picture.

Further to eliminate flicker, it was decided to "scan" the image in a manner known as "interlacing" (see Figure 4). This means that, instead of picking up our lines in regular 1, 2, 3, 4, 5 order, we pick them up as 1, 3, 5, etc., until we have 220½ lines and then jump back and get 2, 4, 6, etc., through another 220½ lines—each complete operation taking not more than 1/60th-second. The full set of 441 lines is known as a "frame" while each half is a "field."

(*Scan page* 54 *next, please*)

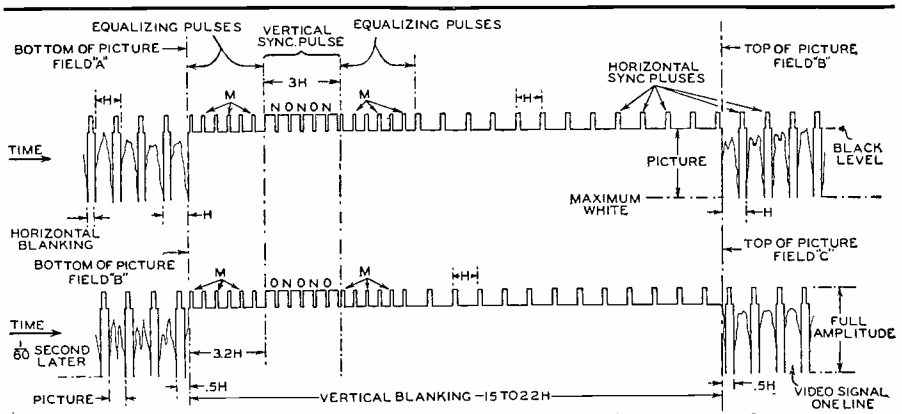
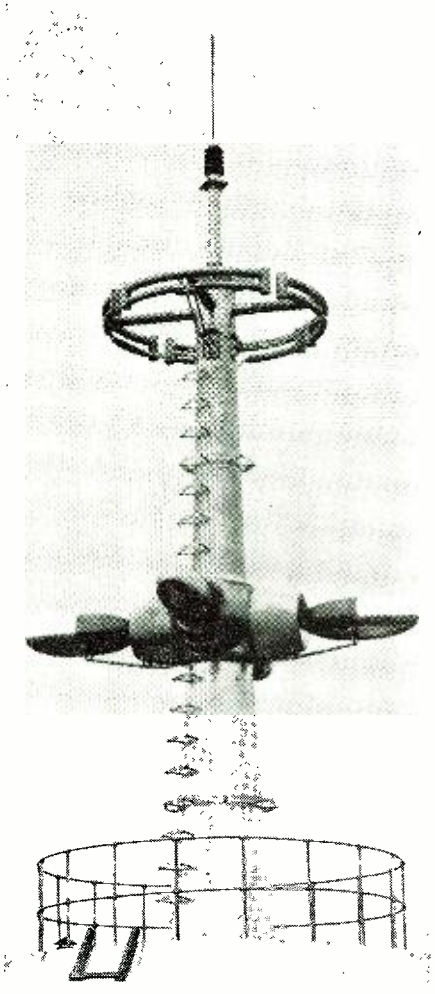


Figure 5. A diagrammatic breakdown of a television signal.

The VIDEO Reporter

BY W. C. DORF

IN sci[illegible] the future will [illegible]d as the year in [illegible]sion made its auspi[illegible]th regular television pro[illegible]ams to the American public? The ever increasing activity in recent weeks, with announcements of new cathode-ray tubes, complete receivers and kits, new design in television antennae, the granting of several important television patents, new stations, and other inter-related progressive advancements, strongly point to '39 as the television year. It is increasingly evident that the large broadcasting chains, receiver manufacturers and parts companies are all set to take their individual places in this new radio field of video art.



Completed NBC Television Antenna.

A review of the statements made by many of the leading executives and engineers emphasized the fact that television's major problem at this time is the program; that is, the type of program best suited to television, the art of staging the program, and primarily its financing. As David Sarnoff, President of RCA, recently pointed out in an address, "You can't have home receivers before you have transmitters to send them programs. You can't have transmitters until you have programs to put on those transmitters." Will these obstacles and other problems confronting this field be overcome, so that the American radio enthusiasts can look forward to the early introduction of television on a commercial basis? "Undoubtedly," says this writer, but the reader can form his own good opinion and at the same time keep posted on all the latest television developments, by reviewing the monthly material gathered here, there and everywhere on the New York television front.

Special Demonstration for the Auto Moguls

DURING the recent auto show in New York City, the various auto manufacturers were given a demonstration in the NBC studio in Radio City on the practical application of television. NBC's mobile unit telecast a parade of the new 1939 cars in Rockefeller Plaza, which was followed by a studio video presentation of the latest motor car advancements in gear shifts, motors, etc.

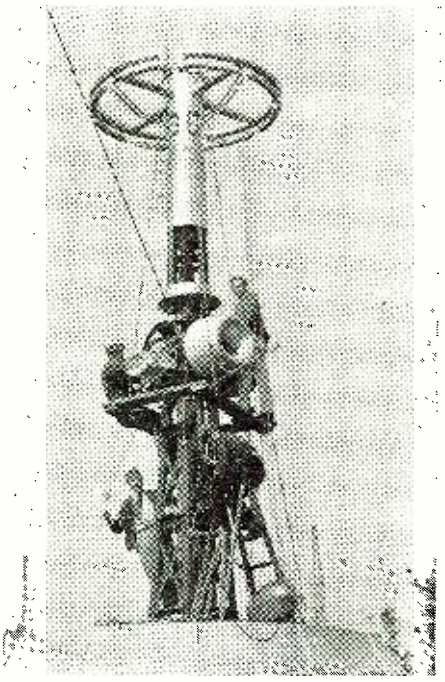
One Up for Schenectady

THE General Elecric Company is constructing a new 10-kw. television station in the Helderberg Hills, twelve miles from Schenectady, N. Y. It is to be linked with the studio by a 1.4 meter ultra short-wave beam instead of a coaxial cable. The station is to be constructed on top of a 1500 foot hill with the antenna on 100 foot towers. The new station is to maintain its own motion picture department and a camera equipped truck roving the Albany district for spot telecasting.

New Profits for Servicemen

M. B. SLEEPER, well known engineer and radio pioneer (and I mean pioneer, remember way back, the *Sleeper reflex* circuit), gave an interesting talk over station WOR on the new Andrea sight and sound receivers. He brought out some excellent points one of which was right down the serviceman's alley, viz—"One of the most serious problems in television is the total lack of trained television servicemen to install and service the sets. They are so different from broadcast receivers that radio receiver experience is not adequate. This makes television an entirely new field." Plenty of work ahead, radiotricians, and there's a tip to get busy and brush up on the mysteries connected with this new radio equipment.

Mr. Sleeper stated the Andrea sets will be released after the first of the year, when the New York television transmitters will start scheduled broadcasting.

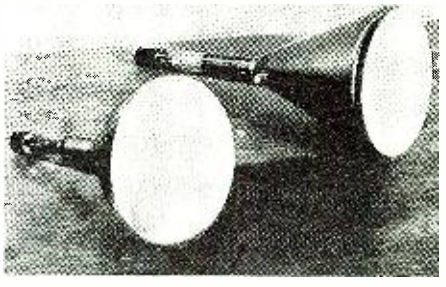


Erecting NBC's Television Antenna.

Compact 16-Tube Kit

YOUR reporter dropped into the Wholesale Radio Service Co.'s showroom the other day and saw the new Garod Television Kit in assembled form. This new rig is adapted to the RMA standards, reproducing images scanned at 441 lines, interlaced, 30 frames per second. The kit is inex-

(*Scan further on page* 50)

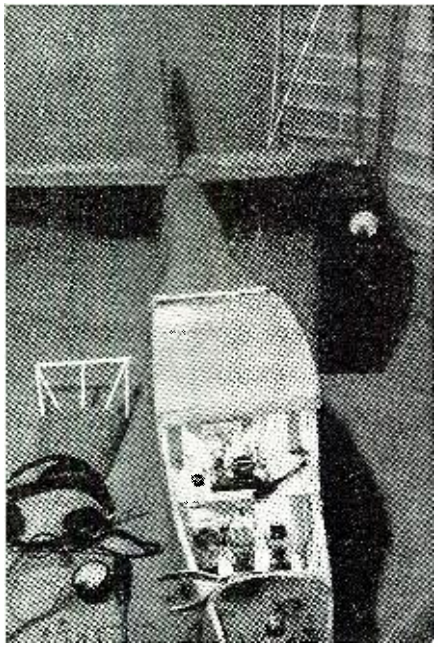


Compare the new "Stubby" with the older type of Cathode Ray Teletube.

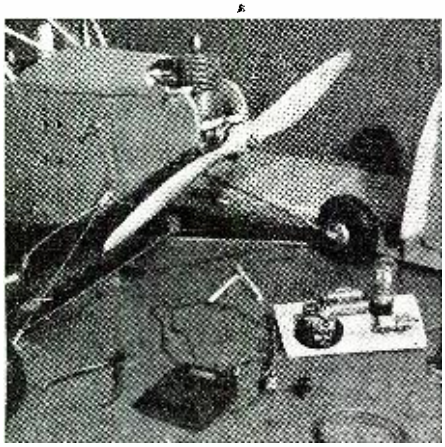
A Radio Controlled Model

By R. A. ISBERG
Engineer, Station KOA
Denver, Colorado

The author gives the first complete, comprehensive study on the radio control of model aircraft with all diagrams on how to build your own.

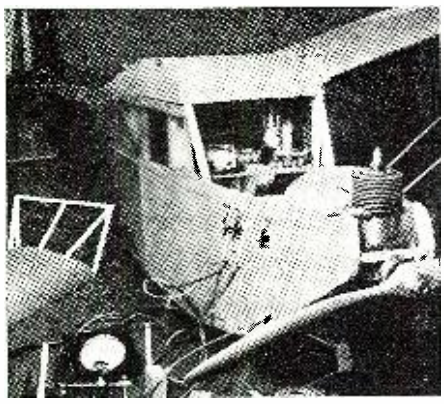


Control equipment mounted in the model plane ready for the takeoff.



The control receiver removed from the plane to show its construction.

All test points and switches are mounted externally for simplicity.



INDESCRIBABLE thrills are in store for the pilot of a model plane whose maneuvers can be directed by radio. Mastery of two highly specialized sciences is requisite, each with its own absorbing problems and the combination presents exceptional opportunities for individual and group achievement, something which is rapidly disappearing in the ham game as a result of the general adoption of manufactured receivers and transmitters.

A radio amateur need not necessarily take up the building of model airplanes in order to have a part in the fun. In fact, that would hardly be advisable, because he would probably slight the airplane in order to better accommodate the radio equipment; likewise, the model builder is poorly prepared to add radio control to his plane. The ideal arrangement, (if you are not already a dyed in the wool ham and aviator combined) is to find someone in your locality who understands model aircraft construction and then form a partnership.

This is not difficult because there are model clubs in practically every town. If you don't know any of the modelers in your community, write to the *National Aeronautics Assn.*, Washington, D. C. (every owner of a gas model is registered) for addresses or shop around the department stores until you find a clerk behind a counter full of model accessories. Another advantage of working with someone else—the expenses are shared and if the experiment ends with a disastrous crackup you will have someone to console—and to console you.

Radio direction of models is by no means a new field, it really started with radio communication; however, the bulk of the equipment necessary plus the unreliability of its operation retarded development and interested only a few advanced amateurs who specialized in model boats. The method most used until recent years utilized a spark transmitter (which is illegal) to send impulses to a coherer type receiver. Naturally, the range of operation was very limited and the results uncertain.

As far as the majority of amateurs and model builders were concerned there were other more interesting things to do and with the exception of an occasional flicker of activity, thoughts of radio control were only day dreams.

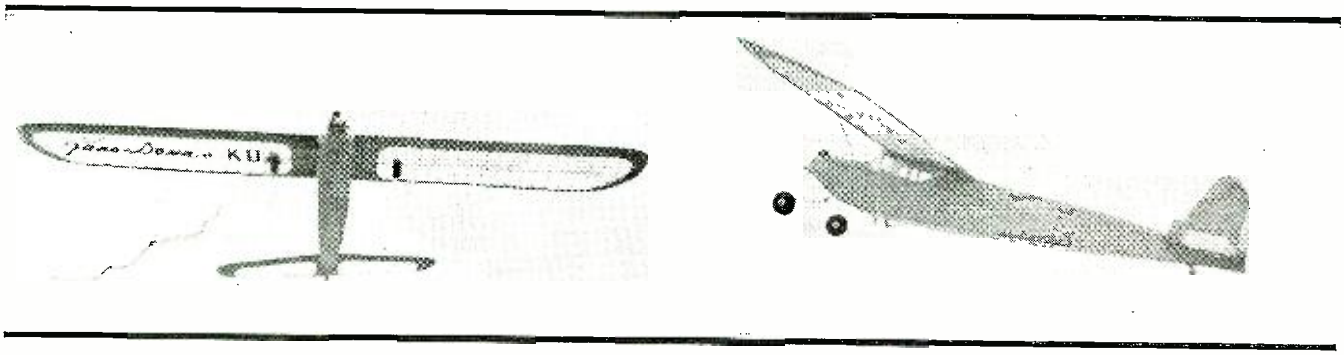
An announcement of a radio controlled model airplane competition at the Detroit meet in 1937, started the first general wave of enthusiasm. Six modelers displayed ships and control systems, but only one ship, built by Chester Lanzo,[1] flew. His control system (for direction only) consisted of a three tube regenerative receiver operating on 80 meters, a homemade sensitive relay, and a small 1½ volt locomotive motor with a gear train to operate the rudder. The controls were demonstrated to be operatable by signals from an amateur station *several hundred miles away.* His plane weighed five and three-quarter pounds including the one and three-quarters pound receiver and control mechanism. A one-fifth horsepower gas engine powered the ship and I understand it was usually hand launched because this was not quite enough power for the weight of the plane.

The late Ross Hull developed a system[2] for controlling sail planes during the same summer. His receiver consisted of a type 30 self-quenched superregenerative detector, a 1B5 first audio and a 1F4 second audio stage. An Eby sensitive relay in the output circuit was used to control a solenoid which operated a simple rubber powered escapement permitting selection of right, neutral, left and neutral rudder positions. This scheme is very practical because the "pilot" on the ground knows exactly what position the rudder is in and how many impulses are required to turn it to a desired position. A system not using an escapement, such as a motor driven gear box without stops, is likely to bring about a crackup due to poor coordination between the pilot and plane.

While the 1938 entries in the Detroit competition were more advanced and were probably capable of more satis-

[1] Lanzo, *Radio Controlled Gas Model*, Air Trails, Vol. 9, No. 4. January, 1938.
[2] Hull & Bourne, *Radio Control of Model Aircraft*, QST, Vol. 21, No. 10, October, 1937.

More Flights...



factory operation than those of 1937, none of them could be demonstrated in the actual competition. The winning ship, Walter Good's, cracked up just after taking off and no other entries were flown due to the uncertain wind conditions. Good's plane was equipped with two radio channels, using two one tube (type 30) receivers of the type shown in Figure 3. His control system operated both rudder tab and elevators by means of Sigma relays and home made electromagnetic escapements.[3] Second place was awarded Clinton B. DeSoto on merit.

The plane used in our experiments was designed and built by Robert Van Buskirk of Denver who has been active in local and national model competition. The plane has a twelve foot wing spread and a seven foot fuselage. It is powered by a ⅓ hp. Forester gas engine and it weighs about twelve pounds complete with all radio equipment, batteries, and fuel. It has sufficient power to take off and climb steadily provided there is not a strong wind.

Our control has been used for direction only because we wanted thoroughly to master turning the ship before we tried diving or zooming. It is easy enough to washout the experiment if there is only one control to manipulate; particularly if the ship turns across a gusty wind when it is only a few feet off the ground. Control of direction is more valuable and necessary than control of elevation. It is most important to keep the plane within vision and to make it land on the field from which it took off; not to mention the fun you can have turning it to the right or left and describing figure eights in the sky.

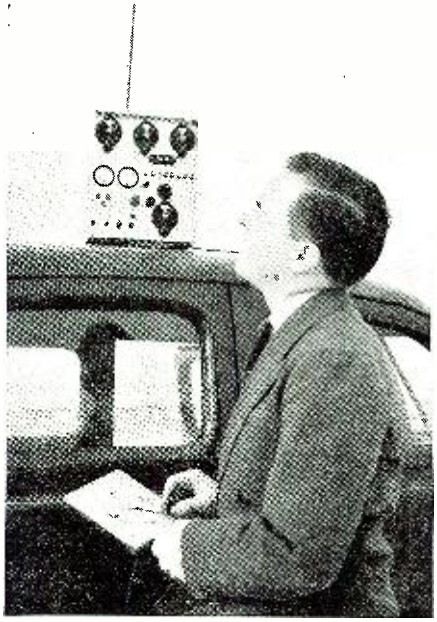
Four receivers have been used in our plane. The first was patterned after the receiver Ross Hull described for use in sail planes. It was found to be impractical for powered ships because its output was too low to operate the relay satisfactorily when the contacts and tension spring were adjusted for minimum effect of motor vibration. The receiver operated on pulses of carrier which would stop the super-regenerative hiss of the detector which in turn caused the bias on the grid of the second audio tube to be substantially reduced, causing a change from .6 to 2 ma. in plate current. The idling current of .6 ma. in plate circuit magnetized the core of the Eby relay enough to make tension adjustments difficult and the additional 1.4 ma. plate current (when a pulse of carrier was transmitted) was not quite enough to close the contacts when they were adjusted for minimum effect of motor vibration.

After taking stock of the situation we decided there must be some other way which would eliminate the relay and its troubles and at the same time reduce the weight of the receiver. A tuned reed system was decided upon because it would permit selective right or left direction and would not be influenced by a frequency other than the resonant frequency of the reed. After considerable effort a reed system which would operate on one milliwatt was built. It worked very well as long as it was fed a pure tone from a good audio oscillator, but distortion of the transmitted wave form on the low frequencies (30-70 cycles which were found optimum for transmitting power to the motor) caused us to abandon the reed experiment.

Those of you who have worked with audio amplifiers on low frequencies will appreciate that distortion of wave form is more apparent and amplifier efficiency falls off rapidly below 100 cycles unless special design features and components are used. The added complications and increased weight of the receiver, let alone the construction of a high quality modulator and accurate tone generators made it impractical. However, we learned that reeds can be operated on low power, and we know that, fundamentally, a reed system can be made to work.

Our next receiver, and the first successful one, was an improvement on the Hull receiver. It used a 1H4G detector, 1E5G second audio, and a 49 in the last audio stage with a 5000 ohm Eby relay in the plate circuit. The 1H4G was found to be better than a 30 as a super-regenerative detector and also less microphonic. It was coupled to the 1E5G through a *coreless* 5 to 1 audio transformer. A transformer is best in this circuit because voltage drop in a plate resistor would be very wasteful with only 45 volts of "B" battery available. The core was removed in order to reduce weight and also because it is unnecessary for amplification of rush frequencies. The 1E5G amplifies the rush noise and

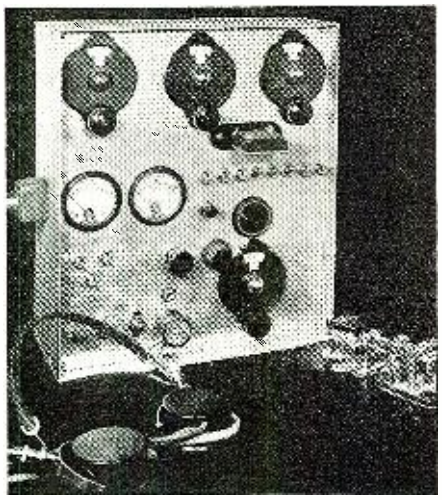
Two views taken of the model in actual radio-controlled flight.



The control end of the flight. A 5 meter transmitter was used.

The take-off must be made into the wind, before radio can help.

[3] De Soto, *Ham Radio & Models*, QST, Vol. 22, No. 9, Sept., 1938.

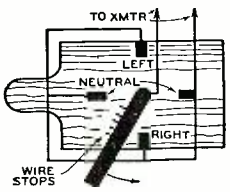


Control was by an ordinary ham xmtr.

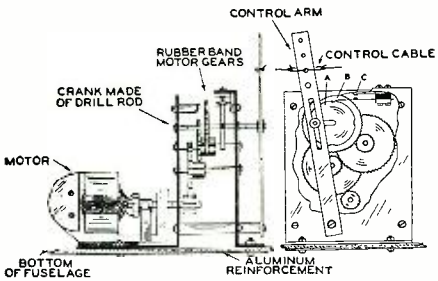
blocks the grid of the 49 when the carrier is off. The plate current of the 49 when no carrier signal is being received is .2 ma.; when the carrier is on the plate current rises to 4.5 ma.

Two-tenths of a milliampere is not enough current to magnetize the relay core and the 4.3 ma. change in plate current is enough to insure reliable operation when the relay tension and contacts are adjusted so as not to chatter with the motor running. In fact, the plate current change is still about 2.5 ma. when the plane is on the ground *two miles* from the control transmitter, thus insuring reliable operation as long as the ship is still in sight.

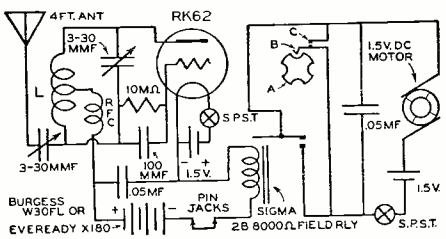
Several successful flights were made until a major crackup resulted from a small whirlwind taking charge of things just after the ship had taken off. By the time the plane had been restored to normal,



The Control Stick.



Control Motor Construction.



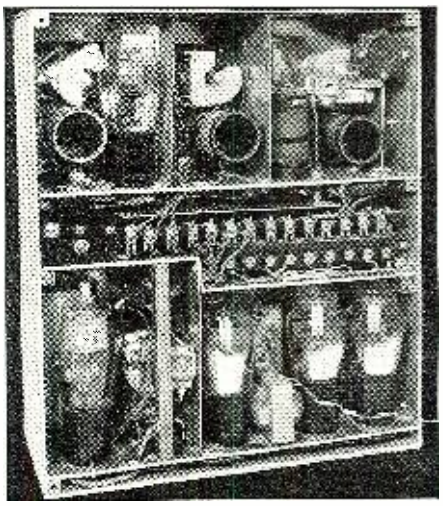
One tube control circuit.

Raytheon Production Corp. had announced a new type gas filled triode, RK62, designed to operate on 45 volts of battery with a large enough carrier on and off plate current change to operate a sensitive relay. The filament current and voltage is also lower (rated at 1.4 v. at 50 ma. d.c.), permitting the receiver to operate on a single flashlight battery of the fountain pen type, though it may be necessary to use two cells and a series resistance to limit the filament voltage to about two volts if the set will not work satisfactorily any other way. A sensitive relay built like a meter movement and capable of operating on only four milliwatts d.c., available in field resistances of 50 to 8000 ohms, is an ideal partner for the one tube receiver. The relay is manufactured by the Sigma Instruments Co., Belmont, Mass., and is available only through them. It is furnished to modelers stripped of mounting base and dust cover and weighs only three ounces.

For those who wish to control both elevators and rudder and possibly ailerons and throttle, the new tube and the light weight relay have opened the way. Such a plane could be built so that it would not be much larger than our ship, but of course such a job shouldn't be tackled by a novice.

Probably the best plan for the newcomer to the "directed" model field would be to build a ship capable of carrying about one and one-half pounds of equipment. Such a plane would be less apt to be buffeted by winds and its lower cost makes it more desirable.

A single channel control consisting of a one tube receiver, relay, motor driven gear box, and batteries can be built to weigh about a pound and a quarter. The gear box should be equipped with electrical stops so that the motor will stop with the rudder in neutral, left, neutral, and right positions. Reference to the figures will clarify the following explanation. The disc A turns on the shaft which moves the control arm. The jack spring contact B rides on the circumference of the disc A. Notches in the disc every 90° allow the jack spring to break contact with C. The control relay contacts are connected across contacts B

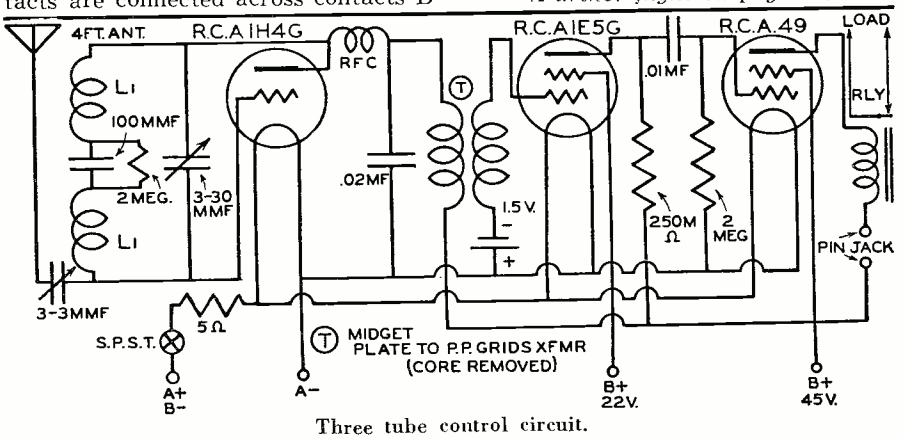


The rear of the ground control rig.

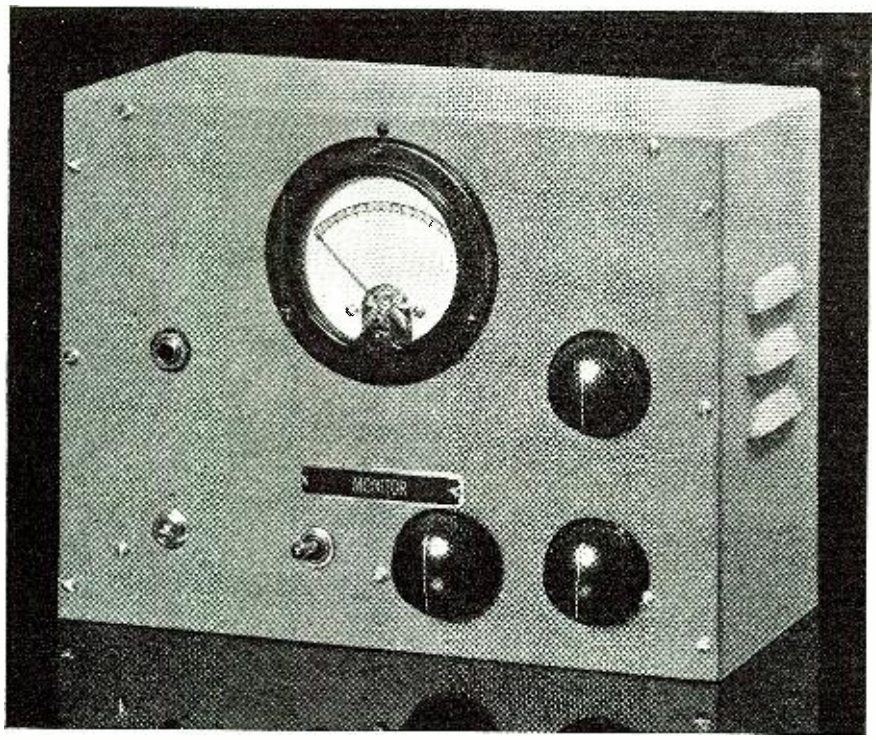
and C in the motor battery circuit. This is how it operates: a pulse of carrier is transmitted causing the plate current of the detector to change from 1.7 ma. to .5 ma.; the relay contacts close and the motor starts. As the motor turns, disc A turns and lifts the spring rider so that contact is made with C until the next notch has been reached when the circuit is again broken. This entire operation requires less than a second, therefore the starting pulse of radio carrier for each operation of the rudder need not last longer than the time required for B to contact C. An ordinary telegraph key or even a push button can be used for keying the transmitter *provided the operator keeps count* of the transmissions. This is necessary with single channel control, because the rudder must pass through left and neutral before it can turn right, and so forth.

Counting the number of transmissions may be eliminated by building a "control stick" keying system. The "control stick" can be built of junk found around most ham shacks. All that is needed is an old ratchet from a screw driver or curtain roller, a piece of ply wood for a panel, a metal strip for a handle, and four contacts. The base board is laid out in quadrants marked left, neutral, right, and neutral. The ratchet bearing is mounted in the center of the board and the handle is fastened to the shaft. If a

(*Further flight on page* 44)



Three tube control circuit.



The meter will show any deviation from transmitter frequency.

Visual Deviation Monitor

By OLIVER READ, W9ETI
Technical Associate, RADIO NEWS

Here at last is a sensitive visual means of checking your transmitter frequency, and not interrupting your best QSO.

BY the time this is in print, many of the amateurs will have complied fully with the F.C.C. regulations requiring an external means of checking their transmitter frequency. Some of them will have used their superheterodyne receivers, and others will have external frequency monitors. Also, they will have had a chance to observe the operations of both of these means of test. Immediately it will become apparent that there are certain inconveniences associated with using the receiver or the external frequency monitor as a means of checking. In the first place, transmissions of voice frequencies must be stopped and an accurate check on the frequency monitor must be made. This will take anywhere from one or two minutes up to five or twenty minutes. During this time the transmitter must run and announcements must be made every ten minutes giving the call letters.

Bearing this in mind, it was decided that there must be some simpler way of determination, *after* the transmitter has been established as being on the correct frequency, that it did not shift or vary from that wavelength. What was required was a *visual* means of continual monitoring, such that if the frequency varied or shifted even by so much as 50 cycles it will become apparent at once and transmissions can be stopped until off-frequency shift can be rectified.

This indicated that a meter type of instrument was to be used. In this way the meter could be directly in eye view at all times and when the frequency shifted, the meter would at once indicate this change. As the work developed in the laboratory, the results were so completely satisfactory that the monitor was developed to the extent that it can now be easily duplicated by anyone at an extremely low cost.

One of the oldest phenomena known to the radio amateur is the effect, termed "zero beat." This occurs when two carriers of identical frequency are superimposed one on the other. The resulting frequency, numerically, will be of zero *audio* amplitude and if either of the two frequencies are changed they will produce a beat note, the frequency of which is the difference, numerically, between the two carriers.

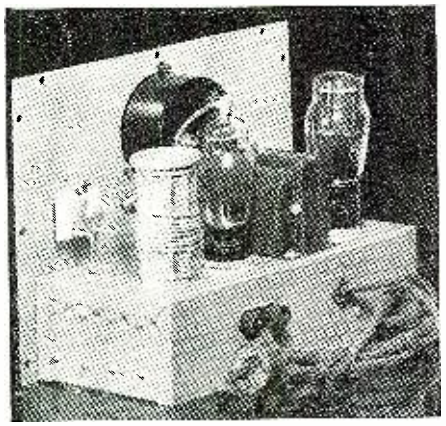
It was this condition of which advantage was taken and the frequency monitor was developed so as to have this beat note become visual rather than aural.

To do this an oscillating detector was built with an amplifier, and in the output of the amplifier a simple a.c. voltmeter was placed.

Since this a.c. voltmeter will read any amplitude of alternating current, and since a beat note is of that character, little or no difficulty was experienced in having the meter register the beat note which was imposed upon it. Fortunately for the author, the average a.c. voltmeter is not linear. By this it is meant that the higher the audio (a.c.) frequency, the less the response of the voltmeter to this frequency as long as the voltage is varied with the a.c. component. The curve of the response of the meter rises to a certain frequency per second in cycles and then drops off rapidly again to zero. This may be checked very easily by any amateur if he will put an audio oscillator across an a.c. voltmeter and see that, rising from zero beat to say about five thousand cycles the meter gradually rises in the indication of the amount of a.c. voltage. From 5000 cycles to 10,000 cycles it drops off very rapidly and beyond 10,000 cycles it fails, or refuses, to register any voltage whatsoever. The frequency has passed beyond the scope of a normal 60 cps. meter. It was this additional phenomenon of which advantage was taken in building the visual frequency monitor.

The action of this visual frequency monitor is as follows: Supposing that the transmitter is operating on a frequency of 3800 kcs. The meter was warmed up to operating temperature and set for a frequency of 3800 kcs. This resulted in a zero beat signal or an a.c. (audio) component in the output of the audio amplifier of zero volts. Now if the transmitter frequency were to shift by one thousand cycles the 3801 kc., frequency of the transmitter and the 3800 kc. oscillating frequency of the detector would beat one against the other resulting in a beat note of 1000 cycles, which, if a pair of phones were placed in the output of the monitor, would be distinctly heard as a high pitched whistle. In addition to this, this 1000 cycle note has a definite a.c. component and is registerable in voltage on the meter.

In using this theory in the construction of the visual monitor it was found in actual operating that this was not practical. This was so because on zero beat the meter did not register anything, and it took a considerable "off-frequency" shift to make the meter show an appreciable amount of increase of voltage. Or the monitor may be loosely coupled to any one of the modulated buffer stages; the higher the frequency the better since the transmitter oscillator frequency



Rear view shows padders at the side.

is multiplied by the buffers. In order to check whether the transmitter frequency has shifted beyond the range of the meter, a 'phone jack is inserted in the output circuit and it can there be determined aurally that the frequency has shifted more than 500 cycles and has shifted beyond the audio range.

Still a third point presented itself, which was that the oscillating detector could be picked up in the receiver when in receiving position. This, of course, would be most annoying when tuned to receive a signal. Therefore, the monitor frequency is detuned to produce a note of—say—500 cycles, and thereafter this setting and frequency of the monitor is used as a reference point.

Thus it can be seen that the visual monitor does not give the actual frequency during operation but *rather shows any deviation* whether plus or minus from the fixed frequency transmission. Summing up, then, with the oscillating detector set at 500 cycles *off* the frequency of the transmitter, any further change by the transmitter will manifest itself as change in a.c. voltage or audio on the output meter, whether this change be up or down. In other words, the note will become 500 cycles plus or minus whatever the frequency to which the transmitter shifts and it is this particular change which is looked for on the meter and which indicates that the transmitter is not operating on its proper frequency.

So far the discussion of the visual monitor has limited itself to c. w. or unmodulated signals. If the signal were to be modulated, the additional a.c. imposed upon the carrier by the voice would immediately become apparent on the meter and would result in a violently fluctuating meter rising and falling with the voice frequencies. This would make it difficult to read so it is only necessary that modulation be momentarily stopped to obtain our reading; on the exact frequency of the transmitter. In order to get away from this it was determined to tune the oscillating detector to a harmonic above the frequency at which the transmitter is operating. Thus with the problem which was above outlined, if one were transmitting on 3800 kcs. the visual deviation monitor would be tuned to 7600 kcs. The signal put out by the oscillating detector on 7600 kcs. would not be audible in the receiver at 3800 kcs. Nevertheless, the visual deviation monitor would work exactly the same as if it were kept on the fundamental frequency. As a matter of fact, it was determined that when operating on the first, second or even third harmonic of the original transmitter frequency, the meter became that much more sharp because of the lesser amount of power picked up by the visual deviation monitor.

Construction

The metal chassis measures 9"x5" and is 2" deep. This size is convenient for the amount of parts which are to be mounted, but any handy size may be used, if the various parts are not crowded. It was first intended that a standard full-wave rectifier be used with a power transformer but after making tests on the stability of the detector it was felt that a half-wave rectifier furnishing a lower plate voltage to the tube would greatly add to the stability.

A combination rectifier and output pentode tube is used which receives its filament voltage through a resistor cord the same as is used in the a.c.-d.c. receivers. This tube is wired in series with the combined detector and first audio tube. Filtering of the rectifier output is done with a 2000 ohm carbon resistor in place of the usual choke. Meter is O-150 v. AC. @ 100 ohms per volt resistance.

The controls on the front panel are arranged so that short and direct leads may be made to the tuned circuits. The upper right-hand knob is the trimmer condenser which sets the frequency of the regenerative detector to a point within a few cycles of the incoming signal from the transmitter. The band-setting condensers mount along the inside of the chassis in order that they may afford short leads to the selector switch as well as being readily accessible to tune from the side when the bands are being set.

Directly under the trimmer condenser is the special shorting type selector switch. This switch is furnished with isolantite insulation to further aid the over-all efficiency. To the left of the switch control knob is mounted the regeneration control. This condenser controls the amount of feedback in the detector circuit and is used to adjust the regeneration to a maximum indication of the needle on the indicating meter after the trimmer condenser has been properly set.

A phone jack is provided so that the signal appearing in the output may be monitored. By so doing, the operator may instantly tell the approximate change in frequency required to change the reading on the output meter and by becoming familiar with this change he can estimate how many kilocycles the transmitter frequency has shifted, assuming that the detector is operating day and night or at least long enough to have reached a proper operating temperature.

The wiring of the various parts is simplicity itself and the only precaution needed is to keep the wires short and direct.

It is important that the temperature in the metal box be kept as constant as possible. It would be even more satisfactory to line the insides of the box with a layer of Celotex or some other form of insulating material. The use of heater-type tubes adds to the operating stability as a change of line voltage does not affect the operating temperature of the tubes as much as would a drop in filament voltage on a filament type tube.

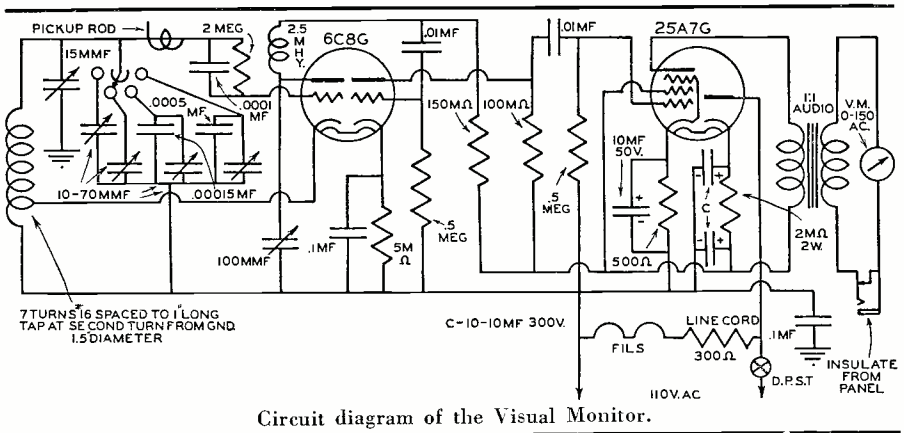
Remember that in order to maintain an even temperature in the monitor cabinet certain requirements must be met. It is not necessary that plate voltage be applied when the monitor is not in service, but the filaments should be left on at all times if the rig is used every day.

While the construction of the monitor may be applied to various types of relay racks, etc., it is best that it be built in compact form so as to have it as close to the operating position as possible or at least near enough to be clearly read.

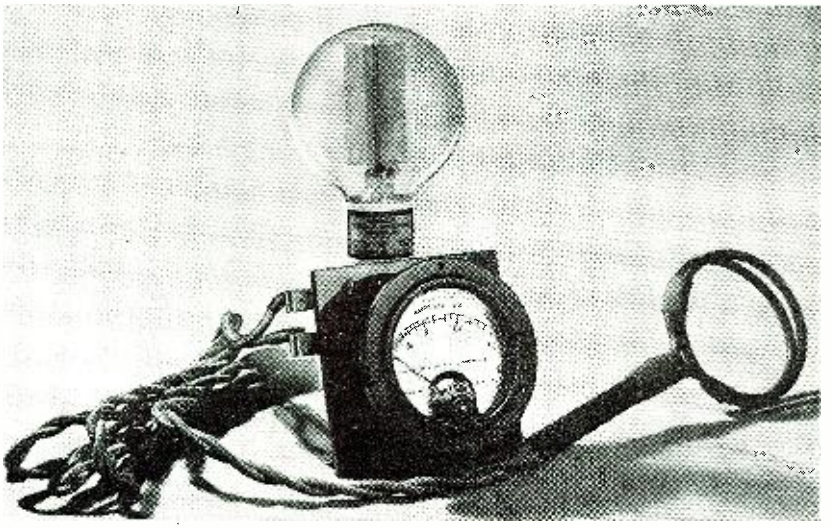
Adjustment

When the monitor has been finished and tested it should be allowed to run for an hour or so to reach a fixed temperature. The unit operates in much the same manner as a regenerative receiver. The amateur bands are first located by means of a signal generator or the signal from the trans-

(Check further on page 52, please)



Circuit diagram of the Visual Monitor.



The set-up used to determine the efficiency of a transmitter.

The output of your transmitter can be raised if you will pay some attention to the efficiency of the stages.

By GORDON E. GRAY, W9CG
Sales Engineer, Ohmite Mfg. Co.
Chicago, Illinois

Raising Your Transmitter's Efficiency

A TRUE *dummy antenna* is useful, of course, in substitution for the regular antenna to check the transmitter before going on the air. The utility of such a device by no means ends here. While its use solely for this purpose was unanimously recommended as early as the spring of 1935 (see *QST* report on the meeting of the Board of Directors, June 1935) by the Board of Directors of the *ARRL* as a means of more effective employment of amateur frequencies, its adaptability as a tool in better transmitter adjustment far over-shadows its limited substitution of the regular antenna.

Technically a true dummy antenna is a compact high wattage resistor of low inductance. It follows, therefore, that such a device has long been one of the chief instruments missing from the long lists of units available to the amateur, experimenter and manufacturer for use in radio frequency work, particularly in connection with measurement of radio frequency power on transmitters, efficiency of receiving antennas, diathermy equipment and like r.f. generating equipment.

The writer, in making a check among fellow amateurs some of whom had rigs as modern as the state of the art permitted, found in almost every instance that the overall efficiency of the final amplifier as well as the associated radiating equipment was an unknown quantity. Each reckoned that in view of the fact that the "plates of the tubes didn't melt the efficiency must be pretty good—probably between 60 and 80%." They further thought that since they worked fair DX and had a reasonable percentage of answers to calls, most of the power must be getting into the antenna. All admitted, however, that the difference between 60% and 80% efficiency represented about one third more useful power which they might or might not be getting. If they were not, it was costing them something on the electric bill on each and every QSO.

While the Dummy Antenna described herein does not of itself radiate, the transmitter under test may do so. All unlicensed persons should familiarize themselves thoroughly with the Federal Communications Commission's Rules and Regulations, so as to avoid violations thereof with the attendant heavy penalties. The Editors.

The improvement in efficiency of all stages of the transmitter would represent a definite saving on the amateur's pocket-book. More concrete and tangible evidence is likely to be noticed through saving in equipment. How many of us have purchased a *PDQ150* for the final which the manufacturer assures us can be driven to the moon and back by a single *PDQ15!* However, after hours of fussing and nursing the driver stage, because we have not had an accurate means of checking the performance of *PDQ15* stage while making the various adjustments, we finally make an unnecessary investment in a higher voltage plate transformer, associated rectifier and filter equipment along with a *PDQ50* to get the necessary drive.

Another angle on the possibility of direct savings can probably best be illustrated by a hypothetical case. Suppose a 200 watt transmitter had a final efficiency of 60% (the broadcast station figure). The useful output would be $200 \times .60 = 120$ watts. Improvement in efficiency to 75% would result in a useful output of $200 \times .75 = 150$ watts. How much would additional equipment cost (power supplies, larger tubes, larger tuning condensers, insulators, etc., to say nothing of the steady increased drain on the light bill for each hour of operation) for a larger transmitter at the 60% figure to obtain this 150 watt output? Simple calculation ($150 \times .6 = 250$ watts) shows that enough equipment to make over the transmitter from a 200 watt job to a 250 watt job would be necessary.

This would undoubtedly include additional driving equipment and associated power supply equipment. There is little doubt that by brute force and cramming every watt of the allowable 1000 watt input into the final, we can get enough out even under extremely poor efficiencies to work all the DX we want to. There is less doubt that the cost of equipment and power under such conditions is far out of proportion to the results obtained.

A simple and direct means of measuring radio frequency power therefore means to the amateur a simple solution of heretofore tedious adjustments of often unknown value in tuning up the various stages of a transmitter, as well as linking the transmitter itself to the antenna.

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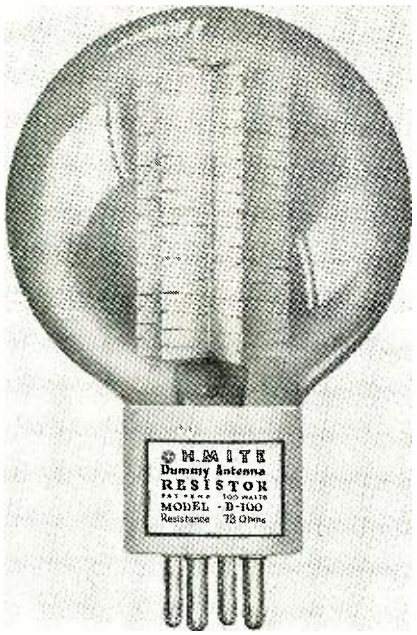


Internal view of the Dummy Antenna.

In connection with an r.f. ammeter the vacuum type dummy antenna, becomes this unit which will become fully as indispensable and important an instrument in the ham shack as the voltmeter, the milliammeter, the monitor and oscilloscope have proven to be.

The dummy antenna becomes an r.f. watt indicator when used in series with an r.f. ammeter, and the following determinations serve as a starting point to better transmitter operation. We have to find out how good or how bad our transmitter really is.

(a) Determination of efficiency and output of the crystal or oscillator stage.
(b) Determination of efficiency and output of intermediate and buffer stages.
(c) Determination of efficiency and output of the final amplifier.

A, B and C are in reality the same problem. They are solved by using the dummy load in series with an r.f. ammeter (or r.f. milliammeter in the case of small wattages as in the crystal stage) and a short length of twisted pair or concentric line with a loop used to couple the device to the plate tank of the stage being measured.

If the quality of the twisted pair and link is in doubt, the combination can be coupled directly to the plate tank (Figures 1a and 1b) remembering, of course, that high voltage d.c. is present and should be treated accordingly. (The technique of the operator is a factor and a short coupling means may prove to give less trouble in adjustment. One foot of concentric feeder has been found less critical in adjustment than direct coupling (See Figure C probably because the r.f. ammeter and dummy are more removed from the r.f. field of the tank coil.)

Where the impedance match for the maximum transfer of energy occurs is dependent upon the design of the tank circuit. Since the resistance of the dummy is 73 ohms, (if it were a different value, the theory remains the same) it is necessary to find that point on the tank where the impedance is likewise 73 ohms, or whatever resistance value the dummy might have. A true experimenter will start with the proposition that his antenna match point on the tank *might* be wrong, and seek the proper match to the dummy experimentally.

The optimum coupling for the maximum transfer of energy is determined experimentally by clipping across additional tank turns progressively until the r.f. meter reads the greatest amount of current flowing at tank resonance. For 600 ohm dummies this may amount to several turns.

In the case of a dummy of 73 ohms, optimum coupling for the best transfer of energy will be found very close (generally a turn or less) from center of the coil for each clip in the case of a balanced tank circuit and a turn or less from the r.f. ground end in the case of a single ended circuit.

It should be mentioned here, that the clips, the connecting wires, etc., can add stray capacity and some inductance into the dummy system. With reasonable care in setting up the test circuit, correction for this should not be necessary for the practical determination of the output of the r.f. stage. For a more accurate determination of efficiency, the stray capacity and inductance of the leads can be balanced out by inserting a small exterior inductance and variable condenser in series with the dummy antenna and r.f. ammeter. The values of the inductance and condenser should be such that resonance can be obtained as is noted by a *dip in the grid circuit* meter (high voltage of plate being off) when tuned to such resonance. In this state all stray capacities and inductances are balanced out, and the dummy is the only resistance effective in the circuit.

The stage can now be fired up and tuned to resonance.

CAUTION: The input should be reduced until it is definitely established that leads have not become shorted either in the series circuit or to ground. The r.f. current in a shorted turn can be unbelievably high even in a low power stage and thermocouples can be burned out. After assurance that all is well the normal input can be applied.

By multiplying the current reading of the r.f. ammeter obtained in amperes by itself and then by the impedance of the device ($I^2 \times \text{Ohms} = \text{Watts}$), the watts being transformed into heat is the result. This represents the output of the stage being measured. The efficiency of the stage is represented by the ratio of the output figure just determined to the d.c. watts input to the plate circuit.

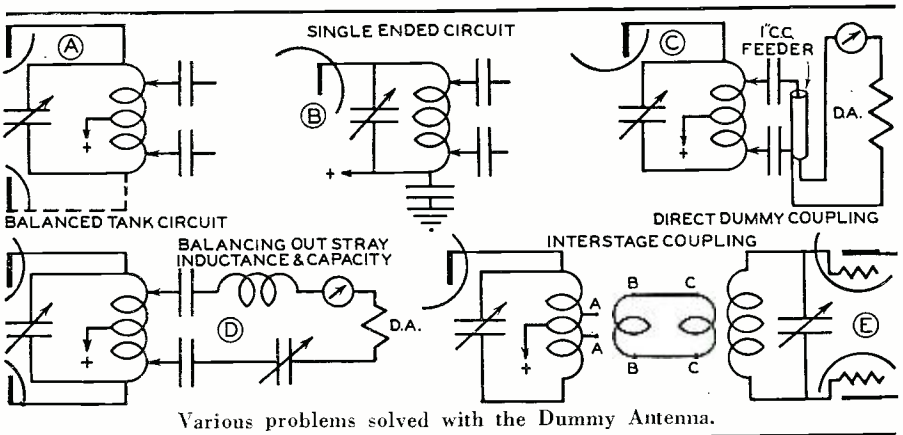
For example, suppose an amplifier is drawing 1/10 ampere at 1000 volts.
Input $= (.1) \times (1000) = 100$ watts.
Suppose the dummy is 73 ohms and the r.f. ammeter reads 1.02 amps.
Output $= (1.02)(1.02)(73) = 76$ watts

$$\text{Efficiency} = \frac{76}{100} \times 100\% = 76\%$$

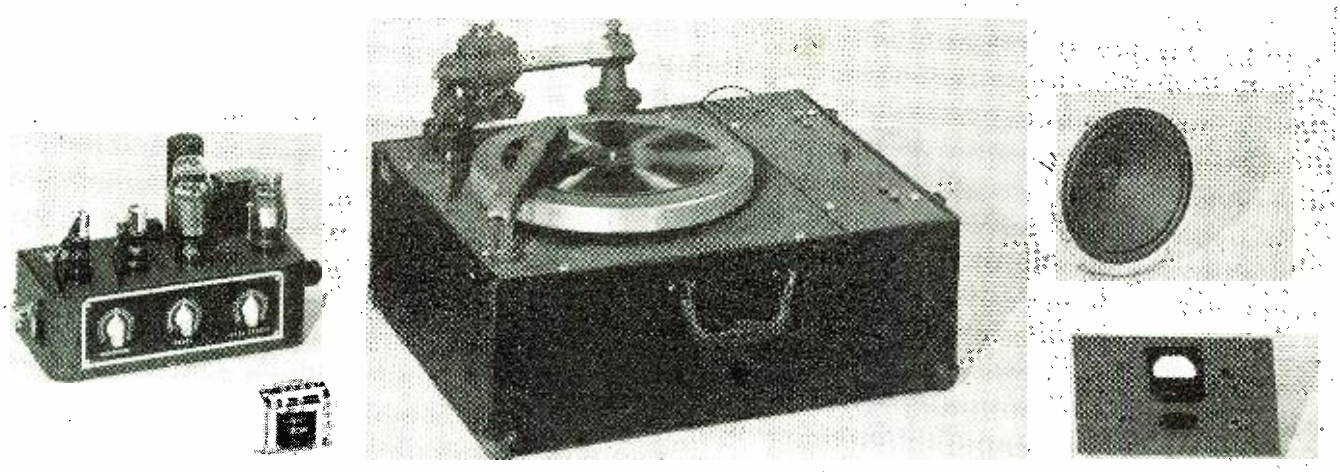
After finding out exactly what output can be obtained from each stage, all the regular adjustments should be made in bias, etc. to obtain the maximum output as measured by the r.f. ammeter, *always referring back to the input* and *calculating* the *efficiency after* each adjustment. After all, if the plate input goes up faster than the output nothing has been gained in efficiency. If the tube is operating in accordance with manufacturers' recommendations as to bias, drive, plate volts, filament volts, etc., and the efficiency is still low, the next step would be to look for circuit components which are robbing the dummy of the power it should take. Remember that the tube can be operating at maximum efficiency, as evidenced by normal temperatures and cool plate, and actually be delivering to the output or tank circuit most of the power that is in turn being delivered to it.

Leaky insulation, high circulating current losses, and so on, may mean that the *load* may not get even an appreciable percentage of this power. Unless warm or hot inductances, bypass condensers, etc. make this undeniably apparent, the engineer may

(*Measure further on page* 52)



Various problems solved with the Dummy Antenna.



The complete set-up needed to make instantaneous recordings.

Make Your Own RECORDS

by L. M. FEILER
Sound Engineer, Allied Radio Corp.
Chicago, Illinois

There are many times when the serviceman can make an increased income by being able to make records. The average serviceman has most of the equipment right in his shop. The author tells how to assemble a home-recorder.

THERE are many times when the serviceman will be asked "Can you make a record?" Invariably the answer will be, "No, I'm sorry." There is not any reason why this situation should exist in the shop of any well equipped serviceman. Especially, if he has an amplifier, a few odds and ends lying around, and if he will purchase a recorder.

Briefly, a recorder is simply a loud speaker from which audio signals have been used making a record instead of giving aural response. The output of the amplifier is hooked to the recording head, which in turn places the audio response on a composition or acetate record. This is not to be confused, of course, with the commercial wax recording outfits, which are far too involved for any serviceman to attempt.

This article will confine itself solely to a simplified method of recording which may be installed by any serviceman so as to realize on a market he has heretofore been turning away from his door.

In the recorder assembled here, a *Knight* 5 Watt High Gain Amplifier, was used as a speech amplifier. Any amplifier of approximately that output may be used. A brief description which will serve as a guide follows:

Amplifier operates from 110 Volts a.c. or d.c. and has two input channels, one for a phonograph pickup (playback) and the other for a high gain microphone such as crystal high impedance dynamic or high impedance velocity types. The tube lineup consists of one 6C8G double triode, two 25L6G's and one 25Z5G rectifier. Resistance or transformer coupling may be used between stages, although some weight and space can be saved with the former. The output of the amplifier is coupled to a DB meter, the use of which will later be explained, and through that to a double pole double throw switch; then to a matching transformer which accurately matches the impedance of the recording head to the output of the amplifier.

The output transformer of the average amplifier system has output of 4, 8, 16 and 200 ohms, and the average recording head is 500 ohms. Some, however, have impedances of 5 ohms. In the particular amplifier used there was not a 500 ohm output tap and so the matching transformer operating from 5 ohms input to 500 ohms output was used to match the output of the amplifier system to the recording head.

In order to play back the record after it has been made, a second switch is used. This throws the microphone out of the circuit and throws in the play-back head. The first switch of which mention was made, is used to throw in the speaker in place of the recording head. By throwing these switches first in the "up" position, a record is made, and by reversing the switch position and putting the play-back head on the record, accurate reproduction is had of what has been impressed upon the record blank.

So much for the brief discussion of the instrument as it is assembled. A lot of ingenuity and difference of construction will, of course, create a lot of different types of machines, but a number of axioms should be observed in making recordings.

Never use more audio than is necessary to get a full recording. The acetate upon which the average recordings are made is only a few thousandths of an inch in thickness. If too much audio is impressed on the cutting head, the groove will be too deep and sometimes even scratch into the aluminum disk beneath the acetate. This will cause distortion and other undesirable features in the record and at times even make it unintelligible. The average groove, if correctly cut, will not exceed two ten thousandths of an inch in depth. The easiest way to judge whether or not you have too much audio (without playing the record back) is to test the thickness of the "scrap" which will unfurl as the record is cut. This scrap should not be thicker than 3 human hairs intertwined. Unfortunately the average serviceman, with his desire to get the maximum recordings, will find that his scrap is of the thickness of a horse's hair, which is far too deep and the recording will be entirely unsatisfactory. For those who

are more accurate-minded, the scrap should be approximately the same size as No. 36 bare copper wire; and it is a good point to have a piece of that size wire on hand together with a pair of cheap micrometers to measure whether or not there is any great difference between the scrap and the sample wire. Dispose of all scrap carefully as it is inflammable.

In making any record it is necessary to "ride the gain." This is a commercial term which has come into general use and means that the operator making the record must sit at the gain control of the amplifier to prevent the peaks from overloading the cutting head. Sometimes this is extremely difficult, especially when the speech or the song is totally unknown to the operator. But a little practice will enable the serviceman to tell in advance when a high peak is about to be reached; and he will gradually lower the gain such that when this peak does come about, the recording head will not be overloaded and a deep scratch in the record will be avoided.

Probably the easiest way to determine both the "level" and the amount of peaks is to have the customer make a test record, trying different audio stages and "breaking in" on the record to announce what audio stage is being used.

These audio stages are read directly from the DB meter as plus or minus so many DB. In playing the record back, then, that stage which gives the finest fidelity should be used for the entire record. This explains the purpose of the DB meter.

Aural monitoring by means of ear phones is resorted to with all records and no record should be made without the operator listening carefully in for hum, peaks, scratches and other impurities of tone which might enter into the amplifier system and thereby be transcribed to the record. Background noise should be kept low.

To make your recordings, proper needles, recommended by the manufacturer should be used, and in playing the record back a similar caution should be observed. If a record is correctly made, it may be played back up to 500 times without destroying it, although this applies only to the heavier coated records.

An indispensable addition to the serviceman's recording outfit is a cheap microscope such as can be purchased by approximately $1.00 in any novelty store. Dismount the microscope from the stand and mount it upon the recording head, placing a 6 volt pilot light so that it will throw its rays directly upon that part of the record being inspected. Inspection is made continuously during a recording. In looking through the microscope the depth and width of the groove both can be observed and the recording head jumping the groove in any overload peak can be avoided.

The recording machine can also be used without the amplifier to make records from the "air." This is a profitable source of income for servicemen living in small towns and communities, which support a local broadcast station. There are any number of artists both amateur and professional who would value a record of their broadcast performance.

The method of procedure is exactly like making a record from the microphone, excepting that the recording head transformer is matched to the output transformer of the radio receiver. It is well to make several tests before going ahead with the recording. This can be done by starting in a good half hour before the appointed time and obtaining a "level" and making a number of test records. Once the level has been obtained through the same means used before, the record may proceed as if the recording artist were in the studio or store of the serviceman. One thing is sure, in recorded radio programs be sure to include the announcement of your customer's name as made by the station announcer on the record; since without it will not have nearly the value as it would have with this little touch.

There are some recorders which use 33⅓ RPM and some which use 78 RPM and there are still others which use both speeds. It will be found that the average 12" record will "take" a full fifteen minute program on the 33⅓ RPM speed. Whereas at the 78 speed the record will take approximately 7 minutes. The slower speed is very much more difficult to record and a higher powered motor must be used to turn the turntable.

Also, the acetate must be very smoothly put on the record and free of impurities. These types of records are slightly more expensive than the other types. With the slower speed it is extremely important to watch the groove and the depth of the cut since with the record turning so slowly any faults are greatly magnified.

In closing, it might not be amiss to state that all business is best run with a "fine" front. If the serviceman will take the trouble to fit up a room with Celotex or other sound deadening material on the walls, rent a piano and set up a professional looking recording studio, he will find himself handsomely repaid in dividends, not only by customers coming to his store to watch others making recordings, but by making recordings themselves. Also, it will establish him in business of recordings as far as the broadcast artists are concerned.

Here is still another legitimate field for the serviceman. The market of home recorders in so far as making permanent records of broadcasts at home is concerned, has hardly been scratched. There are many persons who are denying themselves the pleasure of making records of their favorite broadcasts, because they believe that they must purchase a new expensive radio-recorder receiver.

The serviceman should test his own territory and discover how many there are who would be interested in this fascinating field, and then with demonstrations reap the harvest by selling them not only the recorders and allied equipment, but also the blanks and the installations.

By adding a switch for the insertion of a microphone in the input of the average radio's audio end, and a matching transformer in the output, a simple, fairly good recorder can be made. All of this means added revenue in sales and service which should not be overlooked.

Fortunately for the serviceman there is not anything sweeter to the ears of any customer than to hear his own voice come from a record. Certainly here is a lucrative field to which any enterprising salesman may fall heir if he will but equip himself with the bare essentials.

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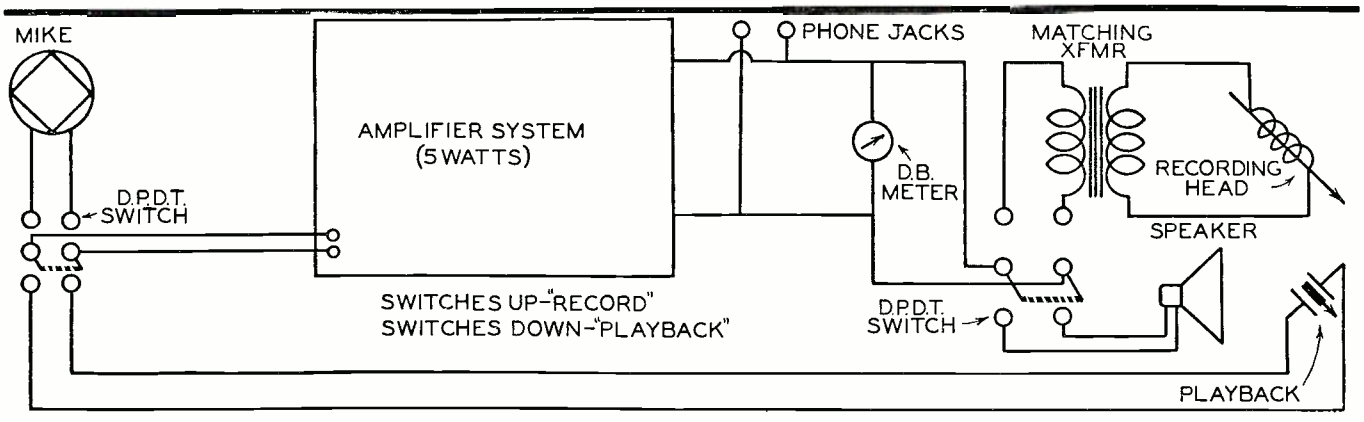


How to hook up the home-recorder.

A. F. C. Measurements

By EDWARD LOVICK, Jr.
Falls City, Nebraska

One of the 3rd Prize Winning Articles of the RADIO NEWS Receiver Contest. The servicing of Automatic Frequency Control is easily understood after reading this very fine description by Mr. Lovick.

AUTOMATIC frequency control, as applied to modern receivers, is easily serviced when once it is understood. As with other special circuits, automatic volume control was an example, automatic frequency control was sprung upon many servicemen who were not in a position to understand it well enough to be able to meet service problems.

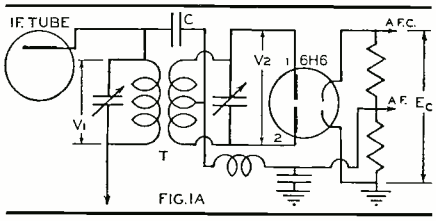


FIG.1A

Basically each automatic frequency control system consists of a discriminator and an oscillator control circuit. The so-called discriminator is a selective rectifier-filter system which supplies a d.c. voltage, which varies with the exciting frequency, to the oscillator control tube. Oscillator frequency control is brought about through regulation of the gain (amplification) of the control tube by means of the voltage supplied by the discriminator.

Figure 1a illustrates a typical discriminator circuit. Consider the transformer T to be loosely coupled and tuned to the frequency of the receiver. The situation at resonant frequency is as follows.

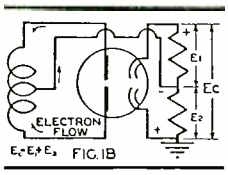


FIG.1B

As the voltage V_1 builds up across the primary a current in phase with V_1 is induced into the secondary. Because the current lags voltage by 90 electrical degrees in an inductance, the voltage V_a induced into the secondary by this current is 90° ahead of V_1 at resonance. At the same time a current through C induces a voltage V_b in the secondary. Because these voltages induced in the secondary are in phase they alternate in step and hence cause equal currents to flow through the diodes. (The induced voltages reach similar values simultaneously.) The total voltage is equal to V_a plus V_b and is arbitrarily called V_2.

Under off resonance conditions either inductive or capacitive reactance predominates and the phase of the voltage V_a changes accordingly. At frequencies greater than resonance, inductive reactance is predominant in the tuned circuits and V_a leads V_1 by less than 90°. Conversely, for frequencies less than resonance, capacitive reactance is the greater and V_a leads V_1 by more than 90°. Since V_b is unchanged in phase, the alternations of V_a and V_b no longer coincide and the rectifier currents become unbalanced because a greater voltage results in one side of the secondary than the other. At higher frequencies than resonance diode 1 will have the greater current flow and vice versa for lower frequencies.

In figure 1b we see just how the control voltage is developed. From this illustration it becomes evident that this control voltage may be either positive or negative and of various amplitudes. Electrons move from negative to positive so that all one must do to determine the polarity of the voltages E_1 and E_2 is to visualize the electron flow. Since these are in series E_c, the control voltage, equals E_1 plus E_2 added algebraicly.

When suitably filtered, the control voltage is delivered to the control tube where the actual frequency control is accomplished. Two methods of utilizing vacuum tubes for frequency control are shown in Figures 2a and 2b. Figure 2a illustrates a typical type involving variation of effective capacity to change frequency, while Figure 2b depicts the inductance variation type.

A triode with a choke in its plate circuit reflects capacity into its grid circuit. Degeneration resulting from the condenser C_1 increases this effect. The actual amount of reflected "capacity" depends upon the gain of the tube and it is this fact which is used to affect frequency control by varying the effective bias on the grid of the tube. R and C are filter components. In actual practice this circuit is not commonly used because it has several disadvantages. The tube acts as a poor condenser and hence introduces losses into the oscillator tank. The amount of control varies considerably with frequency and is unsymmetrical about resonance.

A better system involves inductive control as shown in Figure 2b. In this circuit a pentode is used to control the oscillator frequency. Screen grid, suppressor and cathode connections are made in the standard manner. The gain of the tube is controlled by means of the additional bias supplied by the discriminator.

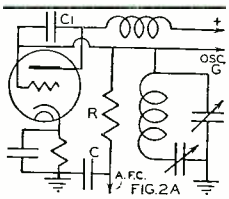


FIG.2A

Two circuits described by author

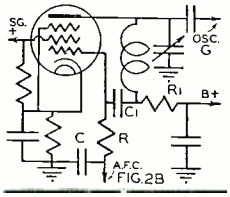


FIG.2B

A small amount of the voltage developed across the oscillator tank is fed into the control grid of the pentode (this same grid is biased by the control voltage) and amplified. This exciting signal voltage undergoes a 90° phase shift across condenser C, and hence causes the plate current of the tube to lag its plate voltage by approximately 90°. The result is apparent shunt inductance across the oscillator tank. Therefore, frequency change is readily accomplished by varying the gain of the tube and hence the amplitude of its output.

Essentially these are the basic principles underlying automatic frequency

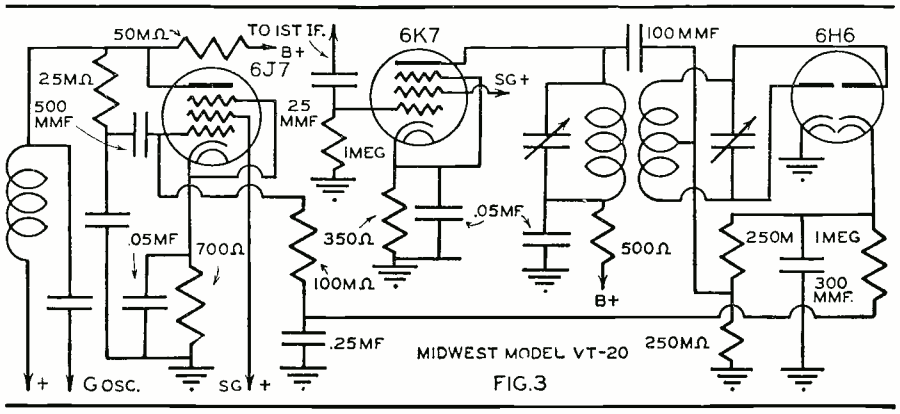


FIG.3

control. And now that they are understood, let's go looking for trouble.

Probably the first thing to be done is to conduct careful tests of the tubes involved. Unbalanced diode currents can cause mistuning or even station rejection so a tester which checks both diodes is essential. Of course the control tube must be able to amplify evenly and well or it should be discarded. A power output or mutual conductance tester is preferable for these tests.

An open in the condenser C (Figure 1a) will result in negligible response of the discriminator. The effects of a shorted condenser should be evident.

Incorrect use, although not a defect, is also a responsibility of the serviceman. In order to be able to help his customers he must know how to use it himself. A set using A.F.C. will select the station (from two or three on adjacent channels) which has the greatest carrier voltage in the receiver's antenna, hence do not set up push button A.F.C. so that a stronger station may over-ride the desired one. If the stations involved have equal carriers the set will select the one with the highest percentage of modulation. Such a set is liable to swing from one to another if their modulation percentages differ enough. Swinging or shifting from one station to another is sometimes troublesome on short waves where fading is quite severe. Situations such as this must be carefully explained to the customer.

Naturally the question of suitable test equipment comes up. Several types of equipment may be used, depending upon the connection used for measurement.

A conventional output meter may be used across the output stage. If such an indicator is used the A.F.C. can be tuned in this manner. After aligning the r.f. and i.f. stages in the conventional way, tune the set to zero-beat with the signal generator which should be set at 1000 kc. Detune the discriminator secondary winding a bit and tune the primary for *minimum* output. Then adjust the secondary winding for *maximum* output. If the output reading does not change when the A.F.C. is switched off and on the adjustment is correct.

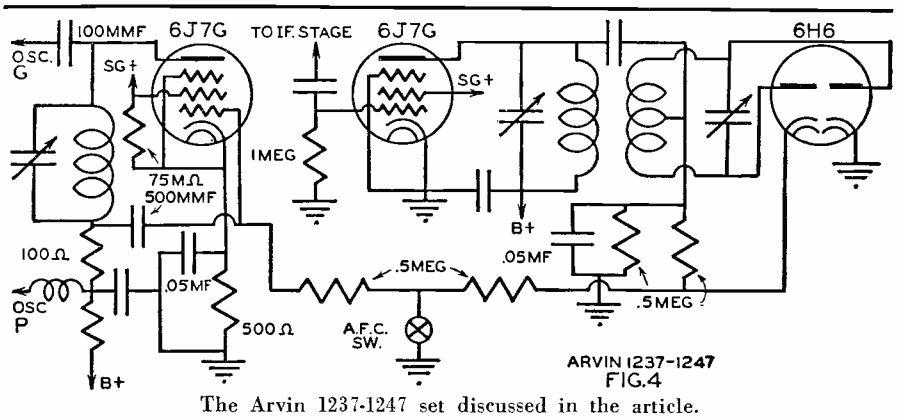
A high resistance voltmeter may be used across the output of the discriminator but is not reliable because it draws current and hence does not show zero voltage accurately. Connect the voltmeter from ground to the junction of the output resistors and tune the primary for *maximum* output. Then, with the meter across both resistors (from cathode to cathode), tune the secondary for *minimum* output. A vacuum tube voltmeter is by far the better instrument to use. Check these adjustments with an output meter. During these alignment operations the set should be tuned to the center of the band, 1000 kc. for the broadcast band.

Testing the A.F.C. is quite important and is easily done if this method is used. Tune in and zero-beat a signal from a signal generator set to 1000 kc., with the A.F.C. off. Then, with the A.F.C. on, the output should not change. After this test try several stations and listen for a change in quality (which should not occur). Try tuning considerably off resonance. The station should snap in.

Commercial versions of the basic circuits previously discussed are presented in Figures 3, 4 and 5.

Figure 3, the Midwest model VT-20, is nearly standard except for the separate A.F.C. amplifier, a 6K7, which serves to isolate the A.F.C. circuit and provide more positive action. Such amplifiers are now quite common.

The Arvin 1237 and 1247 circuit, Figure 4, is very like the one in Figure 3 but the whole set is interesting because it employs the double superheterodyne system. A second oscillator converts the i.f. into another of a different frequency. A.F.C. applied to the second oscillator in the conventional manner results in very smooth and uniform control.



The Arvin 1237-1247 set discussed in the article.

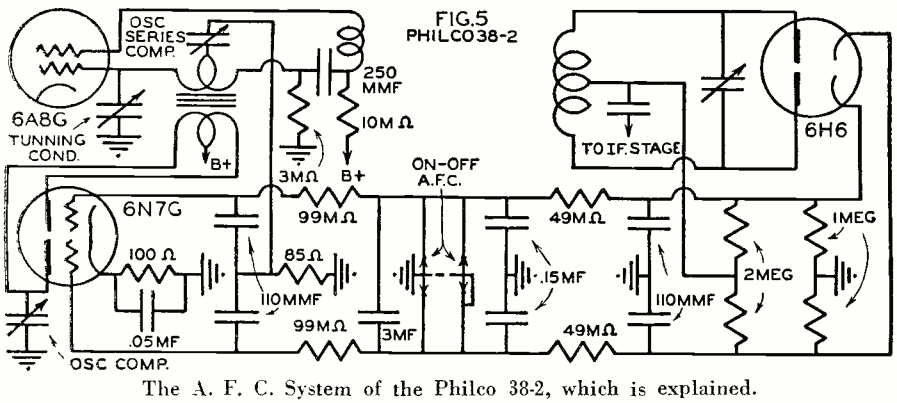
Philco has an interesting setup in their model 38-2, illustrated in Figure 5. The discriminator output is balanced above ground. Two "lines" supply bias to the two grids of the 6N7G used as the control tube. A small amount of voltage from the oscillator is introduced into both control grids simultaneously. The control grids are effectively in parallel for r.f. and so the voltages on the grids are in phase. However, the plates are in push pull and hence the output voltages are 180° out of phase. Cancellation in the plate circuit governs the amplitude of the output.

As in other inductive control circuits the grid voltage undergoes a 90° shift across the coupling condenser and hence the plate current lags the plate voltage by 90 electrical degrees, again appearing as inductance. This apparent inductance is then reflected into the oscillator tank circuit. The amplitude of this shunt inductance is directly proportional to the amount of cancellation in the plate circuit of the control tube. From the foregoing discussion it may be seen that only the method of using the discriminator output is different from the ordinary.

If after checking through all of the discriminator circuits, the set still refuses to function, it is best to remember that there are many other things that may not be in order. Do not put the whole blame on the A.F.C. alone. Checks should be made as for any service job to see that there are no shorts, or opens. Special attention should be given to the tubes to see that they are up to snuff in their emission and characteristics. This is most true of the diodes which have a habit of burning out in the connection end if overloaded for any period of time. A checked tube is one source of freedom from worry.

Careful study of the schematics of several receivers should banish completely any doubt one may have concerning service and adjustment of A.F.C. systems.

—30—



The A. F. C. System of the Philco 38-2, which is explained.

BENCH NOTES

by LEE WARD
Service Manager, San Francisco, California

Repairman's Holiday

NE night last week, after a busy stint in the shop, I put the new tube types, competition, and automatic tuning mechanisms to the back of my mind and sought relaxation in the comparative tranquility of war reports. My favorite evening paper offers them with the proper political bias, so that the present current of events, although excessive, does not overheat me. The editor, evidently, is a very sensible and just person, for his opinions are in resonance with mine.

On this particular night, however, I did not doze at the end of the long sedative journey from the front page back to the radio programs; as a two-column box caught my eye:

> RADIO SERVICE
> Phone JUniper 9970 for a licensed radio service engineer to adjust, inspect, clean your radio, check aerial and ground connections, test all tubes.
> $1 complete
> Smithson's, Inc.

Smithson's department store is a top string place of business; two members of my family swear by it, and many of my friends have traded there pleasantly for years. The ad seemed uninteresting at first reading because it was so stereotyped, but it lead to the thought that I had never come across a repairman who called himself an engineer. I had worked with repairmen who were engineers by qualification, but none of them claimed the title just because they repaired broadcast receivers. The reference to licensing made me curious, too.

Gall, Divided into Three Parts

I wrote to the advertiser, asking:

1. Who licenses your servicemen?
2. What adjustments will they make for one dollar?
3. By virtue of what accomplishments are they called "engineers"?

The answers came in due time, and were in the tone expected from a reliable store. As you read them you will see that the manager of the furniture department (who wrote it) made an honest effort to present his case as frankly as his position would permit. Under such conditions, it might be impolite to exhibit his explanations simply to ridicule *Smithson's* specific case. I believe, however, that an impersonal discussion of the letter will serve to help both the servicing gentry and those who, like the store executive, finds himself drafted into charge of an orphan radio repair department which is necessary whether or not it loses money.

To me, the letter discloses matters of policy which are representative of widespread ills in my profession, and, as such, need treatment. Let us consider the following discussion as a diagnosis, and try to evolve remedies. *Your* opinions, of course, are of equal value to mine. My shirt, simply because I am behind a typewriter, is not so stuffed that I think one man can represent the stata of every type of professional in a field as diverse as radio servicing. If, after you finish this column, you believe professional benefit will result from an expression of your opinion, send it in!

Meanwhile, let's get into the rougher language of the abstract conflict. May both sides win!

Round One

Smithson's retreats cautiously: **"I quite agree with you that the use of the word 'license' was perhaps a little misleading. Probably 'certified' would have been better, since, as you know, the leading (manufacturers) do issue a certificate to repairmen whom they consider qualified; and all of our men have these, of course."**

BENCH NOTES *leads with a china chin:* I am sorry to say I have been in the repair business more than fifteen years without being certified. I have never been pasteurized, either. I am known personally to the various distributors' staffs in this city because I do business with them, and if one of the boys sent me a certificate after all these years, I would not post it in my shop. I would cut it up with my scout knife.

If I ever apply for a job which involves work on one particular make of set, I shall not expect my employer to ask me for proof of my proficiency in affidavit form; I will either give him a distributor's 'phone number, or ask him to clock my work on a chassis he has deliberately jimmied up to test me and my instruments under the actual conditions of the work being sought. I don't suppose there's much harm in a dealer's or serviceman's certificate, if used as a customer exhibit on a sales floor, but I would never show it as a mark of personal merit for fear it would be taken as an indication of inexperience.

The bell.

Round Two

"The adjustments our servicemen will make for $1 are as follows: trimming of condensers, cleaning aerial and ground connections, lining up of speaker, soldering of loose connections, testing of tubes—as a matter of fact, our servicemen will make any adjustments within reason which do not involve new parts. You say you are familiar with the radio service business, and therefore I assume you know a tremendous proportion of service calls are only this type of adjustment."

I didn't know that. The calls to my shop cost me $2.02 before I get to the customer, and my net time cost after that is about one dollar an hour. If a large proportion of my calls required the listed work for a dollar, with no repair or tube sales, the wolf would be wasting his time at my store door, for it would be locked.

"Trimming of condensers" can only mean aligning a super; and any serviceman who, at his own responsibility, risks ruining a speaker cone simply to justify a dollar charge, needs divine guidance, a large stock of free cones, and a new set of reasons for voice coil positioning.

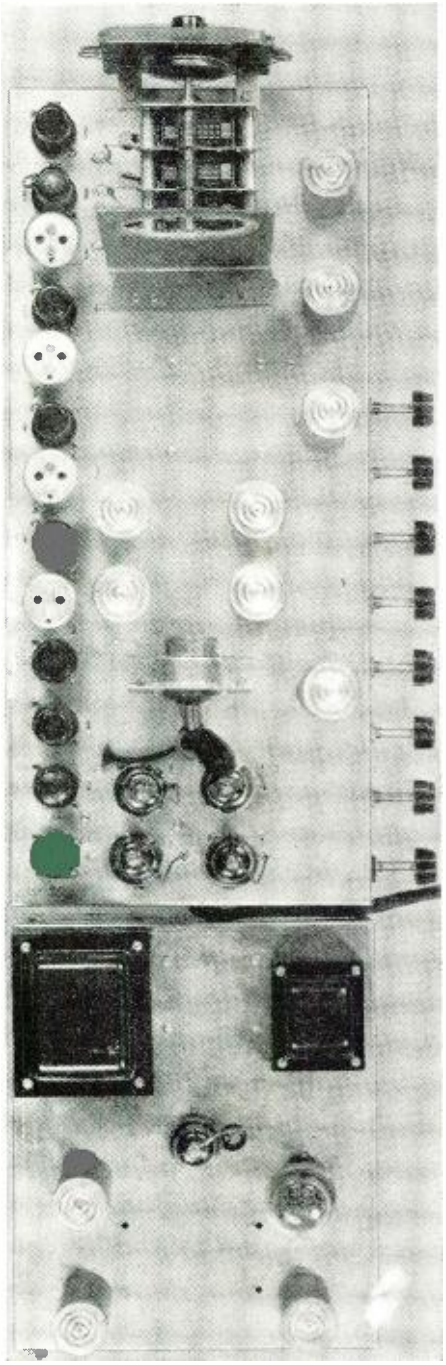
My charge for the job, as listed, would average about eight dollars. A larger store than mine might take the attitude: "Our radio department has always lost money on 'guarantee' calls, but it is necessary to provide this service, even at a loss, to keep our customers. If we go after new business, and keep our advertised word, is it any business of yours? The basic test of any technical phrase in advertising is whether or not it conveys an erroneous impression."

That is a truthful assumption, as far as *advertising* is concerned; nevertheless, I should not like to rankle in a customer's memory because I had contracted for a cheap job which benefitted neither of us, simply to provide

(*More on the fight on page* 61)

B[illegible] Y[illegible] Ow[illegible]

TELEVISION RECEIVER



■ Top view of the television receiver as it will appear when it's completed. It will receive fine telecasts in a radius of about 30 to 40 miles from the transmitter site.

WITH television looming on the horizon an attitude of watchful waiting is being assumed by the radio public in general. But neither the ham nor general radio experimenter is the type to sit and wait for someone else to do things for him. Not so many years ago when there began to be some thought given to the possible practical value of short waves for communication and broadcasting these men didn't wait for someone else to point the way. They dug in and pioneered development. There is every chance that they are likewise going to play a big part in the evolution of television. Even the Radio Corporation of America recognized this possibility when over a year ago it made both information and special television tubes available to experimenters, and particularly to hams.

The public in general can watch and wait, and can plunge when satisfied that television is not only here, but here to stay. But how about the experimenter? Is he going to do this too, and then become a stereotyped looker in? Or is he going to dig in before that time, find out what makes the wheels go round by building his own receiving equipment, and be one of those "in on the ground floor" when the game becomes fully and finally established in the spring of 1939?

There are many experimenters whose minds are made up in favor of the latter course of procedure, just waiting for a ripe time to get going. To these a few words of suggestion may be in order to get these more hardy persons started in this field.

In this video set, which is based on the Garod Model 100, certain refinements have been avoided—refinements whose complications do not justify their advantages. It is believed by the designers, for instance, that to build the sound and video receivers in one unit would add complications not warranted by the saving in space and a few tubes that might result. Moreover, a separate receiver can be more readily used for other ranges such as the 5- and 10-meter ham bands, the u.h.f., high-fidelity broadcast stations, etc. than can one whose circuits are intertwined with those of the video receiver.

The complete circuit diagram for the video receiver and power supply is shown in the figure. These are two separate units as shown and are interconnected by means of cable and plug.

The first six tubes constitute the superheterodyne receiver and include one r.f. stage, combined oscillator-mixer, 3 i.f. stages and diode detector. This differs in a number of respects from conventional broadcast superhets. First of all, every r.f. and i.f. circuit must be capable of passing a tremendously wide band of frequencies which constitutes the video signal. Even where only a single side-band is transmitted the receiver circuits are called upon to pass a band approximately 2500 kilocycles wide or more. This is accomplished by heavily loading the tuned circuits of both r.f. and i.f. with resistors as shown at R1, R6, R10, etc. The r.f. and i.f. tubes are all of the new ultra-high frequency type developed especially for television use. These tubes provide high gain at these frequencies — gain comparable with that obtained at lower frequencies from the 6K7, etc.

The tuning range is approximately 39 to 63 megacycles, and the intermediate frequency 12 megacycles. The receiver is designed to receive pictures from stations using the R. M. A. standards of 441 lines, 30 pictures per second with interlaced scanning. It can be adapted to other standards by alteration of the sweep constants.

The first and second video amplifiers (1852 and 6V6G) function like the audio amplifier in a sound superhet except that they must be capable of passing a wider frequency range. There is also the difference that the signal as amplified by these tubes contains not only the picture modulation, but also the synchronizing impulses by means of which the viewing process at the receiving end is kept in exact step with the scanning operation at the transmitter. There are two groups of impulses, one controlling the horizontal sweep and operating at 13,230 cycles per second, the other the vertical sweep, at 60 cycles per second.

These three components must be separated at the output of the 6V6G so that each can perform its individual function. The image signal is fed to the control grid of the 2005 cathode-ray tube where it varies the brilliance of the spot of light on the end of this tube, thus providing just the right degree of light or shadow for each small element of the image as it is built up. [See Introductory Television Course in this issue.—Ed.]

The scanning impulses are of greater voltage amplitude than the picture signal and are separated from the latter by means of the 6H6 diode just to

For those living within a short radius of the transmission of television pictures, this fine receiver will give entire satisfaction with a large, clear and distinct image reproduction.

By HOLMES WEBSTER
Engineering Dept., Wholesale Radio Service Co., Inc.
New York City, N. Y.

the right of the 6V6G video amplifier. This diode is biased by means of the potentiometer R36 so that it passes current only voltages above a predetermined level appear in the output of the 6V6G. Thus by adjusting this level (by means of R36) to a point somewhat higher than the picture signal output the synchronizing impulses are separated from the picture signal and cause current to flow through the 6H6 corresponding to the synchronizing impulses. Then by means of properly proportioned circuits, the high-frequency and low-frequency synchronizing impulses are separated, the former being fed to the control grid of the high-frequency sweep oscillator and the other component to the low-frequency oscillator.

These two oscillators each utilize two tubes in a multi-vibrator arrangement, the circuit constants of which are adjusted to approximately the desired frequency. Then when the synchronizing frequencies are impressed on their grids, they lock in at the impressed frequency exactly. Their outputs, taken off at the cathode circuits of the 6F8G's are fed to the deflection plates of the cathode ray tube and thus control the horizontal and vertical movement of the electron beam which traces the picture on the sensitized end of this tube.

Separation of the synchronizing signals after rectification in the 6H6 is accomplished through selection of the proper resistance-capacity filter values. C32, having a value of only .00001 mfd. will not pass the low-frequency signal but will pass the high-frequency impulses to the grid of the high-frequency oscillator. The low-frequency impulses are readily passed by C31 to the grid of the low-frequency oscillator but the high-frequency impulses are blocked out of this circuit by the high resistance of R34. Thus complete separation is effectively obtained.

The cathode-ray tube employed is one of the 5-inch type in which the image has a greenish tint. Tubes which provide a black and white image can be used but have the objection that for given anode voltages the images are less brilliant, which is another way of saying that for equally brilliant pictures the "green" tube is less expensive.

All voltages for the cathode-ray tubes are provided by the 879, high-voltage supply. The 5Z3 supply takes care of all other tubes.

Referring to the top view, the tube line-up beginning with the 1852 r.f. stage corresponds exactly with the left-to-right arrangement of the tubes in the figure. The four sweep oscillator tubes are those grouped at the end of the chassis. The cathode-ray tube mounts horizontally above this chassis, being supported by its socket and a large bracket just behind the variable condenser gang.

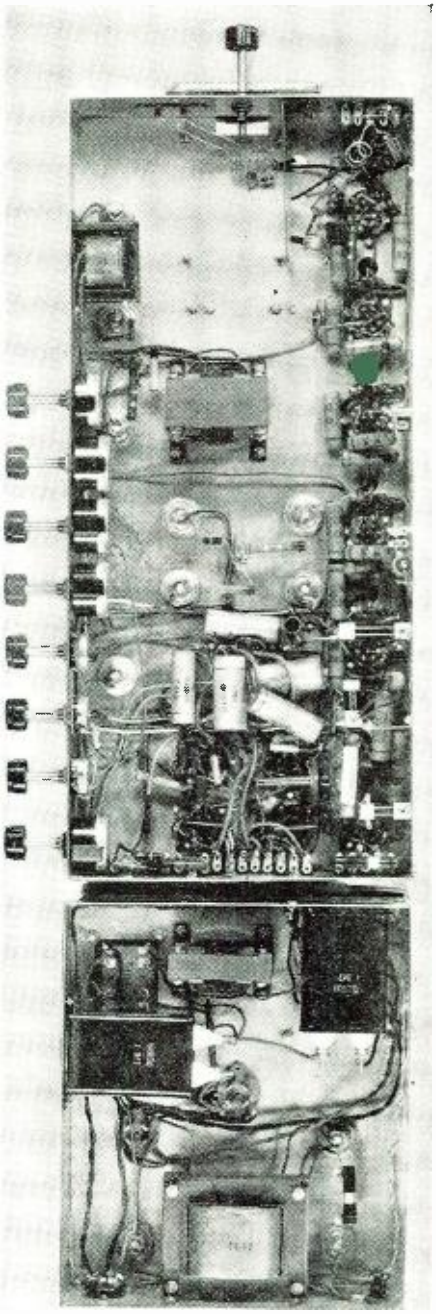
Considering the front of the chassis as the end on which the tuning condenser is mounted, the controls along the left-hand side, from front to rear are: i.f. gain (contrast), vertical (low-freq.) sweep, horizontal (high freq.) sweep, synch. separator bias, vertical centering, horizontal centering, focus, cathode-ray tube bias (brilliance).

As will be seen from the foregoing, the construction is straight-forward and is well within the ability of the experimenter who has had an appreciable amount of experience with radio construction. The building of this equipment is *not* recommended for the novice, or for one whose technical background is not sufficient to provide an understanding of the principles utilized in television circuits. A television receiver necessarily involves a considerable amount of technical complication but is well within the ability of anyone who has a fair understanding of the principles of operation of other modern radio equipment, and who is willing to devote a little study to the fundamentals of television. A more complete discussion of television theory and practice will be found in (1) two comprehensive volumes entitled *Television*, published by the R C A Institutes Technical Press, 75 Varick Street, New York City, and (2) in the extremely simple comprehensive television course appearing in this publication.

So, for the experimenter who is "rarin' to go" it is believed that this set provides the means, and will be productive of real results in actual on-the-air operation. In addition the job of constructing and adjusting the finished receiver will provide first-hand experience which will prove invaluable for the man who looks on television as an opportunity to get into an unquestionable coming field of business activity.

Construction Hints and Data

The antenna primary L16 is connected to the Dipole (or other type) antenna through a twisted pair. The secondary is tuned to the carrier fre-



■ While the connections may seem complicated, they are not; and the set is easily assembled by following the excellent instructions and routine suggested by the author. Careful construction makes good pictures.

quency by the first section of the three gang condenser, and is fed into the grid of the 1852 R.F. amplifier. The plate circuit feeds through inductor L2 as a plate load into the control grid of the 6K8 converter (through the .0001 mfd. coupling condenser). The oscillator is of the Hartley type, although the elements have been used in a somewhat unconventional manner. Note that the oscillator plate (No. 6 pin) is not used. It was found that better stability was obtained with the circuit as shown, than with the conventional arrangement. The converter is followed by three I.F. stages operating at 12 M.C. The 6H6 is used as a diode detector in the usual way. The two chokes L8-L9 together with the .00003 mfd. condenser serve as a filter to remove the I.F. component from the *video* channel. The 1852 and 6V6 act as 1st and 2nd *video amplifiers* respectively for the picture signal. A single 1½ volt cell such as is used for Pen-Lite flashlights supplies the "C" bias for the 1852 first video stage. This cell will last for a considerable period, since no current is drawn. The output of the 6H6 is connected to the control grid of the cathode ray tube as well as the *synch. separator*.

The sweep circuit oscillators are of the multi-vibrator type, are very stable in operation, and can be readily controlled by the *synch.* pulses, which are introduced into the respective grids of the 6L7 tubes. Both sweeps utilize the same circuit arrangement, except of course, that different constants are used for the horizontal *(high)* and vertical *(low)* sweep frequencies. The saw-tooth waves generated in such a multi-vibrator, are, if no compensating means is used, logarithmic in form. Chokes L12 and L13 are therefore inserted to correct this deficiency and produce a saw-tooth, substantially linear, so that the electron beam is carried across the tube at a uniform rate.

The synchronized saw-tooth pulses are then fed to the two sets of deflecting plates to scan the face of the picture tube by means of the electron beam emitted by the electron gun in the neck of the tube. This beam is in turn modulated (through the control grid) by the picture impulses obtained from the output of the 6V6.

Means are provided for centering the picture by varying the fixed positive potential on the two sets of deflecting plates. Other controls focus the beam by changing the potential on the focusing electrode (R59) and adjust the bias on the cathode ray tube (R56) to set the average brightness, *(contrast)*.

Assembly and Wiring

The assembly of the component parts may be seen from the photographs and diagrams. All parts should be assembled as shown and checked against the circuit diagram to prevent any possibility of error.

Note that the end of the shield on the underside of the chassis is soldered to a lug fastened under one of the screws on the gang condenser.

Coils L1, L2, L3, and L16 are wound with No. 16 bare wire. A ½" diameter form is used and removed after winding. Turns are spaced approximately ⅛". The number of turns is indicated in the diagram.

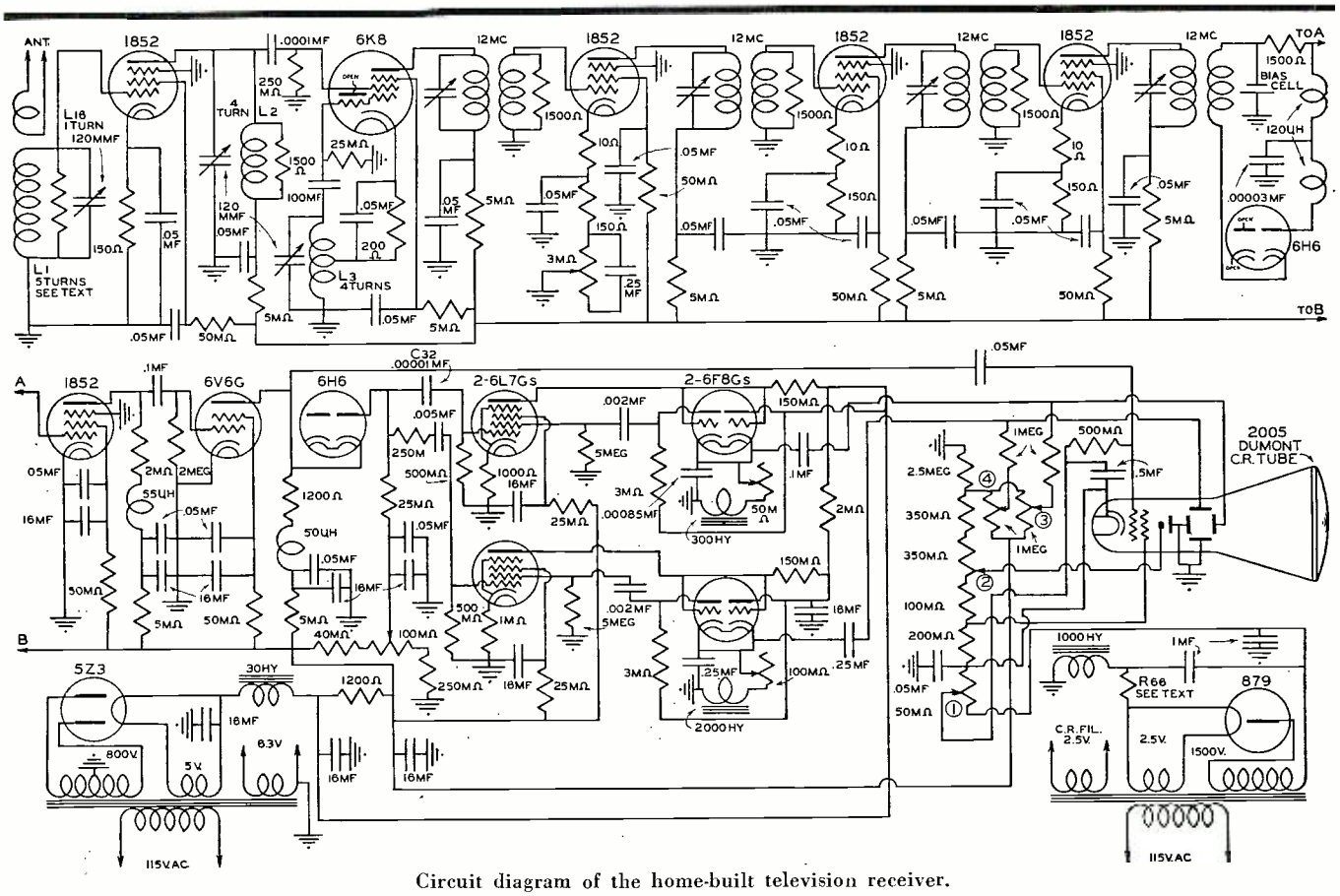
It is important that the wiring shown in diagram be followed carefully. As each wire or component is put in, it should be checked off. The grounds and heaters should be wired first, then the various B voltages, i.f. transformers; then resistors, mica and tubular condensers. All wiring should be as short and direct as possible. Particular care should be taken in wiring the *video amplifier* to avoid high grid or anode capacities to ground, since this will result in a loss of high frequencies with consequent poor detail. This applies especially to leads from the Diode detector to the 1852 and coupling condenser from 1852 to 6V6 as well as wiring from L11. These should be lifted away from the chassis ¼ to ½ inch. Do not fasten the *grid lead* from the picture tube to the chassis or wrap it around the other leads in the cable.

CAUTION

Approximately 1400 volts is supplied to the high voltage Anode. This voltage should be treated with great respect, since under certain conditions it may be DANGEROUS. Be sure that the power switch is OFF or better still, remove the line cord from the outlet, when making any changes, or touching any parts, other than the control knobs.

With a high resistance (1000 ohms per volt) voltmeter, measure all voltages, with respect to the chassis. Results should be approximately as tab-

(*Synchronize further on page* 64)



Circuit diagram of the home-built television receiver.

Serviceman's Experiences

by LEE SHELDON
Chicago, Illinois

Never try to guess the state of a pocketbook by appearances,—is an important axiom of business.

"THIS set doesn't seem to have any of the new improvements," the customer protested. "Can't you show me something more elaborate than this midget?"

I take care of the store while Al is out to dinner, and during that time I try to prove my superior salesmanship by selling as fiercely as I can; but this fellow's clothes indicated he was a poor sales target, even for my expert markmanship. I steered him toward the door, hoping to get rid of him before my partner got back, so I could be alone in my defeat.

But Al came in, leaned against the tube shelves, and watched me perform. I knew his tactics: he hovers over my sales until they die, and then lights into the carcass with both claws. The old buzzard lives on situations like these.

"What do you expect for $18.75?" I demanded of the customer. "This is our most popular midget. Look—it even has tone control!"

"The set I'm throwing *away* has tone control," the economic peasant replied. "Haven't you got one of those deluxe models with three-dimensional volume distension, like I see advertised?"

"Sure," I admitted, "there on the other side of the room. But the price is 'way up—take you two years to pay for it. Why not buy a smaller one for cash?" He understood what I meant—that I didn't wish to take a chance on his payments over a long term contract.

He walked to the biggest console, ran his dirty hand over the celluloid visor, and said: "It looks fine, and it must sound lovely. Mind if I listen to it?"

On the way to the back of the store, I snapped the switch on for him, and warned him not to play it too loud, because I had work to do. He turned up the volume control, mistaking it for the tuning dial, and when the tubes heated, the music came up like dawn on the road to Mandalay. I ran out to yell that the windows were shaking, but Al got there first, throttled it down, and said pleasantly: "These new models are complicated, aren't they?"

"I'm terribly sorry about that noise," the customer said meekly. "Does it harm a set to turn it up so high?"

"Of course not," Al chuckled. "Here—I'll show you how the thing works. The gadgets are worth while after you learn to operate them."

The fellow was enthralled when he found out how to get classical music at the right volume. He sat down and listened with his eyes closed and his head thrown back, and passed into a coma murmuring: "Beautiful, *beautiful.*"

Al stood by quietly, wasting his time. The customer didn't fool *me* any—I knew his common appearance indicated paucity of pocketbook, and that it was foolish to spend time with a ditch-digger on an aesthetic spree.

"Turn it off!" he shouted suddenly. "I can't *stand* it any longer!" Al shut it off, and the derelict continued: "Ever since radio started, I've wanted tone quality like that. How much is it?"

"Two hundred dollars," Al replied, "with all the trimmings."

"How soon can you deliver it?"

"Soon as we finish the paper work," Al said. "There are certain formalities—"

"I understand," the erstwhile indigent said, pulling two crisp pieces of Federal lettuce from a banded packet. "Will these finish the paper work?"

"Practically eliminates it," Al said, seeing they were hundreds, and acting as if cash sales were our usual way of doing business. "Give me your name and address, and I'll have the handy-man deliver it at once. Oh, Lee!"

I started for the front of the store, but stopped when I heard the customer say: "Let me help you—I don't think your errand boy appreciates a good musical instrument."

The happy pair drove away together. The *errand boy* waited in the store until Al came back with the truck. Al, as expected, was loaded with venom when he returned.

"Listen, conclusion-jumper," he announced, "the next time you decide to throw a sweepstakes winner out of the store because you can't sell him the cheapest set in the place, the path of your life will be made to fly out at a tangent to our little business circle!"

"I thought—" I began.

"Every time you think, it costs us money. I don't expect you to sell everyone who calls, but you can keep quiet while they sell themselves!"

"You must admit he looked like a poor prospect," I insisted. "That sale, in a radio repair shop, is an isolated case, and never happened before."

"Never try to guess about tone quality, human nature, or state of pocketbook," Al replied. "And what do you know of precedents?"

"Our first one crossed the Delaware in a rowboat," I said, just to show I didn't take his advice seriously.

If you can't judge by appearances, what *can* you judge by? I hadn't been in the radio business all these years without learning how to size up the persons I met, and my keen, analytical mind had more than once been an asset to *Salutary Sales & Service,* whether Al admitted it or not. Although there wasn't any repair work to pick up, I took the truck out just to get away.

I stopped the car in front of Nick's, preparatory to clearing my mind with

(More Experiences on page 59)

The well-appointed work bench of North Star Radio Service, St. Joseph, Mo.

100 watt Band switch

Front view of the 100-watt transmitter which won 2nd Prize.

WITH apologies to the author, may I ask, "Breathes there a ham who never to himself hath said, this is my own, my ideal transmitter"! Probably every one of us has said that while working on paper plans, but how many can say that of a finished rig? I do not think it is humanly possible to do so, but the one to be described comes closer to this ideal than any other I have built, or seen in other shacks.

This transmitter was built to fit certain specific requirements, such as: a power input of 100 watts or slightly more; Phone-CW change-over rapidly; inter-band QSY rapidly; intra-band QSY easily without too many coils to change; crystal or ECO control with high stability. It was to be used for a period of three months a year as a portable in Maine, and as an exciter for a kilowatt final the rest of the time, or as a regular station rig when high power is not desired. Eminently successful in filling every requirement, it has been giving reliable operation at all times.

The whole rig is built on three relay rack panels and chassis.

R.F. Chassis

The circuit diagram of this unit may seem rather complicated for only a 100 watt unit, but this very complexity produces simplicity in the final operation by supplying abundant excitation without requiring great care in tuning and adjusting to get the last fraction of a watt from each stage.

The crystal oscillator is a 6C5 tube, and is seen in the lower view, tucked away in a corner below decks. An eleven point switch is used to select up to ten crystals, and also to shift to ECO operation. The Pierce type oscillator has a crystal current so low as to be almost unobservable with any type of flashlight bulb in series with the crystal. It has no tuned circuit, so that there will be no chance for a critical crystal to be shifted by an incorrectly tuned oscillator. The oscillator will take crystals for 1.75, 3.5 or 7 mc., and even some 14 mc. rocks will work in it.

The 6C6 following acts as a buffer-doubler for crystal, or as the oscillator when working on ECO. The circuit for this change without additional switches is of my own development, and works excellently, so long as the ECO cathode tank is not tuned to the crystal frequency when using crystal control. In my case the crystals are all either 3.5 or 7 mc., and the plate coil of the 6C6 is tuned to 7 mc. No difference is noted when changing from one crystal to another, the 6C6 doubling as well as it amplifies.

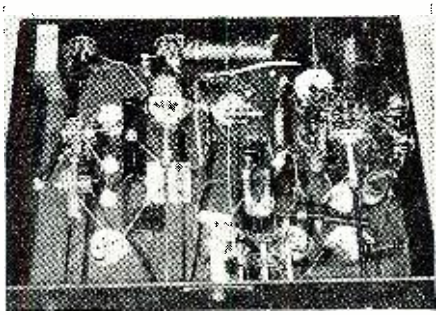
Next in line is a double-triode, providing two doubler stages, to 14 and 28 mc. It will be noted that so far no tuning condensers are used. These coils are all resonated with only the stray capacities of tubes and wiring, and cover a complete band with practically no detuning, except on 28 mc., where only the range from 28.0 to 29.0 is covered with essentially constant output. Somewhat more can be covered with a slight drop in excitation to the final.

By means of a three position, three point switch, the output of any of these three stages is applied to the 807 driver tube. Up to this point, for any three adjacent bands, no coils are changed. If more than three bands are to be covered, it is necessary only to change one or two coils, as these are all plug-in types. The input capacity of the 807 is larger than that of the triode doublers, so that if one of the self-tuned coils is carefully resonated when connected to the 807, it will need a small additional capacity across it when switched to the doubler grid. So each triode grid has a small variable condenser connected from grid to cathode. Each coil is adjusted, by spacing the turns to exact resonance for the middle of the band, while coupled to the 807, then after switching it to a doubler grid, the small capacity is used to tune it again to resonance.

The plate coil of the 807 must be carefully isolated from the grid circuit to prevent parasitic or self-oscillation. So it is mounted in a shielded can, plugging in above the chassis. It is tuned by a 100 mmfd. variable condenser, and by keeping stray capacities low, permits tuning two bands with one coil, one near maximum, and one near minimum capacity. For two adjacent bands, this coil need not be changed. The 807 doubles very well, so that four bands may be covered, instead of three, without changing coils in the exciter section, and with only two coils for the 807.

The final stage may use any of the small triodes now being offered by Taylor, RCA, and Raytheon. I am using T20s, but the 809 would also do very well, especially if the input is desired up around 150 watts. The grid coils, link coupled from the 807, are all in the same type shield cans as the 807 plate coils. Small air variable condensers, mounted inside the shield cans, tune these coils to the middle of the band. (On 28 mc., the condenser is adjusted from the top of the can, so as to permit full excitation over a wider range of frequency) and the 807 is loaded to about 60 ma. plate current, for excitation to the final.

The crystals may be changed from one end of the band to the other with no retuning being necessary, except as noted above on 28 mc. The plate coils for the final are self-supporting for 7

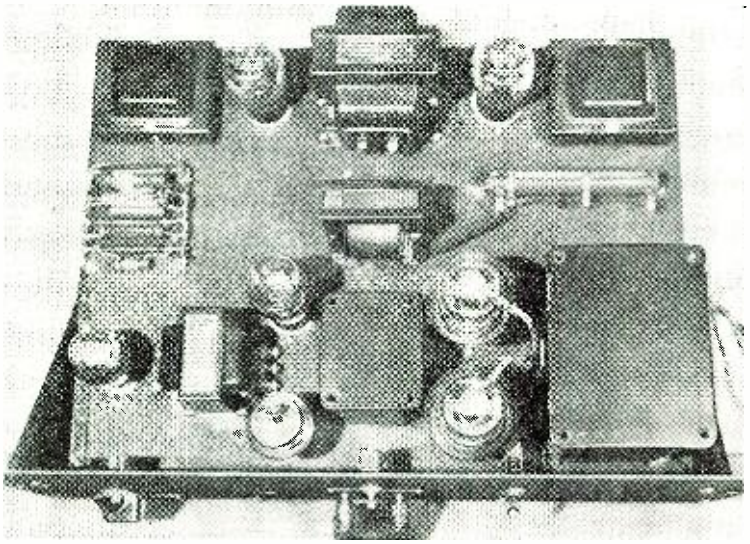


Under chassis view shows how carefully the various parts are placed.

X[illegible] with AMC

This is the Second Prize winning article of the RADIO NEWS Receiver Contest. It features a fine band-switching arrangement and the new automatic modulation control is included. Something for every amateur.

By EDWARD CALDICOTT, W2GVX
New York City



Top chassis view showing the transformer arrangement.

mc. and higher frequencies, mounted on the base made for the *National Buffer Coil* assembly. The link coil is thus made easily variable by bending it into or out of the center of the tank coil, producing a more flexible arrangement than if the coil form were used.

The plug-in base for the coils is held up above the chassis by brackets made from brass strips, bent to shape and drilled, so as to mount in the same holes used for the condenser frame mounting screws.

When changing frequency over a range of not over 3 parts in 100 (such as from 14.0 to 14.4 mc.) only the final plate tuning needs adjusting. This is very handy in a DX contest, as well as for general operating. Two bands are covered by changing only grid and plate coils for the final. Three or four bands are covered by the additional change of the 807 plate coil, only 10 different coils being required for four bands, and this includes operation on 56 mc., with almost the same performance as on lower frequencies. A 50 or 60 watt carrier, crystal controlled, on "5," goes a long way.

Audio and Bias Chassis

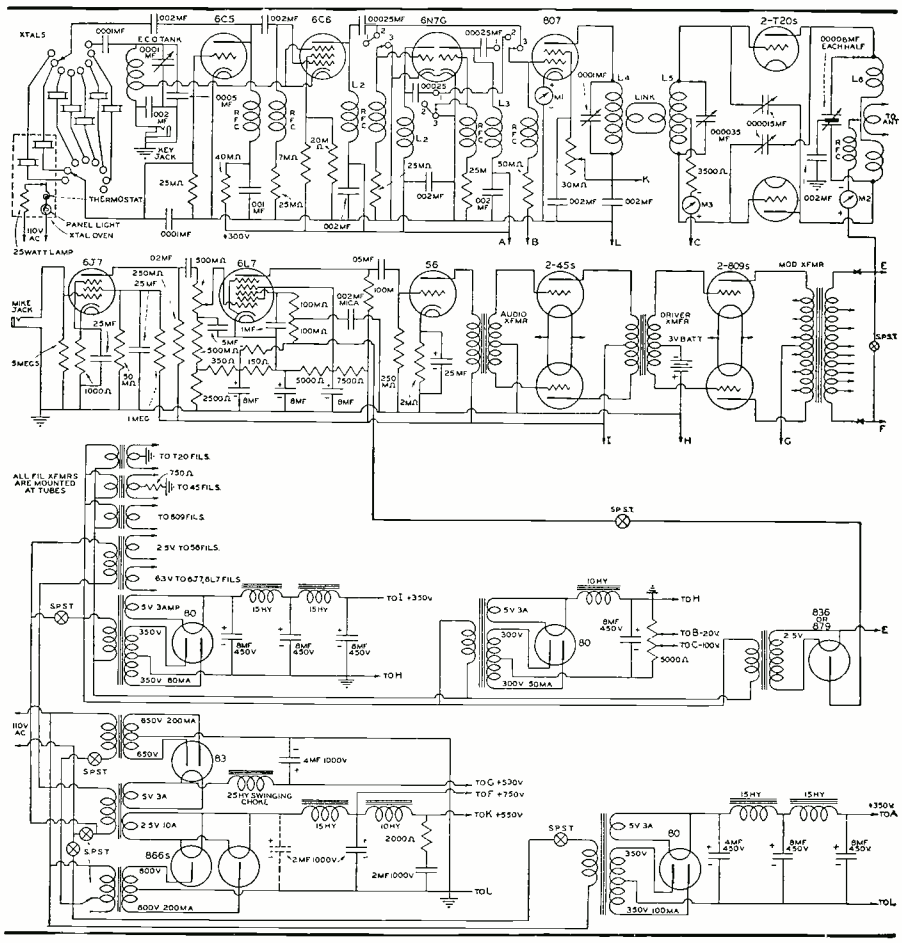
The circuit for this unit shows the top placement of parts. This is the chassis which carries the full audio equipment, the low level audio power supply, and the bias supply for the r.f. unit. Most of this is straightforward, standard material, requiring no special comment. The speech is designed for the popular crystal type microphone.

The one special feature of the audio is the inclusion of the AMC circuit, automatically to reduce the audio gain when the final modulation percentage reaches about 90 per cent or so. No phone can be considered "up to the minute" without this feature incorporated, for it insures no appreciable over-modulation.

This is of particular benefit when someone not familiar with the rig is using it, for you need only open up the gain, and let the AMC circuit take care of the volume for you. If you do not want this feature, it can just be left out, without any change in the audio circuit, and then at some future date you may put it in very easily and quickly.

Some form of fixed bias is almost essential to satisfactory operation, permitting keying in any stage, and

(*Please QSY to page* 56)



Circuit diagram of the entire transmitter.

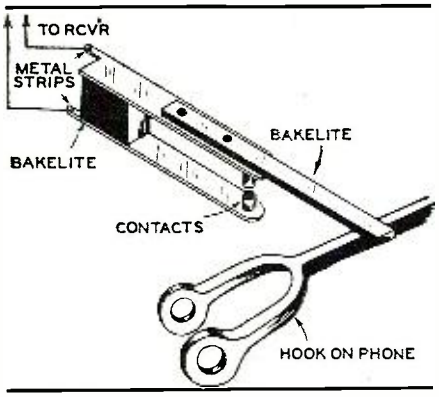
"RADIO Gadgets"

Keeping Battery Terminals Clean

Make a solution of Sodium Bicarbonate (ordinary baking soda) with water, and pour this solution on the battery where the corroded part is, and let it stand for a full three minutes or longer, and then pour clear water to rinse it off. A tablespoonful of soda in a cup full of water should clean the battery. If the first application does not clean the battery very well apply it a second time. The user might find that by using a little more soda in the same amount of water he might get quicker results. CARE SHOULD BE TAKEN NOT TO LET ANY OF THIS SOLUTION GET IN THE BATTERY HE IS CLEANING. By frequently repeating this process it will keep batteries clean and neat in appearance.

Stand-by for Telephones

Here's a handy telephone stand-by switch for the amateur or radio serviceman who receives unexpected calls while a receiver is going full blast. A jack switch from the junk pile is re-arranged as shown, so that when the telephone receiver is removed



from its cradle, the contacts will open and break the circuit to the receiver B— or B+ supply.

This same idea may be employed in reverse, with the jack contacts closed when the phone receiver is off the cradle. By connecting the leads across the speaker voice coil, the audio will be shorted.

Reducing Drift in Receivers

When constructing a communication receiver it is desirable that the filament transformer have a large safety factor to prevent excessive heat within the cabinet. By going a bit farther, it is good practice to allow the tube filaments or heaters to remain turned on at all times which will then maintain a fairly constant temperature around the various parts in the set and a great reduction in frequency drift will be the result. Many of the communication systems leave the receivers in constant operation, including the plate as well as the filament supply. It is a decided advantage to be able to come home with the intention of "looking over the band" as the Ham would say, and find the receiver ready and willing to remain as originally calibrated at the factory. The life of a vacuum tube operated under the above conditions is increased as the heating and cooling effect is reduced when a constant temperature is maintained.

Tinning the Soldering Iron

Many servicemen do not know how to tin an iron with rosin-core solder after the iron has become hot and has been in use. If the iron is too hot to take hold, the cord should be removed for a minute or so to reduce this heat. As the iron cools off it will reach a temperature where solder will readily take hold, providing, of course, the tip of the iron is clean. Filing of the tip will improve matters in any case.

Reaming with Tools Made of Soft Steel

Much trouble can be caused by using handles of pliers, etc., as a reamer when enlarging holes in chassis and panels. The friction may magnetize the tool and then when it is further used near small parts will pick these up and cause no end of grief. Heating the afflicted tool over the gas burner will usually restore the tool to good condition.

Concerning Doublet Antennae

Many an experimenter and serviceman has installed the most expensive type of commercial doublet in an effort to reduce the noise level, and to increase the signal input. Sometimes they have even made up elaborately double spaced double-doublets only to find that after they were hooked up to the set, that they did not work as well as a single wire.

The fault lies not with the doublet, but with the match between the antenna and the set.

The first thing is to determine what the input-to-the-receiver impedance is. Next a doublet must be used that will match that input. We know of at least one receiver that has an impedance of only 200 ohms. It is wholly useless to match a 600 ohm doublet to it, since there will not be the maximum transfer of energy.

Always match the doublet to the set, and make the doublet so that it will match. Formulae are available in most handbooks. —30—

TECHNICAL BOOK & BULLETIN REVIEW

THE RADIO MANUAL, new third edition, has just been released by *D. Van Nostrand Co., Inc.* This very complete and up-to-date technical book has been rewritten to include the very latest developments in a fast moving field. Operators who are preparing for any grade of license will find chapters on all branches. Written by Geo. E. Sterling, an outstanding authority on radio, this book should be a valuable addition to any library.

RCA Institutes Technical press has published a book in two volumes on RADIO FACSIMILE, written from material supplied by the engineers of the RCA laboratories. The student interested in entering the television field will find much of interest within its pages. Contains 353 pages, chapters on different methods of scanning, etc., are covered very completely.

STANDARDS ON ELECTRO ACOUSTICS has been published by *The Institute of Radio Engineers.* It contains chapters on definitions of terms, symbols, methods of testing loudspeakers, etc.

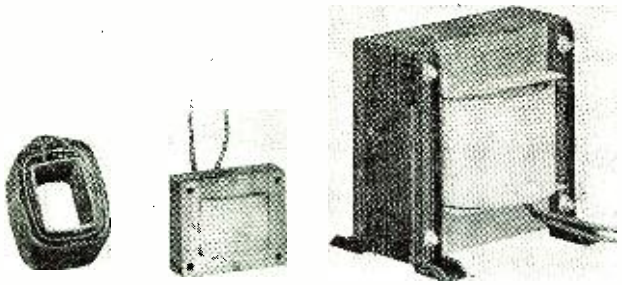
Two new catalogs are now being distributed by the *Tobe Deutschmann Corp.* of Canton, Mass. The latest in Filterettes for noise suppression are shown on one, and the other contains their line of capacitors. Copies may be obtained from the manufacturer.

THE RADIO AMATEURS HANDBOOK, seventh edition, is now available from the *American Radio Relay League* at Hartford, Conn. The new volume contains 560 pages, with over 300,000 words. Written for the beginner and old-timer, this book is a complete source of technical knowledge for the amateur.

Radio, Limited, of 7460 Beverly Blvd., Los Angeles, announce the latest RADIO HANDBOOK, 5th edition. This book has been enlarged and revised and contains many new pages on amateur equipment and theory. The constructional articles have been brought up-to-date and many new transmitters and receivers are shown.

Wholesale Radio Service Co., Inc., 100 Sixth Ave., New York City, have a new catalogue on radio and cameras with special gift section. Many new electrical appliances are listed and illustrated. A postcard addressed to this company or any one of its branches will bring a copy of this catalog free.

THE RESEARCH WORKER, published by *Aerovox Products,* continues to print very fine material on various radio subjects. This leaflet is published monthly and may be had at the rate of 50 cents per year in the U. S. A. or 60 cents per year in Canada. —30—



Three stages in the building of a choke.

Many a serviceman, experimenter, or amateur has wanted to wind a special choke at some time. The author tells how to design and build up your own.

By LOUIS J. GAMACHE, W9RGL
Development Engineer, Standard Transformer Corp.
Chicago, Illinois

Designing a Filter Choke

EVERYONE has heard of chokes and has probably seen a large variety of various sizes. The operation of the choke is not generally understod by all those who have seen them. It may be likened to the action of dirty water through filter paper. The particles of dirt will be held back and the water will continue to flow. The filter offers resistance to the flow of water which compares to the d.c. resistance of a choke, and it holds back the particles of dirt by offering a much greater resistance to these particles than it did to the water, because of the size of pores in the filter paper.

It is safe to state that chokes offer very high resistance to *alternating current* and a much lower resistance to *direct current*. The resistance offered to the alternating current is called impedance. This is converted into the term "henry."

$$L = \frac{X_L}{2\pi F}$$

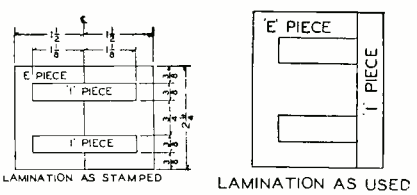
where $X_L = \sqrt{Z^2 - R^2}$

L = henrys of the choke
R = resistance, d.c.
F = frequency of a.c. component
Z = impedance of choke to a.c.

Thus the "henry" formula in terms of resistance, frequency and impedance is:

$$L = \frac{\sqrt{Z^2 - R^2}}{2\pi F}$$

The value of a choke depends entirely on its impedance (henrys) to the circuit to be filtered. Of fundamental necessity, also, are the current carrying capacity of the wire, and the frequency of the a.c. component to be filtered. These three points, then, are the outstanding considerations in choke design.



Wasteless laminations.

Chokes may be built in a form of the open coil type of construction on wasteless *E & I* laminations or in the pot of a speaker field. In detailing the choke design, it is best to take a special case as an example. Then the steps needed to complete the design will become at once clear and apparent. These steps may be followed either in building a coil or checking a manufactured one.

The hypothetical current required for this example was calculated to be 200 milliamperes. By allowing 1,000 circular mils per ampere, it is found that number 27 wire with 201.50 circular mils will be satisfactory. (Note: To determine the circular mils area of any bare wire, measure the diameter in mils, a mil being .001 inch. This value squared is the circular mils area of the wire.) For number 27 wire the diameter is 14.2 mils at 20° Centigrade. Any wire table may be consulted for wire diameter and circular mils derived therefrom; or a chart reading directly in circular mils may be used.[1] The wire size must be such that the circular mils of the wire exceeds the number of milliamperes to go through the wire.

Knowing the wire, size, the next step is to select the proper iron size. With this example, a core 1½" square will be used. The iron size in wasteless lamination is determined by the width of the center leg of the *E* piece. This multiplied by 3 will give the overall length of the iron. The center leg multiplied by 2.5 will give the width of the *E* piece plus the *I* piece.

On Standard iron, the window width is one-half of the iron size, or on 1½" iron it is ¾" wide. The length of the coil is 1½ times the iron size, or 2.25". From this, it may be seen that the window area is ¾" x 2½", or 1.69 square inches on each side of the center leg. It is now necessary to calculate *the build* of this coil.

First, the thickness of the side of the insulating tube, made of Kraft paper used to isolate the winding from the case, is completed, and from practice it is found that .050" is satisfactory.

[1] HENNEY, *Radio Engineering Handbook*, 2nd Ed. Page 10; copper wire tables. *Circ.* 31, Bur. of Standards.

The number of turns per layer of wire allowing .187 inches on each end for insulation for 3,000 volts, and using the *winding factor* of 87 per cent with enameled wire, it is found that each layer will have 103 turns. The winding factor is determined by dividing the winding into the space available. The reason that 100% of the space is not available is that allowance on each wire turn must be made for the enamel.

The selection of the proper thickness of layer of Kraft paper insulation is next in line, and for number 27 wire .003 will be used. A table gives this.

Knowing the above, *the build* must be determined on paper. This is done by measuring the window space, which was found to be .75" and allowing for a calculated total build of 85 per cent of this space. The reason that 87 winding per cent was used is to allow for bulges in the coil and overlapping of the insulation, etc. The net space available is .637 inches. From this is subtracted the thickness of the winding tube (.05") and the thickness of the final standard wrapper, .020". The net winding space is then .637 — .07, or .567 inches. Each layer will be the wire diameter, .0151", plus the thickness of insulation .003", or a total of .018" for each layer. This divided into .567 is 31 plus. Therefore, the coil will have 31 layers of 103 turns, or 3,200 turns. The length of the *average* turn is found to be 9 inches; since the shortest turn is 6" and the longest 12". Therefore, the coil has 2,400' (9" × 3,200) of number 27 wire.

Consulting the wire chart, it is found that number 27 wire has 51.47 ohms per thousand feet at 20° Centigrade, making the resistance of this coil (.2 amperes at 3,200 turns) 127 ohms. The ampere turns in this coil is 640 (200 mils × 3,200 turns). With ampere turns of 640, and with a mag-

(*Build further on page* 58)

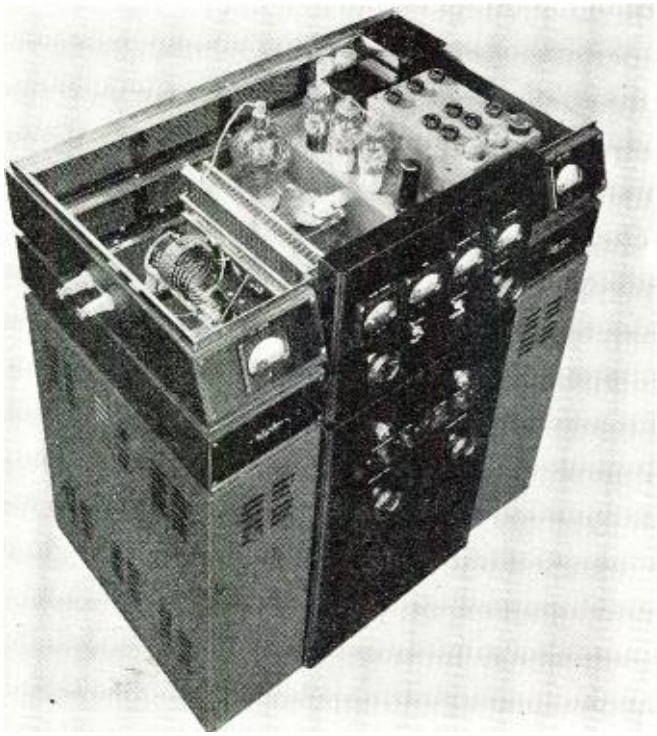
Paper Insulation Table

Wire Size	*Paper Thickness*	*Type Paper*
14-18	*.007"*	*Kraft*
19-24	*.005"*	*Kraft*
25-30	*.003"*	*Kraft*
31-41	*.002"*	*Glassine*

Transmitter

By ROYAL J. HIGGINS, W9AIO
Engineer, The Hallicrafters, Inc.
Chicago, Illinois

A cleverly designed 325-watt transmitter featuring band-switch and reasonable cost.



The entire bandswitching mechanism is housed on top.

EVERY amateur will agree that 325 watts of carrier power on fone and 450 watts on c.w. represents a signal capable of really going places. While stating the power output, in the design of a transmitter, before first considering the oscillator, doubler and the other stages before the final amplifier, might appear to be putting the cart before the horse, practically it's the most straight forward way to plan a transmitter and what goes into it.

It must be appreciated that if the output power of our transmitter were doubled the effective signal strength at the point of reception would go up only about 3 DB,—1 S unit or so—and when the cost for that slight increase in signal strength is considered, one has to ask, is it really worthwhile? Power goes hand and hand with a loud signal but some middle path has to be chosen or one's desires will run away with his pocketbook. Amateurs know that 300 watts of fone carrier power is a really healthy signal and with 400 watts on c.w. they wouldn't have to take the back seat from any signal on the air.

Large tubes cost money and power supplies to run them are also expensive. Still, to have the output power agreed upon as satisfying the high power desired one of two courses must be followed: use one high voltage tube or two or more low voltage, high current tubes. Considering efficiency and co-ordinating it with the price of both the tubes and power supply the high voltage tube wins out. So the 3000 volt RK63 Raytheon tube for the final stage is chosen. This high mu tube requires only 17 watts of driving power amply provided by the parallel RK39 tubes which act as drivers.

Doing a little juggling of convenience, cost and efficiency, "plug-in" is the answer for the final plate coil. Only in the driver stages, where efficiency can be overlooked at no expense of driving power, inasmuch as the parallel RK39's initially provide more power than is necessary, the convenience of band switching dictates its inclusion in this transmitter.

So many old timers, failing to realize the advantages to be gained with the latest screen grid tubes, doubt that a 6L6 doubling could drive the parallel RK39's to full output. Actually the 39's require considerably less excitation than the amount delivered by the 6L6 doubler. Tests show a marked decrease in output from these tubes if more than ¾ watt of grid drive are fed to them.

A 6F6 very reliably performs the function of crystal oscillator. And, when the transmitter is being worked on the crystal frequency rather than a harmonic, the 6F6 has sufficient output to drive the RK39's direct. The band switch is so wired to jump the 6L6 tube when working straight through on the crystal frequency.

Seldom should it be necessary to band switch more than 3 bands. Rather than limit this high powered transmitter for operation on only three bands, however, the coils of the excitation stages are plug-in. The flexibility of such an arrangement is immediately apparent. One might be interested only in 10, 20, and 40 meters for most of the communications work, but imagine how concerned in the investment one would be if one wanted to work on 80 or 160 meters at odd times and your transmitter was wired only for 10, 20 and 40. Coils for the three bands used most are left in the transmitter and output from these shielded coil combinations, seen at the right of the top view of the transmitter, is available at the flip of the band switch. When a seldom used band is desired, one of the coil boxes is removed and the new band coil box substituted. Briefly, coils boxes for all bands can be kept on hand and those for the 3 most used bands plugged into the transmitter and left there until the need arrives for operation on a seldom used band. The shielded coil boxes represent a very foolproof way of conveniently connecting the proper coil and condenser combinations into the band switch circuit. The only other operation necessary when going from one band to another is plugging in the final plate coil for the band on which operation is desired.

The RK63 is rated at 3,000 volts at 230 milliamperes but, inasmuch as its output is going to be modulated, 2,000 volts will allow the desired carrier power to be obtained and still keep the cost of the high voltage power supply within reason. All transformers in the transmitter under consideration are *Kenyon* and are conservatively designed for their particular job. The 2,000 volt power supply, with 866 tubes as rectifiers, is capable of providing plate power for the push pull class "B" RK38's and also power for the RK63 final r.f. amplifier. The regulation of this power supply is excellent

and allows it to properly perform this dual function. When operating the transmitter on c.w. the slight increase in plate voltage on the RK63, due to the modulator being inoperative, is desirable for increased c.w. output.

The RK38 modulators are driven by push pull class "A" 2A3's. A little maneuver in economy at no expense in performance disclosed the possibility of working the 2A3 plates at ground potential which would allow the same power supply to deliver bias for the final r.f. stage as well as the modulator tubes. A separate 5Z3 rectifier takes care of the exciter stages, so the number of power supplies are kept at a minimum consistent with satisfactory performance of the equipment supplied by them.

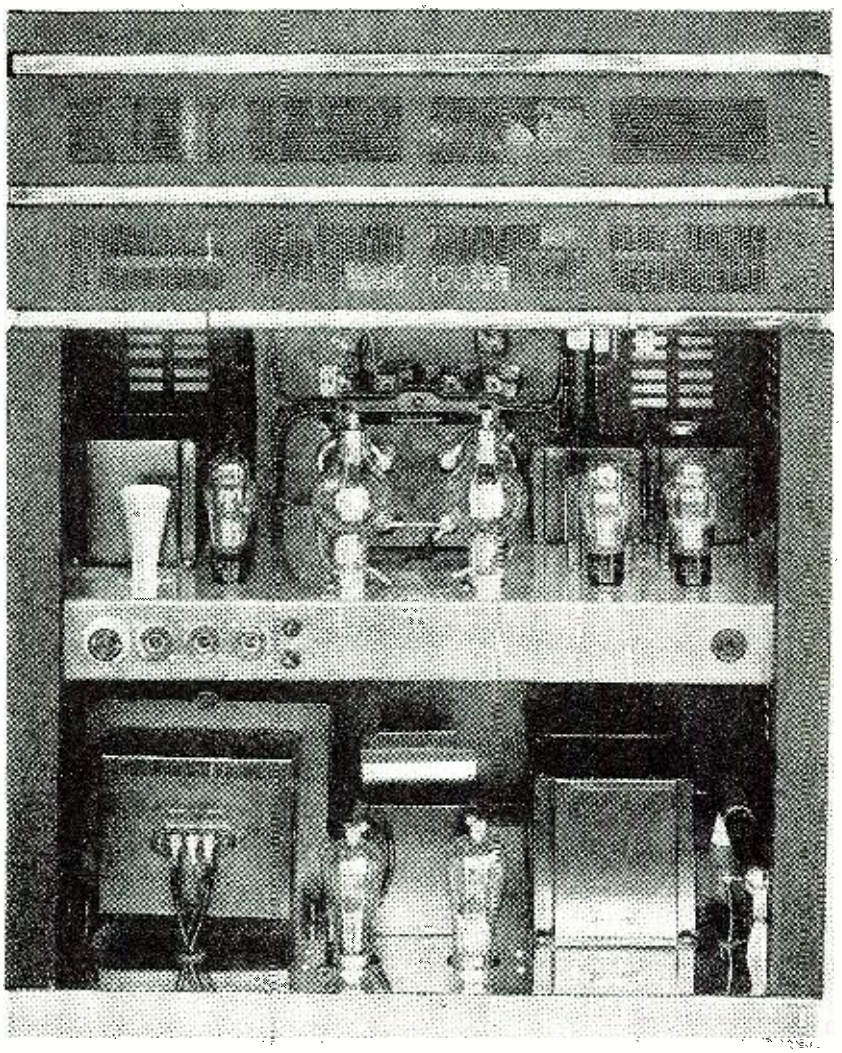
If you have ever been backed against the wall by a high voltage shock you'll agree that some protective measures should be used to remind you of the danger of high voltage. It has been a frequent cause of wonder that each year more amateurs are not killed through carelessness. Two thousand volts can be lethal, so the designed transmitter, when the cover of the r.f. unit is removed to change the final plate coil, an interlock switch is operated which opens the primary of the high voltage power supply. Because of the pains taken to enclose everything but the plate connections to the RK39 tubes, and the fact that tuning adjustments of the exciter stages are made with the top cover removed, plate voltage to the low power tubes remains connected.

Additional protective steps are taken by interlocking the protective perforated back on the transmitter. When the back is removed the high voltage circuit is dead and will remain that way until the back is replaced, which automatically closes the plate interlock switch.

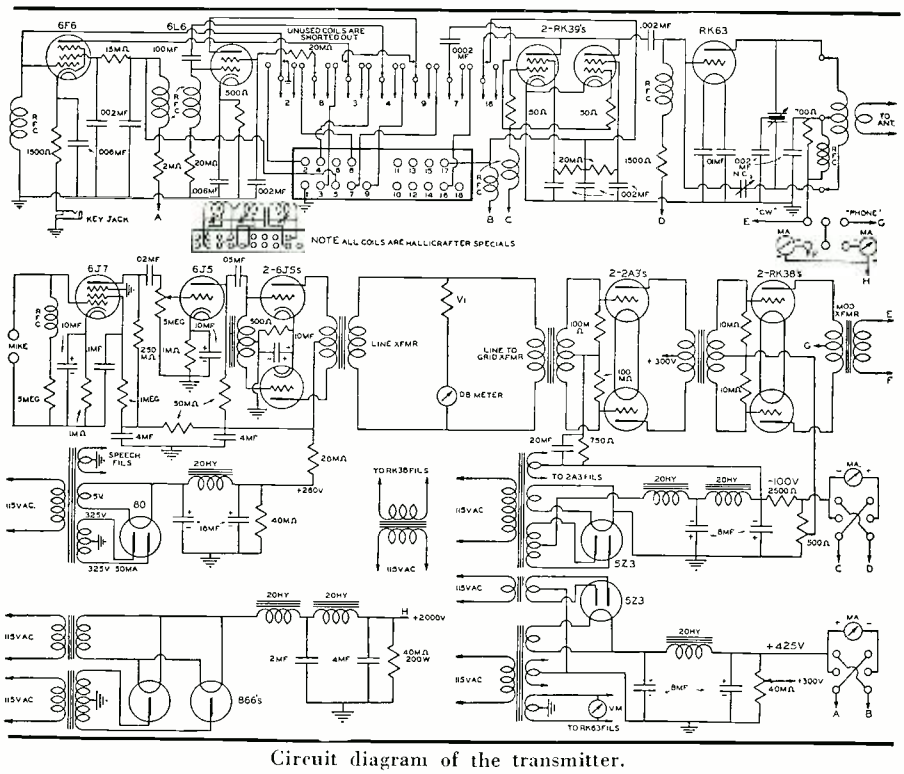
The transmitter is now ready to be placed in operation and the preamplifier, usually set on the operating table next to the receiver, is so arranged to control the unit from the operating position. After the filaments are lighted by closing the switches on the front panel, and the transmitter is resonated to the frequency desired, the whole transmitter can be turned on and off with the standby switch mounted on the front of the preamplifier. On this unit is also provided a jack into which the key is plugged for c.w. operation.

The tube lineup in the preamplifier is a 6J7, 6J5 in cascade, which in turn drives push pull 6J5's. A crystal microphone is connected inside the metal housing around the 6J7, and gain is controlled in the input circuit of the first 6J5. R.f. feedback is eliminated by an ounce of prevention, worth a pound of patience, in first shielding and carefully filtering the high gain amplifier circuit. The output of the push pull 6J5's is transformer coupled

(*Please QSY to page* 53)



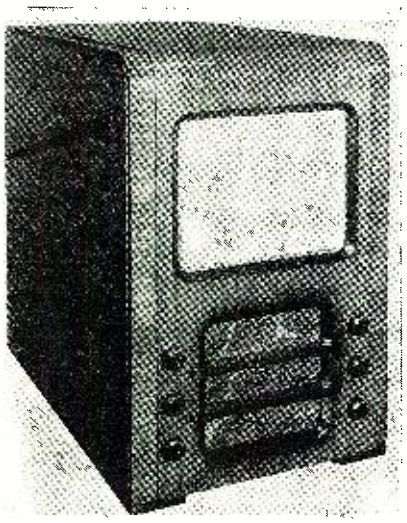
Rear view of the 325-watt transmitter.



Circuit diagram of the transmitter.

What's NEW in Radio

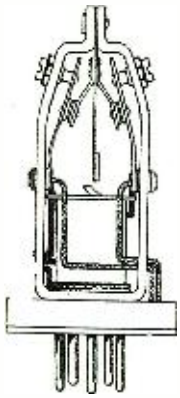
Allen B. Dumont Labs., Inc., 2 Main Ave., Passaic, N. J., are now offering a compact television receiver which is little more in size than a table model broadcast receiver. The use of a 14 inch tube makes



it possible for a large group of people to witness the program. The black and white image measures a full 8x10 inches. The set includes a total of 21 tubes and the large cathode ray tube.

National Union Radio Corp., Newark, N. J., announces the addition of a 9-inch Videotron television picture tube to its present lines of television tube types. The new Videotron has been assigned the number 2109. Complete characteristics are available upon request to the company.

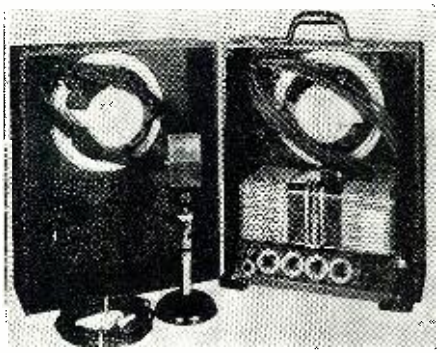
A new 25 watt P.A. System, offering new convenience in installation for portable sound systems, has been introduced by the Radolek Company of Chicago. It affords high fidelity 130 db. gain amplifier with dual microphone input and phonograph input mixing and fading facilities, record player, microphone demountable floor stand and speaker all housed in a single carrying case.



The Pauley-James Corporation, 4619 Ravenswood Ave., Chicago, Ill., manufacturers of various types of vibrators, announce a new type of construction which offers many improvements. Employing a push-pull coil circuit, this full line is now in production. New replacement charts are now available and free copies may be had by writing to the corporation.

An inexpensive power switch may now be obtained from the Clarostat Mfg. Co., Inc., 285-7 North Sixth St., Brooklyn, N. Y. Similar in appearance to the midget type of volume control, these new rotary units will find many applications. Switches are available in S.P.S.T., D.P.S.T., S.P.D.T. and S.P. with bushing terminal. Rated at 1 a., 250 v., 3 a., 125 v., and 10 a., 12 v. Overall dia., 1 3/32".

RCA Mfg. Co. of Camden, N. J., introduces a low cost portable sound system. Two speakers and velocity type microphone are supplied with this twelve-watt amplifier. The speakers are of the permanent

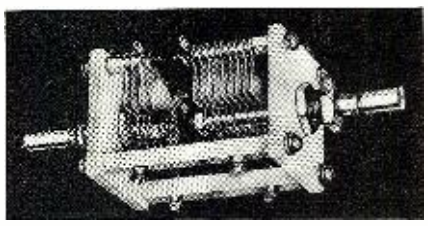


magnet type which simplify the power requirements. The two parts of the carrying case are used as baffles for the dynamics. The case measures 21½" high, 11" deep, and 16¾" wide. The total weight is only 43 pounds, ready to carry.

A new A-B eliminator that changes 110-volt raw a.c. to pure d.c. is announced by Electro Products Laboratories, 549 W. Randolph St., Chicago, Ill. This new eliminator is suitable for use with 1½ and 2-

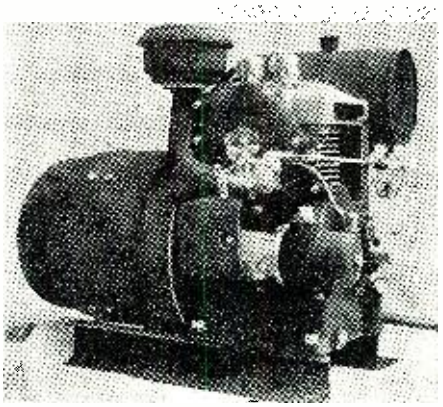
volt farm or battery-operated receivers and the power supply is sufficient for any size set, be it 3-tube or 11-tube. The makers declare the unit to be hum-less in operation.

The Allen D. Cardwell Co. have released types EU-25-100-AF and EU-50-100-AF Band-spread condensers to the trade. These compact condensers will find many uses in frequency meters, etc. The high-capacity tank section may be locked in any



desired capacity. Insulation is Isolantite. Mounting may be accomplished by using the regular Trim-aire brackets, or from the mounting posts. Temperature coefficient of capitance is approximately 50 parts per million per degree C.

The Kato Engineering Co., Mankato, Minn., are making a complete line of gasoline-driven generators with ratings of from 300-10,000 watts. These plants are very compact and are well suited to be used in



mobile, sound trucks, farm and emergency installations. The unit illustrated furnishes 110 volt, 60 cycle current with a capacity of 2000 watts. The overall dimensions are 28" long by 18" wide, and 23" high. Available in remote self-starting types.

A new "Gain Indicator" is now offered to the radio serviceman, engineer for the measurement of power amplifiers. The gain of the amplifier can be measured in decibels. Fidelity curves can be made on amplifiers with speed and accuracy. Model 44 illustrated has an input and output impedance of 500 ohms. Maximum gain that may be measured is 110 db.

John Meck Instruments, 164 N. May St., Chicago, have made available to the trade a new "Bridgemaster" instrument. This unit tests different types of condensers, resistors and inductances. The tester is designed so that speed is attained in making the various measurements, and switching simplified.

The Worner Products Co. of Chicago, Ill., have perfected an extremely sensitive photo-electric relay burglar-alarm device. Models are available for operation on both 110 v. 60 cycle or from self-contained battery supply. The alarms operate up to 300 feet from the light source. Infra-red light filter prevents an intruder from being able to detect it even in the dark. An external alarm may be installed on the outside of the building in addition to the unit within the room.

Coaxial cable in kit form is being manufactured by The Transducer Corp., 30 Rockefeller Plaza, N. Y. C. It contains a supply of Anhygron B separator beads, conductor wire, an outside shielded braid and a complete set of explanatory diagrams. This type of cable is rapidly finding favor in the amateur field for use as link coupling, for antenna feeders and as a low-loss conductor for use with high frequency work. —30—

THE NATIONAL QSO PAGE

HAMSTRINGING THE HAM

"IT IS an unfortunate commentary on our present times that the average amateur is very little interested in his hobby beyond actually calling "CQ" on the air and making an occasional contact. His interest has not extended beyond his immediate shack and he knows very little of what is going on outside nor does he seem to care.

We had hoped by showing the amateur the situation as it exists and wherein the Directors of the ARRL had been remiss in giving him ACTION, that by this time there would have been a concerted movement on the part of these amateurs to get that action. We are sorry to report that the movement has been very slow in starting, and in fact has been so slow as to be almost infinitesimal. Perhaps we are wrong. Perhaps the amateurs are well satisfied with the situation and are satisfied to view 1942 with a complete placid calm and indifference as to what the Rome Convention will bring.

Considering that the hobby of Amateur Radio is probably the freest in the United States and considering further that our government has shown itself most appreciative of the work of the amateur and thereby has perpetuated him this far, it would seem that with the impending threat directed against his status in 1942, that in the last six months some voice would have been heard in the wilderness requesting and urging that something be done at Washington other than what has been done in the past. Obviously, if the "patient" in the past has continued to lose ground because of a certain treatment, it is useless to continue this treatment in the future with the hopes of curing him.

League Makes No Membership Inquiry

As presently constituted, the League makes little or no inquiry into the qualifications of its members and there is not any reason at all why anybody regardless of what he may know or care about amateur radio cannot become a member of the League. This condition has emasculated that august body and brought it to the state of affairs where it seems more interested in the membership fee than in the qualifications of the persons who compose its membership. What must be the natural result of such a practice? The League is composed of approximately 26,000 persons, some of whom are licensed amateurs and some of whom are not. Some of these members are actively interested in furthering the amateur status and others have no further care other than to read the magazine published by the ARRL and to continue to shout their QSO's over the air.

It is the latter type which, in spite of the former type, endangers the status of all. The situation is extremely grave and it is made the more serious by the absolute lackadaisy of the membership toward its ultimate destiny. If the powers of the dictators abroad.—if the current trends stifling not only the free press but also the free expression of ideas by amateurs should be followed, and there is every indication that they might be, then the amateur in 1942, even in these United States, must be brought to such a turn as practically to be legislated out of existence. Although this has been repeatedly said and stated in *The National QSO Page*. the reaction has been very, very sluggish. There are always a few who listen and there are a few who will do something, but the majority has been conspicuous in its indifference to the entire affair.

What Would T.O.M. Do?

We feel confident that if *The Old Man* (Hiram Percy Maxim) were alive today he would not view this situation so stogily. He would not take matters so easily, nor would he shrug his shoulders and say, "Let George Do It." He would certainly take it upon himself to go to Washington. He would find out what the F.C.C. plans to do. He would find out what the Senate plans to do; and he would find out what the Representatives plan to do. If necessary, he would interview the President of these United States to determine for himself, and then report to the members just exactly what the Executive attitude toward the amateur was. He would not be satisfied with a blank white-washed statement that the amateurs had survived this far and that they would survive in the future. Nor would he be pleased to listen to a glorification of what the amateur had stood for in the past in the hopes that that by itself would perpetuate the amateur in the future. He would want concrete assurances insofar as they could be given, that the hobby of amateur radio would be perpetuated *forever* among the amateurs of the United States.

How Will Rome Delegates be Instructed?

We have watched with considerable interest the reaction of the Official Group at headquarters of the ARRL to these statements. Their only reaction was when at one time they took issue with us on the statement concerning the delegates to the Rome convention, stating that such delegates could not be instructed to act in favor of the United States amateurs. Partly, this could not be so, since all delegates by any country are thoroughly instructed as to what the legislative body of that country will or will not approve. Recently the Mexican Seoate refused to ratify that portion of the Havana Treaty which dealt with the broadcasters. This type of refusal can be extended, and probably will be extended to amateur situation in 1942. Already Great Britain has served notice upon us that we need not expect any assistance from her with regard to the international amateur's status and certainly Mr. Neville Chamberlain's policy of Appeasement of the Dictators seems to indicate that he will not contravene their statements nor their demands on what to him must be a small matter—amateur radio. France has her internal turmoil and it must be stated that she, although terming herself the "cradle of Liberty," will not do anything in favor of the amateur. The situation in Germany, Russia, Italy, Greece, Turkey and the other totalitarian states is, of course. well known.

Naturally, there is not any guarantee that in 1942 the present conditions will obtain, but there is certainly every indication that they will not be any *better*.

Meanwhile, in our own western hemisphere there is a certain amount of unrest between the South and North American continents. Argentina, for one, is thoroughly steeped in the dictatorial idealisms of both Germany and Italy and it is hard to conceive that if this situation continues in Argentina, that she will back our demands for more, or even as many, frequencies as the ham has today.

All these things seem to point only one way and that way is that the ham will be legislated out of existence, or at best will be put to such frequencies where his operations in the ham bands will be above 30,000 kcs. Although we have pointed this out regularly, the hams themselves have remained absolutely aloof of the entire situation and *refuse to believe* or have refused to do anything about it.

Now Is the Time to Act!

Certainly, as long as the ARRL is the official spokesman for the American Ham (and it is so considered), it should certainly begin to do something and begin to make plans for 1942. These plans can take effect by establishing a lobbyist in Washington. Statements and representations should be made, not only to the Senate and Representatives, but also to the President, and the F.C.C. Unless a protracted plan of continual favorable publicity and propaganda is carried out from now until 1942 so there is small hope that the delegates then will have the general public opinion behind them in demanding more or at least as much for the amateurs as they presently enjoy.

Nor is this all. A protracted series of conferences with the emissaries of the foreign nations should be held. There is no reason why at this time we cannot determine the attitude of Japan. or Norway or Sweden or any other country toward the amateur so that we will be better guided in figuring out what we will ask for in 1942 and how we will go about getting it. If we know in advance what the foreign nations think of the amateur and if we can get them to commit themselves, then we are that much better prepared with what we have to do in order to counteract this influence. One thing is certain, that is that the "handwriting is definitely on the wall." There is not any doubt in our mind or in the minds of a great many serious thinking amateurs that the American ham is "on the way out." He is in this position solely because of his own lethargy and his aloofness and his absolute belief in the quotation that

"George will do it,"as well as his indifference to what his Director does at Headquarters.

It seems a horrible waste of space and a greater waste of time to continue to tell these amateurs exactly what the situation is, if they will not lift their hands even one mite to help themselves.

Think It Over. Then Act!

We urge all amateurs who read this to think the matter over carefully. Whether you agree or not, we think that you should demand ACTION from the Directors, who in turn should demand the same from the ARRL. Unless there is a concerted movement by all of the 50,000 amateurs in the United States, there is not a single chance of a snow ball in the well known "nether regions" of our coming out of the 1942 conference with anything but a few measly ultra high frequency channels left to us.

MUFFING AN OPPORTUNITY

It is well known that one of the strongest points in favor of the continued existence of the American Radio Amateur is that he had a great deal to do with the development of the present day radio. Not necessarily the radio of the technicians, but the broadcasting as it is enjoyed by millions of our people.

It is within our memory when a group of interested spectators gathered at our house to hear election returns as they came over the ham bands, sent in code from various public spirited ham's shacks. This was the introduction to the general public of what they could expect from the then untried field of "wireless."

In the last few months, and particularly in the last year there has been much controversy among the amateurs concerning television. After the smoke of battle cleared away, the general concensus of opinion was that the ham should not develop television as he had radio, and the F.C.C. was asked to remove television from those of our bands below 2½ meters. This it did.

It was claimed that the television signals took up too much space in the ham spectrum and that were the ham to go ahead with the development of the art, that he would eventually be shoved from the very frequencies in which he had engineered the television signals. This will prove to have been a short-sighted viewpoint.

The ham has definitely muffed the greatest opportunity offered to him since the advent of general public broadcasts. Here was the chance to have the public back him, and even go so far as to demand that he *not* be legislated out of existence.

Picture, if you please, the fact that television will be many years in reaching the proportions that present audio broadcasts enjoy. For the most part, television is already centered in the large cities, and there seems small hope that it will leave these places and go into general coverage until the industry can finance expensive co-axial cables or many relay stations.

The Opportunity

In this state of facts lay the salvation of the ham. He should have jumped at the opportunity. Today all of the television receivers tune continuously from about 42 megacycles to 86 megacycles. This band includes the ham five meter band and a number of presently unused television channels.

Had the ham asked for a special television band on a share-with-a-commercial basis in the u.h.f. brackets plus the right to *rebroadcast commercial video signals*. he would have been instrumental in bringing television to the rural districts far sooner than the commercials will ever be able to do it. Not only would the development of television have been laid, for the most part, at the feet of the ham, but he would have received training that later could have been turned into a source of revenue to himself.

Picking up video signals in the city and relaying it through several other hams into the outlying districts would have sold John Q. Public that the radio amateur had a use after all—even when there were not any floods or major catastrophes. A grateful public would have done much towards moulding the opinion of the Senators and Congressmen to backing the ham.

That is the opportunity that we have thrown away. But it is not too late. Steps should be taken at once to remedy the situation, and the League as the spokesman of the ham should enter into negotiations with the F.C.C. to see whether the chance cannot be revived. And it is up to the membership to see to it that it does this. The Editors.

CORRESPONDENCE

Dear Editors:

I am pleased to report that *The Vigilantes* are gaining ground fast. Members are coming into the folds of our organization at the rate of about 10 a week. We plan on keeping up with our work until we shall be sure that 1942 will not spell out a final "30" to all hams operating below 30mc.

During the last month we have had discussion among the members concerning a plan for taxation of the ham by the Federal Government. The plan is as follows:

Every ham to be taxed 50c a year regardless of power; and a license fee of $1.00 to be imposed on every person taking an examination. This money is to be earmarked for the use of the hams *only*. It is to be used to pay the salary and expense of a separate officer to be *added* to the present FCC, and this official to have sole interest in ham radio and its problems. The official will be recommended to the FCC by popular direct vote of the hams, and he will act on the FCC only in regard to ham matters, by advising the FCC and the Legislature concerning those problems that particularly affect the amateur. The rest of the money is to be used to defray the expense of sending a special accredited delegate to the 1942 Rome Convention whose sole purpose will be to co-ordinate, advise and *vote* on ham radio status.

An amendment to the idea has been suggested that Congress be asked to match the money raised by taxation of the ham, dollar for dollar, so that a complete survey and review of the ham situation may be held.

Another matter under discussion before *The Vigilantes* concerns itself with a Resolution commending the attitude of Chairman McNinch of the FCC in his stand that the air over which all radio is sent belongs to the people of these United States and should be so treated. *The Vigilantes* who have been contacted feel that such a stand will do much to help the ham status against the commercials.

A third proposition on tap is to appeal to the President that he make his position clear on how he stands in regard to the ham insofar as the amateur may be a necessary adjunct to the Armed Forces of our Government and a backstay to our Democracy.

As soon as the ballots have been distributed and the results known, I will let you have them, so that all the hams may know what is going on.

We should have every ham who has his hobby as a serious interest, join up with us. *We are neither pro nor anti ARRL.* We are a direct-action group who believe that the best way to get something done—*IS TO DO IT OURSELVES* and not wait for the other bird to do it.

Membership to date includes the following: ex-W9ZN (Honorary), W9ETI, W9VFO W2JUU, W9WXB, W2DSY, W9IUV, W2JNB, W6NCR, W8RCC, W3GQR, W8DK, W1IZP, W1IKN, W1EOG, W1IHW, W2HMA, W1JYT, W8QVH, W3BMA, W9UII, W9MJQ, W9AUQ, W9SRZ, W3CIC, W9VBF. W9UWD, W9BWN, W5FFS, W2KDY, W2HUS, W6PFF, W1LIG, W1KKG, W9OXT, W9KQH, W9YUR, W9VFH, W9NSK, W9WKL, W9WDO, W9COY, W9VDD, W2IKV. W9FB. W9JPO, W9YAR, W9UVW, W9TLO, W9VUY, W9RYL, W9ZDC, W8GQQ, W8SHA, W2GUX, W2JBY, W2KTJ, W2GTG, W6NTX, W1BIC, W2BUX, W6DDS, W9CNO, W9TPW, W9TKD, W2JJC, W1JFG, W9ITA, and W3CXE.

Best 73
(Sgd) John H. Harvey, W9ISR
for *The Vigilantes*
2617 W. Huron St.,
Chicago, Ill.

■ Thank you, W9ISR, for your report. We will be interested in knowing just what The Vigilantes are doing and what the results of the poll will show. We commend you on your organizing for ACTION. The Editors.

Dear Sirs:

I am a ham as my letterhead will signify but not of USA. I am member of both RN and ARRL. Well I have been following with great interest RN's fight for a better ARRL and excuse me had been content to watch as I was sure that something will be done. But I guess I have something to say.

You have said "Save the bands for US" and I guess that the "us" includes the hams of the whole world. And it is with this spirit I am writing. We haven't and it is not possible either for us to have a powerful body as the ARRL. Of course we are members of BERU too but as I sensed the trouble to the bands long ago I thought that if anything could help keep the bands for us ARRL must be one. So help it in the only way possible "Be a member." The membership of ARRL is not limited to USA and as it admits members outside USA I guess these members has got a claim on ARRL too. *You haven't felt the failure yet, we have.* [Italics, ours. Ed.] A few Xtals are with me which can hardly be used any more, except on 14mc. but if the 14 goes well I think it is time to get rid of the rig now. But could I? That's the trouble here and the mere thought is painful. Also if the rest of the world looses 7 & 14mc. bands what about the amateur fraternity. The contacts on 28 is still not a very sure one. And isn't 14 the band which is linking the worlds amateurs today. The world wants peace and I think *Ham Radio contributes quite a lot towards that.* How can you quarrel with a man to whom you have been saying 73s so long. I am sure BERU will fight for the 14mc. band but it can't fight alone. ARRL would surely lend a strong arm of aid *only if it did.* So I say if Amateur Radio is to remain so interesting a hobby as it is, the whole world must enjoy the frequency facility as it is doing now. Of course by the world I mean the hams. I hope in Rome ARRL will be successful and the changes will be done before then, if necessary. But I have one objection to W8RYL's letter and ideas. *So big a body as ARRL is not built in a day.* So why wreck something ready, when we need one now. The best way to do the stuff will be to improve the present one and use it. *It is ours isn't it, so there is no sense in breaking something which is ours.* I would ask 8RYL to join the ranks and start the goodwork now than to build something. The steel is there only it requires tempering. And finally I would request you to bring it to the notice of hams in USA that the bands in question is valuable because the rest of the world is there to reply the CQ.

(Sgd) A. Banerjee, VU2LL.
Ballygunj, Calcutta, India.

■ Thank you for your letter, VU2LL. If you have felt failure, then you know what is in store for the American Ham. We agree with you. The League SHOULD be built up. But it should also be made to give its members ACTION. The Editors.

Dear Sir:

I want to say that I am in sympathy with your nationwide drive to arouse the amateurs to a fight to retain their rights. Many hams in this section are alarmed at the changes of the last few years. . . .

(Sgd) James Boland,
W7GUR.

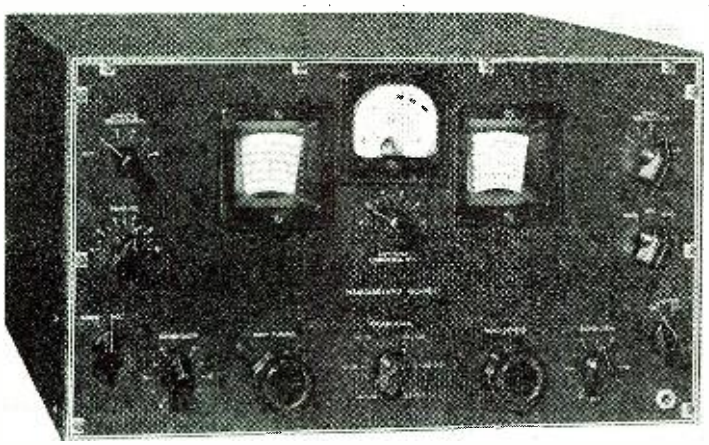
Keep up the good work.
(Sgd) A. J. Scribanis, W2JNB.

Dear Ed:

Please count on me to help you clean house. . . .

(Sgd) Bill Samuel, W8SKX.

—30—



The symmetrical layout makes the receiver easy to handle.

A new receiver that features a different treatment of the crystal stage and noise limiter.

By CARL DORF
New York City, N. Y.

S mething New in Receiv :s

WHETHER or not a "ham" or short wave enthusiast builds his own receiver, it is always of interest to study the new ideas incorporated in receivers by the commercial design laboratories.

The new Hammarlund HQ-120X receiver utilizes a total of 12 tubes which provide one r.f. stage, mixer-oscillator, 3 i.f. stages, detector-a.v.c., noise limiter, b.f. oscillator, power amplifier, meter amplifier, voltage regulator and power rectifier. Its tuning range is from 540 kc. to 31 mc., covered in six bands.

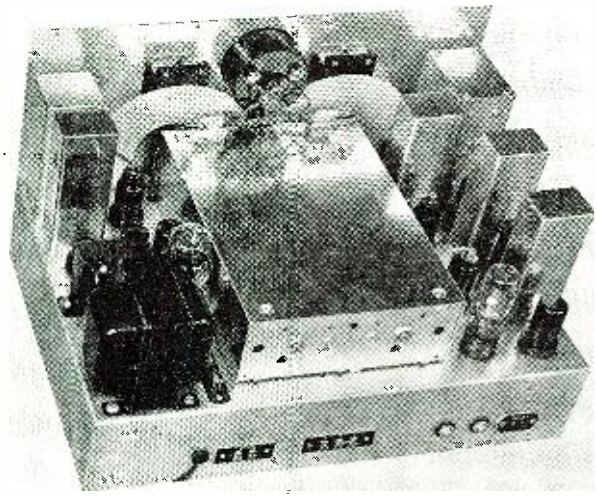
Extreme precautions are taken to insure stability of the oscillator—even to the extent of using a voltage-regulator tube to maintain constant plate voltage on this tube. But with all these precautions it would still seem hazardous at first glance to calibrate the band-spread dial in megacycles. Yet in actual practice the calibration is extremely accurate.

The explanation is that the band-spread tuning gang is in parallel with the main tuning gang, the latter for any given tuning range representing the greater part of the total capacity. Any minor change in the main-gang setting will have little effect on the tuning curve of the band-spread condenser (frequency plotted against degrees rotation). Therefore, should there be even the smallest shift in the stability of the oscillator circuit, this can be compensated by slightly retuning the main dial so that a signal of known frequency will come in exactly at its proper spot on the band-spread dial calibration. Thus the signal from his own crystal controlled transmitter, or a harmonic from its oscillator, can be used to precisely line up the band-spread calibration by setting this dial for his exact frequency and then touching up the tuning on the main dial until the signal is tuned in "on the nose." The band-spread calibration will then be accurate throughout this particular range.

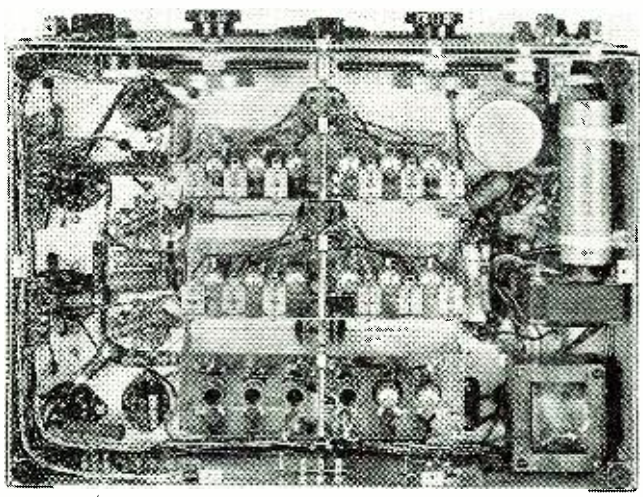
While there are a number of factors which influence oscillator stability, one of the most important is plate voltage changes which result from variations in the applied a.v.c. voltage with signals of different intensity. Thus a strong signal may bias the controlled tubes almost to the point where plate and screen current cuts off entirely, yet a weak signal drops the bias to the normal minimum value and the plate and screen current rise to full value. If there are three controlled tubes, these extreme conditions —and such extremes are commonly encountered—may result in a variation of as much as 30 to 40 ma. in the power supply load and a quite appreciable change in supply voltage even though inherent regulation may be of a relatively high order.

To overcome this the receiver under

(*Please QSY to page* 51)



Extreme care is taken to shield everything.



Short connections and grouped parts make for efficiency.

Seal of Acceptance

RADIO NEWS

ANNOUNCEMENT is made of the following RADIO NEWS Seal of Acceptance awards:

To: CONSOLIDATED WIRE & ASSOCIATED CORPS.
512 S. Peoria Street,
Chicago, Ill.

Awarded RADIO NEWS Seal of Acceptance No. 100.00

Product: Dynamic Conductance Tube Tester. Model 9000.

Claims Approved: Dynamic mutual conductance testing. Counter or portable use.

Compensates for line voltage variations between 90 and 130 volts. Makes hot cathode shorts and leakage tests. Tests all types of tubes—glass, metal and ballast. Tests pilot lights, Xmas tree bulbs. Has neon glow bulb leakage indicator. Highly sensitive meter which needs no special "Diode OK" marking. Simple fool-proof operation. Easy reading tube chart indicates tester settings. Test circuits isolated from power source. Built from excellent materials. Tests tubes under similar to operating conditions. Each section of multi-section tubes tested separately. Rectifier tubes tested under high alternating voltages.

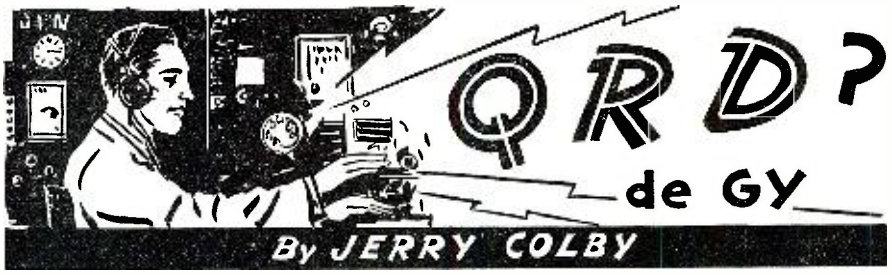
Applications, signed, on hand 18.

SEALS are awarded to those manufacturers whose products exactly measure up to the claims they make for them. The Seals are given out free as a service alike to the buyers and manufacturers. The former can purchase knowing that an impartial source has checked the product against claims made for it, while the latter has the opportunity of getting an unbiased opinion on the article.

For further information, write to the RADIO NEWS Seal of Acceptance Div. 608 S. Dearborn St., Chicago, Ill.

Hereafter each month this Division of the publication will carry a list of products on which Seals have been awarded.

—30—



WE liked the way a certain Uni-Fruitop requested information regarding a billet in the airways. He gave us his qualifications, which included five years batting a key on sea-going ships. Here's what we liked—quote—I have no intention of quitting my present job and seeking an airways berth unless I am thoroughly certain that I meet with all qualifications, not only of *obtaining* but of *retaining* such a position. . . . I wish to get the information that will enable me to attempt to master such prerequisites that I now probably lack. *There's no use of going into anything half-cocked as a fellow can't get away with much bluffing these days* . . . unquote. Now, there's a chap who knows the score and is willing to face facts. Not a bad idea for youse guys and gals to sort of give heed to these words, especially with new fields of radio science opening up every day . . . you've gotta know your stuff . . . or else.

* * *

ANOTHER gentleman genius shoots in an epistle bemoaning the fact that he has had an application filed with most of the major airline companies and so far nothing returns but memories of having written the letters. This radiop has splendid qualifications, good ability, etc., but nobody has ever seen an airlines personnel manager doing a somersault in ecstacy over the application of any radiop. As a matter of fact, if there's room in the file cabinet, the letter is inserted with thousands of other hopeful bon mots, but if no room, then it is filed in the one under his desk, the waste basket. Unless you can be more unique than your brethren in writing applications, such as different colored paper, different methods of delivering the letter, etc., your petition, regardless of your qualifications, is just another application.

* * *

SHUFFLING through the deck of mail, here's another: Red Gale (GL) flash from the Orient, short circuited his plans to go home and see how the mortgage was going. It's still there . . . on the roof . . . so Red's looking for a soft billet with the Airways. Here's how, Red. Write to the Dept. of Commerce for an application, and good luck.

* * *

SHIP owners received a setback from the representatives of organized radiops who testified before the FCC hearing as to the inadequacy of the 50 watt Xmtrs. Section 12 (c) of the *Ship Radiotelegraph Safety Rules of May 31, 1937*, provides for the installation of 200 watt xmtrs to further the safety of life at sea. But the ship owners were only worried about the extra cost for this new equipment, which is approximately $1,750 per vessel. F. Howe, of the *ARTA*, took the stand and exhibited printed forms which had been filled out by radiops on ships all over the world to prove that a 50 watt xmtr could not cover 200 miles during the daytime in many parts of the world. Said Howe, " . . . I do not believe the engineers of the commission are competent to say what a xmtr will do under all conditions and circumstances in all parts of the world. **The ops who work these sets are the only ones who know what they will do.**" The hearing closed with the FCC taking all the evidence under consideration.

THE ingenuity of former Ham ops Bob Brooke and Miv Adams, now NBC technicians, saved the day for a lot of firefighters during the three day, half billion dollar fire near Los Angeles. When they were cut off from each other by the flames, they signalled to each other from mountain tops two miles away, using ordinary flashlights.

* * *

WE were sure happy to note that Brother Pennywell is now the sole Owner, Captain, Radiop and Navigator of the Tunaclipper *Destiny*. Goes to prove that a good man must go up the success ladder. As an op on the TC Northwestern, AF saved every dime he could until he had enough money to buy his own boat. In the meantime he kept studying for his Skipper and Navigation tickets. And the *Destiny* is nothing to sneeze at! Just shows to go you what perseverance and the wherewithal can do for you. Good Luck, skipper, and good sailing, always.

* * *

DAN BROADHURST will be remembered by many of the oldtimers, having sailed the seven seas for the past thirteen years. He gave ye colyumist a few pointers in oratory whilst visiting Local 7 of the *ARTA*. His pet peeve, and it's a reasonable one, too, is whyinell don't shippers squawk when they see American oil being shipped to foreign countries in foreign bottoms. He insists there'd be a few less seamen on the beach and a few less radiops warming local chairs. Not a bad thought to give to your local representative. Dan knows his commercial setup, we'll say.

* * *

RADIOPS on one man, auto alarm equipped vessels will not be required to get up at 4 A.M. PST (1200GCT) mornings to send the usual wea msg. Instead, the WeaBu has changed this time to 10 P.M. PST (0600 GCT). This was the good news sent out by E. H. Bowie of the 'Frisco WeaBu.

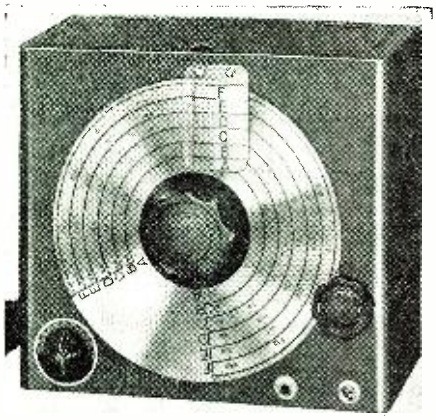
* * *

SEVENTY-NINE radiops employed on vessels of the Soconj will receive an approximate increase of $17,000 per year under an agreement which was worked out by the *ARTA* and the *Standard Oil Company of New Jersey*. Incidentally, this is the company that employs Hoyt Haddock, former President of the *ARTA*, as Labor Advisor. This agreement had been under consideration for more than a year, so that some of the men will receive back pay for the past six months. Vacations with pay, better living quarters and clerical allowance were a few added features to the wage increases.

* * *

WITH South America and Europe being focal points for important political and commercial news, CBS has just completed new directional antennae, W3XAU, near Philadelphia. The antennae are of the horizontal "V" type, with each leg of the "V" approximately 500 feet long and the radiating portion 110 feet high. It is stated that this 10KW Xmtr will give a signal to listeners in the area of the beams as great as though 100KW. Xmtr were pushing it. **This is the answer to European propaganda broadcasts directed to South American countries.**

(*Further QRD? on page* 60)



A large dial makes checking easy.

An Amateur's Freq-Meter

By IRVIN L. GLERUM
Chief Engineer, E. I. Guthman & Co.
Chicago, Illinois

A commercial frequency monitor with good accuracy, using any broadcast station as a standard.

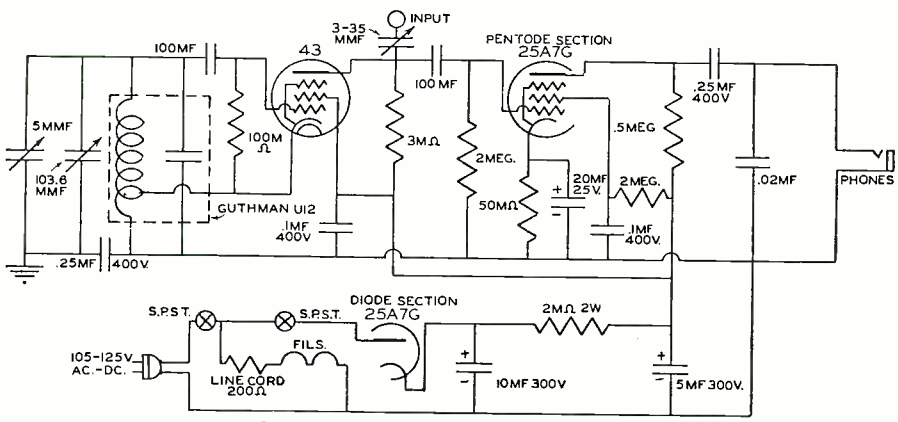
THE new Federal Communication Commission regulations for amateur stations, effective Dec. 1, 1938, have imposed a new and stringent requirement upon all their transmitters. Section 152.44 requires that every "amateur station shall provide for measurement of the transmitter frequency and establish procedure for checking it regularly." No longer may the use of an oscillator crystal of supposedly-known frequency in the transmitter satisfy the law, which specifically requires that the means of frequency measurement shall be independent of the transmitter itself. Separate frequency measuring apparatus is required to be available to every amateur licensee, and to be regularly used by him in measurement of his transmitting frequency.

Fundamentally, a frequency meter is a very stable and accurate oscillator against whose frequency an unknown, or to-be-measured frequency may be compared. The excellence of the frequency meter is therefore dependent upon the stability, accuracy, and readability of the instrument—to quickly summarize the numerous detailed requirements affecting its design. Two schools of thought exist with reference to frequency meters. The first attempts to build one or more frequency standards for calibration right into the instrument, while the second relies upon calibration of the frequency meter against standard frequency signals now available to any good receiver. Besides resulting in a simpler, and therefore more desirable instrument, the premise of the second school sems to be more sound technically. It is rather beyond the scope of the amateur to provide the primary frequency standard essential to really precise calibration and measurement, this being properly the job of the Bureau of Standards. With regular standard frequency transmissions available to every amateur from Bureau of Standards station WWV, accurate to one part in the 5,000,000 cycles of its 5,000 kc. transmissions, it is foolish for the amateur to try to duplicate such accuracy in building a calibration oscillator into his frequency meter. It is so much more simple, and much more accurate, to rely upon the Bureau of Standards for calibration signals. This is additionally apparent when it is realized that any attempt to build in a calibrated oscillator will require that its accuracy must be checked against such a primary frequency standard as WWV, and the actual frequency meter oscillator then compared against it. It is obviously simpler and more accurate to make not two checks, each yielding a small but possible error, but to check direct against the primary frequency standard of WWV. This is in the interest of the type of precise frequency measurement that enables safe transmitter location close to the edge of any amateur band, with the assurance that the transmitter so located will definitely be within band.

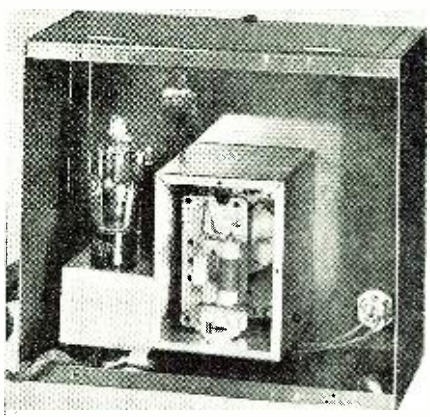
This frequency meter-monitor proceeds upon this technically sound premise and was designed by McMurdo Silver. But instead of depending upon only the one standard frequency station WWV, it can be checked to a very high order of accuracy upon twenty-two different frequencies available from over seventy stations. These many calibration-setting frequencies are, at the poorest, accurate to 6 parts in 850,000. They are provided by WWV and two additional standard frequency stations and by the broadcasting stations operating between 850 and 1030 kc. Required by law to maintain frequency to within 50 *cycles,* check of the logs of these stations as submitted to F.C.C. shows that their accuracy is better than 6 cycles against their assigned frequencies. Station WSUI, at Iowa City, Ia., for instance, has for four years past been within minus 1 cycle of its assigned frequency of 880 kc.

Upon the basis of a 1000 kc. broadcast signal accurate to 6 cycles, frequency meter accuracy when calibration is set against such a station is 12 *cycles* at 2,000 kc., increasing harmonically for the intervening amateur bands up to only 360 *cycles* at 60 mega-

(*Check further on page* 49)



Circuit diagram of the freq-monitor.



Coils are enclosed separately.

"SIRELA"
—A UNIVERSAL RADIO LANGUAGE

by E. STANTON BROWN
Associate Editor, RADIO NEWS

News of forthcoming Spatari programs and club activities is given this month and the new phase of the radio language introduced in the last issue is continued.

THE air is full of SIRELA, the Spatari Radio Language, this month. The first news that should be released is about the formation of the first Spatari Club. A group of radio fans in Seattle, Washington, have organized and have been meeting twice weekly. The promoters of the project hope that other clubs of like nature will be formed throughout the United States, and eventually throughout the world, thus making international communication comparatively easy. The group has not released complete information as yet, but will soon announce their future plans to help popularize Spatari, induce stations to broadcast in Spatari, and inform existing radio clubs of Spatari activities. Some of the groups cooperating on the use of SIRELA are: The International DX'ers Alliance, Bloomington, Ill.; National Radio club, Erie, Pa.; International Listener's Association, Dryden, Wash.; Jackson Short Wave League, Jackson, Mich.; and the International Short Wave club, East Liverpool, Ohio.

Second on the list of news items is an announcement of a number of DX programs to be broadcast in SIRELA during the month of January. Arranged through the cooperation of the International DX'ers Alliance, these programs will come from Canada, Cuba, and Guatemala. The programs are listed below, together with the SIRELA equivalents for the stations' call letters.

DOFABO—*CFAC* (930 kc., 322.4 m.) Calgary, Alberta, Canada. January 15th from 4:00 a.m. to 5:00 a.m. EST.

DODOFARE—*TG-1* (1310 kc., 228.9 m.) Guatemala City, Guatemala. January 21st from 3:00 a.m. to 4:00 a.m. EST.

DODOMISI—*TG-2* (6.19 meg., 48.47 m.) Guatemala City, Guatemala. January 21st from 3:00 a.m. to 4:00 a.m. EST.

DOSODOFA—*CMHJ* (1160 kc., 258.5 m.) Cienfuegos, Cuba. January 22nd from 2:00 a.m. to 6:00 a.m. EST.

DODOFARE—*TG-1* (1310 kc., 228.9 m.) Guatemala City, Guatemala. January 22nd from 3:00 a.m. to 4:00 a.m. EST.

DODOMISI—*TG-2* (6.19 meg., 48.47 m.) Guatemala City, Guatemala. January 22nd, 3:00 a.m. to 4:00 a.m. EST.

DOSODOMI—*CMHM* (1450 kc., 206.8 m.) Cienfuegos, Cuba. January 28th from 2:00 a.m. to 6:00 a.m. EST.

These programs will give you an excellent opportunity to receive the announcements in SIRELA and to send in your verification request cards in the Spatari Radio Language. All of the stations named will send Spatari veri's to those accurately verifying reception. Direct your communications to the stations at the following addresses:

CFAC, 1006 Southam Building, Calgary, Alberta, Canada.
TG-1 and *TG-2,* Julio Meza Caballeros, Director General of Electrical Communications, Guatemala City, Guatemala.
CMHJ, Calle Santa Cruz No. 94, Box 112, Cienfuegos, Cuba.
CMHM, Hotel Union, Cienfuegos, Cuba.

To facilitate the copying of SIRELA, Professor Spatari has devised the simple form illustrated on this page. While it is not necessary to use this form (the syllables may be copied down as you hear them), it does provide a reception sheet that is always ready and easy to use.

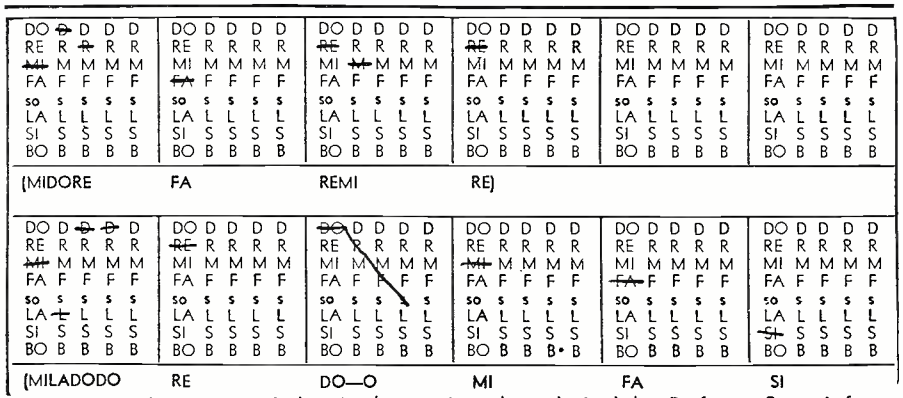
The copying chart is used in the following manner. Suppose that the combination **MIDORE FA REMI RE** is heard on the air. It would be copied in the manner illustrated in the first horizontal column of boxes illustrated. It is not necessary to use the vowels in copying since the vowel is understood by the consonant preceding it. To distinguish between SO and SI, write SO with a small "s" and SI with a capital S.

Only one syllable should be marked in each column and only one combination should be marked in one box. In the illustration the code words have been printed below each box merely to show the simplicity of copying in this manner. They do not appear on the copying chart itself. Comma, space, decimal point, and separation of proper names may be expressed by repeating the vowel in the last syllable of the combination preceding the punctuation mark. In such cases a diagonal line is drawn as shown in the accompanying illustration.

Those who are interested in securing copying charts may purchase them in pads of 125 sheets for sixty-five cents from the Spatari Language Foundation, 27-20 25th Avenue, Astoria, N. Y.

The code word groups for the General Program Data, which was begun last month, are continued on the next page. Unfortunately the columns cannot be given completely this month because of space limitations. Consequently, the upper halves of the MISO, MILA, and MISI columns are reproduced in this issue, and the lower halves will be given next month. The pages may then be clipped from the two issues and pasted together to form the complete columns. Also, because of lack of space, only reference Column A is given this month. Reference Column B will be given in the March issue of RADIO NEWS. This will then complete the pages for the General Program Data.

—30—



Above is shown part of the simple copying chart devised by Professor Spatari for taking down SIRELA broadcasts. A line is drawn through each syllable as it is spoken.

GENERAL PROGRAM DATA

(Continued From January Issue)

33
MISODO —PROGRAM AND SCHEDULE
MISODODO—This radio station will have a special program, and we invite the entire world to tune in from: (B
" " **RE**—This station will broadcast a special program for the benefit of: (A
" " **MI**—The broadcast is being arranged in cooperation with: (A
" " **FA**—The program will come to you through the courtesy of: (A
" " **SO**—The time for the broadcast will be from: (B
" " **LA**—This radio station will feature a Two-Way conversation with radio station:
" " **SI**—This radio station will broadcast the following complete program from: (B
" " **BO**—We keep no regular schedule but will appreciate reports on these transmissions.

34
MISORE —PROGRAM CONCLUSION
MISOREDO—This concludes our program but we will be on the air again at the usual time. This is radio station.
" " **RE**—This concludes our program but we will be on the air again from: (B
" " **MI**—We have just received an S. O. S. Please stand by this is station:
" " **FA**—This concludes our program but we will be on the air again every: (B
" " **SO**—This concludes our program but we will be on the air again tomorrow from: (B
" " **LA**—You have been listening to:
" " **SI**—Due to unavoidable circumstances we are forced to suspend our broadcast. This is station:
" " **BO**—This concludes our program but we will be on the air again tomorrow at the usual time. This is radio station:

35
MISOMI —PROGRAMS (present)
MISOMIDO—This program comes to you as a presentation of this radio station.
" " **RE**—This program has been arranged in cooperation with radio station:
" " **MI**—This broadcast has been arranged in cooperation with: (A
" " **FA**—This program comes to you through the courtesy of: (A
" " **SO**—This broadcast comes to you by courtesy of the sponsors of this program.
" " **LA**—We are now going to rebroadcast a program from radio station:
" " **SI**—Our associated stations for this broadcast are:
" " **BO**—We are now going to feature a two-way conversation with radio station:

36
MISOFA —SPECIAL PROGRAM (Present)
MISOFADO—This program is an anniversary feature in honor of the birth of a great man: (A
" " **RE**—This is a special program celebrating: (A
" " **MI**—This program is especially arranged for listeners of:
" " **FA**—This program is dedicated to: (A
" " **SO**—This program is in honor of: (A
" " **LA**—This program is sponsored by: (A
" " **SI**—This program comes to you as a presentation of the maker of: (A
" " **BO**—This program is in honor of Prof. Carlo Spatari, originator of the Spatari Radio Language.

41
MILADO —OPENING, REOPENING AND SOUVENIR
MILADODO—Greetings. We take great pleasure in presenting to you the opening program of this new radio station. The combination just heard is the Spatari Call Letters. Make complete record on Call Letter Section: (A
" " **RE**—Glad to be back on the air again with our reopening program. We operate on: (B
" " **MI**—Listeners who report this program will receive a: (D
" " **FA**—Many prizes will be forwarded to listeners who report this program.
" " **SO**—Listeners reporting this program will receive a picture of our station.
" " **LA**—Listeners who report this program will receive a souvenir.
" " **SI**—We are pleased to open this new station with Spatari broadcasts.
" " **BO**—Greetings. We are very glad to be back on the air again and present to you the reopening program. The combination just heard is the Spatari Call Letters. Make complete record of Call Letters Section: (A

42
MILARE —SPONSORSHIP AND PRESENTATION
MILAREDO—Please take notice that many short wave organizations have sponsored this system of communication and ask its members in all parts of the world to cooperate in order to have it used universally.
" " **RE**—At this time we bring to you a musical program presenting:
" " **MI**—This program will be heard again over this radio station from: (B
" " **FA**—At this time we bring to you:
" " **SO**—You have been listening to a talk given by: (A
" " **LA**—You have been listening to a musical program sponsored by: (A
" " **SI**—You have been listening to a program presenting:
" " **BO**—The opinion expressed by these speakers does not reflect the opinion of this station but is in line with the station's policy of presenting unbiased speakers and subjects. This is radio station:

43
MILAMI —PRESENTATION, REQUESTS FOR CRITICISM, CORRESPONDENCE AND DEDICATION OF SPATARI RADIO LANGUAGE
MILAMIDO—These messages come to you by means of the Spatari Radio Language, a new method of communication eliminating the problem of language.
" " **RE**—When communicating with us regarding these messages, verifications, questionnaire, etc., use the Spatari Radio Language.
" " **MI**—In order that we may check reception please let us hear from you.
" " **FA**—This program comes to you through the courtesy of the makers of: (A
" " **SO**—If you like this program write in care of this station or direct to sponsor.
" " **LA**—We will now present a program of news events.
" " **SI**—At this time we bring to you a talk by: (A
" " **BO**—The Spatari Radio Language Book is dedicated by its inventor to Mr. Arthur J. Green of East Liverpool, Ohio, U.S.A., for his pioneering organization work in behalf of short-wave broadcasting; and to the millions of DX'ERs and radio fans of all nationalities throughout the world.

49
MISIDO —CHANGE OF SCHEDULE
MISIDODO—This station's operating schedule is changed as follows: (B
" " **RE**—This station's change of schedule will be as follows: (B
" " **MI**—This station's operating schedule has been changed daily from: (B
" " **FA**—This station after this date will broadcast from: (B
" " **SO**—This radio station has changed its operation to 24 hours daily.
" " **LA**—The hours of this program will be changed from: (B
" " **SI**—Please change time for the program scheduled for: (B
" " **BO**—Please change time for the Spatari News broadcast to: (B

50
MISIRE —SCHEDULE AND CHANGES
MISIREDO—Spatari Radio Language broadcasts will be heard daily at: (B
" " **RE**—This station has no regular schedule as yet.
" " **MI**—This radio station operates 24 hours daily.
" " **FA**—Please take notice that the day of our program was changed to: (B
" " **SO**—Our schedule will be changed soon. New schedule will be announced from: (B
" " **LA**—Please change time zone after our call letter to read: (A
" " **SI**—Our schedule will be changed soon. New schedule will be announced later.
" " **BO**—No regular schedule is maintained by this station as all transmission at present is for test purpose only. Any change will be announced later. This is radio station:

51
MISIMI —SCHEDULE, CHANGE OF LOCATION
MISIMIDO—Please take notice of the change in time for our broadcast. We will be on the air from: (B
" " **RE**—Our broadcasts now originate from:
" " **MI**—Please change our previous announcement of: (B
" " **FA**—The mailing address of this station is: (A
" " **SO**—This station has changed its correspondence address to: (A
" " **LA**—This radio station has moved to the following location: (A
" " **SI**—Our new address will be: (A
" " **BO**—The transmitter location of this radio station has been changed to: (A

52
MISIFA —CALL LETTERS, SUSPENSION, CHANGE OF CALL LETTERS
MISIFADO—This radio station has changed its regular Call Letters to: (A
" " **RE**—This radio station has changed its Spatari Call Letters to:
" " **MI**—Note the following changes of identification: (A
" " **FA**—Besides regular identification we use the following signal:
" " **SO**—Our station call is: (A
" " **LA**—Due to atmospheric conditions we must suspend broadcasting.
" " **SI**—Circumstances beyond our control necessitate suspension of broadcasting for this period.
" " **BO**—The combination just heard is the Spatari Call Letters. Insert to the right of said combination, the following: (A

COLUMN A

DO—0 (th
RE—1 (first
MI—2 (second
FA—3 (third
SO—4 (fourth
LA—5 (fifth
SI—6 (sixth
BO—7 (seventh

DO —FREQUENCIES
DODO—8 (eighth
DORE—9 (ninth
DOMI—Frequency in kc.
DOFA—Frequency in mc.
DOSO—Kilocycles
DOLA—Megacycles
DOSI—Meters
DOBO—Watts

RE —ARTICLES, CALL LETTERS, ETC.
REDO—And (on, at, in)
RERE—From (for, with, is)
REMI—To (our, or, are)
REFA—Last (Days or Week)
RESO—Yesterday (at, on, in)
RELA—Our Spatari Call L. (are)
RESI—Our regular Call L. (are)
REBO—Refer to column B

MI —CHANGE, SCHEDULE, ANNOUNCER, LOCATION
MIDO—Change our:
MIRE—Schedule (for, of, on)
MIMI—This is our:
MIFA—Also (on, at, in)
MISO—Our location is:
MILA—Your announcer is:
MISI—Only, (on, at, in)
MIBO—Change time zone after C. L., to read: (A

FA —DAILY, DAYS OF WEEK
FADO—Daily (on, at, in)
FARE—Sunday (and)
FAMI—Monday (and)
FAFA—Tuesday (and)
FASO—Wednesday (and)
FALA—Thursday (and)
FASI—Friday (and)
FABO—Saturday (and)

SO —ALPHABET
SODO—A
SORE—B
SOMI—C
SOFA—D
SOSO—E
SOLA—F
SOSI—G
SOBO—H

LA —I
LADO—I
LARE—J
LAMI—K
LAFA—L
LASO—M
LALA—N
LASI—P **(for 0 use DO)**
LABO—Q

SI—R
SIDO—R
SIRE—S
SIMI—T
SIFA—U
SISO—V
SILA—W
SISI—X
SIBO—Y

BO —SPECIAL LETTERS
BODO—Z
BORE—Á
BOMI—Ä
BOFA—CH
BOSO—É
BOLA—Ñ
BOSI—Ö
BOBO—Ü

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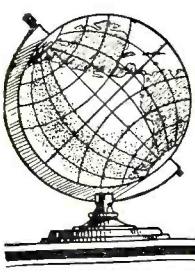
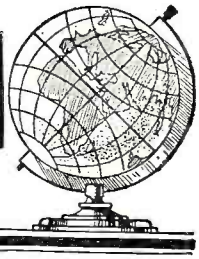


WORLD SHORT WAVE TIME-TABLE



Compiled by the Editors of RADIO NEWS

Hours of transmission for the World's Short Wave Broadcast Stations

HOURS OF TRANSMISSION

8 9 10 11 M 1 2 3 4 5 6 7

EASTERN STANDARD TIME

Wave-length Meters	Call Letters	Frequency Kc.	City Country
13.93	W8XK	21540	Pittsburgh, Pa.
13.93	GSJ	21530	Daventry, England
13.94	W2XE	21520	New York, N. Y.
13.95	W2XAD	21500	Schenectady, N. Y.
13.97	GSH	21470	Daventry, England
13.99	DJS	21450	Zeesen, Germany
15.77	HS8PJ	19020	Bangkok, Siam
16.86	GSG	17790	Daventry, England
16.87	JZL	17785	Nazaki, Japan
16.87	W3XL	17780	Bound Brook, N. J.
16.88	PHI2	17770	Huizen, Holland
16.89	DJE	17760	Zeesen, Germany
19.56	DJR	15340	Zeesen, Germany
19.57	W2XAD	15330	Schenectady, N. Y.
19.60	GSP	15310	Daventry, England
19.62	LRU	15290	Buenos Aires, Arg.
19.63	DJQ	15280	Zeesen, Germany
19.65	W2XE	15270	New York, N. Y.
19.66	GSI	15260	Daventry, England
19.68	TPA2	15243	Pontoise, France
19.71	PCJ2	15220	Huizen, Holland
19.72	W8XK	15210	Pittsburgh, Pa.
19.74	DJB	15200	Zeesen, Germany
19.76	GSO	15180	Daventry, England
19.79	JZK	15160	Nazaki, Japan
19.82	GSF	15140	Daventry, England
19.84	HVJ	15121	Vatican City
19.85	DJL	15110	Zeesen, Germany
19.88	RKI	15090	Moscow, U.S.S.R.
20.04	LZA	14970	Sofia, Bulgaria
20.08	PSE	14935	Rio de Janeiro, Brazil
20.64	HBJ	14535	Geneva, Switzerland
22.00	SPW	13635	Warsaw, Poland
24.52	TFJ	12235	Reykjavik, Iceland
25.00	RNE	12000	Moscow, U.S.S.R.
25.21	XEWI	11900	Mexico, D. F.
25.24	TPA3	11885	Pontoise, France
25.27	W8XK	11870	Pittsburgh, Pa.
25.29	GSE	11860	Daventry, England
25.34	OLR4A	11840	Podebrady, Czech.
25.36	W9XAA	11830	Chicago, Ill.
25.36	W2XE	11830	New York, N. Y.
25.40	2RO4	11810	Rome, Italy
25.42	DJZ	11801	Zeesen, Germany
25.42	JZJ	11800	Nazaki, Japan
25.45	W1XAL	11790	Boston, Mass.
25.49	DJD	11770	Zeesen, Germany
25.51	OLR4B	11760	Podebrady, Czech.
25.53	GSD	11750	Daventry, England
25.58	CJRX	11720	Winnipeg, Canada
25.60	TPA4	11718	Pontoise, France
25.60	CR7BH	11718	Lourenzo, Marques
25.63	SBP	11705	Motala, Sweden
25.64	HP5A	11700	Panama, Pana.
25.66	XTJ	11690	Hankow, China
26.01	SPD	11535	Warsaw, Poland
26.24	COCX	11435	Havana, Cuba
26.31	HBO	11402	Geneva, Switzerland
27.17	CSW	11040	Lisbon, Portugal
27.27	PLP	11000	Bandoeng, Java
29.04	ORK	10330	Ruysselede, Belgium
29.24	PMN	10260	Bandoeng, Java
29.35	PSH	10220	Rio de Janeiro, Brazil
30.43	EAQ	9860	Madrid, Spain
30.52	IRF	9830	Rome, Italy
30.81	CSW	9737	Lisbon, Portugal
31.02	W3XAL	9670	Bound Brook, N. J.
31.06	LRX	9660	Buenos Aires, Argentina
31.09	CS2WA	9650	Lisbon, Portugal
31.10	HH3W	9645	Port-au-Prince, Haiti
31.14	12RO3	9635	Rome, Italy
31.20	HJ1ABP	9616	Cartagena, Colombia
31.25	RAN	9600	Moscow, U.S.S.R.
31.28	VK6ME	9590	Perth, Australia
31.28	W3XAU	9590	Philadelphia, Pa.
31.28	VK2ME	9590	Sydney, Australia
31.28	PCJ	9590	Huizen, Holland
31.28	HP5J	9590	Panama City, Pana.
31.32	GSC	9580	Daventry, England
31.32	VKVLR	9580	Lyndhurst, Australia
31.35	W1XK	9570	Millis, Mass.
31.37	OAX4T	9562	Lima, Peru
31.38	DJA	9560	Zeesen, Germany
31.41	W2XAD	9550	Schenectady, N. Y.
31.42	OLR3A	9550	Podebrady, Czech.
31.42	XEFT	9550	Veracruz, Mexico
31.45	DJN	9540	Zeesen, Germany
31.48	W2XAF	9530	Schenectady, N. Y.
31.48	LKC	9530	Jeloy, Norway
31.49	ZBW3	9525	Hong Kong, China
31.51	OZF	9520	Skamlebak, Denmark
31.55	GSB	9510	Daventry, England
31.55	HJU	9510	Buenaventura, Colom.
31.55	VK3ME	9510	Melbourne, Australia

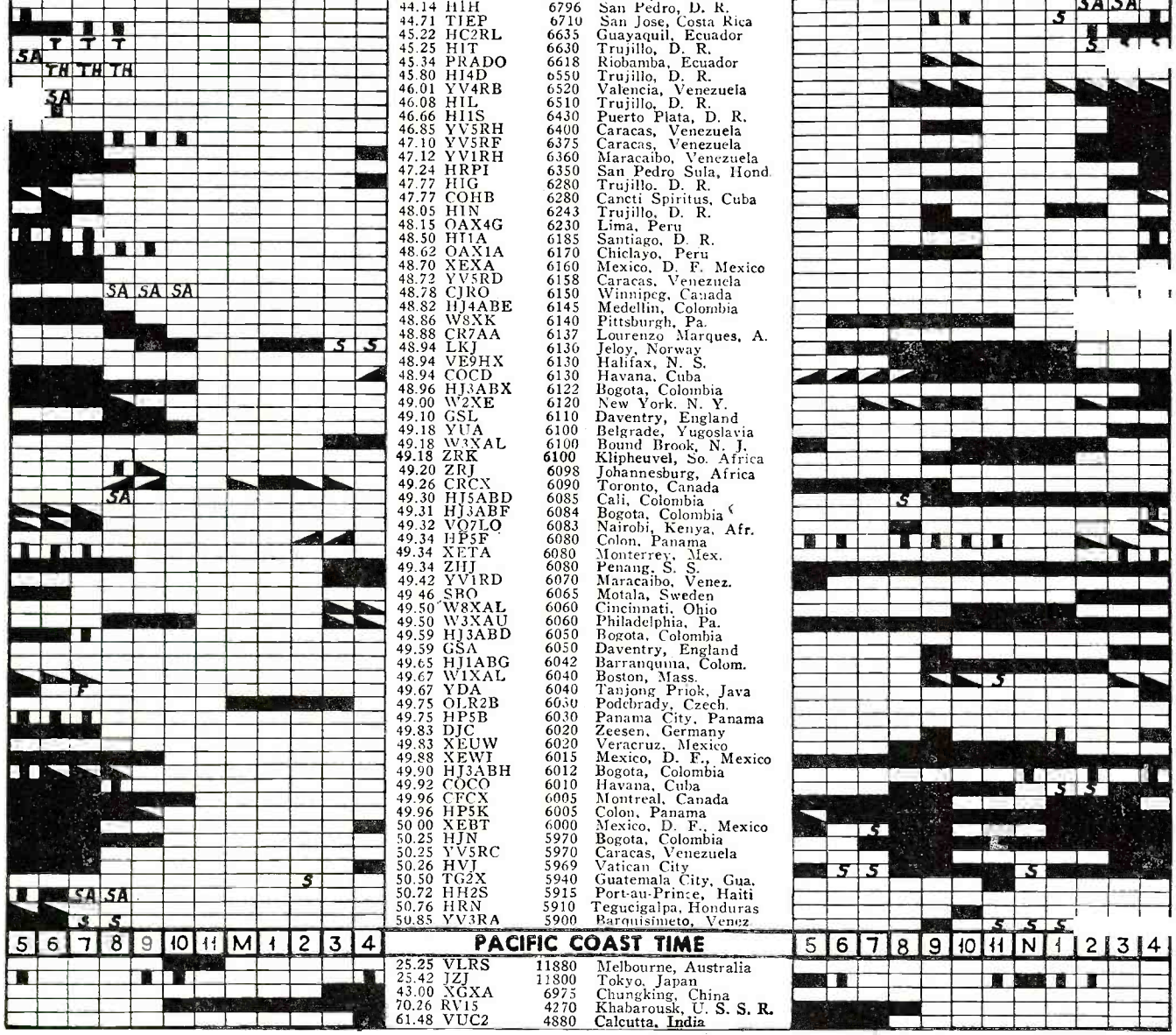
HOURS OF TRANSMISSION

8 9 10 11 N 1 2 3 4 5 6 7

WORLD SHORT WAVE TIME-TABLE

Compiled by the Editors of RADIO NEWS

Hours of transmission for the World's Short Wave Broadcast Stations



Wave-length Meters	Call Letters	Frequency Kc.	City Country
31.82	COCH	9428	Havana, Cuba
32.12	OAX4J	9330	Lima, Peru
33.32	COBZ	9030	Havana, Cuba
34.62	COJK	8665	Camaguey, Cuba
38.48	HBP	7797	Geneva, Switzerland
44.14	H1H	6796	San Pedro, D. R.
44.71	TIEP	6710	San Jose, Costa Rica
45.22	HC2RL	6635	Guayaquil, Ecuador
45.25	HIT	6630	Trujillo, D. R.
45.34	PRADO	6618	Riobamba, Ecuador
45.80	HI4D	6550	Trujillo, D. R.
46.01	YV4RB	6520	Valencia, Venezuela
46.08	HIL	6510	Trujillo, D. R.
46.66	HI1S	6430	Puerto Plata, D. R.
46.85	YV5RH	6400	Caracas, Venezuela
47.10	YV5RF	6375	Caracas, Venezuela
47.12	YV1RH	6360	Maracaibo, Venezuela
47.24	HRPI	6350	San Pedro Sula, Hond.
47.77	HIG	6280	Trujillo, D. R.
47.77	COHB	6280	Cancti Spiritus, Cuba
48.05	HIN	6243	Trujillo, D. R.
48.15	OAX4G	6230	Lima, Peru
48.50	HI1A	6185	Santiago, D. R.
48.62	OAX1A	6170	Chiclayo, Peru
48.70	XEXA	6160	Mexico, D. F. Mexico
48.72	YV5RD	6158	Caracas, Venezuela
48.78	CJRO	6150	Winnipeg, Canada
48.82	HJ4ABE	6145	Medellin, Colombia
48.86	W8XK	6140	Pittsburgh, Pa.
48.88	CR7AA	6137	Lourenzo Marques, A.
48.94	LKJ	6136	Jeloy, Norway
48.94	VE9HX	6130	Halifax, N. S.
48.94	COCD	6130	Havana, Cuba
48.96	HJ3ABX	6122	Bogota, Colombia
49.00	W2XE	6120	New York, N. Y.
49.10	GSL	6110	Daventry, England
49.18	YUA	6100	Belgrade, Yugoslavia
49.18	W3XAL	6100	Bound Brook, N. J.
49.18	ZRK	6100	Klipheuvel, So. Africa
49.20	ZRJ	6098	Johannesburg, Africa
49.26	CRCX	6090	Toronto, Canada
49.30	HJ5ABD	6085	Cali, Colombia
49.31	HJ3ABF	6084	Bogota, Colombia
49.32	VQ7LO	6083	Nairobi, Kenya, Afr.
49.34	HP5F	6080	Colon, Panama
49.34	XETA	6080	Monterrey, Mex.
49.34	ZHJ	6080	Penang, S. S.
49.42	YV1RD	6070	Maracaibo, Venez.
49 46	SBO	6065	Motala, Sweden
49.50	W8XAL	6060	Cincinnati, Ohio
49.50	W3XAU	6060	Philadelphia, Pa.
49.59	HJ3ABD	6050	Bogota, Colombia
49.59	GSA	6050	Daventry, England
49.65	HJ1ABG	6042	Barranquma, Colom.
49.67	W1XAL	6040	Boston, Mass.
49.67	YDA	6040	Tanjong Priok, Java
49.75	OLR2B	6030	Podebrady, Czech.
49.75	HP5B	6030	Panama City, Panama
49.83	DJC	6020	Zeesen, Germany
49.83	XEUW	6020	Veracruz, Mexico
49.88	XEWI	6015	Mexico, D. F., Mexico
49.90	HJ3ABH	6012	Bogota, Colombia
49.92	COCO	6010	Havana, Cuba
49.96	CFCX	6005	Montreal, Canada
49.96	HP5K	6005	Colon, Panama
50 00	XEBT	6000	Mexico, D. F., Mexico
50.25	HJN	5970	Bogota, Colombia
50.25	YV5RC	5970	Caracas, Venezuela
50.26	HVJ	5969	Vatican City
50.50	TG2X	5940	Guatemala City, Gua.
50.72	HH2S	5915	Port-au-Prince, Haiti
50.76	HRN	5910	Tegucigalpa, Honduras
50.85	YV3RA	5900	Barquisimeto, Venez
PACIFIC COAST TIME			
25.25	VLRS	11880	Melbourne, Australia
25.42	JZJ	11800	Tokyo, Japan
43.00	XGXA	6975	Chungking, China
70.26	RV15	4270	Khabarousk, U. S. S. R.
61.48	VUC2	4880	Calcutta, India

LIST OF SYMBOLS

S—Sunday

M—Monday

T—Tuesday

W—Wednesday

Th—Thursday

F—Friday

SA—Saturday

SS—Saturday, Sunday

—Daily

—Irregular

—Daily Except Sunday

—Daily Except Saturday, Sunday

SHORT WAVE FLASHES

BY CHARLES A. MORRISON

and JOHN D. CLARK

by CHARLES A. MORRISON

Frequency in megacycles *Time is Eastern Standard*

Short-Wave International Friendship Programs

SUNDAY, January 15, from 9 to 10 p.m. over OAX4J (9.34), of Lima, Peru.

Saturday, January 21, and Sunday, January 22, from 3 to 4 a.m., over TG2 (6.19), of Guatemala City, Guatemala (program will feature announcements in SIRELA).

Saturday, January 21. from 9 to 10 p.m., over HP5G (11.78), of Panama City, Panama.

17 Nations to Salute N. Y. World's Fair

Each Sunday, from 1:30 to 2 p.m., elaborate programs saluting the N. Y. World's Fair are being broadcast jointly by the *National Broadcasting Company*, the *Columbia Broadcasting System* and the *Mutual Broadcasting System*, and their affiliated short-wave outlets. Each broadcast features a short talk by the ruler, or outstanding figure of a foreign nation. The following short-wave pick-ups with principal speakers for each have been scheduled:

Jan. 15—Denmark: King Christian X;

Jan. 22—Netherlands: Queen Wilhelmina;

Jan. 29—Russia;

Feb. 5—Canada: Governor General Lord Tweedsmuir;

Feb. 12—Rumania: King Carol;

Feb. 19—Norway: King Haakon;

Feb. 26—Belgium: King Leopold III;

March 5—Yugoslavia: Prince Paul, regent;

March 19—Hungary: Admiral Nicholas Horthy, regent;

March 26—Poland: President Ignatz Moscicki;

April 2—Japan: Prince Yasuhito Chichibu;

April 9—Sweden: King Gustav V or Crown Prince Gustav Adolf;

April 16—Brazil: President Getulio Vargas, and

April 23—Great Britain: Sir Louis Beale, Commissioner General to the Fair, and others.

Short-Wave Broadcasts to South America Intensified

For years the propaganda stuffed broadcasts radiated by the powerful short-wave stations of Germany and Italy completely dominated the dials of all short-wave receivers in South America, but since the advent of United States short-wave broadcasters into this highly competitive field the picture has changed. *The National Broadcasting System* is intensifying its coverage of Latin America by the installation of new short-wave antennas that will swing radio beams over South America like rays of a powerful searchlight at the mere touch of a button. Programs for Latin listeners are now being broadcast 16 hours each day. An even more powerful impetus will be given to our international broadcasts with the official inauguration of *General Electric's* new 100,000 watt super-power short-wave station at Schenectady, New York, and the opening of its new 20.000 watt Pacific coast station, W6XBE, on Treasure Island in San Francisco Bay. *The Columbia Broadcasting System* is also expanding its international facilities by combining the services of W2XE in New York, and W3XAU in Philadelphia, in such a way that it can direct its short-wave broadcasts to South America and Europe at the same time.

New Short-Wave Stations

(On the Air)

ALBANIA—A 3,000 watt short-wave station has been opened in Albania. The studios are in the Tirana City Hall, the transmitter in a new building near Tirana. The following frequencies have been allotted the station: 7.487. 9.9875, and 15.765; the latter being used for occasional broadcasts to America.

CANADA—Ray Shaffar of Waterloo, Iowa. reports CFBT (6.03), heard testing at 2 a.m. This may be a new call for VE9CA.

CHINA—Ashley Walcott of San Francisco, Calif., writes that XGSA (7), announcing as the Kweiyang Broadcasting Station, Kweichow Province, China, is operating daily from 6:30 to 7:30 p.m., 1 to 2 and 8 to 10:10 a.m. Announcements in English are made every quarter hour, while the news in English is given at 9 a.m. Both men and women announcers are employed.

XOZ (15.51), and XOY (9.37), both of Chengtu, West China, are broadcasting news in English, for Europe and the United States respectively, from 9:45 to 10:30 a.m.

FINLAND—New calls and frequencies that have been assigned to the transmitter at Lahti, Finland, are as follows: OII (21.55), OIH (17.8) and OIE (15.19).

GUATEMALA—R. B. Oxrieder of Corozal, Canal Zone, reports hearing a partially unidentified station whose call started with TG ——, on a frequency of 11.704, near noon.

PANAMA—HOA, the first station in the newly assigned Panama Tropical Band, is relaying HP5G nightly from 8 to 10 p.m., on a frequency of 2.34.

PERU—OAX2A (11.85), power 250 watts, owned by Rafael Larco H. Hoyle of Hacienda Chiclin, Trujillo, Peru, is on the air and has been heard testing near noon.

SPAIN—According to a letter of verification received by Roger Legge of Binghamton, New York, RR6 (11.991), *Radio Requete*, Postas 19, Vitoria, power 450 watts, is operating as follows: daily from 4 to 4:30, 8 to 10 a.m., 1 to 1:30 p.m., 1:30 to 2 p.m. in French and English, 4 to 7 p.m., and every Wednesday and Saturday from 8:30 to 9 p.m. for Spanish America in Spanish, but soon to be in both Spanish and English.

UNITED STATES—W2XQO (26.55), the Knickerbocker Broadcasting Co. of Flushing, New York, has been granted a license for the operation of a 100 watt station. W6XBE, the first short-wave station in the U. S. A. west of the Mississippi River, will be erected on Treasure Island, site of San Francisco's world's fair, and will be in readiness for operation with the opening of the fair the middle of February. This 20,000 watt *General Electric* transmitter will operate on 9.53, and 15.33, sharing time with W2XAF and W2XAD in Schenectady, New York. Hours of operation will be daily from midnight to 6 a.m.. which will afford evening reception in the orient. W9XA (26.45), the Commercial Radio Equipment Co. of Kansas City, Missouri, relays KITE; has a short-wave mail bag program daily from noon to 12:15 p.m. Those reporting reception will receive a valuable booklet giving data on W9XA and other ultra-high frequency stations.

Notes of Interest

BERMUDA—ZFB (10.05), Hamilton, may be heard working British ships near noon, 5, and 7 p.m. irregularly.

CHINA—XGX (9.09) has been off the air since the fall of Hankow. . . . An unidentified station announcing as "The Voice of China," being heard on a frequency of approximately 11.38, from 8 to 8:35 a.m., may be XTJ of Hankow which formerly operated on 11.69.

COLOMBIA—HJ1ABB of Barranquilla, is being heard on dual frequencies of 4.875 and 8.

D. R.—HIN, HI1X and HIZ sometimes work as a network after 7:40 p.m.

EGYPT—According to Warren Stark of Wauwatosa. Wisconsin, SUZ (13.82), Cairo, often works GBB2 (13.595) after 3 a.m.

ETHIOPIA—ETA (18.27), Addis Abara, is being heard irregularly between 4 and 5 a.m.

FRANCE—A weird three-tone whistle and a peculiar background hum are characteristic marks of identification for most of the French commercial phone stations. . . .

INDIA—VUD2 (9.59), Delhi, has been excellent of late near 8 a.m., sometimes reaching a good R8 to 9. . . . QSL cards are being prepared for use of All-India Radio's short-wave stations in confirming reports of reception.

JAMAICA—VRR4 (11.595), Stony Hill, often works WNC (15.055), Hialeah, Florida, near 6 to 6:15 p.m.

JAPAN—For verification purposes JZK is now issuing a new QSL card picturing the Diet Building, and a pagoda in Uyeno Park.

MACAO—The mysterious transmitter whose call starts with CR9 which is being heard about one day a month between the hours of 9 and 10 a.m. is believed by some to be CQN with a new call.

MARTINIQUE—*Radio Fort-de-France* (9.7), has been boosted in power to 1,600 watts.

MEXICO—XETA (6.08), Monterrey, is being heard irregularly evenings to 10:30 p.m.

PERU—OAX1A (6.334), Chiclayo, signs-off at 11 p.m. with the Goodnight Song.

SPAIN—*Radio National*, Burgos, usually in the vicinity of 10.37, is being heard nightly to 9:30 p.m. . . .

U. S. S. R.—ROU (14.79), Omsk, heard testing with musical recordings and contacting Moscow at 11:30 to 11:55 p.m. RIR (10.08), Tiflis, can be heard nightly near 1 a.m. RIS (13.74), may often be heard working Moscow in clear speech near 5:20 to 6 a.m.

UNITED STATES—The Amers of Pomona, Calif., inform me that the owners of WXA (9.74), of Seattle, advise that it is against their policy to issue verifications. WXE (12.25), of Anchorage, Alaska, part of the same aircraft network, verifies. W2XAA (8.655 or 12.8625), owned by the Bell Telephone Company of Chicago, Illinois, may be heard testing irregularly throughout the day with phonograph recordings. The following new frequencies have been granted to W8XAL of Cincinnati: 21.65, 17.76, 15.27, 11.87 and 9.59. Power is to be increased to 50,000 watts. KSET (2.6), Lake Bluff, Illinois, may be heard intermittently throughout the evenings handling shore to ship telephone traffic.

YUGOSLAVIA—Listeners sending reports to YUA (6.1). Belgrade, are put on that station's mailing list for weekly advance program bulletins which also contain scenic photos.

Special Transmission of Interest

Daily—at 4 p.m., news in English, over TPB11 (9.55) of Paris, France; from 7 to 7:30 p.m., *Radio Newspaper*, edited by George Williams, over HP5J (9.59) of Panama City, and over HP5F (6.08) of Colon, Panama; 7 to 8 p.m., North American broadcast, over HAT4 (9.12) of Budapest, Hungary; 9:15 to 10:15 p.m., broadcasts in French, over RAN (9.6) of Moscow, U. S. S. R.

Week-Days—noon to 12:15, and 5 to 5:15 p.m., short-wave mail bag, over W9XA (26.45) of Kansas City, Missouri.

Week-Days except Saturdays—at 4:55 p.m., URSIgram broadcasts of scientific data, over W1XAL (11.79) of Boston, Mass.

Sundays—1 to 3 a.m., special dx program, over Guatemalan stations TG2 (6.19), TGQA (6.4) and TG3 (2.34).

Mondays—8 to 9 p.m., *Modern Radio* course, over W1XAL (6.04) of Boston, Mass.

Mondays and Fridays—at 4:15 p.m., and *Tuesdays and Wednesdays*—at 2 p.m., international educational programs, over W2XAD (15.33), and W2XAF (9.53), of Schenectady, N. Y.

Wednesdays—7 to 7:30 p.m., program for North America, over ZIZ (6.384) of St. Kitts, B.W.I.

Fridays—11 to 11:30 p.m., English hour, over XEXA (6.172) of Mexico City.

Revised Schedules

BELGIUM—ORK (10.33), Ruysselede, now operating daily 1:30 to 3 p.m., beamed on the Belgian Congo.

FRANCE—the Government Short-Wave Stations are now operating as follows: over TPB3 (17.81), from 9:30 to 11 a.m. for the Far East; over TPB6 (15.13), from 7 to 9:15 p.m. for South America; over TPA2 (15.243), 6 to 11 a.m. for Far East; TPA3 (11.885), 2 to 5 a.m. for Africa, and from 11:15 a.m. to 6 p.m. for Africa; TPB7 (11.885), 9:30 p.m. to midnight, for North America; TPA4 (11.718), 7 to 9:15, and 9:30 p.m. to midnight, for America, and TPB11 (9.55), 2 to 5 a.m. for Africa, and 11:15 a.m. to 7 p.m. for Africa.

INDIA—VUD3 (15.16), Delhi, now operating nightly 9:30 to 11:30 p.m.

SWEDEN—SBP (11.705), of Motala, is now operating weekdays from 1 to 4:15 p.m. and on Sundays from 1:15 to 4:15 p.m., and on Wednesdays and Saturdays from 8 to 9 p.m. for North America.

SWITZERLAND—The revised schedule for *Radio Nations* is as follows: Sundays, 10:45 to 11:30 a.m. for India, over HBJ (14.535); 1:45 to 2:30 p.m., for Africa and Europe, over HBO (11.4) and HBQ (6.675); 2:30 to 2:45 p.m. for Europe, over HBQ; 7 to 7:45 p.m., for North America, over HBL (9.345) and 8 to 8:45 p.m.. for South America, over HBL; Mondays, 3:30 to 3:45 a.m., over HBO (11.4) and from 4 to 4:15 a.m. over HBJ, and from 6:50 to 8:15 p.m., for North America, over HBL (9.345) and HBP (7.797).

Frequency Changes

(*Tune to page 45, please*)

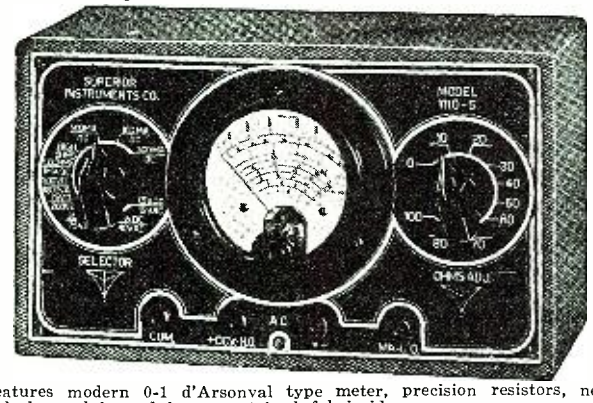
SUPERIOR PRESENTS 5 INSTRUMENTS

from its NEW 1100 series!!!!! Never before has Superior offered so much for so little! Always the Best Buy in the Instrument Field, Superior in this new 1100 series gives you even more value! We have incorporated many refinements, many new features . . . all proven to be sound and practical. We urge you to read the descriptions below carefully; see how these instruments fit your needs. Buy direct from manufacturer and save 50%.

SUPERIOR INSTRUMENTS ARE GUARANTEED FOR ONE YEAR

THE NEW MODEL 1110-S
A.C. - D.C. VOLT OHM MILLIAMMETER

A Midget in Size—A Giant in Performance



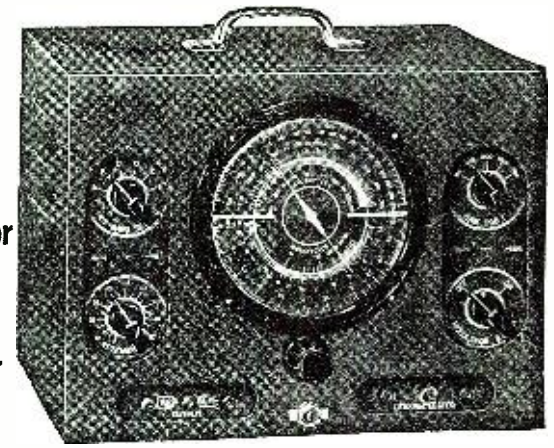
Features modern 0-1 d'Arsonval type meter, precision resistors, neat etched panel housed in new striped fabricoid case.

SPECIFICATIONS:

0-1.5 volts	D.C.	0-500 ohms.....500-500,000 ohms.		0-15 volts	A.C.
0-15 volts	D.C.	0-1	ma. D.C.	0-40 volts	A.C.
0-25 volts	D.C.	0-10	ma. D.C.	0-75 volts	A.C.
0-75 volts	D.C.	0-100	ma. D.C.	0-200 volts	A.C.
0-500 volts	D.C.	0-500	ma. D.C.	0-1200 volts	A.C.

Model 1110-S supplied complete with batteries, test leads and instructions. Size: 8½" x 5" x 3¼". Shipping weight, 5½ pounds. Our net price..... **$7.85**

THE NEW MODEL 1130-S
Signal Generator with Audio Frequencies



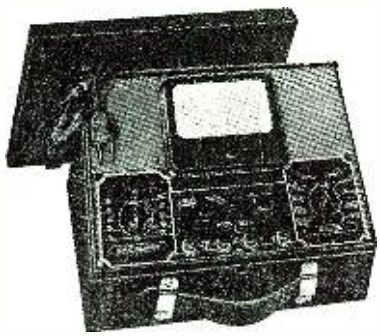
SPECIFICATIONS:

1. Combination R.F. and Audio Signal Generator, R.F. 100 kc. to 100 Mc., A.F.—100-7,500 cycles. All Direct reading, all by front panel switching. 2. R.F. and A.F. output independently obtainable alone or with A.F. (any frequency) modulating R.F. 3. Accuracy is within 1% on I.F. and Broadcast bands; 2½ on higher frequencies. 4. Audio frequencies in 5 bands; 100, 400, 1000, 5000, and 7500 cycles. 5. Giant airplane full vision, direct-reading dial. 6. Condenser and other leakages tested to 100 megohms. 7. All services on 90-130 volts A.C. or D.C. (any frequency).

Model 1130-S comes complete with tubes, test leads, carrying handle, instructions. Size 12" x 9" x 6½". Shipping weight 15 pounds. Our net price..... **$11.85**

THE NEW MODEL 1150-S
SUPER-ALLMETER

Featuring the New Sloping Panel



A genuine achievement! For accurate and rapid measurements. Note the following features: A.C. and D.C. Volts. A.C. and D.C. currents. Resistance. Capacity. Inductance. Decibels. Watts.

SPECIFICATIONS:

D.C. Voltage: 0-15, 0-150, 0-750 volts D.C.
A.C. Voltage: 0-15, 0-150, 0-750 volts A.C.
D.C. Current: 0-1, 0-15, 0-150, 0-750 ma. D.C.
A.C. Current: 0-15, 0-150, 0-750 ma. A.C.
2 Resistance Ranges: 0-500 ohms
500-5 megohms
High and Low Capacity Scales: .0005 to 1 mfd. and .05 to 200 mfd.
3 Decibel Ranges: −10 to +19, −10 to +38, −10 to +53.
Inductance: 1 to 700 Henries
Watts:
Based on 6 mw. at 0 D.B. in 500 ohms. .006000 to 600
Utilizes new 4½" square 0-1 d'Arsonval type meter with precision resistors housed in our newly devised sloping case for rapid and accurate servicing.

Model 1150-S supplied complete with test leads, tabular charts and instructions. Size 10" x 7¼" x 4¼", shipping weight 9 pounds. Our net price **$11.85**
Model 1150-A Portable carrying cover 75c additional.

THE NEW MODEL 1180-S
SET TESTER

A Complete Laboratory All in One Unit!

Featuring Our New Type Sloping Panel for Precise and Rapid Servicing

A complete testing laboratory all in one unit! Combines Superior models 1140-S and 1150-S. For specifications read the description of both these models herewith. Comes housed in sturdy, black case with sloping panel for rapid and simple measurements. Complete with test leads, tabular charts, instructions and tabular data for every known receiving type tube, including many transmitting types. Size 11¼" x 9¼" x 5"; shipping weight 18 pounds . . . Our net price **$17.85**

Model 1180-A for Portable Cover, add 95c.

THE NEW MODEL 1140-S
TUBE TESTER

A really modern tube tester conforming to all standards of good engineering practice. Utilizes a 3" d'Arsonval type meter with calibrated scale. Furnished in a sturdy black case with sloping panel for easy operation. Removable cover and carrying handle for either portable or counter use.

SPECIFICATIONS:

1. Tests all 4, 5, 6, 7, 7L, and octal base tubes, including diodes.
2. Tests by the well-established emission method for tube quality, directly read on the GOOD? BAD scale of the meter.
3. Affords separate neon test for leakage and shorts between elements.
4. All services performed by the use of only five controls at maximum, and many tests do not require working all the controls.
5. Supplied with instructions and reference table so that the filament voltage and emission measuring controls may be properly set for the enumerated long list of tubes, which includes all tubes commonly encountered in servicing.
6. Works on 90-120 volts A.C. 60 cycle.

Model 1140-S comes complete with instructions and tabular data for every known receiving type of tube as well as many transmitting types. Shipping weight 10 pounds, size 10" x 7¼" x 4½". Our net price **$10.85**
Model 1140-A with Portable Cover ..... 75c additional

SUPERIOR INSTRUMENTS CO.

136 Liberty St., NEW YORK, N. Y. RN-2

Radio Airplane Model
(*Continued from page* 12)

ratchet is not available, several heavy wires or pins may be soldered to the metal arm which will prevent it from being run backwards. If a mistake is made, the pins dig into the wood and stop the rotation. Four contacts, connected in parallel, are mounted on the board between the quadrants so that the handle will brush over them as it is turned from quadrant to quadrant. Keying line to the transmitter is connected to the handle and the four contacts. The "control stick" setting should be checked with the position of rudder before each flight, i.e., when rudder is neutral and next position is right, be sure control stick is set at neutral with next position indicating a right turn.

In order to simulate actual flying conditions of a plane, that is, in order to instantaneously turn the rudder right or left a desired amount another radio channel will have to be added which will reverse the control motor. Reversible control motors which will operate on 1½ to 3 volts are not difficult to obtain. The one we used was a *Varney* locomotive motor which is sold with *Varney* model locomotive kits. It has a permanent field magnet so that it can be instantly reversed by reversing the polarity of the battery. A separate battery in conjunction with the second radio channel and relay is the most satisfactory method for reversing this motor. The auto radio industry has provided a neat little tuning motor which will do the job admirably and it has a separate winding on its field for reversing purposes thus eliminating a second battery. The reduction of weight is questionable as it requires 3 and preferably 4½ volts to operate reliably. Utah Radio Products Company of Chicago is one of the manufacturers who build this type of motor and it weighs six ounces, about the same as the *Varney* used in our experiments.

The gear box shown is easy to build but the design details are left to the individual because nearly everyone has an alarm clock that can be junked for gears and the most fun of this business is to design your own equipment. The gear ratio is not important as long as the motor is geared down so that plenty of power for turning the rudder is available. With the *Varney* motor any ratio of from 80 to 150 to one is excellent with 1½ volts of battery. Care must be exercised in laying out the gear box because unnecessary friction or binding will either make the device inoperative or it will require three volts to operate it reliably. Build everything as well and as lightly as possible. Use aluminum every place metal is necessary and lock washers under all nuts and screws. Vibration of the little gas engine can shake everything loose before the plane is off the ground if precautions are not taken.

The energy expended in building an electrical stop system is justified even with a two channel reversible system because it insures that the controls are either stopped at the extreme of their movement (right or left) or at neutral. When an airplane is in trouble it is always best to have the controls in neutral, that is for flying straight ahead and on an even keel.

Control tabs should be rather small. On our ship a tab nine inches long and two inches wide at the bottom and tapered to a point at the top was plenty when turned ten to fifteen degrees. The stabilizer has an area of 116 square inches. A larger rudder tab would lead to overcontrolling and probably a crackup. Unless an obstruction is in the path, it is best not to try to turn the plane until it has sufficient altitude so that it can regain its stability if flying speed is lost. Probably this altitude should be set at a hundred feet or more for initial flights. Low altitude turns are more safely made *against the torque* of the motor and propeller because the plane will be less likely to spin. It is even recommended that the neutral position of the rudder tab be set so as to counteract the torque even to the extent that the plane will execute counter torque turns of large radius.[4]

A radio control transmitter does not differ from conventional ham rigs except that operation may be necessary on several frequencies if two or more receivers are installed in the model. Electron coupled oscillators, or crystal oscillators on 14 mc. with outputs doubling to 28 mc. and driving a doubler on 56 mc. will be very satisfactory for a radio control transmitter. The power output need not be very great, but depends upon how far away positive control of the model will be necessary. Two to five watts is enough for most work, but this depends upon how sensitive the receiver is.

Everything should be taken into account in order to make the one tube receiver work properly. Variations in individual tubes and circuit constants make it more than a cut and dried proposition, but even a type 30 tube can be made to work though it may be necessary to select it from an assortment. Out of six 30's that I tried, only one had the necessary plate shift to operate the relay reliably. Even with the RK62, it may be necessary to adjust the plate voltage as well as antenna length and coupling, grid leak and plate bypass condenser.

When the RK62 is operating correctly, it will produce audio as well as rush frequency oscillations until a signal is received. The gas will be ionized and plate current high. The Raytheon Production Corp. recommends a variable series resistance in the plate circuit of the RK62 to limit the plate current to the conservative maximum value of 1.5 ma. It is more economical from the weight standpoint to tap the "B" lead down on the "B" battery cells until the maximum recommended current value is reached and then remove the unnecessary cells. Some value between 30 to 45 volts will be best for a given value of plate resistor and bypass.

The maximum plate current may be increased by increasing the value of the plate bypass, decreasing the value of the plate resistor, or both. The average plate to filament voltage drop of the tube (plate resistance) may be reduced by decreasing the L/C ratio of the tank circuit, increasing the antenna coupling or length, or both.[5] Thus there are a number of variables and all are related; change one and then adjust the others for maximum performance. This may appear to be a lot of trouble, and to some an almost hopeless task, but it really isn't very difficult.

A pair of head phones, a 0 to 5 milliameter, and a high resistance voltmeter are all the test equipment necessary to get a receiver in operating condition and keep it that way. Plate current of the detector normally should be about 1.7 ma. (slightly above rating but gives better sensitivity) without signal and with a local signal it should be about .5 ma. A distant signal (from anticipated maximum range of operation) should shift the plate current at least .8 ma.

It is best to make final adjustments in the open and under as nearly actual flying conditions as possible. The tuning and general operation of the equipment should be checked before each flight. Having pin jacks mounted on the side of the fuselage for inserting a milliameter in the plate circuit will facilitate tests. Mount the filament switch and a switch to open the battery circuit of the control motor near the pin jacks. Fountain pen type flashlight cells may be used for filament and motor control if they are replaced frequently. All testing should be done with external batteries for economy's sake.

The battery manufacturers have been on their toes the past few years and have developed all sorts of light batteries for experimental and scientific purposes. The fact that these batteries are available is probably the contributing factor making radio control of model aircraft possible. A 2 oz. 45 v. battery X 180, not much larger than a flashlight cell and having a useful life of about two hours may be obtained direct from the National Carbon Co. Burgess has an 8½ oz. 45 v. battery designated as W30FL. This battery will give much longer service and is recommended if the weight can be carried. Three volt ignition batteries are available to gas model fans, but they weigh slightly more than two large flashlight cells and do not seem to give longer service. Bright Star flashlight cells seem to be better than other makes for ignition, motor, and filament power. –30–

[4] *Model Aeronautics Yearbook for 1938*, Model Aeronautics Publications, 83 East 10 St., New York City.

[5] Raytheon Engineering Service Bulletin, #CS1663 for RK62 Tube De Soto, *Radio Control of Power Models*, QST, Vol. 22, No. 10, October, 1938.

Shortwave Flashes

(Continued from page 42)

CUBA—COBC to 9.98. COCD to 6.135. COJK, Camaguey, to 6.688.

CHILE—CB1180, Santiago, to 11.95.

DOMINICAN REPUBLIC—HIZ to 6.315.

ECUADOR—HC1GQ, Quito, to 9:18; now signing-off at 10:30 p.m. HC2CW, Guayaquil, now variable near 9.06.

EL SALVADOR—YSP, San Salvador, varying from as low as 10.36 to as high as 10.41 is usually in the vicinity of 10.4.

HONDURAS—HRP1, San Pedro Sula, has shifted slightly to 6.36.

ITALY—IQY, Rome to 11.68.

PANAMA—HP5F, Colon, being heard irregularly on new frequency of 6.137. HP5J, Panama City, still highly variable, is now in the vicinity of 9.61.

U. S. S. R.—RV96, Moscow to 15.27

Data

ANGOLA—The following stations are in operation in Angola: CR6AA (7.174 and 7.615), Lobito; CR6RS (14.269), Lobito, 40 watts, and CR6RC (11.79), 50 watts, owned by the Radio Club of Angola, Luanda, which may soon receive a power increase to 5,000 watts.

AUSTRALIA—VLR3, Melbourne, is operating on 11.88, daily from 3:30 p.m. to 3 a.m.

CANADA—CHNX (6.13), Halifax, operates weekdays from 7 a.m. to 10:15 p.m. and on Sundays from 12:15 to 10 p.m.

CHILE—CB970 (9.73), power 1,000 watts, owned by the Sociedad *La Cooperative Vitalicia*, in Valpariso, operates nightly from 6:30 to 11:30 p.m., or midnight. Interval signal is a chorus of "Anchors Aweigh."

COLOMBIA—Many changes have taken place in the calls and frequencies of short-wave stations in Colombia. The following list presents what is believed to be a fairly accurate picture of the stations actually in operation at present.

HJ6ABB	6.103	Manizales
HJ1ABG	6.050	Barranquilla
HJ3CAX	6.012	Bogota, formerly HJ3ABX, relays HJ3CAZ
HJ6ABU	5.880	
HJ3CAH	4.895	Bogota, formerly HJ3ABH, relays HJ3CAI
HJ7EAH	4.890	Bucaramanga
HJ4ABP	4.880	Medellin
HJ6FAH	4.870	Armenia, formerly HJ6ABH
HJ2BAJ	4.860	Santa Marta, formerly HJ2ABJ
HJ1ABZ	4.860	
HJ3CAF	4.850	Bogota, formerly HJ3ABF
HJ3CAB	4.840	Bogota, formerly HJ3ABD
HJ1ABE	4.830	Cartagena
HJ5ABD	4.820	Cali
HJ2BAC	4.810	Cucuta, formerly HJ2ABC
HJ6FAC	4.790	Ibaque, formerly HJ6ABC
HJ1ABB	4.785	Barranquilla
HJ7GAB	4.775	Bucaramanga, formerly HJ7ABD
HJ7ABB	4.760	Bucaramanga

COSTA RICA—TILS (5.9), *Radio Pirati*, uses the organ solo "Donkey Serenade," as an interval theme.

CUBA—CGBZ (9.02), Havana, has a new photographic QSL card picturing views of its studios and transmitter.

DOMINICAN REPUBLIC—HIH (6.775), *La Voz de Higuamo*, San Pedro, signs-off at 8:30 p.m. with English announcements and the National Anthem. HI5G (6.66), now at Isabel la Catolica (Altos), Trujillo City, relays HI6Y. HI5N (6.15), Moca City, is off the air, but operating as amateur HI9U on the 20 and 40 meter bands. HI9T (6.12), San Cristobal, formerly HI6H (6.6) of Trujillo City, is operating daily near 3 and 6 v.m.

EL SALVADOR—YSP (10.4), *La Voz de Cuscatlan*, owned by Fernando Albayeros Sosa of San Salvador, relays broadcast station YSP, daily from 1 to 3 and from 6:30 to 11 p.m. The QSL card is light blue.

GUADELOUPE—Roger Legge of Binghamton, New York, writes that FG8AA (7.05), announcing as *Ici Pointe a Pitre a la Guadeloupe au Antille Francaise*, operates nightly from 6 to 7 p.m. and sometimes from 9 to 10:30 p.m., amid considerable c.w. QRM.

GUATEMALA—The Cleveland Radio Club supplies the following revised schedules: TGWB (6.5), weekdays 7:45 to 9 a.m., 12:45 to 3:45, 7:30 p.m. to 12:15 a.m. and Sundays 10:30 a.m. to 5:15 and 7 p.m. to midnight; TG2 (6.19), *Radio Morse*, Guatemala City, weekdays 7:30 to 9 a.m. (Sundays to 11 a.m.), Mondays and Fridays 6 to 11 p.m., Saturdays 6 p.m. to 1 a.m. and Sundays 3 to 8 p.m.; TGQA (6.4), Quezaltenanto, Mondays and Fridays from 9 to 11 p.m., Saturdays from 10 p.m. to 1 a.m., and Sundays 1 to 3 p.m.; TG2X (5.945), Guatemala

City. Mondays and Thursdays from 9 to 11:30 p.m., Saturdays from 10 p.m. to midnight, and Sundays from 2 to 5 a.m.

ITALY—The new Imperial Short-Wave Center, at Prato Smeraldo, near Rome, was officially inaugurated on October 31. The installation includes two new 100.000 watt transmitters, and two new 50 000 watt transmitters. So far transmissions have been made on the following frequencies and under the following calls only: 2R06 (17.82), 6 to 7:30 and from 10 to 11:15 a.m.; 2R05 (15.3), 11:15 a.m. to 12:15 and from 2 to 4 p.m.; 2R04 (11.81), 4:40 a.m. to 12:05 p.m. and 2R03 (9.635), 12:05 to 9 p.m. Several other frequencies will be put into use in the near future. it is believed.

NEW CALEDONIA—According to Alan Breen of Dunedin, New Zealand. FK8AA (6.122) of Noumea, operates Wednesdays and Saturdays from 2:30 to 3:30 a.m. The power of the station is soon to be increased from 30 to 70 watts.

NICARAGUA — YNRS. *Radio Nicaraguente*, Managua, appears to be operating on dual frequencies of 6.74, and 8.57.

PHILIPPINES—KZIB (9.5), Manila, is now operating daily from 7 to 9 a.m. Announcements in Philippine and English. Chimes similar to the *NBC* are used as an interval signal.

PORTUGAL—CSW2 (11.04), Lisbon, is now broadcasting daily from 9:30 a.m. to noon and from 2 to 5:30 p.m.

SOUTH AFRICA—ZRD (9.72), Durban. is being heard on the West coast with excellent signals daily from 9 to 11:30 a.m.

SPAIN—*Radio Nacional* is still broadcasting on dual frequencies, one near 10.37, the other in the vicinity of 11.01. The station on 7.49 carrying the Nationalist programs is EAJ43 of Tenerife. . . . Roger Legge of Binghamton, New York, writes that station AZ (6.74), relays the Nationalist program of Salamanca daily from 7 to 8 p.m., as also does EA1BO (7.5) of Bilbao.

STRAITS SETTLEMENT—ZHP (9.69), is operating week days from 4:40 to 9:40 a.m., Wednesdays from 12:40 to 1:40 a.m., Saturdays from 12:25 to 1:40 a.m., and on Sundays from 5:25 to 9:40 a.m. and from 10:40 a.m. to 1:10 p.m. The station's QSL card depicts a sunset through palm trees.

TURKEY—The new 20,000 watt station at Ankara was officially inaugurated on Oct. 30. TAP (9.465), is on the air daily from 11:30 a.m. to 4, or 5 p.m. TAQ (15.195). operates daily from 9:30 to 11 a.m. and from 5:30 to 7 a.m. irregularly. Frequent announcements are made in German, French, Turkish, and English.

U. S. S. R.—RV15 of Khabarovsk, which formerly operated on 4.27, is now broadcasting on 6.045. where it may be heard with excellent signals relaying broadcast stations RV69 and RV54, daily from 2 to 11 a.m.

UNITED STATES—The operating schedule for W1XAL, Boston, Mass., is as follows: on 15.25, weekdays except Saturdays 2 to 3:30, or 4 p.m.; on 15.13, Sundays from 10 a.m. to 1 p.m.; on 11.79, Mondays, Wednesdays and Fridays, from 4:55 to 6:30 p.m., Tuesdays and Thursdays from 4:40 to 6:30 p.m.; Saturdays from 1:45 to 6 p.m. and on Sundays from 3 to 6:30 p.m.: on 11.73, weekdays except Saturdays from 9:15 to 11:30 p.m. and on 6.04, weekdays except Saturdays from 7 to 8:30, or 9 p.m. . . . According to the Universal Radio DX Club. the schedule for W9XF (6.1), Chicago, Illinois, is Mondays through Fridays from 4 to 6:50 p.m., and 1 to 2 a.m.; Saturdays from 4 to 5:30 p.m. and 1 to 2 a.m., and Sundays from 1 to 5:50 p.m.

VENEZUELA—The signature selection for YV1RI (6.21), Coro, is the *Tres Colores Marcha;* the interval signal is 5 marimba notes.

Amateur Reception Notes

ALBANIA—ZA1CC (14.1) is being heard near midnight. English listeners think *this is an unlicensed Italian* using the ZA call to escape detection, since no one has received his QSL or knows his QRA.

BOLIVIA—Henry E. J. Smith, CP1AA of Casilla 669, La Paz, writes that the dispatching of QSL cards has become such an expensive proposition that he is forced to put the following limitations upon those sending in reports to be verified in the future. Report must contain sufficient information to check satisfactorily with station log. must enclose an international reply coupon, a self-addressed envelope and a card to be filled in by CP1AA in lieu of the ordinary QSL card. Such letters will be answered immediately.

DUTCH NEW GUINEA—Earl Roberts of Indianapolis, Indiana, writes that PO6ZA (6.425 and 11.355), is the commercial call for PK6XX of the Archbold Expedition at Hollandia. These frequencies are usually used near 3:30 a.m.

FRANCE—Charles Guilbert, F3LG, 35 Rue Jean-Mermoz, Deauville (Calvados), France, reports he is on the air daily from 2 to 3 a.m. on a frequency of 14.006, and from 3 to 5 p.m., or later. on fone or c.w., on frequencies of 14.006 or 14.31.

IRAQ—YI2BA (14.33), is being heard again near 12:15 a.m. The new operator is Eddie Behnan, who has taken over from Mellon—who didn't have time to QSL. Behnan is trying to catch up on forwarding QSL cards.

NIUE—Walter Kamman, Caracas. Venezuela. has received the first QSL card, I know of, from ZK2AA in Niue (Oceania). The card pictures a view of Niue harbor.

PITCAIRN—VR6AY's QSL card pictures a map of the island. and the pieces of equipment donated by various manufacturers. (hi).

SOUTH AFRICA—The SAARL (*South African Radio Relay League*) is sponsoring a "ZS Amateur Contest." on both phone and c.w. The rules will be about the same as the *ARRL International Contest.* It will take place on Saturday, January 14, from 11 a.m. to Sunday, January 15, at 5 p.m.

UNITED STATES—New amateur prefixes recently assigned by the FCC to the Insular possessions of the United States are as follows: K4, Puerto Rico; KB4, Virgin Islands; K5, Canal Zone; K6, Hawaii; KB6, Guam; KC6, Wake Island group; KD6. Midway Islands; KE6, Johnston Islands: KF6. Baker Island, Howland Island, American Phoenix Islands; KG6, Jarvis Island and the Palmyra group: KH6. American Samoa, and K7, Alaska, including the Pribilof Islands.

Last Minute Notes

John DeMyer of Lansing. Michigan, writes the following India short-wave stations are being heard with amazing signals between 7 and 8 a.m. EST: VUC2 (4.88), VUB2 (4.905), VUM2 (4.95) and VUD2 (4.995). Each carries a different program. VUC2 and VUM2 were the loudest of the four. This reception was recorded without an antenna. using only a few feet of lead-in wire for an aerial. Are there any others who have heard these?

SHORT WAVES IN THE WEST

(All Times Are PACIFIC STANDARD)
by JOHN D. CLARK

China

STATION XGOX has shifted location to Chungking, China, and is now on the air with a powerful new transmitter. Using a frequency of 15.19 meg., broadcasts are now being carried out from 6 to 9 p.m. daily, and good reception is reported in all parts of the Pacific Coast. Although announcements are almost entirely in Chinese, as are also the programs, the station may be easily identified by the call "X-G-O-X . . . X-G-O-X" which is repeated at irregular intervals.

The first hour is the best for west coast reception, as signals often become weak and erratic after 7 or 7:30. Programs are relayed from long-wave station XGOY in Chungking. It is understood that the present transmission is experimental only, but may be put on a permanent basis if reception reports are satisfactory.

Station XGXA, also located in Chungking, is now being received as early as 4 a.m. on 6.975 meg., despite numerous printed timetables which list a later schedule. The powerful 35.000 watt transmitter comes through with excellent volume until sign-off at 7:20 a.m. The announcer of XGXA is female, while that of XGOX is male.

XGAP of Peking is still working on 9.56 meg. near 6 a.m., but is completely blocked by Germany's powerful DJA.

Station XTJ of Canton is again being heard irregularly on 11.7 meg. near 4:15 a.m. after being silent for several weeks. This transmitter is also used for phone work near 7 a.m.

U.S.S.R.

The Siberian broadcast situation is again thrown into confusion. It was announced in this column last month that RV15 had shifted from 4.27 to 6.04 meg., and for a time an additional frequency of 6.80 meg. was used simultaneously.

After a short trial, 6.80 meg. (which produced an almost unbelievably strong signal on America's west coast) was discontinued. Two weeks later, RV15 also vanished from the 6.04 meg. wave and promptly reappeared on 4.27 meg.

Then still a stranger thing took place. A few days later, a mysterious new Russian (perhaps RV59) appeared on 6.03 meg. near 7 a.m. with a program different from that of RV15. And to further complicate matters another new Russian appeared at the same time on 9.52 meg. relaying the same program as that on 6.03 meg. Both new stations announce only in Russian, and the 49 meter wave is heterodyned slightly by Canada's VE9CA.

As we go to press. we note a reliable report stating that an unidentified Russian used a frequency of 6.49 meg. for a few days, before shifting to 9.52.

Evidently the Soviets are conducting extensive experimental broadcasts, and it is impossible to say whether the present set-up of 4.27, 6.03, and 9.52 meg. will be continued. It does appear, however, that the super-powered RV15 will continue to operate on 4.27 meg. from 10:00 p.m. to 8:30 a.m. daily. [Ed. note: *RV15 is still probably the most powerful overseas station now being heard on the Pacific Coast.*]

Siam

A new Siamese broadcaster is now working on 6.11 meg. from 5 to 7 a.m. irregularly. It has been reported on Monday, Wednesday, and Saturday with fair volume, but call letters have not as yet been ascertained. Programs consist almost entirely of recorded music with announcements in Siamese and French at about 10 minute intervals.

Japan

Despite the fact that the *Broadcasting Corporation of Japan's* time schedule lists only JZJ on the daily 5 to 5:30 p.m. transmission. the carrying station is actually JZK (15.16 meg.) which sends a fine signal to the United States at this time.

Although JZJ is still being used for the Overseas Broadcast directed to this region between 9:30 and 10:30 p.m. reception here has been very erratic during the past few weeks. At times. reception is excellent during this broadcast, but on certain occasions it has been all but impossible to pick up the station's signals. Several reports indicate that JZJ is not always audible from 5 to 6:30 a.m.. although JVP (7.51 meg.) is usually excellent at this hour.

Station JIB (10.53 meg.) announces in English at 6 a.m. daily "You will now hear the news in English from the radio station in Taiwan."

A strong Japanese phone transmitter works on about 6.32 meg. irregularly near 10:30 p.m.

Indo-China

The powerful signals of Mexico's XEWW have been causing considerable interference with Indo-China's *Radio Hanoi*, on 9.51 meg. XEWW heterodynes the *Hanoi* transmitter until the latter leaves the air at 6 a.m., thereby rendering reception from the trans-Pacific station all but impossible. *Radio Hanoi* also works on 11.90 meg.. but is usually very weak on the higher frequency.

Australia

According to announcements. CLR3 (11.88 meg.) is now on the air from 2 to 8 p.m., as well as from 10 p.m. to midnight. At 12:15 a.m., VLR takes over on 9.58 meg., and relays the ABC programs until 5:30 a.m. daily. and until 6 a.m. on Saturday. The higher frequency is very close to that now in use by the French TPA3 (commencing at 11 p.m.), but as yet the Parisian broadcaster has not caused any serious interference.

Late Western Tuning Tips

CZECHOSLOVAKIA. Station OLR4B of Prague (11.76 meg.) has been heard on an unannounced schedule near 7:15 a.m. with a woman announcer. This is one of the strongest Czech transmissions to reach the Pacific Coast at the present time.

INDIA. Stations VUC2 of Calcutta, VUD2 of Delhi, and VUM2 of Madras (on 4.88. 4.90, and 4.99 meg. respectively) seem to be getting stronger every day. All three of these broadcasters may now be tuned in with surprising volume near 5 a.m. daily. VUC2 continues to hold up well until after the English news broadcast at 7:15.

JAVA. A new and unidentified Javanese broadcaster is releasing programs of native music on about 6.04 meg. near 5 a.m.

MISCELLANEOUS . . . Our listeners tell us . . . that KZRG (9.50 meg.) which was heard near 5 a.m. for several weeks has left the air for a short time, and that KZRM (9.57 meg.) is completely blocked by W1XK of Springfield, Mass. . . . that ZHJ of Penang, Straits Settlements. is improving with winter atmospheric conditions, but is still quite weak on 6.08 meg.. working from 3:40 to 5:40 a.m. . . . that a new Nicaraguan broadcaster YNRS of Managua now operates on 6.75 meg. until 8:30 p.m. daily . . . that Chile's new CB960, working on a frequency of 9.60 meg.. and testing until 8 p.m. irregularly, is one of the strongest South American stations to be heard on the Pacific Coast at the present time . . . that Cuba's COCQ has again shifted frequency—this time to 8.83 meg.—in another attempt to avoid interference . . . that CSW of Lisbon, Portugal, is now reaching the western states with surprisingly good volume on 9.74 meg. This is the first Portuguese broadcaster which has ever succeeded in reaching America's western coast with a truly satisfactory signal. Maximum volume is attained between 5:30 and 6:00 p.m. . . . that an unidentified newcomer has been heard several times on 11.41 meg. near 5:30 a.m. This is probably the new Chinese XGRV of Chungking.

Early A.M. on 31 Meters

With the great improvement in a.m. reception from the European transmitters, the 31-meter band is now almost as crowded during the early morning hours as the 49-meter band is during the early evening.

For west coast fans, strong stations are now audible on almost every available channel. XEWW of Mexico City is extremely loud on 9.50 meg.; *Radio Hanoi* of Hanoi, Indo-China, is fair on 9.51 meg. until 6 a.m.; the new Russian transmitter is fair on 9.52 meg. until 7:30 a.m.; ZBW3 of Hongkong, China, is good on 9.53 meg. until 7 a.m. daily, and until 8 a.m. Saturday; VPD2 of Suva, Fiji Islands is good on 9.54 meg. from 2:30 to 4 a.m.; YDB of Bandoeng, Java, is fair on 9.55 meg. until 7:30 a.m., and until 8 a.m. on Friday and Saturday; W1XK of Springfield, Mass., is strong on 9.57 meg. heterodyning Manila's KZRM; VLR of Melbourne, Australia, is excellent on 9.58 meg. to 5:30 a.m., and 6 a.m. Saturday; VUD2 of Delhi, India, is usually very good on 9.59 meg. from 4 a.m., but fades out rapidly after 7; ZRK of Johannesburg, South Africa, is surprisingly good on 9.61 meg. near 7 a.m.; and

JFO of Taihoku, Taiwan, is fair on 9.62 meg. until 7:15 a.m.

Treasure Island

Construction is now under way on the powerful new short wave broadcasting station which will be located on *Treasure Island* in San Francisco Bay. The new station will be a feature of the 1939 Exposition, and will operate on 9.55 and 15.33 meg. from 9 p.m. to 3 a.m., Pacific Time. It will be the only regular short wave broadcasting station in the western United States.

Treasure Island will also be the setting for the *1939 International DXers Convention* from July 11 to 14. Further details will appear in this column at a later date.

Last Minute Flashes

NEW ZEALAND. An unconfirmed report has been received stating that a New Zealand station announcing as 2ZB or 2ZE is working on the low frequency of 3.48 meg. Sign-off is at approximately 4 a.m.

PHILIPPINES. KZRM of Manila has an alternate frequency of 11.84 meg. which may be used in the near future to avoid interference with W1XK of Springfield.

INDO-CHINA. Station announcements indicate that *Radio Hanoi* of Hanoi, Indo-China is also on the air from 9 to 11 p.m. (in addition to its early morning broadcast). As yet, no reports of this evening transmission have been received for either 9.51 or 11.90 meg.

RUSSIA. Another new and unidentified Soviet broadcaster has been heard several times on approximately 9.41 meg. near 2:30 a.m. and again near 6 a.m.

SUMATRA. The latest schedule from Medan indicates that YDX is now using 8.09 meg. for daily transmissions which conclude at 11 p.m. YDX also still operates on 5.17 meg. from 5 to 7 a.m., but is often blocked by United States airport stations.

BURMA. The British owned and operated station in Rangoon, Burma, has evidently increased power, and is now being received in all parts of the Pacific Coast with good volume. Signals are strongest just before the sign-off which usually takes place at approximately 7:08 a.m. The announcer states that a frequency of 3.49 meg. is also being used simultaneously with 6.007 meg. Programs consist almost entirely of recorded music, and all announcements are in English.

Commercial Freq-meter

(*Continued from page* 37)

cycles, the top end of the 5 meter band. This is quite some accuracy, while using WWV for calibration setting, its accuracy of 1 *cycle* in 5,000,000 multiplies to any error of only 12 cycles at 60 megacycles. To this must be added the accuracy of the operator's zero-beating of the frequency meter against the standard frequency signal. This may be quite small indeed, and, even allowing 20 cycles against WWV at 5.000 kc. still gives an error of only 240 cycles at 60 megacycles. With such accuracy the instrument to be described may safely be relied upon for setting a transmitter within 500 to 1000 cycles of the edges of the 5 meter band in the hands of a careful operator, and, in proportionate harmonic relation, much closer in the lower frequency bands. [*Operation of 'phone signals is not now permitted that close to the edge of any band.* Ed.] Such accuracy assumes calibration check against WWV, measurement of transmitter frequency, and recheck of calibration against WWV. Accomplished within a couple of minutes, this check and double-check eliminates any possibility of drift or change in the frequency meter itself, and gives a very precise order of frequency measurement indeed.

The frequency meter-monitor has a 7¾" chromium dial calibrated to hair-line accuracy and reading against an anti-parallax indicator, for all except above 5 meter amateur bands. Calibration covers 324° of a full circle, with low frequency bands at inside and high frequency bands at outside. This gives a maximum effective scale length of 21⅞" for the outerscale, which is devoted to a vernier scale of 500 divisions. Accurately readable to one-half division, each band may be accurately read to 1/1000th part, and even more closely with a little care, by virtue of the long dial scale length.

This main dial may be operated by its center large knob, or for precise setting by the 10 to 1 vernier reduction knob at its lower right. To the lower right is the on-off switch and headphone jack, with input coupling through the small jack at the upper right. The small knob and dial at lower left are the zero-setter, or calibration setter. By first setting the main dial to any standard frequency station signal and then adjusting the zero-setter knob to zero beat, calibration is automatically made accurate for the entire range. Despite a very high order of stability, no reliance is placed upon such stability, and never should be in precise frequency measurement, over long periods of time. Calibration should be definitely checked and set with the zero-setter before any period of use. Yet the stability is such that the frequency meter will hold zero beat with a standard frequency signal for many hours at a

time, and easily for 24 hours and more.

The stability is obtained by an electron-coupled oscillator circuit consisting of a very wide-spaced, Steatite-insulated, ball-bearing tuning condenser, high-Q 15/41 Litz inductance wound on low temperature-coefficient Steatite form, and a padding or "swamping" capacity of low-drift silver-plated-on-mica construction completely ceramic-sealed. All are housed in a tightly closed metal box. This box provides a "dead air" mass around the frequency determining circuit which effectively resists temperature changes. In turn, enclosed inside the outer cabinet 9½" high, 10½" long and 6" deep, the effects of external short-duration temperature changes such as might affect stability are effectively eliminated from the tuned circuit. Stability is further assured by running tube heaters continuously. The heating elements maintain temperature within narrow and stable range well above ambient temperature.

The fundamental range of the oscillator is 850 to 1030 kc., so that it may be checked directly against the signals of broadcast stations tuned in on the receiver—or even directly upon the frequency meter in the case of locals for it is in itself a receiver. Harmonics of this range cover 1700 to 2060 kc. thus including both new and old 160 meter amateur bands. Through the use of a 43 power pentode as oscillator, it can both be run in the frequency stable range well below maximum rating, and at the same time put out husky harmonics right down into the 5 meter band. Coupling is to the plate of the 43 electron coupled oscillator, in itself forming no part of the oscillator circuit, and additionally isolated by a small 3-35 mmfd. adjustable coupling condenser which may be so set that external coupling will not affect oscillator frequency.

To be fully useful for measurement of received signal frequency, a high-gain pentode is used as beat-note detector-amplifier, and is coupled to the isolated oscillator plate circuit; thus may the user measure not only his own transmitter frequency, but the frequency of signals heard upon his receiver. This detector-amplifier is the pentode section of a 25A7G dual tube, its diode being the power supply rectifier. A.c.-d.c. operation is provided, not in the interest of cheapness, but in order to obtain the best possible supply voltage regulation. Omitting the usual power transformer, which always introduces some regulation problems, operation is direct from the power line, with only the B supply filter and rectifier tube as factors to impair regulation. By isolating the power line from the metal cabinet, the possibility of shock usual to user simultaneously touching a grounded metal object and the chassis is eliminated completely, and the frequency meter cabinet may be directly grounded.

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The Video Reporter

(*Continued from page 9*)

pensively priced (sells around $99.00), it is well designed and compact. It employs a five-inch electrostatic deflection type cathode-ray tube, and the video receiver utilizes 16 tubes in all, which includes 5 of the new type 1852 high-transconductance tubes. The power supply employs one 5Z3 and one 879 high voltage type rectifier.

To Be, or Not to Be?

IS television right around the corner??? As previously stated we in common with many others believe that it is. Yet it is rumored that one executive associated with the business end of broadcasting has expressed his opinion that it will be four years hence before any appreciable number of New York City homes are equipped with television receivers—due primarily to lack of suitable programs before that time. What is more, this same rumor has it, he has placed a wager that the end of 1940 will still find television so much in its infancy that not one home out of a thousand in New York City will be equipped for television reception. And New York is supposed to be the ringleader in this new art. The funny part of it is, this bet was snapped up by another man who has been identified with the technical end of the game for years.

If the experts can't agree among themselves, where does that leave Mr. John Q. Public?

Stubby Videotron for Lower Cost

THE National Union Radio Corp. just made an important announcement of a new improved type of cathode-ray television receiving tube, the size and design of which should materially lower the cost of televisors. It has been designed by Marshall P. Wilder, television engineer of the above company.

The tube is considerably shorter than the earlier 9-inch screen models permitting the use of more compact cabinets and direct "off-the-screen" viewing. Also, the image is reproduced in black and white tones preferred by many television enthusiasts.

Mr. Wilder has nicknamed the tube "Stubby" because of its shape in comparison to the earlier 9-inch models. Offering the same size picture as the old 23-inch-long tube, the new Videotron measures only 16 inches in length—approximately the length of the present tube with 5-inch viewing screen.

New Streamlined Antenna

THE new RCA-NBC unique streamlined television antenna marks a revolutionary engineering advance in telecasting antennas. Mounted on top of the *Empire State Building* in New York City television signals are now being launched into space from its torpedo-shaped radiators.

RCA engineers say that the device

overcomes a technical bottleneck in the transmission of television signals by departing from the use of wires or their equivalent in pipes or masts in various arrays. The new device is designed to radiate television waves over a band-width of 30 megacycles a second without accentuating or "peaking" the energy contained in any segment of the band. In engineering terms, the transmission characteristics of the antenna is "flat" over a 30 megacycle band.

The desirability of creating such an antenna (which is still so new that it has not yet been named) was realized in the first field tests conducted on the present experimental standard of 441 lines to the picture. Antenna designs existing at that time were found insufficient to handle the desired bandwidth. The new device, in contrast, will accommodate six times the desired band coverage.

When this antenna problem was presented some months ago, it was erected by a research group under N. E. Lindenblad of the RCA Laboratories at Rocky Point, L. I. With them worked R. K. Gallup, E. D. Thorne and L. A. Batterman, as well as G. L. Usselman, whose specially designed test transmitter made possible vital observations.

The radiation components of the new antenna consists of two "doublets" for the picture signal and four "doublets" for accompanying sound. Both antennas are energized through concentric feeders in a common vertical shaft. Interference between sight and sound signals is eliminated by calculated arrangement of the two antennas and by using the equivalent of a closed loop for the sound channel and open radiators for picture signals.

The electrical measurements involved in the new structure are as precise as the specifications for a watch, yet in service it must withstand the rigors of the elements at its precarious perch. The antenna includes electrical heating units to prevent the formation of ice, which would enlarge its effective physical dimensions and detract from the perfection of its performance. The entire structure is topped by a lightning rod.

The radiating units nearest the top are for sound signals, and consist of a unique type of doublet, which doubles back on itself. The four together form a complete loop.

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A New Receiver
(Continued from page 35)

discussion employs a type VR-150 regulator tube in the plate supply circuit. Its function is to keep the oscillator plate voltage constant regardless of variations that may take place in either the line voltage or the output voltage of the power supply. The regulating facilities of this tube are likewise applied to the meter amplifier tube to maintain the accuracy of the signal strength meter readings even against line voltage variations.

An exclusive feature of the HQ-120-X receiver is the new crystal filter circuit, providing a complete range of variable selectivity from the maximum band-width of the set to the usual razor-edge selectivity of ordinary crystal filters. It has heretofore been the practice in receiver design to vary overall selectivity by varying the coupling between i.f. stages, but once the crystal is switched in the selectivity becomes fixed or nearly so, as determined by the crystal. If the crystal circuit is designed to provide most effective selectivity for c.w. operating it is proportionately less effective for phone and vice versa. But in this new design variable selectivity is provided solely by the crystal circuit and selectivity can be varied in five steps, from ¼ to 2½ kilocycles (all measurements at 10 times down). This means that anything from excellent single-sideband c.w. selectivity to a band width that permits not only completely understandable but good voice and music quality is obtainable, all by virtue of this innovation. With the crystal cut out the normal selectivity is 3½ kc. at 10 times down. Selectivity variation is accomplished by a six position switch on the front panel, the crystal being in the circuit in five of these positions. This circuit is not to be confused with other so-called "variable selectivity crystal" circuits.

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Visual D-Meter

(*Continued from page* 14)

mitter. In the 5 meter position the trimmer condenser only is used to cover the band. Set the selector switch to the off position which will disconnect the padders and tune the trimmer to a 10 meter signal. Advance the regeneration control to the point where the tube breaks into oscillation.

Tune for a whistle which will give a reading on the output meter and then readjust the trimmer for maximum indication on the meter. Now any variation in the signal will change this beat note or whistle and will likewise change the reading on the output meter. Remove phones.

The above procedure is followed for the other bands and the initial adjustments are made by adding additional capacity from the selector switch and its associated padding condensers. A shorting type switch must be used so that as the switch is rotated, the condensers will add to each other in capacity.

A total of five positions cover the 5-10-20-40-80 meter bands with the capacities shown on the schematic diagram. Each variable padder has a capacity range of from 10 to 70 mmfd. The 40 and 80 meter bands are tuned with a higher capacity than would be reached with the padders alone so additional capacity is furnished by the fixed mica condensers as shown. The high C. greatly adds to the stability of the monitor.

In actual use with a low power oscillator it was found that a short piece of wire about one foot in length offered sufficient pickup to the monitor even though located some 10 feet away. Do not use too much pickup as to do so will block the monitor signal.

The extreme sensitivity of the meter makes it important that the case be grounded to reduce body-capacity effects. A vernier dial in place of the knob shown will further add to the operating ease and precision adjustment.

In conclusion it is well to repeat that the monitor reads changes in frequency in cycles and is therefore fast reading if this condition takes place. A frequency change of but a fraction of one kilocycle will cause the needle on the output meter to drop to zero if care is taken in properly setting the regeneration and trimmer controls.

The users of this instrument will be amazed at the drift in their transmitters, but it can safely be said that if the monitored signal stays on the meter in any position above 0 reading, that no change will be recorded at the receiving position. [Grand Island Station is the exception, hi, Ed.] The meter should not be relied on for *exact* edge-of-the-band transmissions.

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NEXT MONTH!
"A SPECIAL RECEIVER"

Transmitter Efficiency

(*Continued from page* 16)

overlook these possible sources of inefficiencies unless they practically jump right out at him. The writer remembers only too well a metal clad plate blocking condenser mounted on a metal chassis without benefit of stand-off insulators. Without a means of measuring the output, the writer rested snug in the satisfaction of a job well done because the tube apparently was doing its stuff, until a pool of compound dripping to the stage below indicated that about half the tube output was melting compound instead of going up the feeders.

Visible proof of losses may not always be so apparent. There is no doubt that the difference in the plate current reading between the loaded and unloaded conditions gives a fair indication of the presence of losses, however, several factors (tube characteristics, bias behavior) involved make it practically impossible to estimate the probable efficiency. It is not intended in this article to more than border on the many possible sources of inefficiencies in r.f. circuits. Practically all amateurs have handbooks and other sources of information on the subject treated with far more thoroughness than could be employed in an article of this type.

I have endeavored to show, however, that a simple means of measurement of power will enable the amateur to see some tangible proof of his efforts to improve his transmitter antenna and stages. As a matter of fact, even if the final amplifier had proved to be 80% efficient in the first place, there is a great deal of personal satisfaction in knowing what the actual figure is. Then, too, 90% efficiency is still worth trying for and not at all unattainable.

Because the dummy load can be used as an accurate indicator of r.f. power, additional uses other than the determination of efficiency alone become apparent, for example:

(d) Determination of the optimum setting of all coupling devices for maximum transfer at the nominal impedance (impedance matching) between stages.

This is solved as follows. Regardless of what the efficiency of the stage being measured is, there will be one setting of the coupling device (link or otherwise) which will give the maximum reading of the r.f. ammeter representing the best impedance match between the stage and the load. Any other load having the same impedance as the dummy will also be matched perfectly with this setting. (The chances are that the grid and plate circuits of the stages being coupled may have widely different impedances both between themselves and the coupling method. Reference here is made to the actual link circuit itself

which is generally used and which has been found guilty of losses even in short lengths of 6″ or so.)

Consider Figure 1d as a typical case. Generally the output of the driver can be measured at point BB although if the coupling coil itself is suspected of losses the output can be measured at point AA as described in previous paragraphs and at point BB after the optimum setting for maximum energy transfer is made. A decrease in indicated power at point BB with the same plate input would mean losses in the coupling system itself. *The plate input would, of course, be referred to again as it may have been reduced through wrong adjustment of the coupling coil and less power at point BB may be due to this reduced plate input rather than losses. The comparison between plate input and power output must always be made before any conclusions can be made as to losses occurring.* Repeating the power measurement at point CC will allow calculation of losses occurring in the line from point BB to point CC, again *referring to the plate input* before definite conclusions are made. The same procedure can be followed for further information in

(e) Determination of the efficiency of the transmission line between the final amplifier and antenna.

After the final stage is adjusted for maximum output (say e.g. on a 73 ohm dummy load) suppose we substitute a 73 ohm concentric line and place the dummy at the far end which would normally attach to the antenna. Without readjustment of the transmitter the r.f. current at the transmitter should be approximately the same as with the dummy. Likewise, the plate current and plate voltage. On a poorly regulated plate supply, in the event of a plate current change, plate voltage will also change.

If there are any appreciable line losses the current will be progressively less out to the end of the line where the dummy is attached. The current measured at this point is the current in the dummy and the power is calculated as before. The difference between this figure and the previous figure determined at the transmitter would be the approximate line losses, providing mismatches have not occurred which may alter the efficiency of the amplifier itself due to several reasons. This loss figure then may not be strictly true since the line losses are in part due to insulation resistance which in effect shunts the dummy and lowers the nominal resistance of the whole system.

If the plate current or voltage changes appreciably, this is due to mismatches and/or appreciable distributed capacity entering into the system. Any change in plate current or voltage means that the efficiency of the final amplifier will alter and the figure for line losses may also include a change in amplifier efficiency as well. As a matter of fact, if the match was poor in the determination of the amplifier efficiency and should happen to be improved upon when the line was brought in to the system, an increase in overall efficiency might be the result. The above possibilities would also apply to previous measurements made on the link coupled stages described in the previous paragraph under (d).

[Next month the author concludes this interesting subject with a complete explanation of different dummy antennas and their application towards improving the radiation efficiency of an antenna. This applies to receiving as well as transmitting antennas. Ed.]

325-Watt Transmitter
(*Continued from page* 31)

into a line of 500 ohms, which is cable-connected to the 2A3 input circuit in the modulator section of the transmitter. The volume indicator on the front of the preamplifier provides a convenient means of checking the level of modulation with a gain control readily available for close, quick adjustment. Examination of the schematics will show how the various units are interconnected.

The pictures show clearly the placement of components and the schematic diagrams how they are connected.

Television Course

(*Continued from page 8*)

Quite a few factors entered into the choice of 441 as the correct number of scanning lines; any less than this did not give satisfactory detail from a complex scene, while more than this created serious problems. Important, however, as will be shown later, the number has simple factors and can be had by multiplying odd numbers—3x3x7x7. This enters into the generation of synchronizing signals at the transmitter.

Which brings me to the all-important matter of synchronization. Most of the devices, and many of the practices, essential to successful transmission of images were developed many months, and even years, ago. Video transmission is very similar to sound transmission insofar as modulation, envelope, detection and amplification are concerned — the *Iconoscope* and *Kinescope* tubes have been in laboratories quite awhile — but until RMA pooled the ideas and plans of the various experts, and set standards, everyone had his own favorite ideas for synchronizing—and receivers could not be built with any assurance that their synchronizing systems would match those of a nearby transmitter.

At first thought, it would seem that the speed of the scanning beam in a receiver's *Kinescope* could readily be set to the speed of the scanning beam in the transmitter's *Iconoscope,* and one could sit back and forget them. Unfortunately, this does not work out in actual practice. So accurately must these two electron beams function together that it is necessary to inject a synchronizing "pulse" into the signal not only at the end of every 1/60th-second field, but also at the end of every 1-13230th-second scanning line, and then make provision for the separation of these pulses from the video signals in the receiver.

To use the language of the RMA *Recommended Television Standards Report,* I will, hereafter, refer to the length of time required from the start of one line to the start of the next line in a field as "H," and the time required from the start of one field to the start of the next as "V." These times are, of course, 1/13230th-second and 1/60th-second respectively.

To see how they are used, I now refer to Figure 5. The upper half illustrates the television signal covering the bottom edge of the picture in one scanning field ("A") and the top edge of the following field ("B"); the lower half of Figure 5. portrays the signal during transmission of the bottom edge of the second field ("B") and the top three lines of what would be a third field ("C"). This is necessary to show the differences in pulse arrangement, which explain how interlacing is accomplished.

As in voice transmission, the carrier provided for video transmission has a definite amplitude (voltage maximum) which it maintains evenly until modulated, whereupon the voltage rise in each sideband varies with the impressed signals. In the television transmitters and receivers, it is so arranged that full black (of the picture) will be at 75 to 80% of maximum amplitude. The remaining 25 or 20% is to be used for synchronizing pulses. Thus, all variations in the image transmitted are taken care of by variations in carrier voltage from zero to 75 or 80% of maximum amplitude.

Since we have full black at 75% amplitude, anything that may be done with the other 25% would not be visible on our *Kinescope,* and it is here that we put the synchronizing pulses. At the left end of the upper half of Figure 5 we come into the middle of the fifth line from the bottom of the picture of one field. As illustrated, it is going from dark to light (sloping down). The narrow upright pedestal shown represents the last 15% of this line, at the right edge of our transmitted picture. What is called a "blanking pulse" is injected which immediately jumps the carrier to full black. In other words, we do not "see" the last 0.15H on each swing of the *Kinescope* beam.

The narrower extension on the top of the pedestal is the "horizontal synchronizing pulse," whose job it is to swing the traveling *Kinescope* beam back to the left for the start of the next line (4th from bottom) while a condition of full black exists. This horizontal synchronizing pulse starts 0.01H after the front edge of the blanking (full black) pedestal pulse. It lasts but 0.08H in time, then the voltage drops back to the blanking pulse level for 0.06H more, and, at its end, we are starting the 4th from the bottom line of the picture. This cycle continues through the last line of picture.

You will note a vertical broken line identified as "Bottom of Picture—Field A." This is the bottom edge of that which is visible; our electron beam will continue swinging but the final 15 to 22 lines of the field will be blanked out or black. The recommended standards say this period, known as "vertical blanking" shall be 0.07 to 0.10 of the time of one field (1/60th-second) which is, roughly, 15 to 22 lines of our 220½ per field.

With the *Kinescope* held black, six narrow pulses, termed "equalizing pulses" are introduced. They are 0.04H wide and spaced at 0.5H intervals, beginning 0.01H after vertical blanking began. Three of these are, in effect, horizontal synchronizing impulses to keep the beam horizontally synchronized; the three marked "M" are necessary to assure proper interlace in the receiver, and their action will be described in article three.

The vertical synchronizing pulse, which comes next, requires the time 3H. It is composed, as shown, of six 0.46H pulses and six serrations or slots which are 0.04H each. It should be noted that the front edge of the ver-

tical synchronizing pulse and two of these serrations (0) correspond in their timing with the horizontal synchronizing pulses. The other three (N) are necessary to make identical the vertical synchronizing pulses of odd and even fields (see the vertical synchronizing pulse directly below in the following field).

While these slots are shown with vertical sides, because they are so small in the illustration, the sides are really sloping, so there is a slanting fall on one side of each slot equal to 0.005H in time, and a slanting rise on the other side of 0.005H in time. That is only 5/1000th of 1/13230th of a second, but these slopes are necessary that a wave of the proper form be supplied to the deflecting circuits of the receiver's *Kinescope*.

While the vertical synchronizing pulse has now thrown the *Kinescope* beam back to the top of the picture for the start of another field, there remain six more equalizing pulses, which must be present for the same reason as was the first group. A series of horizontal pulses then follows before the vertical blanking is removed, and the picture is resumed. The number of such pulses at this point may vary from approximately six to thirteen and this will not affect reception, except that it shortens the height of the picture by an infinitesimal amount if more are used. At the point marked "Top of Picture—Field B" the vertical blanking ends and slightly over four lines of the next field are shown.

The lower half of Figure 5 is similar in its cycle of pulses to that of the previous field, but certain features should be stressed. Note that the last line of Field B (odd field) is not complete when the vertical blanking begins at the bottom of Field B's picture. These are (presuming 30 lines of blanking per frame) lines 407, 409 and 411, and their timing must be ½H "off" in relation to those above in Field A (even field) which are 406, 408 and 410. At the right end of the lower illustration, a half video line is indicated following the finish of vertical blanking, whereas above it, a full video line is shown. In the upper drawing, these top-of-field (B) video lines are 1, 3, 5, 7, etc., while below, these first lines are 2, 4, 6, 8, etc., of an even field (C).

When the fact that "an aspect ratio of 4:3 is recommended to conform with existing motion picture practice" is added, we have concluded our review of the more important introductory features of television. This quoted sentence simply means that the height of the picture shall be ¾ the width, regardless of size of *Kinescope* used.

For Additional Reading

ELECTRON OPTICS IN TELEVISION
I. G. Maloff and D. W. Epstein
McGraw-Hill Book Company

ELECTRONIC TELEVISION
George H. Eckhardt
The Goodheart-Willcox Co., Inc.

TELEVISION WITH CATHODE RAYS
Arthur H. Halloran
Pacific Radio Publ. Co.

TELEVISION RECEPTION TECHNIQUE
P. D. Tyers
Sir I. Pitman & Sons. Ltd.

THEORY & PERFORMANCE OF THE ICONOSCOPE
V. K. Zworykin, G. A. Morton & L. E. Flory
Institution E. E. Journal—Jan. '38—May '38.

TELEVISION INTERMEDIATE FREQUENCY AMPLIFIERS
E. W. Engstrom and R. S. Holmes
Electronics Magazine—June 1938

A LABORATORY TELEVISION RECEIVER
Donald G. Fink
Electronics Magazine—Sept. and Oct. 1938.

[Next month the author continues with Part 2 of this interesting course.—Ed.]

—30—

100-Watt Transmitter

(*Continued from page 27*)

also offering protection when any excitation failure occurs. Since the Class "B" modulators use simply two flashlight cells, the bias supply shown is entirely satisfactory for all the other needs of the rig. It is also a handy source of 200 volts for any special needs around the shack.

The modulators and the Class B transformer are slightly oversize for the 100 watt final input, but this is a wise choice in this case. First, it means long tube life, and less possibility of poor quality due to overloaded equipment. Also, the final input may be increased to 150 watts and still be modulated easily, without overload of any component. The bias for the 809s is supplied by one or two 1.5 volt flashlight cells, which need only be replaced at long intervals.

When operating on CW, one switch on the panel turns off the unnecessary filaments, another shorts the Class B transformer secondary, to prevent sudden voltage surges, due to the final plate current changing rapidly.

Power Chassis

The chassis carries three power supplies, for the entire r.f. unit and for the modulators. They are all quite conventional, and require no particular comment.

The switching arrangement may seem a bit complicated, but at the expense of a few toggle switches, complete flexibility is achieved. The first switch on the panel lights all filaments. The second is a master power control, turning on whatever units are set up on the following three switches. So any combination of exciter, final, and audio may be selected, and then controlled by the single master switch.

The power transformer for the final r.f. has a tapped primary, permitting variation of the voltage from about 500 to 650 with choke input filter. By using condenser input, the voltage may be raised to about 720 volts, at 200 milliamperes final, and 80 ma. to the 807 plate.

The value of screen dropping resistor for the 807 will vary with the plate voltage applied, so I suggest a variable, about 30,000 ohms maximum, and adjust with the highest voltage applied, to give not over 250 volts on the screen. Otherwise climbing plate current will be encountered.

For the Class B plate current, a well damped meter should be used, so as to better indicate the average current drawn. I use a 1 ma. panel type *Weston*, with a shunt in the audio chassis, and the meter leads brought out to the meter which is placed directly in front of the operator.

The AMC circuit should function without any trouble or adjustment. With the AMC switch in the *off* position, apply a steady audio input tone (with the whole rig operating, and feeding a dummy antenna). With gain control open wide, drive the modulators up to 200 ma. or so. Then throw in the AMC, and the modulator current should drop down appreciably, for 200 ma. will be enough input to very definitely over-modulate 100 watts final input. If the circuit does not work properly, check the voltages across the various portions of the voltage divider, which supply the bias for the control tube, and the rectifier.

Crystal Oven

A feature not usually found in small layouts is a self-contained crystal oven. It is evident in the top view of the r.f. unit, as the large black box in the left back corner. It holds four crystals, and maintains the temperature to within about two degrees Fahrenheit.

The outside is a shield can, about 5"x5"x6". This is lined with a double layer of Masonite, to prevent excessive heat leakage through the walls. Four sockets are mounted through the bottom for the crystals. A 25 watt electric light is used for the heater. The thermostat is taken from a cheap dial type thermometer. It is soldered to a bolt, screwed into a small insulator having a threaded hole in each end, and fastened in the center of the base, between the crystals. A short piece of stiff wire is mounted on another insulator, and pressing against the extended portion of the thermostat forms the other contact. A 6.2 volt flashlight bulb, on the panel, indicates when the oven is operating. If the contact on the thermostat is kept clean, this oven will give excellent performance.

The combination of an untuned, low current oscillator, and a crystal oven permits a signal of unusual stability, both during transmissions, and from day to day, even with x-cut units.

Keying

This transmitter may be keyed in any of several ways, to suit your particular preference. The 6C5 oscillator may be keyed when using crystal, with no appreciable chirp. Keying the 6C6 is very satisfactory for both crystal and ECO. —30—

COIL TABLES

ECO cathode coil, 13 turns, 1" diam., close wound, tapped at 3rd turn from bottom. Wire is No. 18 enamel.

Coil:	Freq.:	Turns:	Diam.:	Length:	Link Turns:	Wire No.:	Form:
L_1	7 mc	23	1.5"	1.5"	..	18	yes
L_2	14	11	1.5"	1.5"	..	16	yes
L_3	28	4.3	1.5"	1"	..	14	yes
L_4	7–14	17	1.2"	1.3"	3	14	yes
L_4	14–28	9	1.2"	1.3"	2	14	no
L_4	28–56	4	1.2"	1"	2	12	no
L_5	7	36	1"	1.2"	3	20	yes
L_5	14	22	1"	1.2"	3	18	yes
L_5	28	12	1"	1.2"	3	14	no
L_5	56	8	1"	1"	2	14	no
L_6	7	28	2"	2.5"	4	14	no
L_6	14	12	2"	2.5"	3	12	no
L_6	28	6	2"	2.5"	3	12	no
L_6	56	4	2"	2.5"	2	10	no

Within Earshot

(*Continued from page 4*)

So far we have had a great many radio-minded persons in attendance. The exchange of views has brought about more than one idea which has appeared here, and we hope that more and more of you will avail themselves of the chance to come and talk things over with us.

It is this means that we use to keep in touch with our readers and get their reactions to our various programs. We are "at home" from 8 p.m. until the last fellow leaves.

* * *

TWO columns continue to suffer through lack of material. The "Hamchatter" is conspicuous by its absence, and the serviceman never writes in. We can use copy on both subjects. Send it along with pictures.

* * *

TO THE READERS of GY's column: Please send in your photos of interesting shots taken on ship-board or of yourself. Jerry tells us that he will publish all that he can. It is up to the commercial ops to make the column the best in the biz!

* * *

MR. LEE WARD writes in as follows: "Dear Ed: I don't know what the servicemen want me to write about . . . and I don't know why they do not want to send in their pictures of their shops for publication. . . . Won't you please jack them up on this?" We think Lee has something there. You servicemen who have spent hours on end fixing up your shops, why not send us a photo so that we can in turn tell the world and show the readers how *you* did it. They would be interested, we know. And on the other question, let Lee know what you would have him discuss and you'll probably see his expert opinion on it in an early issue.

* * *

WHILE it is not the habit of RADIO NEWS to stray too far afield from the technical side of radio, still in this day and age, any publication that closes its eyes to a national situation such as the present investigation of the broadcasters by the F.C.C., would not be serving its public. We servicemen, experimenters and amateurs, who are the backbone of the industry, not only because from our ranks spring the engineers of tomorrow, and the inventors of the future, but because most of us have either our hobby or our business tied up with radio, should be keenly interested in what is now going on down at Washington.

Briefly, and to review the situation, there is an investigation into a so-called monopoly of certain broadcast chains. The basic foundation for opposing such a monopoly is that the air over these United States belongs—and rightfully so—to the people. What will be uncovered remains to be seen; but the theory on which the investiga-

tion is being made, to our minds represents the highest form of democracy. Chairman McNinch of the F.C.C. insists that the frequencies that the broadcasters use belong to the people and are only loaned to the broadcasters. In a speech, he has indicated that those who use these wavelengths have accepted a unique responsibility. He pointed out that the radio is the greatest social power on earth today and must be used here in furtherance of democratic ideals. This of course, is the direct antithesis for what the dictators use their radios, and it must be said that if the honorable chairman succeeds in uncovering a monopoly, that there will be a radical change in the granting of wavelengths, etc. It is not so much the monopoly that is bad, as the chance that such a monopoly could be used to embarrass the government or to foist un-American 'isms on the people without a chance of check.

We of RADIO NEWS commend the careful following of the Washington investigation to all our readers, and specially to those of them who are radio amateurs. We can see the handwriting on the wall that there might be a shake up in the present set-up of the amateurs too, so that the tail would not be always wagging the dog!

* * *

We wonder what the ensuing year has in store for the field of radio.

BCNU!-W9QEA.

Filter Choke Design

(*Continued from page 29*)

netic path of 9 inches, it is found that the ampere turns per inch are $\frac{640}{9}$ or 71 +. Consulting the iron curves supplied by the steel manufacturer, it is found that the iron used in this choke will have an a.c. permeability μ of approximately 300. Using this μ a.c. of 300 in the following formula, we find the inductance to be 22 henrys.

$$L = \frac{.4\pi\mu N^2 A K_1 10^{-8}}{Q}$$

Where

$.4\pi = 1.257$ m.m.f. Steinmetz factor or conversion factor
μ = A.C. permeability
N = Turns of wire
A = Area of core in centimeters
K_1 = Stacking factor of the iron (manufacturer's rating)
Q = Length of magnetic path in Centigrade

Centimeter = 2.54 inches

By using these formulae and the facts here presented not only can the enginering student and serviceman rewind old burnt-out chokes, but special chokes can be made where none are available commercially. The greatest use can, however, come to those desirous of checking manufacturer's specifications. Ask for wire size, number of turns and thickness of insulating paper and determine for yourself if the choke will do the job you want it to. —30—

Serviceman's Experiences
(*Continued from page 25*)

a cup of his analgesic coffee, but stopped with one foot on the pavement. An unshaven man, dressed in arctic clothing, lurched out of Kennedy's *Alcoholic Recreation Room,* made a wide semi-circle from the swinging door, went off the sidewalk and up again without noticing a change of level, and came to rest by seizing a lamp-post.

"Run away from me, will you?" I heard him mutter.

I recalled my foot and closed the door of the car. Drunks have a way of singling me out with a refractory eye. To them, no matter how I am dressed, my sedate bearing is symbolic of vested authority. The drunk, inattentive to the curious audience which circled him, took a long whip from his belt, and snapped it in the middle of the street.

"Mush!" he shouted.

Then he saw me, and walked toward the truck. I stepped on the starter, put it in second, and held the clutch in readiness for a quick start. My heart was beating so loud I had to look at the ammeter to see if the motor was running. It was, but the stranger, walking in my line of flight, prevented me from taking off.

He came alongside, opened the offshore door, and stood with his heavy boots two feet apart.

"How things panning out, podnah?" he asked me, protruding a paw. "Put 'er thar!"

I couldn't appear frightened with the whole neighborhood looking on, so I steeled myself and said, very firmly: "I got witnesses!"

"Sure," he laughed, "but you can't take them with you. I'm going to drive you home with me. Move over!"

I slid over, and hoped Al had been right when he told me never to be afraid of a customer because I was born for hanging. Ah, me! What attraction have I for persons of low culture and high odor?

When the car was in high, he cracked his whip every fifty feet, and yelled: "Mush!" He parked in front of the *Venus Arms*—the swankiest apartment in our section, and said:

"C'mon in—we'll rustle up food."

Although I was agreeably surprised to see he did not live in a cave, I was in no mood to have hospitality rammed down my throat. I edged toward the wheel furtively, but he took the keys and grabbed my arm.

"Ain't seen you nigh onto a year—got somethin' I wanna talk over with you," he explained, pulling me effortlessly into the lobby. In his apartment, he fell into a chair and laughed.

"Lee," he said, "your fright flatters me! If you don't recognize me, take a look at that radio."

He was Peterson, a customer Al had trusted for a $20 repair on the plea he would buy a better set from us when he got a job! I *told* Al at the time

the fellow was nothing but a bum in suspended animation, but he wouldn't listen. Boy, what a chance to get back at him, especially after he had jumped on me for judging human nature! Here was no sweeps winner!

"Mr. Peterson," I said, sternly, "I've waited long enough for that money you owe. I'm going to take the set back until you settle. If you want to know why, drop into the shop during a sober interval!"

The set was a large table model; I disconnected it hurriedly and strode out with it. Peterson didn't let out a peep.

I felt so elated on the way back, I stopped off to review the events of the evening with Kennedy. "Give me a 'ball," I said. "Did I just put your Alaskan friend in his place!"

"Yeh," Kennedy replied, "he puts on a great performance every time he leaves here. By the way—he was asking for you a few days ago—said he wanted to buy a combination."

"That bum!" I said. "I wouldn't sell him a bent needle! Why don't you keep him out?"

"What—my best customer?"

"Why not—if he's running the place down? *I* told him off quickly enough—used to be one of *my* customers, too, before he went to the dogs."

Kennedy laughed, and said: "Wish all my customers were like him. You know, ever since he got the lead as sledge-driver in the hit play *Frozen Footsies* six months ago, he stops in every day to show his old friends success hasn't turned his head. He sets 'em up for the house every time, too. It 'maintains his artistic mood,' he says. He talks loud, pounds on the bar, and cracks his whip, but doesn't touch the stuff himself. The other boys take the strong stuff, but he takes his from a special bottle I keep filled with black coffee."

Kennedy glanced at me when I didn't move or answer, and stopped wiping the bar when he saw the expression on my face. "Here, have a chaser," he said. "You shouldn't use the stuff if one drink hits you that hard."

—30—

QRD?

(*Continued from page* 36)

TAKE heed from FCC release: Harry W. Smith was found guilty on two counts charging unlawful radio operation in violation of Sections 301 and 318 of the Communications Act of '34. On the first count he was fined $50.00 and on the second the court sentenced him to be imprisoned for six months. Both sentences were suspended.

* * *

THIS may happen to you. On Zane Grey's *Fisherman 2nd,* the SW MOPA Xmtr was always troubled with tubes. Oscillator tube was always low on emission, with no plate voltage registering. Still it radiated from the antennae. Swapping tubes did not make any difference. After investigation it was found that because the Osc was a gassy tube, it oscillated enough to drive the Amplifier, which was also a gassy tube. Contributed by JA Yurgionas, RO 1st. And we'd like to hear of your experiences!

TSK, tsk. "Boy, break out the towel." Vidrine (JL) who brass-pounded his way to a billet on the *Kishacoquillas*, is weeping the blues. An aunt dies . . . leaves him the pot of gold . . . he buys a house and lot . . . takes his YL out . . . biff, bang, boom . . . no more dough. He's now looking for another berth where he can rest and think about what he should have done with the filthy lucre . . . well, we live and learn.

* * *

WE'RE giving a thought to publishing a photograph and thumbnail sketch of the men who have helped to bring radio to the point where it is today. Men in every field of radio science; radiops who have been a credit to the profession; including every one who has had some hand in the advance of radio, technically or operating. But we'd like to know your choice for the first photos. So shoot in your answers quickly!

* * *

AND so, me hearties, some more water goes under the bridges, another new year is born, new ships are coming off the ways, new uses for radio are being perfected and new plans for the betterment of working conditions, wages and recognition are being promulgated. Are you in the swim? Have you personally advanced your position, knowledge or ambitions? Sit down some evening and ask yourself these questions. If you haven't . . . find out what's the matter. Like the youngster said, "Ya can't send your ship out and then wait. Ya gotta do sumpin' more. Pray for wind to blow her back." With that for a thought. 73 . . . ge . . .GY.

—30—

Bench Notes

(*Continued from page* 21)

a wedge for set sales. Whether or not such advertising is fair, I would rather enter the house with the understanding the repair or recommendation for a new set would be based on the conditions I encountered in his home—not those set up as a frame-up in a distraught advertiser's office. The customer is instinctively wary of a bargain concerning something he doesn't understand.

The "loss-leader" sale of a staple, tangible item such as a cheap camera is not a parallel case. The customer who buys a dollar camera knows, from previous camera experience, that it might fly to pieces after the fifth exposure, and is reconciled to the possibility. In radio repairs, however, what the customer gets for a dollar is determined by store policy as interpreted by the serviceman. No set owner ever asked me for an inferior set repair; they all want either the best work and parts possible, or none. If they didn't, they threw their sets out the window and went shopping for the best ones they could afford, instead of calling me.

A customer come-on ad which offers eight dollars' worth of intangibles for one dollar is as distasteful to most persons as the announcement of a bargain day in a doctor's office.

The bell.

Round Three

"As far as the use of the word 'engineer' is concerned, I know of no law or even custom which limits the use of this word to people who necessarily

have a degree from a university. Our department uses the word to convey the truthful impression that our repairmen are capable of engineering or constructing a modern radio, and are therefore ultimately qualified in repairing one. The men now working for us must be graduates of one of the best technical schools, in addition to meeting our own requirements."

Bench Notes fights on:

Perhaps, because of the common misuse of the word "engineer," no advertising ethics are violated; but it is certain that an engineer is one thing, and a serviceman is another. If the choice of designation were put up to the servicemen themselves, they would not choose "engineer," and if they don't know, who does? If you know any one repairman who thinks he deserves an engineering title simply because he maintains broadcast receivers, ask him what he wants to be called if he ever *is* an engineer.

Both custom and law speak against the loose use of "engineer." In some states, it is a misdemeanor to set yourself up in business with an engineering title, unless you have passed a State Board examination. No servicing school writes "engineer" on their diplomas, and the graduates themselves do not claim such a title. A university degree is not a requirement for engineering, and the lack of one will never keep you from being one. The nature of your work, and the amount of accomplishment, are more important factors. It is natural to find more radio engineers who have university degrees than those who haven't, but it is only because those in the former group have better tools.

I would rather have the title "serviceman," and have it mean something, than one which was thrust upon me by a man in another profession. I don't care what entrance requirements a department store sets up for their applicants, but it would be better if school standards were set up by men *within* the profession. It also annoys me to see servicemen advertised as engineers when the choice of the servicemen themselves is against it.

Perhaps we servicemen are partly to blame for not having more rigid standards within a profession that is twenty years old. Some day, I suppose, the delineations between the various radio fields will be better defined; until then, we should resist any attempts which are made to add confusion by use of "engineer" by outsiders. If "engineer" comes to mean nothing, neither will "technician," "serviceman" or "repairman." When the functions of these classifications are made less diffiuse, engineers and servicemen will be maintained as disparate groups.

The final bell — the opponents, breathing heavily, retire to their corners. Did Smithson's win a moral victory, or did BENCH NOTES score a technical knockout? You are the judges, and we await your decisions!

—30—

RADIO PHYSICS COURSE

(Continued from last month)

Experiment: Heat a small piece of iron or steel (a hack-saw blade or a ten-penny nail will do) in a gas flame. It will first become warm and then hot, as you can prove by removing it from the flame every few seconds and placing your hand near it. Continuing the heating causes it to emit light and change color, first turning to a "dull red," then a bright "cherry red", to slightly "orange", and finally it gets "white hot". If the flame were hot enough to bring the temperature of the iron up to its melting point we would find it would give off a very bluish-white light just before melting.

What has taken place during this experiment? Applying heat to the iron caused its molecules and atoms to vibrate faster and faster as its temperature increased. This rapid vibration caused some electrons to jump to other orbits than their own, resulting in electromagnetic radiations within the particular band of frequencies which have the power of affecting our skin. Our nerves carried the effect to our brain, where the intelligible impression of heat was formed. As the heating was continued the rate of vibration of frequency of the molecules increased, causing the radiations to follow one another more closely, i.e., the frequency increased. These higher frequency radiations produced the sensation of light in our optic nerve and became visible as red light. Continuing the heating, increased the frequency of vibration of the molecules and radiations, resulting in the production of orange, yellow and finally blue-white light. If we could increase the frequency of these electromagnetic radiations still more by some means, we would produce violet light, ultra-violet light, X-rays, and finally gamma rays and the cosmic rays. All of these radiations, heat, light, X-rays, gamma rays, etc., are fundamentally the same. They are all electromagnetic radiations differing only in frequency. Sound waves differ from these in that there is nothing electrical about a sound wave, it is simply a mechanical vibration, or actual to and fro motion of air particles.

How radio radiations are produced: There are many different methods by which atoms can be made to radiate at various frequencies, but we must confine ourselves now only to the one used for producing radio rays. In order to produce the frequencies used for radio transmission, which are very much lower than those necessary for light and heat, we must establish what might be called an artificial electron orbit, having a circumference infinitely larger than the largest natural orbit of the electrons found within an atom.

A coil of one or more turns of copper wire constitutes such an orbit.

(To be continued)

Television Receiver

(Continued from page 24)

ulated. Variations will occur due to line voltage conditions and tubes. If there is any substantial deviation in voltage from that given in this table, ascertain the reason, and correct it before proceeding further, or damage to tubes or other parts may result.

WARNING

Be sure that the Voltmeter prongs are well insulated and use great care in making these measurements to avoid shock from the High Voltage supply.

Alignment and Operation

Set the picture tube bias control (No. 1) all the way to the right. Set the horizontal and vertical sweep (Nos. 6 and 7) controls half way.

Now turn the spot locating control (No. 3) all the way to the left and rotate the other spot control (No. 4) through its entire range. If neither a spot nor a *raster* (the scanning pattern) appears, move the first spot locating control (No. 3) slightly to the right and rotate the other locating control through its entire range again. Continue this procedure step by step until something appears upon the viewing screen of the C-R tube.

Now adjust the vertical and horizontal sweep controls until a complete *raster* appears. This should be approximately 4" square (the actual picture will be somewhat smaller due to the presence of the blanking and sync pulses in the station carrier).

By means of the spot location controls (Nos. 3 and 4) this pattern may now be centered on the tube face.

The size of the picture is determined by two factors, namely: the sweep circuit voltage and the voltage applied to the second anode. The picture increases with increase in sweep voltage and decreases *inversely* as the square of the second or high voltage anode potential. The saw-tooth voltage developed by the multi-vibrators is a function of the "B" voltage applied to the plates. Since we are operating near the voltage limit of the 5Z3 rectifier tube, it is impractical to obtain any improvement in this direction. Amplifiers could be used to increase the sweep voltages, but this would complicate matters greatly. The other alternative is to reduce the 2nd anode voltage. Referring to the circuit diagram, a 100,000 ohm (R66) dropping resistor is indicated in series with the low voltage filter system. This results in a larger picture, at only a slight sacrifice in brilliance. The use of this resistor is optional, depending upon which characteristic is the more desirable.

The image ratio should be 4:3. If the picture does not conform to this ratio, a rearrangement of resistors in the sweep plate and screen circuits will correct this. Potentiometers could be inserted to control the voltages applied to the deflection plates, but these additional controls are hardly necessary, since once this adjustment is made, it need not be changed, for a given set of tubes.

After this has been satisfactorily checked, we may proceed to the i.f. amplifier adjustments. An output meter or preferably an oscilloscope is connected across the output of the video amplifier (6V6 plate). A signal from a signal generator or equivalent source is now introduced at the converter grid (6K8). The intermediate frequency is 12 mc. The i.f. transformers are now adjusted for maximum output in the conventional way.

Now introduce a signal, whose frequency is approximately that of the principal station to be received, into the antenna circuit. Tune this signal by rotating the dial, then align the antenna and r.f. circuits for maximum output by means of the trimmers on the variable condenser.

After this has been done, the receiver is ready for a test on the air. It is best to make adjustments on the fixed pattern transmitted by television stations during test periods preceding the regular scheduled programs. The i.f. system should now be readjusted by staggering the peaks to accept a wide band of frequencies (2 megacycles). This will result in considerable improvement in picture detail, with relatively slight loss in gain.

The i.f. transformers are heavily loaded (with 1500 ohms across each secondary). It is possible to omit these, with an increase in gain if they are carefully realigned so as to stagger the peaks, with a resultant "square top" resonance curve over the band.

The r.f. circuits should now be realigned for best tracking. It may be necessary to adjust the r.f. coil inductances slightly to obtain the proper range and tracking. If necessary the end plates of the variable condenser may be bent to accomplish this.

About 20 volts at the control grid of the cathode ray tube is necessary in order to obtain a good picture. If everything is functioning properly this should be easily obtained from stations within range. This can be checked with a vacuum tube voltmeter or calibrated oscilloscope.

A little experience will enable the user to tune in a station quickly and clearly. Proper manipulation of the controls is important, and the function of each should be studied carefully and thoroughly understood.

T_1—1500V. Power transformer 8C12
T_2—Rcvr. power trans. 8K93
L_{15}—Rcvr. Filter choke 20H No. 1 L 11 R
L_{11}—Hi-Voltage filter choke 1000H No. 1 F45R
L_{13}—Low frequency sweep choke 2000H No. 1 F47A
L_{12}—High frequency sweep choke 300H No. 1 C42J
L_{11}—R.F. Choke—50 MH
L_{10}—R.F. Choke—55 MH
$L_{9, 9}$—R.F. Choke—120 MH
$L_{1, 5, 6, 7}$—I.F. Transformers—12 M.C., U100 SIZES:
C—21, 23, 25, 28, 30, 33, 34, 39, 46, 47, 48—*525V. Peak net electro.*
C—44, 45—*2000V. (J347)*
C—41—*1000V. (J345)*
C—37—*1000V. (J344)*
C—42, 50—*2000V. (J346)*
C—40, 43, 26, 5, 7, 9, 10, 12, 14, 15, 17, 18, 20, 22, 24, 27, 29, 49—*400 volts.*
C—51, 4, 13, 16—*200V.*
C—35, 36, 8, 52, 19, 31, 32, 38—*Mica*
C—1, 2, 3—*3 gaug variable*
R—64, 36, 52, 56, 44, 61, 62—*Wire wound pots.*

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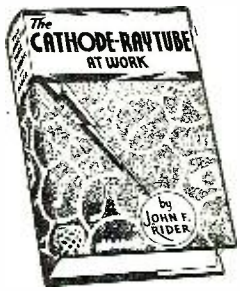

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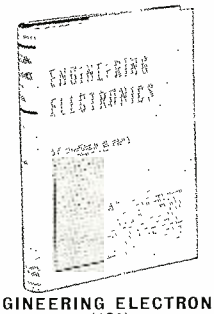

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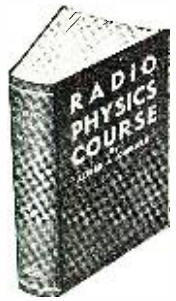

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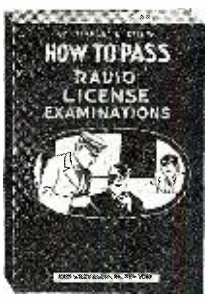

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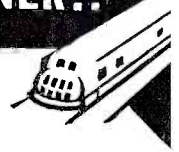

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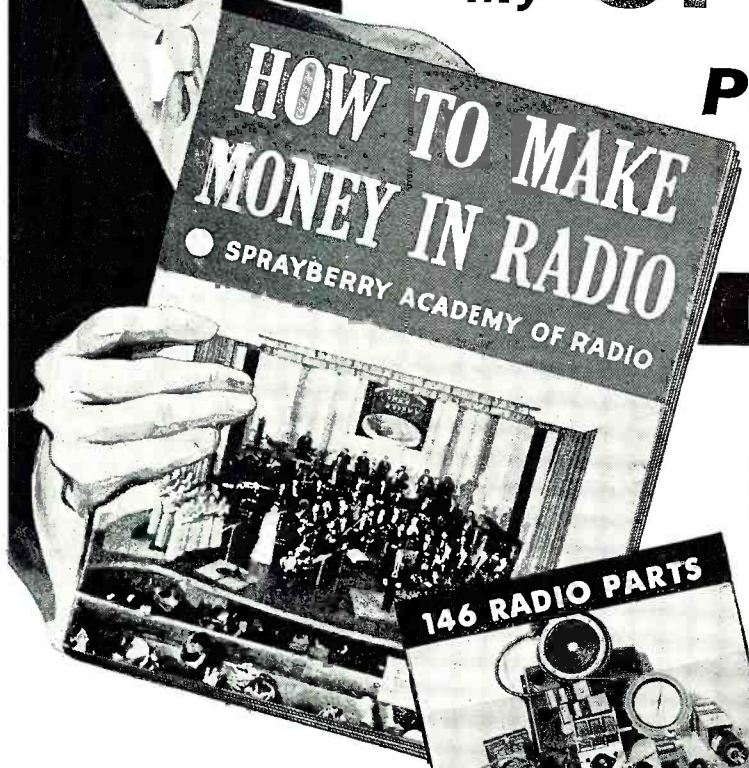

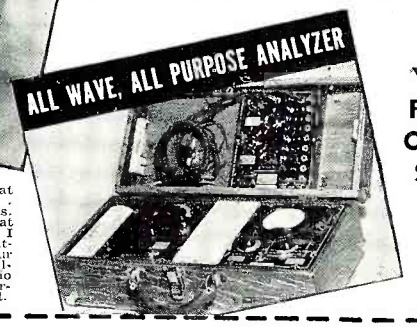

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The GUBA, $250,000 Consolidated Flying Boat used by the Archbold New Guinea Expedition.

Hallicrafters Dual Diversity Receivers to be Used to Maintain Contact with Archbold New Guinea Expedition

STEAMING across the Pacific to remote Hollandia in Dutch New Guinea, a fast ship is carrying a new Dual Diversity Receiving System to the Archbold Expedition for the American Museum of Natural History. In the shack of W6LYY in San Diego, Calif., Barney Boyd already has installed another Dual Diversity. Soon these two Hallicrafters Diversity receivers will be helping maintain dependable communications across 7000 miles of Pacific Ocean, between the crew of the gigantic $250,000 Consolidated flying boat "GUBA" of the expedition and their base station, Barney Boyd's shack.

Realizing the importance of regular communications between the expedition and their home base, these two Hallicrafters Dual Diversity Receiving Systems were recently ordered, to provide the most modern and dependable radio reception available today. You will find Hallicrafters Dual Diversity Systems used wherever the finest of Radio Reception is demanded.

Ask your Hallicrafters Dealer about the Hallicrafters Dual Diversity Receiving System, or write for complete information.

Winner Picks SUPER SKYRIDER

The winner of the Radio News Prize Contest for the best technical article on radio, C. C. Springer, W9EMR, given a choice of receivers, picked a Hallicrafters Super Skyrider.

Below. *The Dual Diversity, with special speaker, shipped to New Guinea headquarters of the Archbold Expedition.*

Above. *The Hallicrafters Dual Diversity installed in Barney Boyd's shack at San Diego.*

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