RADIO

ESTABLISHED 1917

October, 1937 — 30c in U.S.A. and Canada — 1/8 in the United Kingdom; 2/- in Australasia — No. 222 ®

THE WORLDWIDE TECHNICAL AUTHORITY • OF AMATEUR • SHORT WAVE AND EXPERIMENTAL RADIO •

"R" Meter Circuit PP54

This Month

The Story of Sound-on-Film Recording

◆

A 5 and 10 Meter Exciter of Modern Design

◆

High Frequency Impedance-Measuring Device

◆

A Station Receiver for Ten Meter Phone

THE AMERICAN RADIO RELAY LEAGUE

RADIOGRAM

VIA AMATEUR RADIO

CITY OF ORIGIN	STATION OF ORIGIN	NUMBER	DATE	CHECK
Schooner Effie M. Morrissey	W 10 XDA	#66	July 30, 1937	

To Radio Mfg. Engineers, Inc., Peoria, Ill. (PLACE)

306 First Avenue, (STREET)

WORDS FAIL TO EXPRESS HOW WELL THE RME-69 and DB-20 ARE PERFORMING UNDER SEVERE CONDITIONS. WE COULD WISH FOR NOTHING BETTER. GREETINGS FROM NORTHWEST GREENLAND.

CLIF FOSS,
RADIO OPERATOR,
SCHOONER MORRISSEY,
BARTLETT EXPEDITION.

SENDER'S ADDRESS AND PHONE NUMBER FOR REFERENCE:

REC'D	FROM ST'N	LOCATED AT	DATE	TIME	OP R	SENT
	W10XDA	77 deg. N. Lat.	7/30	10:25P	Foss	

PLEASE READ OTHER SIDE — IMPO

PRINTED IN U. S. A.

R M E 69

Captain Bartlett and Radio Operator Clifton Foss on board the Schooner Morrissey just before departing on its expedition to Greenland under the auspices of the Smithsonian Institution and the Chicago Zoological Society. The schooner carries the RME equipment shown (call letters 10XDA) and similar equipment was installed at the base station in Brooklyn.

"Words Fail to Express"

Operator Foss has put into his radiogram the impressions and experience of many other hams all over the world.

When you order your RME-69 it can be built to your specifications. It may be had with built-in noise suppressor, band spread, break-in controls or any combination of these features in black or grey "crackle" finish metal cabinet.

We will be pleased to supply detailed information

Radio Mfg. Engineers, Inc., 306 First Ave., Peoria, Ill., U.S.A.

RME-69

RADIO

7460 BEVERLY BLVD., LOS ANGELES, CALIFORNIA TELEPHONE YORK 7226

New York Office:
500 Fifth Avenue
Phone: LAckawanna 4-5967

Chicago Office:
3618 No. Bernard Street
Phone: JUNiper 5575

Direct all correspondence to the home office at Los Angeles except as otherwise requested.

Staff...

Technical and Editorial Dept.

Editor
W. W. Smith, W6BCX

Technical Editor
Raymond L. Dawley, W6DHG

Associate Editors
K. V. R. Lansingh, W6QX
E. H. Conklin,[1] W9FM

Assistant Editors
Herbert Becker, W6QD
George D. Walker,[2] W4CTO
Rufus P. Turner.[3] W1AY
Charles A. Hill, W6BRO

Technical Consultants
R. S. Kruse, W1FG
Ralph O. Gordon, W6CLH
James M. Sharp, Jr., W6DMY
Charles D. Perrine, Jr., W6CUH

Engineering Draftsman
B. A. Ontiveros, W6FFF

Laboratorian
Faust R. Gonsett, W6VR

Laboratory Assistant
Harry M. Leonard, W6MBD

Business Department

Los Angeles

Publisher
K. V. R. Lansingh

Managing Editor
M. M. Lloyd

Circulation Manager
B. L. Hover

New York

Eastern General Manager
V. R. Lansingh

Eastern Advertising Manager
Clarence W. Emerson

New York Circulation Representative
Edward J. Byrne

Chicago

Midwestern Advertising Manager
Clyde W. Nelson

Address all correspondence and manuscripts to the home office at Los Angeles except as follows:

1. *Radioddities, Strays,* and the like may be sent to Rufus P. Turner[3].
2. Calls Heard may be sent to George Walker[2]; also dx news and station descriptions from eastern America and from transatlantic countries.
3. Advertising inquiries may be directed to our nearest office, but all copy and cuts should be sent direct to Los Angeles.

Unusable, unsolicited manuscripts will be destroyed unless accompanied by a stamped, addressed envelope.

[1] 512 N. Main St., Wheaton, Illinois.
[2] Box 355, Winston-Salem, North Carolina.
[3] 159 W. Springfield Street, Boston, Massachusetts.

PRINCIPAL FOREIGN AGENTS

Europe: N. E. Read, 37, Willow Street, Oswestry, Shropshire, England. **Australia:** "The Bulletin", Box 2521BB, Sydney; McGills, 183 Elizabeth St., Melbourne; Swain & Co., Ltd., Pitts St., Sydney. **New Zealand:** Te Aro Book Depot, Ltd., 64 Courtenay Place, Wellington. **South America:** F. Stark, Caixa 2786, Sao Paulo; *Revista Telegrafica,* Peru 165, Buenos Aires.

Radio. *Entered as second-class matter. Published at 7460 Beverly Boulevard, Los Angeles, Calif.*

RADIO, October, 1937. No. 22

RADIO is published ten times yearly (including enlarged special annual number) about the middle of the month preceding its date; August and September issues are omitted. Published by

RADIO LIMITED
TECHNICAL PUBLISHERS
7460 BEVERLY BOULEVARD
LOS ANGELES

IF YOU MOVE notify us in advance; we cannot replace copies sent to your old address. Full details and a handy coupon will be found elsewhere in this issue.

SUBSCRIPTION RATES, postpaid: U.S.A., Canada, Newfoundland, Cuba, and Mexico, $2.50 the year; two years, $4.00; (add 3% tax in California). Other independent American countries and Spain, $3.00 the year; two years, $5.00. Elsewhere (except New Zealand), $3.50 or 14s. 6d. the year; two years, $6.00 or £1 4s. 6d. Remittances must be payable at par in continental U.S.A. except as noted under "Remittances" below. New Zealand only, 18s. 6d. local currency, from Te Aro Book Depot, 64 Courtenay Place, Wellington. Special Issues are included only with subscriptions of one-half year or longer. Refunds will be made on cancelled subscriptions at the difference between the amount paid and the rate earned.

THREE YEAR SUBSCRIPTIONS, $5.00, net, in advance, in U.S.A. and Canada only.

REGULAR ISSUE SINGLE COPY RATES: at newstands, book stores, and radio parts dealers, 30c per copy in U.S.A. and Canada, 1s. 8d. in the United Kingdom, 2s. in Australia and New Zealand. By mail, postpaid, from home office, 30c in U.S.A., Canada, Newfoundland, Cuba, and Mexico; 35c in countries taking the $3.00 subscription rate; elsewhere, 40c or 1s. 8d. Regarding remittances, see below.

BACK ISSUES (when available), 5c extra; they will not be included in subscriptions.

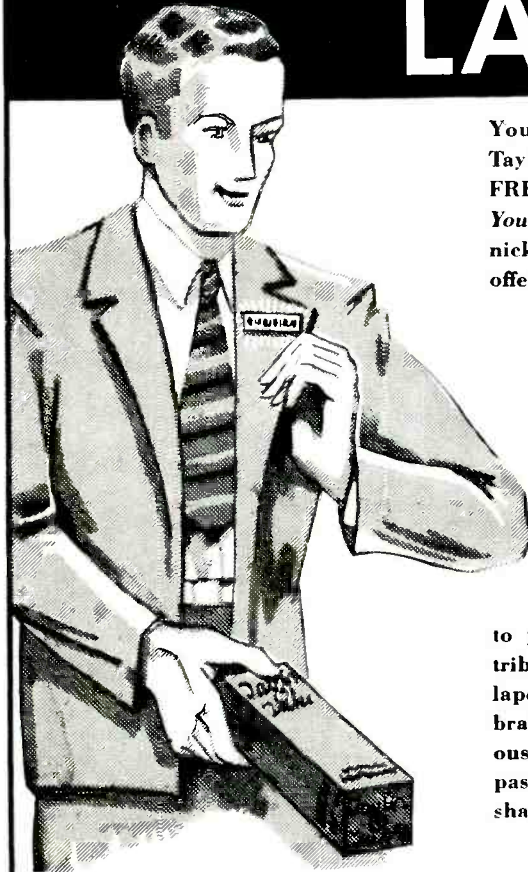
ENTERED as second-class matter February 6, 1936 at the postoffice at Los Angeles, California, under the Act of March 3, 1879. Registered for transmission by post as a newspaper at the G.P.O., Wellington, New Zealand.

BRANCH OFFICES transact business with customers who call in person; mail orders should be sent only to Los Angeles.

RESPONSIBILITY will not be accepted for subscriptions placed with unauthorized agents. Prospective subscribers are urged to inspect carefully the credentials of anyone soliciting their business. Agents are never authorized to vary the rates above quoted.

REMITTANCES must be payable at par in continental U.S.A. except as follows: Canadian postal notes accepted; please add 10c exchange to Canadian checks below $2.50; British postal orders and cheques drawn on or payable at par in London are accepted at rates quoted in British currency. From elsewhere remit by Bank Draft (preferred) or international money order.

Free CALL LETTER LAPEL PIN



Your favorite Distributor, cooperating with Taylor Tubes, offers all amateurs, absolutely FREE, a genuine W1DNF lapel pin. Think of it: *Your own* call letters on a beautiful, substantial, nickel silver lapel pin 1″x¼″. This Taylor Tubes offer is in effect on all purchases from October 1, 1937 to December 31, 1937.

READ THE RULES

You can only secure these fine lapel pins through an authorized Taylor Tubes distributor. No direct orders will be accepted. Tear off the tops from *two* Taylor 866,T-20 or TZ-20 cartons, or the top from *one* of any other Taylor Tube carton except the 866 Jr. (866 Jrs. are not included in this offer.) Present the tops to your favorite authorized Taylor Tubes Distributor. Within a short time he will have a lapel pin for you, *absolutely FREE*. This celebration offer is in appreciation of the tremendous sales success of Taylor Tubes throughout the past year. Your Distributor and Taylor Tubes are sharing in this great celebration.

SEE YOUR DISTRIBUTOR TODAY

He will give you the complete dope. Hurry up, this offer expires midnite, December 31st. If you can't see your distributor in person, drop him a note and he will tell all.

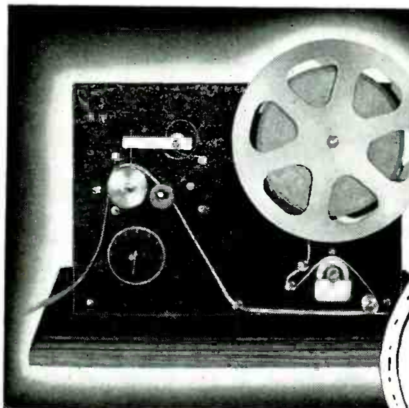
New Taylor Manual acclaimed the finest by thousands. Don't delay—get your copy FREE from your Distributor or write to us.

Guaranteed Actual Size

"More Watts Per Dollar"

Taylor HEAVY **CUSTOM BUILT** DUTY **Tubes**

TAYLOR TUBES, INC., 2341 WABANSIA AVE., CHICAGO, ILLINOIS



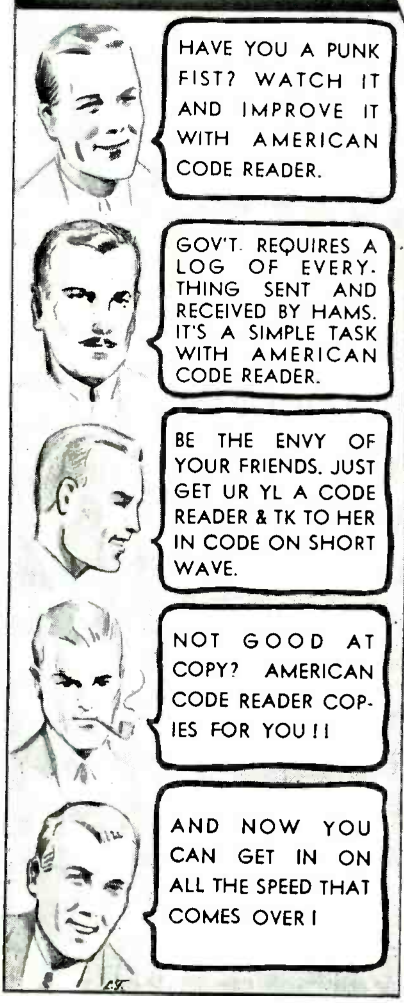
A NEW THRILL IN RADIO

CODE CONQUERED

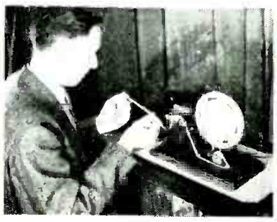
WITH THE

AMERICAN CODE READER

PATENT APPLIED FOR



ANNOUNCING A SENSATIONAL NEW 'FISTMAKER' THAT WILL MAKE YOUR STATION OR LISTENING POST COMPLETE!



The enthusiastic praise with which the American Code Reader has been received proves the long felt need which it fills. Amateurs and Beginners alike marvel that such efficiency, such genuine service can be rendered by a device in this price class . . . a price well within the reach of every licensed amateur and beginner.

SIMPLE TO USE

The American Code Reader is simple in its operation. Simply connect the Code Reader to the voice coil leads on the loud speaker transformer in the radio receiver. Signals are fed into the recorder and converted into DC impulses which in turn are fed to the stylus which records dots and dashes electro-chemically on an electric motor-driven tape. The motor does not produce radio interference.

FOR THE AMATEUR

The licensed amateur can use the American Code Reader for making permanent records for QSO's, thus replacing or supplementing the usual station log. He can use it for checking his own "fist" or those of others. Now the amateur can get all the speed that is thrown at him, for the Code Reader will record up to 100 words per minute. By means of a photo-electric cell he can play-back, for supervised automatic transmission through his own rig.

FOR THE BEGINNER

For the beginner just breaking in, the American Code Reader is a big help. It is so designed that a standard telegraph key, connected in series with a 4.5 volt dry cell, may be connected to the input for personal tape recordings. Those studying for Class B amateur exams can practice sending to improve the fist. By using it with the American Audio Oscillator, the beginner can see and hear his fist at the same time.

ADVANTAGES

Unlike other recording devices, the American Code Reader uses no ink. Therefore, there is no smudging, no blotting, no punching. Recordings may be made permanent or temporary by means of a variable potentiometer. Its low list price of $20 (including one 100-ft. roll of special tape) is among its most attractive features. Additional tape replacement rolls of 250 feet may be purchased for 25c each.

ASK FOR DEMONSTRATION

See the American Code Reader today at your Dealer's. Inspect its many advantages. If your Dealer has not yet received his supply, write us direct (with his name and address) and we will see that you are supplied.

American Communications Corp.

1650 Broadway **Code Division** **New York, N. Y.**

RADIO

October · 1937 Number 222

In this issue "Radio" presents:

ARTICLES

DEPARTMENTS

"RADIO" CONTRIBUTIONS

Contributions to our editorial pages are always welcome; though they will be handled with due care we assume no responsibility for those which are unsolicited; none will be returned unless accompanied by a stamped, addressed envelope. We do not suggest subjects on which to write; cover those you know best; upon request, we will comment on detailed outlines of proposed articles, but without committing ourselves to accept the finished manuscript.

Since we regard current "chiseling" policies as decidedly unfair, a small payment will be made, usually upon publication, for accepted material of a technical or constructional nature. Freehand, pencilled sketches will suffice. Good photographs add greatly to any article; they can easily be taken by the layman under proper instructions. For further details regarding the taking of photographs and the submission of contributions see "Radio" for January, 1936, or send stamp for a reprint.

THE WORLDWIDE TECHNICAL AUTHORITY OF AMATEUR, SHORTWAVE, AND EXPERIMENTAL RADIO

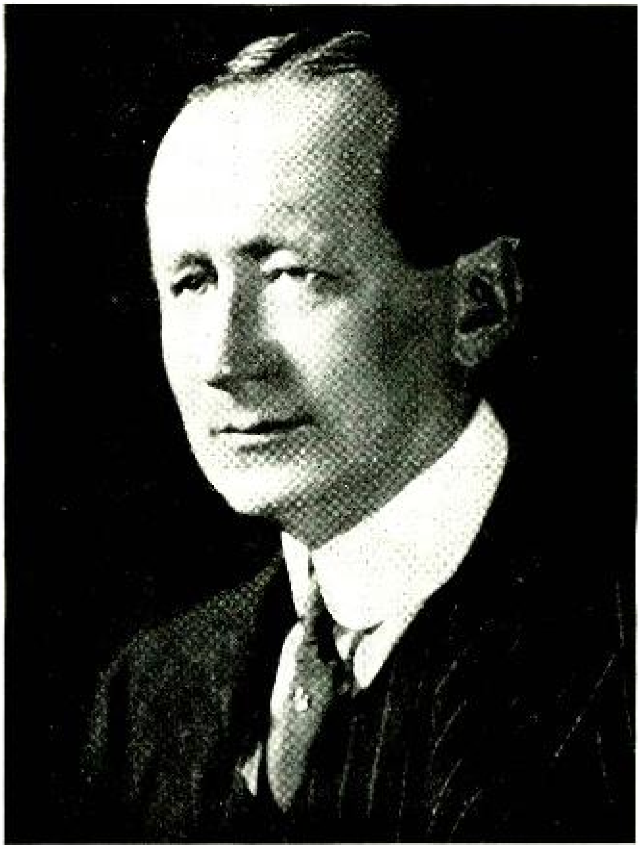
SAVE $2.40

Buying individual copies of "Radio" for two years costs you:

18 issues* at 30c =	$5.40
2 issues* at 50c =	1.00
Total	$6.40
A 2-year subscription costs	$4.00
You save (in U.S.A. or Canada)	$2.40

(For foreign rates, see opposite page)

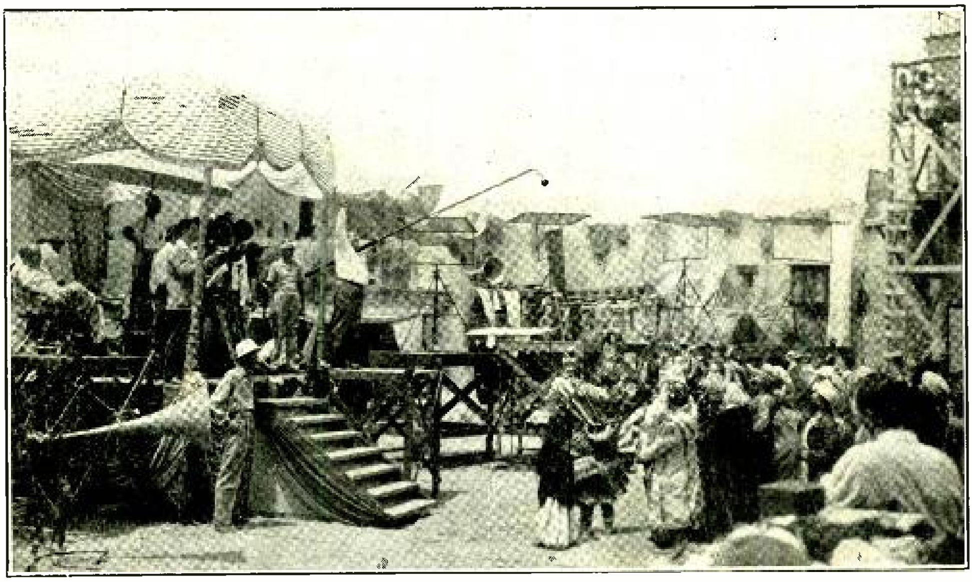
*RADIO *is published ten times annually including special enlarged annual number.* *See page 4 for foreign rates.*



—Photo courtesy of U.P.-Underwood

THE WORLD STILL MOURNS for Marchese Guglielmo Marconi, the father of radio, who passed away during the early morning of July 20, 1937, the victim of a heart attack. Two events of the past year are believed to have accelerated his death: the passing of his brother, Alfonso, in London, a few minutes before he was to have left for Rome to visit the inventor and a fire which broke out on his yacht, the Elettra, a short time ago. Much of the Senatore's experimental radio equipment in his floating laboratory was destroyed, and Mr. Marconi over-exerted himself in attempting to fight the blaze. ■ Senatore Marconi needs little introduction to the amateur fraternity. He was, in fact, the first radio amateur and he kept closely in touch with amateur activities throughout his life. It was Mr. Marconi, assisted by P. W. Paget, who succeeded in transmitting the first intelligence, the letter "S", from Poldhu, England, across the Atlantic. With Marconi's death the radio art lost a great inventive genius—probably the greatest who has devoted his thought to the advancement of wireless communication.

• Figure 1. Director Butler leads Arabs in a yell during filming of Eddie Cantor's latest picture.



The Story of SOUND ON FILM

By FAUST GONSETT,* W6VR

It is surprising what a large number of the technicians in the motion picture industry are amateur radio enthusiasts. For example, in the sound department of Twentieth Century Fox, you will find among the more active hams W6IZ, W6MBD, W6BMA, W6MBO, W6MBZ, W6ITD, W6BBO, W6BL, and W6LXZ. The situation is the same in every motion picture studio. Hence, thinking that the story of how sound is recorded on film would be interesting to amateurs, we approached Edmond Hansen, W6IZ, "chief" of the sound department at Twentieth Century Fox. He arranged visits for us to the various departments and sets, with Harry Leonard, W6MBD, as guide. We first visited the set where they were shooting the new Eddie Cantor picture, "Ali Baba Goes to Town" (figure 1). We learned that the average sound crew working on a production consists of four men: the "mixer", an "assistant mixer", the "cable man", and the "stage man".

The mixer is in charge of sound for the production, and works under the supervision of the head of the sound department. His position is at the portable mixing table (figure 2) which is placed on the set, permitting him to be close to the action. From this mixing table he has control of all microphones on the set.

*Laboratorian, RADIO

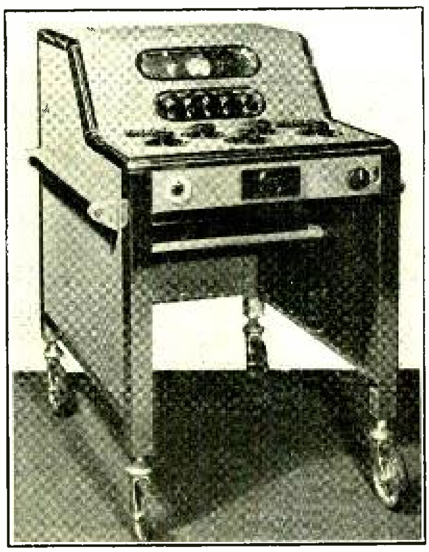


Figure 2. Portable Mixing Table

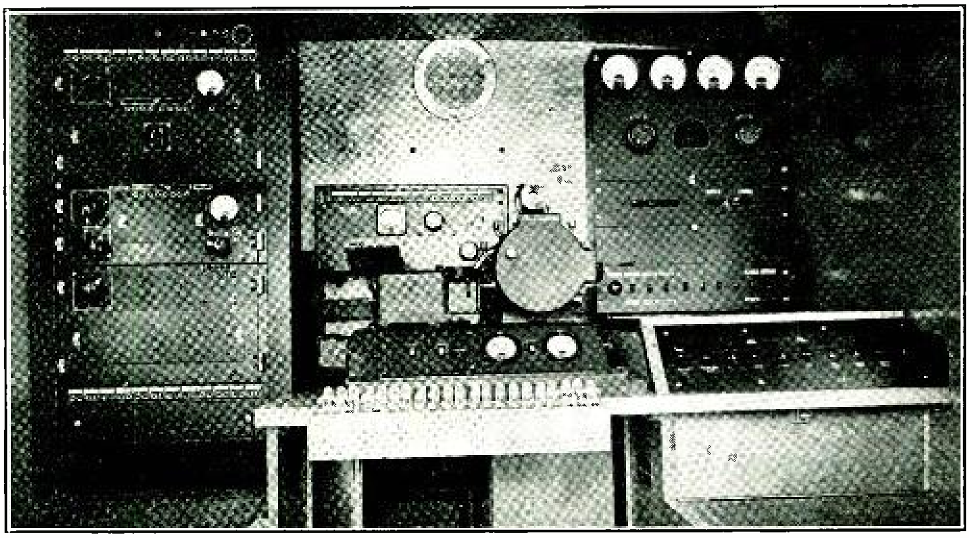


Figure 3. Interior View of Recording Truck. Recorder proper is at the center.

The assistant mixer operates all of the equipment in the portable sound truck in which the recorder is located. The inside of one of these trucks is shown in figure 3.

The cable man handles the cables to the various microphones, which are placed and operated by the stage man. On large sets it sometimes becomes necessary to use more than one stage man.

Several types of microphones were in evidence on the various sets, the most common ones being Western Electric 618-A and 630-A dynamics. RCA velocity mikes were seen mostly where the field of action was stationary and the mike was not being swung around on a "boom". It seems that ribbon mikes are very sensitive to vibration and to swishing air currents encountered in a wind or when swinging the mike around to follow the action.

In the schematic diagram, sound is shown entering the microphone, which transforms the sound energy to electrical energy. The microphone is coupled to its respective pre-amplifier, which is usually placed in the rear of the mixing table. These pre-amplifiers have a gain of about 45 db.

The signal, at a level controlled by the mixer, is then sent to the recording truck, which is located near the set. On the Twentieth Century Fox lot, the entire recording channel, with the exception of the mixing channel, is mounted in the recording truck.

Upon reaching the truck, the signal is first sent to the "main gain amplifier", which has about 80 db gain and an undistorted output of 400 milliwatts from the pair of 71's in the output stage.

From here the sound goes into two "bridging amplifiers". One of these drives a monitor speaker; the other actuates the vibrator on the recording machine. Bridging amplifiers have an output of about two watts.

In addition to the sound recording machine, the assistant mixer has control of the motion picture camera. The motors on both recorder and camera are electrically interlocked with a "master distributor", also located in the truck.

This master distributor consists of a three-phase generator driven by a d. c. motor. This motor has built into it a 720 cycle a.c. winding, and the voltage generated by this winding is used as a speed control through a system of vacuum tube relays.

After a day's work by the production crew, there are two films ready for processing in the "film laboratory" (department B); one is the picture taken by the camera and the other the sound film made by the recorder. For technical reasons, positive film is used for sound recording and panchromatic negative film for the cameras.

In the film processing laboratory, developing of both films takes place. To obtain a finished "print" of either type (sound or picture) each must be transferred to a positive stock. If sound alone is desired, one printing is all that is necessary; but if both sound and picture are required, the positive is subjected to two separate printings. It is first run through the printer along with the picture negative, and during the exposure of the picture, that portion of the positive print later to be occupied by the sound track is masked off.

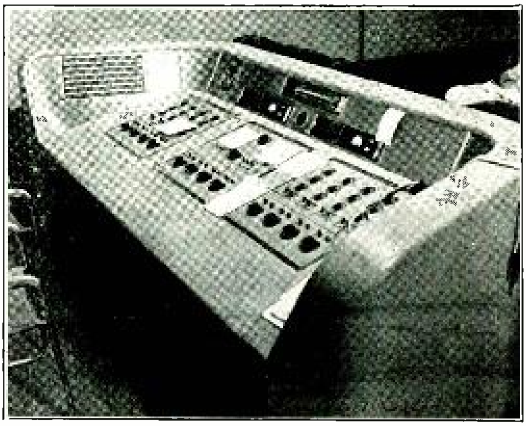
The same positive print is then run through the printer again, this time along with the sound negative. On this trip through, the picture track is masked off from the printer light.

After the printing process is completed, the film is known as "composite" and is ready to go to the projection room for viewing by the director, producer, and others. This is usually the following day after the scene was shot, because of the time required to process and print the film. After viewing these "rushes" as they are called, the director and mixer know what corrections or changes should be made in either acting, sound, lighting, or other technique.

There are two types of sound track used in motion picture work for recording sound on film. The Western Electric method uses *variable density* light valve recording. The RCA method utilizes a *variable area* shutter track. How these two types of sound track appear to the eye can be seen in figure 4.

After the rushes are shown, the film is sent to the "cutting department", where the various scenes are placed in their proper sequence.

When work by the cutting department is



Dubbing Room Mixer Console for Adding Sound Effects, Music and for Correcting Sound Levels.

completed, the picture is considered finished so far as the previous departments are concerned, and is then sent to the "re-recording department" (section C in the schematic). The work done by this department is the last major step before the picture can be previewed and released.

When the film enters the re-recording department, it is first projected for the benefit of the sound cutters, who make notes on all the "sound effects" that are to be added to the picture. When the picture is first taken, very rarely do they place in it any sound effects such as gun shots, train noises, automobile noises, singing, music, etc.

It will probably surprise you to learn that when music and singing are present in a scene, the actual recording of the sound you hear usually is made weeks before shooting of the picture is even started.

Figure 4. Left: RCA variable area recording from Eddie Cantor's picture, "Ali Baba Goes to Town". Right: W. E. variable density from "Heidi" starring Shirley Temple.

There are many technical and economic reasons for this procedure. For one thing it greatly simplifies the problem of sound continuity, besides making it unnecessary to have a band or orchestra replay a piece each time a scene is reshot. Also, there is no need either to "hide the mike" or cut down the field so that no microphone appears in the picture of an artist singing as on a stage. The singer can walk around and back and forth; it is not necessary to follow him with a microphone boom because the singing has already been recorded. All he has to do is to be sure to make his lips follow the recorded singing as it is played to him through a loudspeaker placed on the set. This is known as the "playback".

The "playback" does not necessarily have to be the actor's own voice. This is another advantage of recording the sound before the picture is started. It permits the studio to record the voice of a good singer and use it for the playback to a good actor with a poor singing voice. Few actors or actresses look very pretty when actually singing. The "playback" method allows them to "make pretty faces" simulating singing, synchronizing their lips to the playback but making sure their facial and neck muscles do not stand out enough to detract from their appearance.

Let's get back to the re-recording department, film cutters, sound effects, and "dubbing".

After the mixers have selected all of the necessary sound effects after consulting notes made during the projection for their benefit, they are ready to make a finished sound film. The film cutters take the various sound effects, procured either from the studio film sound library or by sending out a sound crew to get them, and synchronize them in their proper places. To simplify the process, let us consider the following scene:

A man arrives at an airport in a car, leaves the car, bidding goodbye to the driver, and walks to a plane in the background, the plane meantime warming up its motors.

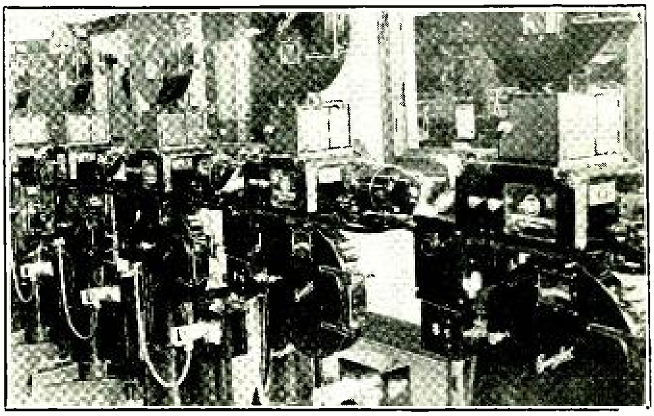
When the picture is shot, only the dialogue is recorded. To this must be added the sound of the car both running, stopping, and idling; and the airplane warming up. The sound effects library will supply these noises, but as they are to be heard along with the dialogue in various combinations, they will have to be added. This process is known as "dubbing".

Sound film number 1 has the dialogue, sound film number 2 contains the motor noises, and sound film number 3 has the warming up of an airplane on it.

Each reel of film is 900 feet long, and dubbing is usually done by the reel. Let us say that for the first 300 feet we see the man sitting by the driver, talking to him while they are traveling along. This calls for sound films 1 and 2. Film 3 has no sound on it as yet. At 350 feet the car stops, which is recorded on sound film 2, and film 3 contains the sound of the airplane warming up in the background. At 700 feet the man walks over and gets in the plane. Film 1 has no dialogue at this point, film 2 has the car idling, and sound film 3 the sound of the plane motor warming up.

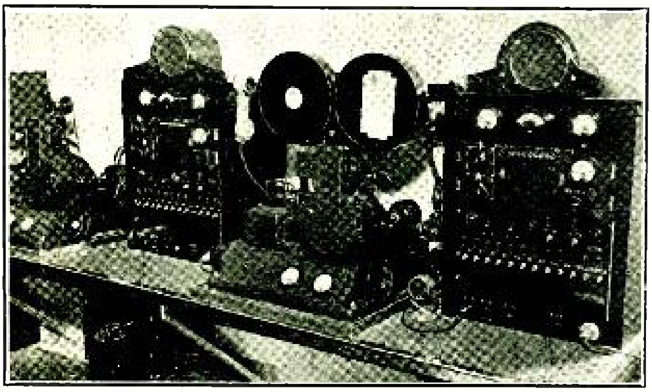
Now these various sounds are ready to be *levelled* properly for the scene. Each sound track is placed in a separate reproducer, all of which are electrically interlocked. The mixer takes his place at the mixing console in readiness to level the sound effects which may be any number up to eleven.

In our case there are five films being run at once at this stage of the process. The first is the master sound film having the *dialogue* taken at the time the scene was shot. The second film contains the motor noises and the third the airplane noises. The fourth is the picture film having no sound, and the fifth is the recorded composite result.



RCA Film Reproducers Used in Re-recording Dept.

By means of volume controls on the mixing console, the mixer can adjust the levels of the reproducers individually and independently. Thus all the various sounds are fed simultaneously through the amplifier at their proper corresponding levels into the recorder, where a single composite negative track is made of the different sounds. This fifth film is the sound track that is finally printed alongside the picture film. Actually the sound is placed 19½ "frames" ahead of the picture, because on the projection machines used to show the film, the sound is "picked off" at a point ahead of the picture frame with which it should be synchronized. Obviously it is mechanically impracticable to pick off the picture and sound at the same point on the film.



Recorder and Control Panel. Here the Final Sound Negative is Made

The finished negative, containing both picture and complete sound, is sent to New York where two or three hundred release prints are made and distributed throughout the world. On the best pictures, prints are made in all of the more common foreign languages.

To make this possible, the re-recording department runs through one film with all sound effects *except* the dialogue. Prints of this are sent to the various countries, where a voice track is made containing dialogue in the native tongue. When the picture is shown, the motion of the actors' lips belies what they say, but the pictures seem to be enjoyed just the same, the realism of the sound effects making up to an extent for the lack of dialogue synchronization.

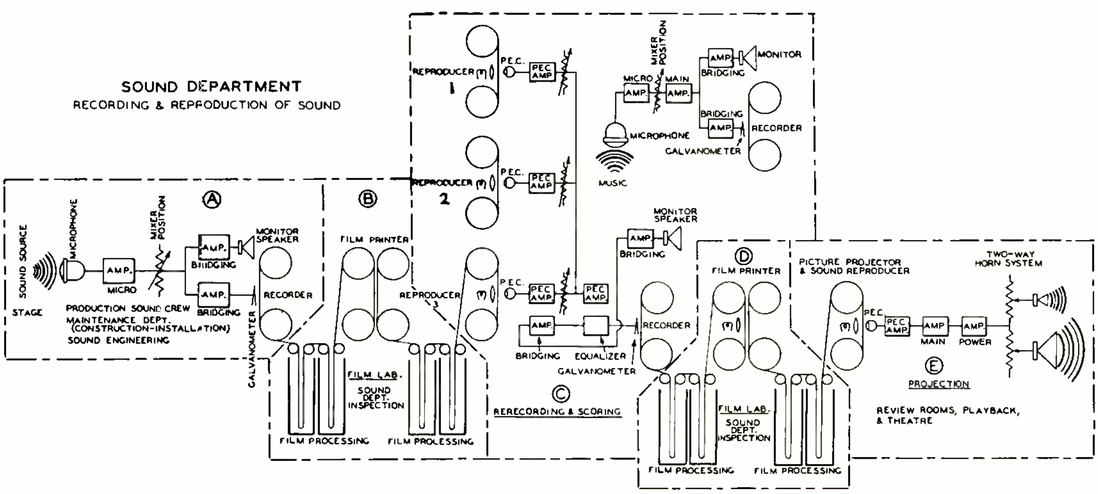
In the accompanying schematic, "E" indicates the theatre in which the film is projected. The sound is picked off the film by a photo electric cell, which feeds an amplifier system usually ending up in a push-pull stage delivering around 50 watts of undistorted output. The speaker system ordinarily consists of several husky dynamics on a large baffle, and a couple of high frequency units or "tweeters".

A dividing network sends everything below 400 cycles to the large dynamics and everything above 400 cycles to the "tweeters".

The writer is appreciative of the co-operation extended by Edmond Hansen, W6IZ, head of the sound department of Twentieth-Century Fox Studios, in furnishing the data for this article. Hansen is one of the old timers who started in "wireless" around 1907 with a spark coil fed from an interrupter and with a library consisting of catalogues from the J. H. Duck Co. and the Electro Importing Co. By 1912 he had progressed to a ¼ kw. Packard spark rig with a rotary gap. He was assigned the call 8AZ in 1913.

Hansen turned commercial at DR, Detroit, and later worked for the Marconi Co. and others in the Great Lakes area. During the war he served in the navy, seeing duty in Florida and at sea on the USS Pittsburgh and the USS Utah. He was also in the Naval Attache's office in Rome and London.

After the war, he joined the RCA as consulting engineer on radio photo development in 1925-26, then sound pictures brought him to Hollywood.

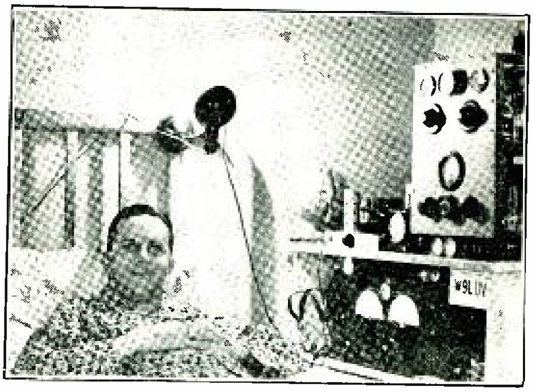


INTRODUCING . . .

Amateur Radio

• "Lu" Mida, W9LW, in her radio den. Evidently y.l.'s don't go for "haywire" and breadboards.

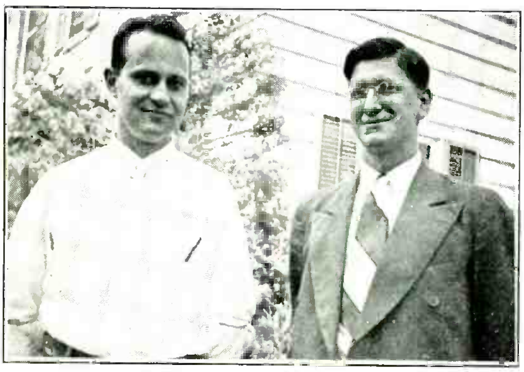
• Roy Walters, Jr., W9LUV, has had as his QTH for the last three years a hospital bed. However, what with a ham rig and plenty of time to work the many friends he has made over the air, Walt says that being laid up has its good points.



• On the left we present G. P. Huntley, Jr. (W6LIP to you), another radio man who makes motion picture work his profession. When not busy playing featured roles for Universal Pictures, he's industriously tearing down the rig or re-building it. Tim—his real handle is Bruce Timothy Huntley — uses both c.w. and a modulated Bi-Push on 20 meter phone, with 34 watts input.

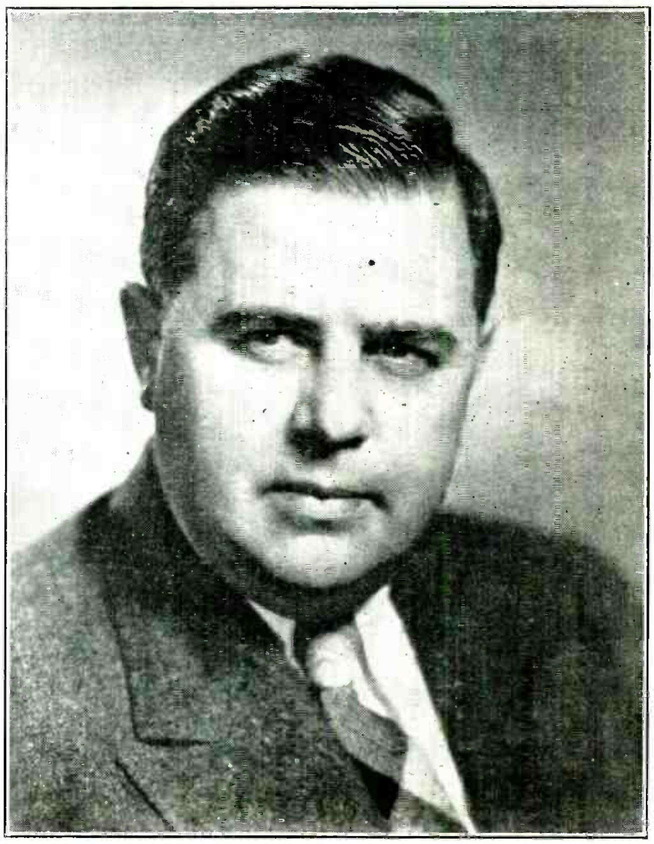
Personalities

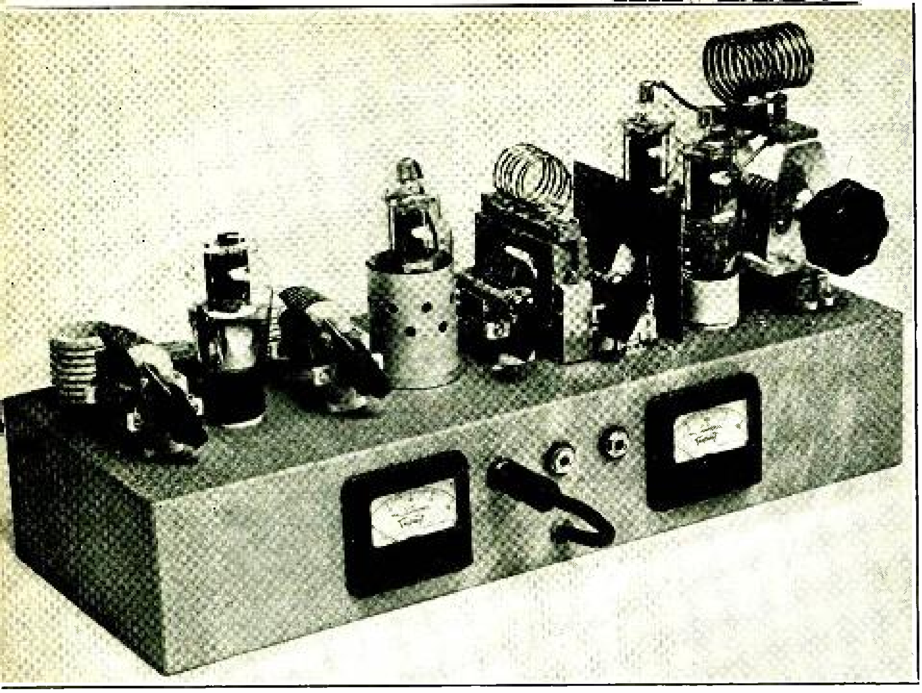
• Dorothy Hall, W2IXY, and her famous dx hound.



• Johnny Kraus, W8JK, (left) and Bill Conklin, W9FM, two personalities familiar to readers of "Radio", pause for a wink from a friend's "Minnie".

• Here is Edmond Hansen, W6IZ, who, as "chief" of Twentieth Century Fox's sound department, sees to it that the wheels go round in proper fashion. Hansen is one of the boys who is active on 10 and 20-meter c.w. (naval reserve net). He was commander N.C.R. 11th naval district in 1929-30.





● The neat external appearance of the W6KW exciter exemplifies its efficient layout.

Five and Ten Meters . . an exciter of modern design

● *By* JOHN R. GRIGGS,* W6KW

● The design of a satisfactory exciter for use on the high-frequency bands, such as 28 and 56 Mc., necessitates the use of tubes having low driving requirements, low inter-electrode capacities, and high output capabilities. Furthermore, all parts across which an r.f. voltage will appear (tuning condensers, sockets, tube bases and coil forms) must be adequately insulated with a good grade of "high-frequency" dielectric. For this reason all three tubes that operate at the higher frequencies, the RK-25 and the pair of RK-39's, are equipped with isolantite bases. For the same reason all tube sockets are made of isolanite, the coil forms are of low-loss material (isolantite or steatite is used in the exciting stages and the final grid and plate coils are of the "wound-on-air" or self-supporting variety), and the receptacles for the grid and plate coils of the RK-39's are made of mycalex. All these contribute to unusually low losses throughout the exciter.

Another prime factor in such a design is the proper use of shielding. Ample shielding is used in the unit to be described; the base of the RK-25 is shielded from the top by means of a conventional-type 24A tube shield which has been slightly shortened so that it will only extend from the chassis to the bottom insulator inside the pentode. A metal baffle plate is placed between the RK-39 tubes and their associated grid tuning condenser; also, the grid coil for the final is placed below the chassis, thus using the chassis pan itself as a shield. Details of these various shields easily can be seen in one of the accompanying photographs.

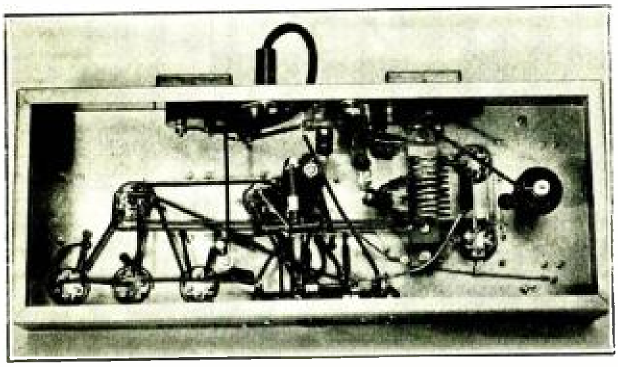
In addition to the above considerations, it was the author's desire that the exciter operate on low voltage and that it be capable of real output with good stability on both the 5 and 10 meter amateur bands. It is felt that all of these points have been accomplished: the exciter is capable of approximately 75 watts output on 28 Mc. and of an exceptionally stable 35 or 40 watts output on the 56 Mc. band. The output stage, the pair of RK-39's, is operated as a push-pull screen-grid amplifier on 28 Mc., and as a push-pull doubler for 56 Mc. output. The preliminary stages, the 6L6G and the RK-25, are not touched when changing from 28 to 56 Mc.

On the 28 Mc. band, the exciter has ample power output to drive a one kw. final amplifier to full output; on 56 Mc. sufficient power is available to excite the same final to 500 watts input at good efficiency.

Constructional Details

The crystal oscillator employs a 6L6G tube in a conventional tritet circuit; a 7 Mc. crystal is used, and the output circuit is tuned to 14 Mc. The plate of the 6L6G is capacitively coupled to the grid of the RK-25 doubler through a small mica condenser. This stage, when operating as a doubler, gives more than ample output to drive the two RK-39's as a

*3575 Boston Ave., San Diego, Calif.



● **Under-chassis view showing parts placement and the location of the grid coil for the final amplifier.**

buffer amplifier on 28 Mc. and as a push-pull doubler to 56 Mc.

If desired, the complete exciter may be operated from one power supply. Such a supply, however, would necessarily have to be capable of 550 to 600 volts output at approximately 300 ma. drain. This of course is in addition to the filament drain of the exciter, 6.3 volts at about 4 amperes. A more satisfactory method of supplying the plate and filament power would be through the use of two power supplies. One, using a standard receiving type power transformer, could furnish the filament power to all tubes and about 400 volts at 100 ma. to the 6L6G, the RK-25, and the screens of the two RK-39's. A voltage divider should be placed across this supply to obtain the proper operating voltages, as indicated in the schematic diagram, for the RK-25 suppressor and the various screens and plates of the other tubes. The other supply, using a small transmitting-type transformer, should be able to supply from 500 to 600 volts at approximately 200 ma.

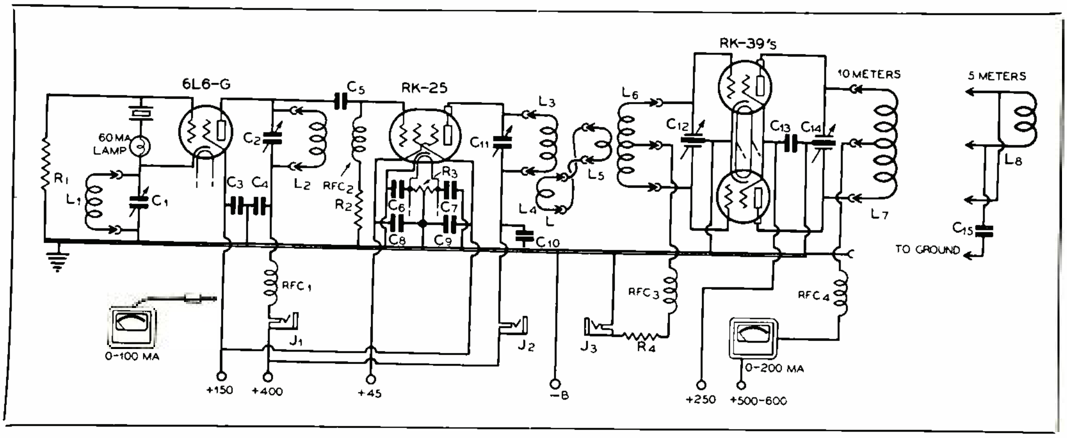
One feature of this exciter is the fact that the low inter-electrode capacities of the RK-39 allow the use of quite low-C tank circuits in both the grid and plate circuits. As can be easily seen by looking at the 28 Mc. coils in the photographs, the final coils, especially the plate coil, are unusually large considering the band of operation. By concentrating the tuning capacity in the tank condenser and through the use of low-C tank circuits, the unloaded circuit Q is quite high. This is evidenced by the fact that the minimum unloaded plate current on the RK-39's when operating on 28 Mc. is only about 10 ma. While the efficiency of the circuit is not as good at 56 Mc., as the RK's are doubling to this band, quite a good plate current dip is still obtainable.

The circuit is entirely standard in every respect as can be seen by reference to the circuit diagram and to the above and below-chassis photographs. The tube lineup has been mentioned before. The coils for the crystal stage are wound on small steatite or isolantite forms. The doubler plate coil and the final grid coil are air wound; the doubler coil is supported on one of the small R-39 plug-in connectors; the final grid coil is supported on a mycalex strip. The final plate coils are self-supporting and plug directly into a mycalex mounting strip. All sockets in the rig are of isolantite. The gridleak resistors are of the carbon type, consequently they are non-inductive and have low distributed capacity. All fixed condensers used in the rig are of the molded-mica type and are mounted edgewise, whenever practical, to reduce capacity-to-ground effects.

By proper tuning of the oscillator it is possible to obtain six to eight watts output on 14 Mc. with quite low crystal current. Incidentally, this output is far more than ample to excite the next stage; a large reserve of excitation is available. In actual operation the crystal stage draws only 25 to 30 ma. at 400 plate volts; under these conditions of operation the crystal current is so low as to show merely a faint glow in a 60 ma. lamp placed in series with the crystal lead at the socket. Best output consistent with low crystal current was obtained with a screen voltage of 150 on the 6L6G. When the loaded crystal stage is used with a standard x-cut crystal, no crystal heating nor frequency drift was noticeable.

An RK-25 pentode is used in the doubler stage. Its grid is coupled to the 14 Mc. output of the crystal oscillator through a .00005 µfd. mica capacitor. To give the high grid bias necessary for efficient doubling a 50,000 ohm, 2 watt carbon resistor is connected in the grid return of the RK-25. Experimentation showed that this stage also will operate best with a screen supply of about 150 volts. Operating the suppressor grid approximately 50 volts positive also will give a slight increase in the 28 Mc. output of the RK-25. All these return circuits are by-passed with suitable mica condensers as shown in the circuit diagram.

The r.f. output of the RK-25 stage is about 12 to 15 watts on 28 Mc. This is more than ample to drive the grids of the final tubes. A one-turn link, made of no. 14 bare copper wire, is placed on the cold (B supply end) of the



Circuit diagram of the Griggs Exciter

C_1—250 μμfd. midget variable
C_2 — 50 μμfd., 2000 volt midget
C_3,C_4—.006 μfd. mica
C_5—.00005 μfd. mica
C_6,C_7—.002 μfd. mica
C_8—.001 μfd. mica
C_9—.002 μfd. mica
C_{10}—.002 μfd. mica
C_{11} — 50 μμfd., 2000 volt midget
C_{12} — 35 μμfd. per section, 2000 volt spacing midget variable
C_{13}—.01 μfd. mica
C_{14} — 35 μμfd. per section, 2500 volt spacing diathermy variable
C_{15}—.002 μfd. mica
R_1 — 50,000 ohms, 1 watt
R_2 — 50,000 ohms, 2 watts
R_3—20 ohm c.t. resistor
R_4 — 25,000 ohms, 5 watts
L_1—6 turns no. 20, 1½" dia., spaced to 1"
L_2—8 turns no. 20, 1½" dia. spaced to 1"
L_3—5 turns no. 14, 1⅜" dia., spaced to 1⅛"
L_4—(Link) 1 turn, no. 14, 1⅜" dia.
L_5—(Link) 2 turns no. 14, 1" dia.
L_6—10 turns no. 10, 1⅜" dia., spaced to 2¼"
L_7—10 turns no. 8, 1⅝" dia., spaced to 2¼"
L_8—8 turns no. 8, ¾" dia., spaced to 1½"
$RFC_{1,2,3}$—2½ mh. 125 ma. chokes
RFC_4 — 2½ mh. 500 ma. choke
$J_{1,2,3}$—Closed circuit jacks

doubler plate coil. This serves as the coupling medium to the grid circuit of the final amplifier. The grid condenser for the final amplifier is placed above-chassis along with the other tuning condensers but the grid coil, along with its two turn coupling link, is placed below the chassis pan. The grid coil itself consists of ten turns of no. 10 bare copper wire, 1¼" in diameter and 2" long, self supporting, and mounted on a mycalex plug-in support. It is quite important that the grid coil be completely shielded and that the grid tank condenser also be isolated from the plate circuit of the final amplifier.

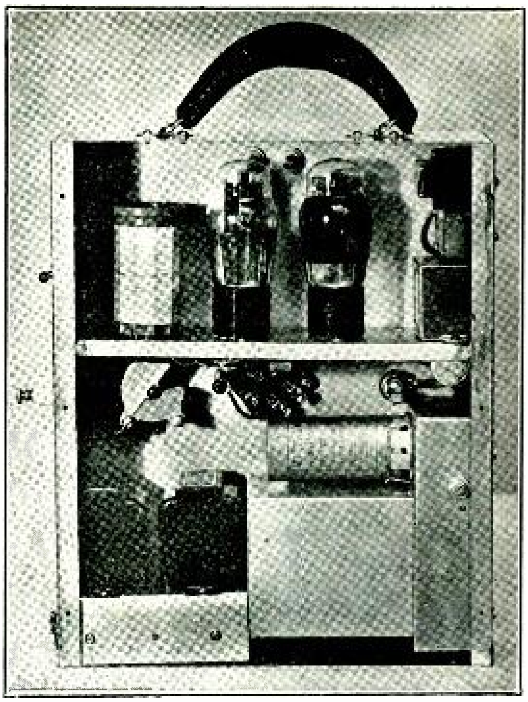
A 25,000 ohm 5-watt carbon resistor is placed in the grid return of the final amplifier. This value of resistor, with normal grid current of 7 to 9 ma. flowing through it, furnishes an optimum amount of bias for operation of the tubes either as push-push doublers or as a push-pull amplifier. A jack is provided in the grid return to facilitate checking the current flow.

The final tank condenser, a 35 μμfd. per section split-stator with 2000 volt insulation, is one of the newer type primarily designed for diathermy use. The final plate coil for 28 Mc. is wound of no. 8 bare copper wire, is self-supporting, and has small plugs attached to both ends and the center to facilitate mounting in the mycalex plug-in base. The screens of the RK-39's are supplied with 250 volts positive and the *center* of the wire that connects the two screens is by-passed to ground by a .01 μfd. mica condenser. Be sure that this condenser is of at least this capacity; if a larger condenser is available in mica (.02, .03, .04 μfd.) it can be used to advantage in this position.

The plates of the two RK-39's should be supplied with from 500 to 600 volts d.c. and under normal loading will draw from 175 to 200 ma. On 28 Mc. the final stage may well be modulated to provide a very convenient low power transmitter. It must be remembered, of course, that the screens must be modulated along with the plates of these tetrode tubes. The most satisfactory method of accomplishing this is to use a modulation transformer with a tapped secondary winding. The plates are supplied directly from the hot end of the winding and the screens are supplied, through a dropping resistor with a good sized by-pass, from the tap. The tap should be made at approximately the center of the winding. If a tapped modulation transformer is not available, combined plate and

(Continued on Page 78)

• Rear view of the transmitter unit described in the following pages.



"MAYDAY!"

Here's a little portable for emergency use. The receiver is self-contained; the transmitter will operate from a storage battery with 7½ watts output on 75 or 160 meter phone or c.w.

• *By* **W. W. SMITH,* W6BCX**

● A transmitter and receiver designed for emergency work in time of disaster should certainly be "self-powered." But, just what kind of "self power" should be used?

This will depend a lot on whether phone and c.w. or just c.w. is desired. With c.w., considerably less power is required to communicate over a given distance, and also there is no filament and plate power required for modulator tubes. In addition to this, plate power is drawn only when the key is down, which represents only a fraction of the time the set is in operation. Therefore, where c.w. only is desired, dry batteries will serve admirably for both transmitter and receiver.

Many amateurs who have had experience during emergency work contend that the ability to work phone, even though not absolutely necessary to the carrying on of emergency communication, is of great importance. One reason is that most of the modern b.c.l. receivers, both a.c. type and self-powered farm models, will take in the amateur phone bands, and the emergency transmitter can be used to make "broadcasts" when such procedure is necessary or desirable.

The main drawback to an emergency transmitter capable of working phone is that it requires several times the input power (including modulators, etc.) to work a given distance. Dry batteries become cumbersome, and the drain on them is quite heavy, making frequent replacements necessary if much power is used.

This indicates some sort of converter to work from a six volt battery, auto batteries being generally available everywhere and easily rechargeable or replaceable by hunting up an auto. In fact, the battery need not even be removed from the car. The generator can be set ahead as far as one dares (most of them start throwing solder after a time at from 17 to 20 amps.) and the car started up and idled for a few minutes every hour or two, giving it just enough throttle to allow the generator to deliver "full stuff."

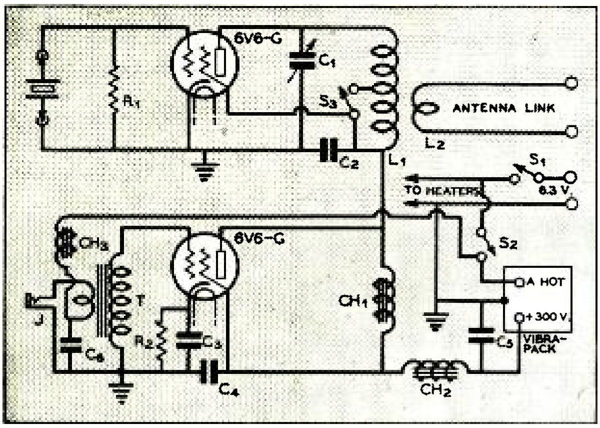
The converter also can be used to run the receiver, if desired. However, a receiver can be designed to draw but little power, and such a receiver can be run from dry batteries very satisfactorily, making it much more versatile. In addition, it obviates the necessity for elaborate "hash filters", usually necessary with such converters when used to supply high frequency receivers.

Our requirements boil down, then, to a self-contained, battery-powered receiver that has very low battery drain, yet will provide reception adequate for the purpose; and a transmitter that will provide a 5 to 10 watt modulated phone carrier when supplied by nothing other than a 6 volt battery, and do it without excessive battery drain.

The transmitter illustrated will deliver a 7½ watt carrier on either 75 or 160 meter phone, 80% modulated, with a total drain on the battery of *less* than 8 amperes. It utilizes only two tubes, two 6V6-G's, each drawing but 0.4 amp. heater current. A single 6V6-G can be carried as a spare, as no other tubes are used.

One 6V6-G acts as a 75 or 160 meter crystal oscillator, running at about 14 watts input. This is plate-screen modulated by another 6V6-G, which is driven directly from a good-quality high-output carbon microphone (single button). Both tubes operate at between 275 and 300 volts. At this voltage the modulator provides sufficient audio power to modulate the oscillator 80% with low distortion. More audio

*Editor, RADIO



R_1—300,000 ohms, 1 watt carbon
R_2—250 ohms, 5 watts
C_1—100 µµfd. midget
C_2—.004 µfd. mica
C_3—25 µfd. 25 volt electrolytic
C_4, C_5—Dual 8 µfd. midget electrolytic
C_6—25 µfd. 25 volt electrolytic
CH_1, CH_2—6 hy. 100 ma. chokes.
CH_3—110 volt primary winding of midget 2.5 or 6.3 volt filament transformer
T—Midget "transceiver" single button mike transformer
L_1—64 turns no. 22 d.c.c., center tapped, on standard 1.5 inch dia. form. Slightly more output can be obtained on 75 by using a separate 75 meter coil consisting of 35 turns of no. 20 d.c.c.

• Wiring diagram of the emergency transmitter. Connections indicated are for phone use. For c.w., remove the 6V6G modulator tube and insert a by-passed key in the cathode circuit of the oscillator.

power is not only unnecessary but is undesirable, because it is inadvisable to modulate an oscillator more than 80%.

While modulating a crystal oscillator directly is not to be recommended as a general practice, the frequency modulation is by no means bad enough to be objectionable. For this reason, the expedient of dispensing with an amplifier stage was considered justifiable, especially in view of the fact that the transmitter is designed expressly for emergency work. An oscillator-amplifier combination would reduce the overall efficiency, putting a heavier drain on the 6 volt battery. Because the limited amount of audio power available makes it impossible to overmodulate the transmitter in the usual sense of the word, the signal is no broader than the majority of low power 75 and 160 meter phones, incorporating buffers and overmodulated amplifiers.

But don't be fooled by "80% modulation." It covers a multitude of sins, yet it takes careful listening to tell the difference in volume as represented by 80% and 100% modulation.

Power

The vibrator-type converter used to supply the transmitter is mounted in the same cabinet as an integral part of the unit. It is rated at 300 volts and 100 ma. maximum. On the high tap it actually delivers slightly over 300 volts to the plates of the tubes under load, provided the battery voltage is up and low resistance connections are used from the battery to the converter unit. For this reason the voltage adjustment tap is set on either "2" or "3".

The oscillator and modulator each draw about 55 ma. total plate and screen current under normal operating conditions. This makes 110 ma. total, slightly more than the 100 ma. maximum rating on the converter unit. However, no fear need be felt so long as the voltage tap is kept on either "2" or "3".

No milliammeter is provided, because when the oscillator is tuned for maximum output, the plate current will not run over about 55 ma. at the plate voltage used, provided the constants indicated in the diagram are followed. A meter may be used the first time the rig is fired up to make an initial check on the plate current, but if everything seems according to Hoyle nothing is needed for future tuning of the transmitter except a flashlight bulb and loop of wire.

It will be noted that no cathode bias is used on the oscillator. The modulation is better when nothing but grid leak bias is used. This means that the oscillator will draw heavy plate current when out of oscillation, and it should not be left in this condition for more than a few seconds at a time while tuning up. After the rig has once been tuned up, the dial setting can be noted and when setting up the rig in future installations this setting can be used as a preliminary adjustment to cut down the amount of time the oscillator is out of oscillation during the tuning up process.

While a separate dry battery could be used to provide microphone current, it was thought more desirable to make the transmitter a strictly one-battery affair and utilize the same six volt battery for microphone current. However, this is not as simple as it might seem, as the input to the modulator is very sensitive, and the vibrator hash component in the microphone voltage will modulate the carrier very heavily if precautions are not taken to prevent it. The filtering action of CH_3 and C_6 removes all trace of hum from this source.

The converter unit contains no ripple filter of its own; hence a filter must be incorporated. C_4, C_5, and CH_2 provide pure d.c. to the plates of the tubes.

Construction

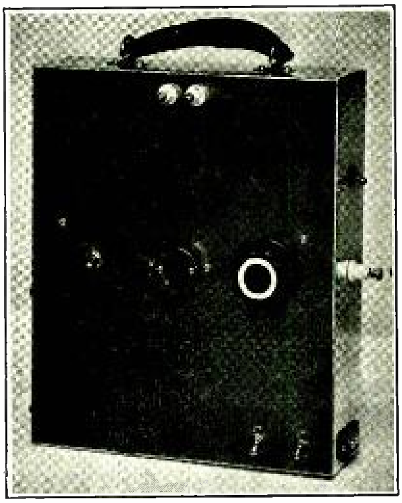
The entire transmitter, including converter unit, is mounted in a blank b.c.l. receiver chassis of standard dimensions. It measures 9"x12"x3", and is used "on end" rather than the way the manufacturer probably intended. A leather handle is fastened to one end, which then becomes the top. The converter unit seemed to fit into the picture best when mounted lying down. This allows removing of the vibrator unit, an important feature because of the fact that the vibrator unit must be removed from its socket and inserted "backwards" when tying onto a car with different polarity (different pole connected to chassis frame). However, if the transmitter chassis is left "floating" (no electrical connection between the transmitter chassis and car body), the same result may be effected by merely reversing the two wires carrying the 6 volts, using the "ground" wire from the car body as a "hot" wire. You will readily know it if you have the wires reversed, as the converter will put reverse voltage on the tubes, permitting no output. If left long in this manner, the electrolytic filter condensers will be damaged. Hence, it is a good idea to study the instructions on the converter and the polarity of the battery being used before turning things on.

Band Changing

Because it is rather a chore to get into the transmitter when the back is screwed in place (removed in the illustration to show detail), a bandswitch is incorporated and the crystal is made plug in from the front panel. This allows one to change from 75 to 160 meters and vice versa without removing the back cover. The bandswitch consists simply of an ordinary toggle switch shorted across half the turns of the coil *from the ground end.*

Compact "Local" Antenna

Incorporated in the transmitter illustrated in the photo, but not shown in the wiring diagram. is a connection through a .0005 μfd. midget



• **Flat as a pancake, it takes up but little room.**

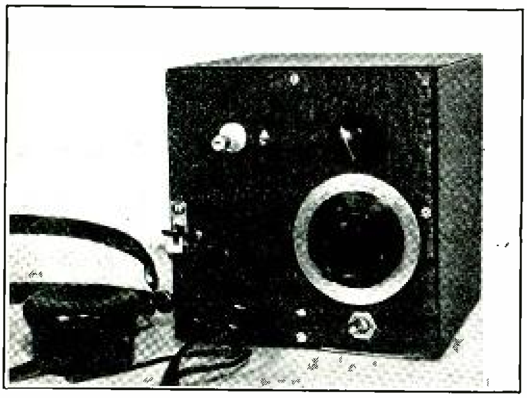
fixed condenser from the "hot" end of the coil to a terminal on the side of the cabinet (the single porcelain feed-thru insulator seen in the photograph). This permits the transmitter to be used for short-haul work (up to 2 or 3 miles) by simply tying on a 10 or 15 foot piece of well-insulated wire for 75 meters or about 20 or 25 feet for 160 meters. If too long a piece of wire is used, the transmitter will not oscillate. The wire should be in the clear (not inside a stucco building, for instance).

The radiation efficiency with this arrangement is rather low, but it is sufficiently good for short distances and is the quickest way to get on the air where time is a factor, or it is impossible for any reason to get up a better antenna, as would be the case in a small boat during a flood. The wire should preferably be vertical, and well insulated from metal objects.

"DX" Antenna

For 75 meter operation the transmitter is designed to work with a twisted pair doublet, the radiator being about 119 feet long. This antenna can also be used successfully on the high frequency end of the 80 meter c.w. band. Telephone wire, lamp cord, or in a pinch even twisted "annunciator" (bell) wire (triple cotton covered and paraffined as usually found in the attic or at the five and dime) will do for the feeders, even the latter having fair efficiency at this frequency if not too long and not waterlogged.

For 160 meter operation the feeders should



• The receiver is only six inches square (batteries included), but it makes a big noise just the same.

be tied together and worked against a waterpipe or other good ground and the whole works used as a Marconi. Unless the feeders are quite long, the affair probably will not resonate on 160 meters without recourse to a loading coil. This may consist of almost anything, just so it has the required amount of inductance to enable a series condenser to tune the thing to 160. If you cannot rob a condenser from a b.c.l. set, it is even possible, with some juggling, to resonate the antenna by using only the loading coil, pruning the coil as necessary.

Tuning

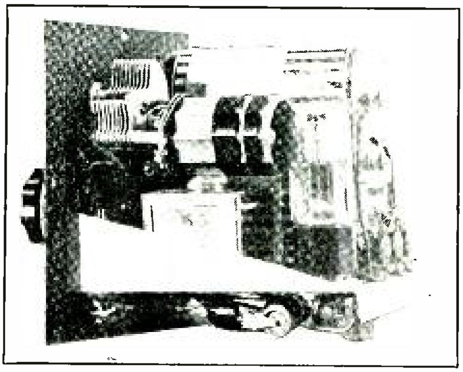
The smallest size flashlight bulb procurable is used in conjunction with a two-turn, 2½" diameter pickup loop to tune up the transmitter. The reason for this is that a large flashlight bulb might represent quite a large percentage of the 7½ watt output when lit to anywhere near full brilliancy.

To tune up on 75 meters, fan the twisted feeders at a point a couple of feet from the transmitter until they are about 3 inches apart, in the form of a circle. Couple the flashlamp pickup loop to the feeders at this point, adjust the transmitter tuning condenser and coupling between the feeders and plate coil for the most current in the feeder that it is possible to obtain while still maintaining upward modulation as indicated by a very slight increase in brilliancy when whistling directly into the microphone. There will be little, if any, increase in brilliancy when talking into the microphone, but a slight increase should be noted on a lusty whistle. If it will not modulate upward regardless of the tuning condenser setting, back off the coupling slightly and try different adjustments of the tuning condenser again.

Use just enough coupling between the flashlamp and feeders to give an easily visible indication on the flashlamp, as greater brilliancy means that just that much more power is being burned up by the indicator lamp. If a small enough lamp is used, it will do no harm to leave it coupled all the time, even after the transmitter has been tuned up. Performance can then easily be checked by an occasional whistle.

With the average high-output single button microphone, sufficient output is obtained to modulate the transmitter fully by talking directly into the microphone in a voice a little louder than ordinarily used to talk on the telephone. This makes a stage of speech amplification unnecessary. The very high power sensitivity of the 6V6-G makes this possible.

Tuning up on 160 meters is accomplished in the same way except that it is necessary to tune or prune the antenna system to resonance (approximately). The flashlamp is coupled to the ground lead by taking a hitch or two in the ground wire and coupling the pickup loop to



• Most of the space inside the receiver cabinet is occupied by the batteries.

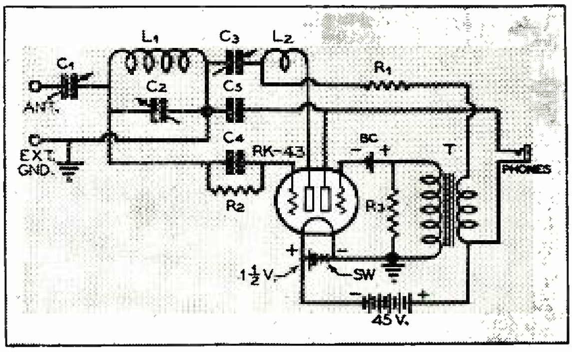
the turns taken in the ground lead. Tune for maximum brilliancy as described before.

Needless to point out, we hope, is the obvious fact that S_3 should be open for 160 meter operation and closed for 75 meter operation.

The Receiver

The receiver and all batteries are contained in a 6"x6"x6" cabinet. The batteries are sufficient to run the receiver for approximately 300 hours, which means a lot of operating. In spite of the

C_1 — 35 μμfd. mica compression trimmer
C_2—75 μμfd. midget
C_3—140 μμfd. midget
C_4—150 μμfd. mica
C_5—.002 μfd. mica
R_1—5000 ohms, 1 watt
R_2—3 meg., 1/3 watt
R_3—0.5 meg., 1/3 watt
BC—Bias cell
L_1 L_2—Tickler should have approximately half as many turns as L_1



Wiring Diagram of the Portable Receiver

small size and economy of power, the performance of the receiver is surprisingly good. While the discrimination against loud, nearby stations is rather poor, both the selectivity on stations off a ways and the sensitivity are very good. It does, however, require more of an antenna for decent reception than do the modern factory-built superhets. From 75 to 100 feet of wire, as high and in the clear as possible, are required for best operation. A longer antenna is required for good operation on 160 meters than is needed on 75 meters.

For short haul work, quite good results can be had with a 10 or 15 foot antenna. In fact, for c.w. operation this much of an antenna will usually suffice. But for reception of phone signals from any distance, more antenna is required.

The receiver is built around one of the new RK43 twin triodes. This is a 120 ma., 1.5 volt tube designed to operate directly from a dry cell. It is equivalent to a pair of type 30's except for a slightly higher μ and lower voltage filament. A single "little 6" compact number 6 standard dry cell will run the tube almost indefinitely. A midget 45 volt "B" battery is used for plate power.

The bias cell (BC) cuts down the plate current drawn by the amplifier triode from approximately 5 ma. to about 1.5 ma. without reducing the undistorted output. This increases the life of the B battery, making its incorporation worthwhile even though the amplifier can be run at zero bias if desired.

As the circuit and operation are the same as for the two tube regenerative receivers shown in the various handbooks for the last several years, detailed description and operating instructions will not be given here. All pertinent data are given in the caption under the wiring diagram.

If you have had experience with the 2 volt tubes, you will not be surprised at one annoying characteristic of the RK43—a tendency to be microphonic. However, inasmuch as no manufacturer seems to have licked this trouble completely in the 2 volt series, there probably is no kick coming.

Oh, yes, that little hole in the panel next to the antenna post is to allow access to the antenna coupling condenser, a compression-type mica trimmer. A ground connection is necessary to the chassis of the receiver to minimize body capacity, especially if a long receiving antenna is used. The body of an auto will do in a pinch, provided you are sitting in the car and not standing on the ground while tuning the receiver.

The transmitting antenna described for use with the transmitter can be used for the receiver also by clipping the feeders together and connecting to the receiver. A switching arrangement can be incorporated to cut down changeover time.

•

"Joke"

If you don't like this magazine, talk a friend into subscribing. It is sure to be a good joke on somebody.

If after getting the magazine his opinion is the same, it is a good joke on him.

If he happens to like the magazine, it is a good joke on you.

If he says "Okeh" and then doesn't send in his subscription, it is a good joke on us.

If it isn't a good joke, at least it is as funny as some of the stuff we hear in the amateur bands preceding frequent remarks of "Hi hi".

New IONOSPHERE BROADCASTS

***By* ELMER H. CONKLIN,* W9FM**

•

Bureau of Standards adds a new service to its Standard Frequency broadcasts by making current ionosphere information available on the day of observation.

•

● The national Bureau of Standards has added another service[1] to its several Standard Frequency Broadcasts. Each Wednesday the Bureau now broadcasts information about high frequency radio transmission conditions, based on its continuous measurements of the ionosphere at Washington, D. C. Transmission is by 'phone from its relay station WWV each Wednesday at 1:30 p.m. E.s.t. on 10 Mc.; at 1:40 on 5 Mc.; and at 1:50 on 20 Mc., using about 20 kilowatts with 30% modulation.

The object of these broadcasts is to make current ionosphere information available on the day of observation. This should aid in choosing optimum frequencies for long-distance communication and in interpreting results. It supplements published information giving long-time trends and averages.

The broadcasts include statements of critical frequencies for normal incidence and virtual heights of the layers of the ionosphere, followed by estimated skip distances for a number of frequencies, all based on observations made at Washington on the day of the broadcast. The data are given for noon and midnight, and estimated variations from these values for other hours are also given. Any unusual conditions during the preceding week, such as those accompanying magnetic storms, are described briefly. The service may be extended later, if the demand warrants, to a more frequent dissemination of ionosphere data and the inclusion of data from other parts of the world.

Sample Broadcast

This is station WWV of the National Bureau of Standards. We have just completed a standard-frequency emission on .... kilocycles, which will be repeated on .... and .... kilocycles. We now give a summary of radio transmission conditions.

Based on observations at noon today, March 3, 1937, the normal-incidence critical frequencies and virtual heights of the ionosphere layers at Washington, D. C., latitude 39° North, were as follows: For the E-layer, critical frequency 3940 kilocycles, height 120 kilometers. For the F_2-layer, critical frequency 13,700 kilocycles, height 240 kilometers.

The frequencies corresponding to several skip distances are approximately as follows:

300 kilometers for a frequency of 14,400 kilocycles.
800 kilometers for a frequency of 18,000 kilocycles.
1500 kilometers for a frequency of 25,800 kilocycles.
2500 kilometers for a frequency of 33,900 kilocycles.
The frequencies corresponding to the skip distances lie approximately between the values given and 10 per cent less, from about 10 a.m. to 6 p.m. local time.

At midnight last night the normal-incidence critical frequency of the F layer was 7600 kilocycles and the minimum virtual height 270 kilometers. The night skip distances for several frequencies are approximately as follows:

300 kilometers for a frequency of 7,800 kilocycles.
800 kilometers for a frequency of 9,500 kilocycles.
1500 kilometers for a frequency of 13,600 kilocycles.
2500 kilometers for a frequency of 17,900 kilocycles.
The frequencies corresponding to these skip distances hold from about 9 p.m. to 7 a.m. within about plus 15% and minus 25%.

During recent weeks the day-to-day variations of ionosphere conditions have been small except during occasional magnetically disturbed days. No sudden ionosphere disturbances were observed during the past week.

This announcement will be given again at .... p.m. Eastern standard time, on .... kilocycles.

Description of the Ionosphere

A discussion of the ionosphere and the application to radio communication is for the most part straightforward. An understanding of the subject is not beyond the technical capabilities of the beginner. Certain symbols and definitions are used which are not readily understood without explanation.

The first word which requires explanation is "ionosphere." Above the earth's surface is a layer of air which is most dense near the sur-

*Associate Editor, RADIO.

[1]National Bureau of Standards Letter Circular LC499, dated May 15, 1937, from which we have quoted liberally in the preparation of this discussion.

face, becoming more rare with altitude. The air is composed of molecules of various gases (nitrogen, oxygen, hydrogen, carbon dioxide, and the rare gases helium, neon, xenon and krypton). Under certain conditions (solar radiation) these molecules can subdivide into "ions" or electrically charged particles. These particles may be compared with the ions formed in a water solution of many chemicals, making water a conductor of electricity. The ions in the atmosphere in general increase in number at the high altitudes where the air is so rare that relatively few collisions of ions take place to reform molecules. Such an atmosphere of ions has the property of bending a radio wave. When a wave is transmitted upward, an echo may be heard a short while later, making it possible to determine the distance it has traveled, assuming the speed. At different frequencies, this distance varies, giving rise to the statement that the ionosphere has layers. Figures 1, 2 and 3 show a typical series of measurements of the height of the reflecting layers at different frequencies.

FIG. 1

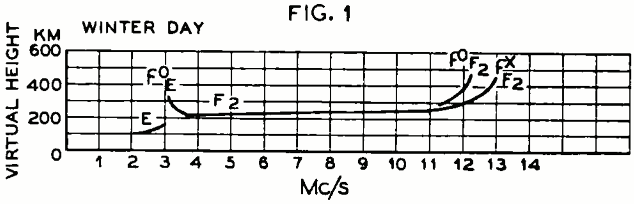


FIG. 2

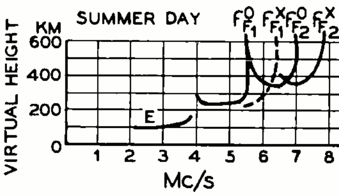


FIG. 3

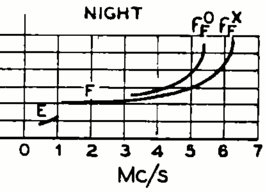


FIG. 4

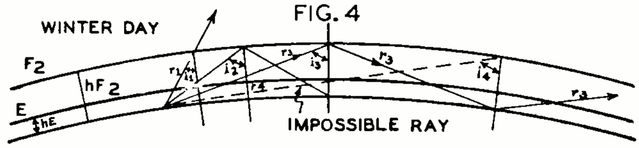
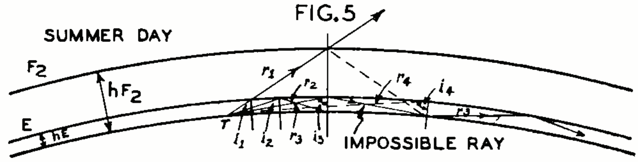


FIG. 5



The words "virtual height" are applied to the measured height of the layers using the above method of timing the echo. The wave may, of course, be slowed down and then reversed in direction without reaching that height, but for convenience the layer is considered to be a mirror with a sharp reflecting surface located at the "virtual" height. These symbols are used:

h_E E region virtual height
h_{F1} F_1 region virtual height
h_{F2} F_2 region virtual height
h_F night region virtual height—when F_1 and F_2 subdivisions merge.

The "critical frequency" is that frequency at which the wave penetrates one layer and goes on upward, sometimes with a very long delay. At a slightly greater frequency, the next higher layer makes its appearance as is also seen in figure 1. Because of the presence of the earth's magnetic field, the F_1 and F_2 layers show an "ordinary ray" and an "extraordinary ray" whose critical frequencies are separated at Washington, D. C., by an almost constant 800 kc. as shown in figures 1 to 3. The virtual height and critical frequency in general move in opposite directions; that is, a low layer will reflect a high frequency. These symbols are used to designate various critical frequencies:

f_E E region critical frequency in kc.

f^o_{F1} F_1 region critical frequency in kc. (ordinary ray)

f^x_{F2} F_2 region critical fiequency in kc. (extraordinary ray)

f^x_F night F region critical frequency (extraordinary ray)

Absorption should be mentioned as an important factor limiting transmission, generally being greatest in daytime and on lower frequencies than the highest reflected by the F_2 layer. It occurs chiefly in the lower ionosphere below or in the E layer.

Another term frequently encountered is "angle of incidence," which is the angle between a vertical line and the path of a wave. It is therefore a measure of the obliqueness with which the wave strikes a layer or ground. "Normal incidence," therefore, is at zero angle and describes a vertical wave path.

Practically all data are given in kilometers. A kilometer is 0.6214 miles or slightly less than ⅝ miles. A mile is 1.6093 kilometers.

The E and F layers are the principal ones in the ionosphere, though there is evidence of lower layers.[2] In addition, there is frequently observed at irregular intervals a sporadic condition in the E layer, varying in geographical distribution. Sporadic E reflections are very common in summer. They often provide intense signals at high frequencies and sometimes at ultra-high frequencies, taking control of transmission away from the higher F layer, and accounting for 500-1000 mile communication in 56 Mc. At such times, lower frequencies also generally show short skip effects, making it possible to notice on 28 and 14 Mc. a condition which may cause the 56 Mc. band to open for long distance contacts.

Regular Variations With Time

The virtual heights of the E and F_1 regions do not vary substantially during a day or over a year,[3] the E layer height being about 110 to 130 km. (68-81 miles) while the F_1 layer is found at about 200 to 240 km. (124-149 miles). The F_2 region, however, varies over much wider limits, from 230 km. (143 miles) during a winter day to between 350 and 500 km. (217-310 miles) during a summer day, and around 300 km. (186 miles) at night. Winter conditions in the F_2 layer continue for several months centered on December, and summer conditions for several months centered on June or July. During the spring and fall, and especially around April and September, there is a transition period in which the change occurs between winter and summer conditions. This period is marked by erratic behavior of the F_2 region, a series of typical winter days being interspersed with typical summer days.[4]

The variation in the critical frequencies of the normal E layer are regular, the highest being near local noon, with the seasonal maximum in midsummer. The night critical frequency is usually between 600 and 1000 kilocycles although the daytime value in summer is sufficient to be important to high frequency communication.

The F_1 layer is normally unimportant for transmission except for short distances and for a very limited band of frequencies, being usually found only on a summer day.

The F_2 layer is of great interest for high frequency work. The critical frequencies are higher in winter than in summer, in contrast with those of the E layer, although a broad maximum centered at about 1:00 p.m. local time occurs in winter with a maximum nearer sunset in summer. The lower height and higher critical frequencies in the winter day make the F_2 layer important for high frequency transmission, although the critical frequency of the low E region may on a summer day rise to a point where this layer takes control. The F_2 critical frequency is, with the exception of irregular scattered reflections, the highest frequency returned vertically (normal incidence).

Since the sunspot minimum in the winter of 1933-34, the critical frequencies of the various regions have increased over a period associated with the eleven-year sunspot cycle, subject of course to the usual seasonal and daily fluctuations. The next sunspot maximum is expected about 1939.

Variations With Latitude

The condition of the ionosphere varies with latitude. For the latitudes of the United States the differences from the Washington values appear to be small. Considerably different results have been reported from the southern hemisphere, a subject which has not yet been fully investigated.

Applications to Radio Transmission

Figures 4 and 5 show ionosphere conditions for typical summer and winter day conditions. In figure 5 we show the high F_2 virtual height for a summer day, and make the assumption that the E layer is dense enough to reflect a given frequency traveling directly upward (striking the layer at "normal incidence"). Under this condition, a wave will not penetrate the E layer at any angle but will travel between this region and the earth, as indicated by the rays r_2 and r_3. However, if the frequency is increased to just beyond the critical frequency for the E layer, a ray (r_1) leaving the transmitter at a high angle will go up to another layer, which might be capable of turning it

[2] N. Smith and S. S. Kirby, "Critical Frequencies of Low Ionosphere Layers," *Physical Review,* May 15, 1937.

[3] For a discussion of recent diurnal and seasonal variations in the ionosphere and other information on the subject, see Gilliland, Kirby, Smith and Reymer, "Characteristics of the Ionosphere and their Application to Radio Transmission," *Proceedings I.R.E.,* July 1937.

[4] This condition has been noticed particularly on 28 Mc. and has been responsible for much abandonment of that band for long distance amateur communication before summer conditions finally set in.

down again. Low angle rays, however, may still be reflected by the lower E layer.

In figure 4, which shows the F_2 layer at a lower height but greater ionization density on a winter day than on a summer day, we assume a transmitting frequency high enough to penetrate the E layer at any angle, but low enough to be reflected by the F_2 layer if the waves strike the layer at angles greater than i_1. For angles of incidence smaller than this, the waves pass into space and are not returned. Lower frequencies would of course be reflected from the E layer over long distances but E layer transmission for a few hundred kilometers could not occur unless the transmitting frequency were considerably decreased, say to less than half the values reflected by this layer over long distances.

The "impossible ray" shown in these figures (r_4) represents zero angle radiation from the transmitter.

The angle of incidence (i_1, i_2, etc.) of a wave upon the layer depends on the distance of transmission for one hop and the virtual height of the layer. Given the two quantities, therefore, the angle of incidence, i, may be calculated and the maximum frequency which can be used also can be calculated approximately from the critical frequency for normal incidence using the relation known as the "secant law."[5]

For frequencies near the critical frequency, the virtual height is considerably greater than the minimum values given, since reflection then takes place at a height corresponding to a point well up on the band of the critical frequency curve, as shown in figure 1. This results in a maximum useful frequency lower than would be expected from the virtual heights given. Consideration of the virtual height-frequency curves gives the following approximate values for the factor by which the normal-incidence critical frequency must be multiplied to give the maximum useful frequency for great distances:

Sporadic E layer	5.0
Normal E layer	4.5
F_2 layer (winter day and summer sunset)	2.5 to 3.0
F layer (summer and winter night)	2.2 to 2.7
F_2 layer (summer day)	2.0 to 2.5

[5]The equation, where f is the maximum frequency which can be used and f_c is the normal-incidence critical frequency, is:

$$f = f_c \text{ secant } i$$

The given distance will be within the "skip zone" for all higher frequencies. A chart useful for calculating the factor "secant i" is given in Letter Circular LC499 of the National Bureau of Standards. It was also reproduced in *QST* for May, 1937.

Widely different conditions sometimes prevail over different parts of a path because of large differences in local time and latitude encountered. In such cases the transmission frequency will have to be lowered to satisfy conditions in the part of the path in which the critical frequency is lowest. Under such conditions absorption is likely to occur in the part of the path with the high critical frequencies.

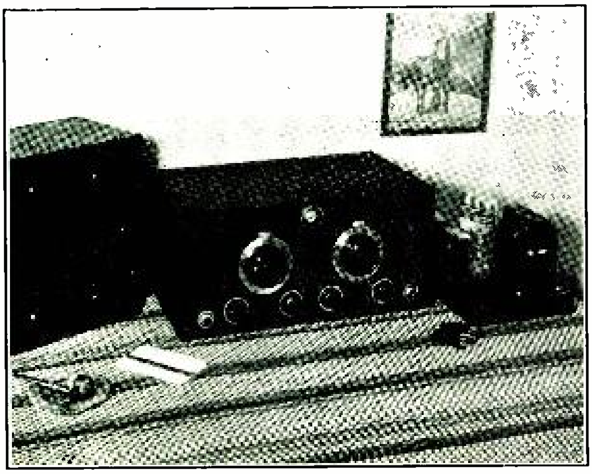
Location of Point of Reflection

The geographical part of the ionosphere which controls long-distance high-frequency propagation is that part at which the wave in the useful direction strikes the reflecting layer. This point on the transmission path may be as much as 1000 to 2000 kilometers from the transmitter and also from the receiver. Consequently, depending on the time of day, different frequencies might be necessary for transmission in different directions. For example, around sunset in winter, lower frequencies would have to be used in transmitting eastward than might be used in transmitting westward from the same location. This does not mean, however, that different frequencies would be necessary or desirable in opposite directions over the same path.

The maximum possible distance for one-hop transmission, corresponding to zero angle of elevation of the ray above the horizon, is about 2400 kilometers for the E layer and about 3500 to 4400 kilometers for the F_2 layer, depending on the virtual height of the layer. Practically, it is usually impossible to accomplish high frequency transmission at this zero angle because of absorption at the earth's surface. If a practical limit of 3½ degrees is assumed for the angle of elevation, the maximum distance for one hop is about 1700 kilometers for the E layer and 2800 to 3600 kilometers for the F_2 layer. Single-hop transmission may often be possible at these or greater distances, while at the same time multi-hop transmission over the same path may be more efficient.

Local weather—pressure, temperature, humidity, precipitation—therefore appears to have little to do with *transmission* taking place through the ionosphere in spite of the emphasis placed on these factors by some amateurs.

A Ten-Meter Phone Station



RECEIVER

•By RAYMOND P. ADAMS*

The average amateur, who swings from band to band as conditions require and flexibility of apparatus permits, has come to consider the fixed-service receiver (the five or ten meter affair, for instance) as an instrument more or less adjunct to the regular station job. (We like to think of a "station" receiver as the major piece of receiving equipment, functioning constantly during periods of communication, and upon which such communication largely depends; and as distinguished from auxiliary, emergency, stand-by, or special band tuners which, however much they are used, are not essentially necessary to general operations.) For this type of ham, the main receiver generally represents an appreciable investment, and for that reason, and as auxiliary apparatus is expected to give service more on occasion than as a regular thing, he finds it advisable in designing and constructing such "complementary" items to keep their cost, first and last, down to a practical minimum.

Economy and relative usage largely dictate, then, that the average fixed-band receiver, the 10-meter phone receiver, we'll say, as this article has to do with a job primarily designed for 28 Mc. work, shall be neither complex nor costly. But be that as it may, there is such a man in this ham's world as the amateur who spends nine out of ten operating hours on some one frequency band—10 or 20 meters, perhaps—and though he may shift to other parts of the assigned spectrum, with the season and as long-time band conditions demand, he tends to conduct the majority of his communications activities in one place, especially if he's exclusively "phone."

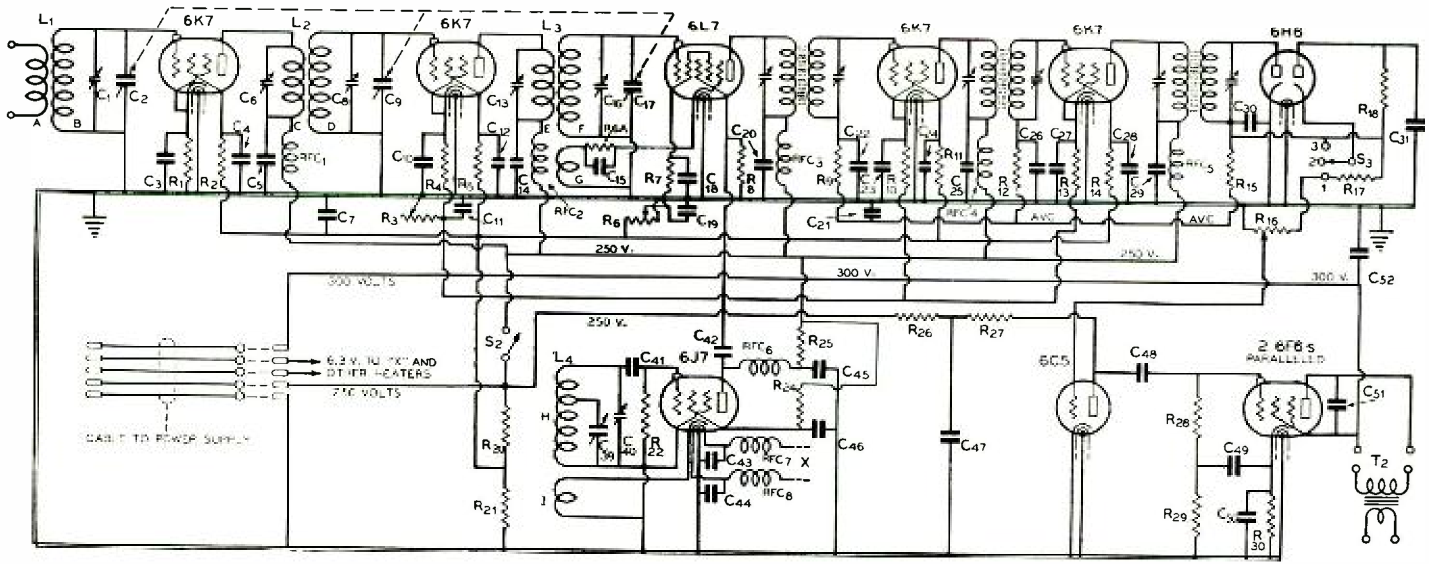
For this type of operator—and we shall refer definitely to the 28 or 14 Mc. phone man—there must be a station receiver designed primarily for single-band service but adaptable to operation on other bands without complete reconstruction. Ultra-high frequency equipment of the accessory or adjunct variety won't interest him, nor will the typical all-band, all-wave, all-service job which remains at best a compromise affair, affording highly effective image and signal selectivity only over a certain portion of the tuning range. He insists—as he should insist—upon an engineered receiver built for efficient service on the band in which he remains essentially interested; and such a receiver is the writer's new 10-meter job, presented here.

28 Mc. Phone Receiver Requirements

A good ten-meter receiver, like any other receiver, must have the maximum possible signal and image selectivity. Good mixer conversion and high r.f. gain in the first tube are important; these features make for proper signal-to-noise level and, of course, affect both sensitivity and selectivity. Without good rejectivity, considered simply as a function of the characteristics of the tuned circuits, a 28 Mc. job of special "station" design won't be worth the time and expense involved in building it.

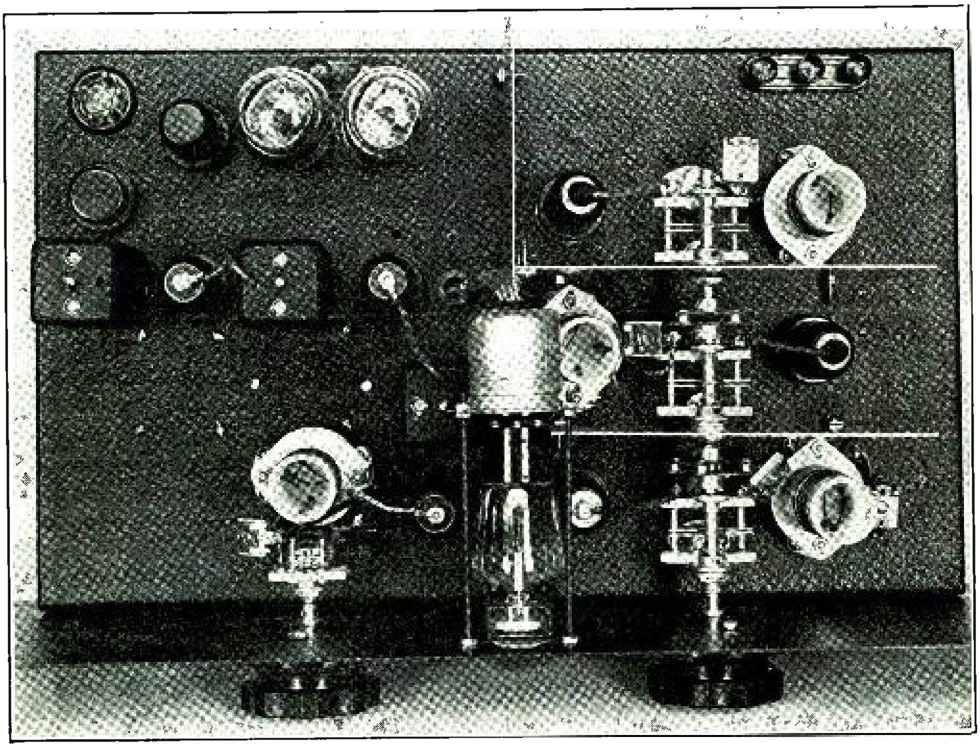
456, 465 and 500 kc. are recognized intermediate frequencies for conventional all-wave 550 kc. limit. These are compromise frequencies, and while definitely necessary for clearly apparent reasons in such a receiver, they hardly remain suitable for exclusively 28 Mc. service.

*1717 North Bronson Avenue,
Hollywood, California.



SCHEMATIC DIAGRAM AND CIRCUIT VALUES

- C_1—3-30 μμfd. trimmer
- C_2—20 μμfd. midget variable
- C_3,C_4—.006 μfd. mica
- C_5—.01 μfd. mica
- C_6—3-30 μμfd. trimmer
- C_7—.05 μfd. 400 volt tubular
- C_8—3-30 μμfd. trimmer
- C_9—20 μμfd. midget variable
- C_{10}—.006 μfd. mica
- C_{11}—.05 μfd. 400 volt tubular
- C_{12}—.006 μfd. mica
- C_{13}—3-30 μμfd. trimmer
- C_{14}—.01 μfd. mica
- C_{15}—.006 μfd. mica
- C_{16}—3-30 μμfd. trimmer
- C_{17}—20 μμfd. midget variable
- C_{18}—.006 μfd. mica
- C_{19},C_{20},C_{21},C_{22} — .05 μfd. 400 volt tubular
- C_{23}, C_{24}, C_{25}, C_{26}, C_{27}, C_{28}, C_{29} — .05 μfd. 400 volt tubular.
- C_{30}—.00005 μfd. mica
- C_{31}—1.0 μfd. 200 volt tubular
- C_{32}, C_{33}—.05 μfd. 600 volt tubular
- C_{34}, C_{35} — .002 μfd. mica
- C_{36}, C_{37}, C_{38}—16 μfd. (8-8) 450 volt electrolytics
- C_{39}—15 μμfd. midget variable
- C_{40}—3-30 μμfd. trimmer
- C_{41}, C_{42} — .0001 μfd. mica
- C_{43}, C_{44} — .01 μfd. mica
- C_{45}—.006 μfd. mica
- C_{46}—.006 μfd. mica
- C_{47}—0.1 μfd. 400 volt tubular
- C_{48}—.05 μfd. 400 volt tubular
- C_{49}—0.1 μfd. 400 volt tubular
- C_{50}—25 μfd. 25 volt electrolytic
- C_{51}—.006 μfd. mica
- C_{52}—4 μfd. 450 volt electrolytic
- R_1—300 ohms, ½ watt
- R_2—5000 ohms, ½ watt
- R_3 — 12,000 ohm potentiometer
- R_4—300 ohms, ½ watt
- R_5—5000 ohms, ½ watt
- R_6 — 50,000 ohm potentiometer
- R_{6A}—600 ohms, ½ watt
- R_7—5000 ohms, ½ watt
- R_8—50,000 ohms, ½ watt
- R_9—250,000 ohms, ½ watt
- R_{10}—300 ohms, ½ watt
- R_{11}—5000 ohms, ½ watt
- R_{12}—250,000 ohms, ½ watt
- R_{13}—300 ohms, ½ watt
- R_{14}—5000 ohms, ½ watt
- R_{15}—250,000 ohms, ½ watt
- R_{16}—100,000 ohm potentiometer
- R_{17}—80,000 ohms, ½ watt
- R_{18} — 1 megohm, ½ watt
- R_{19}—25,000 ohms, 50 watts, slider-type
- R_{20}—25,000 ohms, 3 watts
- R_{21} — 25,000 ohms, 1 watt
- R_{22}—50,000 ohms, ½ watt
- R_{24}—40,000 ohms, ½ watt
- R_{25}—10,000 ohms, ½ watt
- R_{26}—50,000 ohms, ½ watt
- R_{27}—50,000 ohms, ½ watt
- R_{28}—500,000 ohms, ½ watt
- R_{29}—100,000 ohms, ½ watt
- R_{30}—200 ohms, 3 watts
- CH_1—10 hy. 150 ma., 200 ohms
- CH_2—50 hy. 60 ma., 1400 ohms
- T_1—Power trans. 750 c.t., 125 ma.; 5 volts, 3 amp.; 6.3 volts, 4 amp.
- T_2—Output trans. 3500 ohms to speaker
- S_1—A.C. line switch
- S_2—Communication switch
- Coils—See coil table
- $RFC_{1,2,6}$—2.5 mh. 125 ma. r.f. chokes
- $RFC_{3,4,5}$ — 10 mh. shielded r.f. chokes
- $RFC_{7,8}$—Filament chokes. See under-chassis photograph
- L_1,L_2,L_3,L_4—See Paragraph 6 in Construction Notes and the illustration of the coils.



TOP VIEW OF THE RECEIVER

They make for high gain and good signal selectivity, but their use leaves much to be desired in the way of image rejectivity; an external preselector becomes an imperative refinement. 3000 kc., similarly conventional and found in most 5 and 10- and exclusively 5-meter supers, is the logical i.f. for 56 Mc. It does afford a desirable image selectivity at 28 Mc., but it will not give sufficient signal selectivity for best results on 28 Mc.

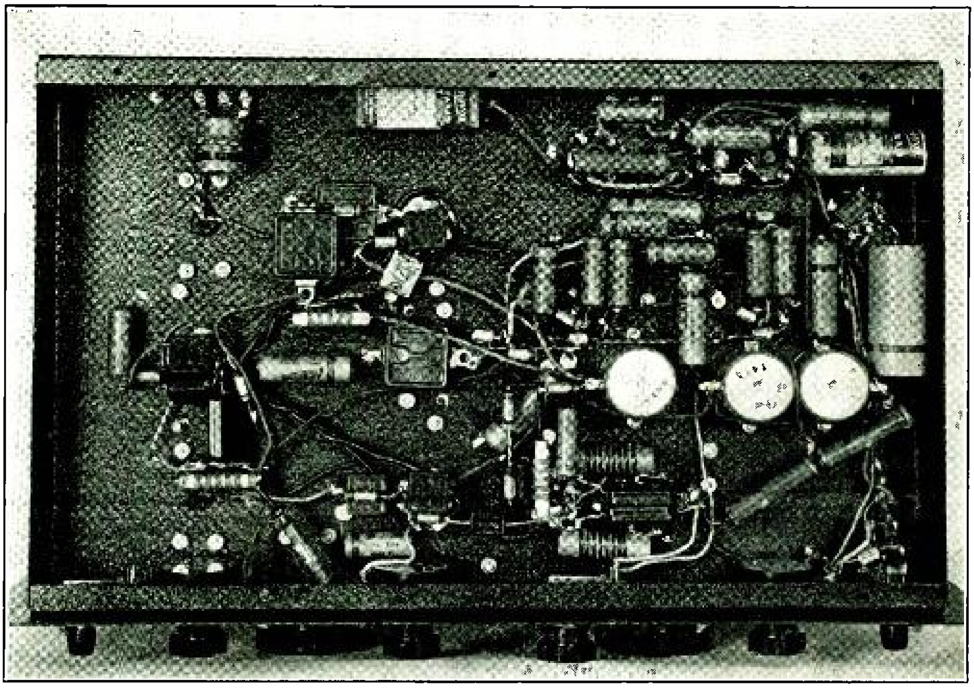
Analysis has shown us that the normal or standard frequencies, as afforded by available i.f. components, are hardly suitable to the good 10-meter receiver. Lately, however, the manufacturers have released items designed to peak at 1500 kc.; this i.f. seems to work out as the logical compromise for any 28 Mc. job. Image rejectivity remains excellent so long as there is adequate r.f. pre-selection. Signal selectivity is ample, being increased 50% over that given by an intermediate around 3000 kc.

Two stages of r.f. pre-selection are desirable for best image rejectivity. Also, for the best signal-to-noise ratio, the first stage should be adjusted for maximum gain at all times. At 1500 kc., two i.f. stages will afford sufficient gain and selectivity, particularly if iron-cored transformers are employed, to permit the use of a linear second detector. The a.v.c. voltage for the two i.f. stages will thus be related entirely to carrier strength and unaffected by modulation depth. Crystal filter and b.f.o. refinements will not be required for the exclusively phone receiver—but some effective means for noise suppression will be imperative, particularly because of ignition QRN around 28 Mc. Should it be desired, a b.f.o. can be installed easily. As to the crystal filter, filter crystals are not generally available for this high a frequency. We are informed, however, that they will be available on the open market within a short time.

General Description

The writer's new 10-meter phone superhet consists of three units: a 10-tube tuner-amplifier, a power supply affording more than ample voltage and current to meet all requirements, and a 10-inch p.m. speaker housed in a crackle-finished case.

The tuner-amplifier, or receiver proper, is installed in a standard cabinet, uses a standard relay rack, 8¾"x19" front panel, and is pro-



UNDER CHASSIS VIEW
Note H.F.O. Filament Chokes Near Front Panel

vided with micrometer or "true vernier" dials for separate r.f. and h.f.o. tuning. Large knobs afford "finger tip" control, and the 5 to 1 knob-to-condenser vernier ratio is such as to permit a quick sweep across the band. In general design, the receiver meets quite closely the various requirements previously outlined for a 10-meter superhet.

Plug-in coil forms are used in all high-frequency stages, but this should not imply that the receiver remains essentially of plug-in coil design. Better mechanical support for the two winding inductances, and a method of construction that would permit band changes to 20 meters, if and when conditions on 10 make such change necessary, prompted the idea; but fixed band layout is none-the-less featured.

The R. F. Circuit

Two stages of 6K7 r.f. are employed, gang-tuned by 20 μμfd. condensers with the first detector stage. Coupling between stages is inductive, and all three coil secondaries are trimmer-bridged to permit band spotting and accurate circuit alignment. The regular tuning capacities, C_2, C_9, and C_{17} afford approximately 20 divisions of r.f. dial band spread. More might have been effected by removing one stator from each tuning condenser or by connecting the variables across fewer than the total number of coil turns. But the rather solid construction of the condensers discouraged us from attempting the first move, and the physical layout—already worked out—gave us little chance to try the second. Besides, the 20-division spread eventually was found to be in every way acceptable as the *oscillator* dial spreads the band over a full 180 degrees.

C_6 and C_{13} are small trimmers connected across the coil *primaries*; they are adjusted to tune the plate windings to the approximate center of the 28 Mc. band. Their use increases the gain tremendously.

Both r.f. plate circuits are well filtered with midget chokes and small mica by-pass condensers. Screen circuits are decoupled with 5000 ohm resistors and are twice by-passed, once at each socket, and once, for all circuits collectively, at the point of common screen voltage supply. The cathode return for the first tube is brought through the usual bias resistor directly to chassis to keep the gain in this stage high at all times. The return for the second tube is tied to R_3 for knob control of r.f.-i.f. gain. Note that this cathode circuit, like the screen circuit, is twice by-passed, once at the socket with a small postage stamp condenser, and once at R_3.

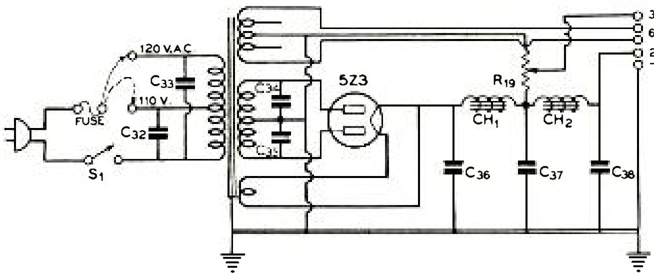
In the schematic, no a.v.c. control is shown for either r.f. stage. A.v.c. is not at all desirable for the first of these, although it might advantageously be applied to the second.

The mixer is conventionally connected, e.c. feedback permitting a slight amount of regeneration which is controllable by the screen supply potentiometer. A little regeneration will be advisable, but too much will spoil the pudding as e.c. feedback tends to nullify the effect of internal shielding in a suppressor grid tube unless the suppressor is connected internally to the cathode. Therefore, the screen cannot do a perfect job of keeping independent the oscillator and detector circuit tuning if more than a certain amount of feedback is permitted.

Grid leak detection for the 6L7 would afford increased sensitivity; but with some regeneration and with both r.f. stages working efficiently, there seems to be no real reason why it should be used.

The H.F.O. Stage

L_4, the oscillator coil, is physically and inductively similar to the secondaries of L_1, L_2 and L_3, and is loaded up to the high frequency band limit by C_{40}, a midget trimmer. C_{39}, an ultra-midget variable of 15 μμfd. max. capacity, connects across approximately one-half the number of L_4 turns to give a full 180 degrees of dial bandspread on 28 Mc. The oscillator tube is a 6J7 with the suppressor grounded; plate voltage (choke filtered) is set at 200 and screen at 160, and the filament circuit is bypassed and choked at the socket terminals.



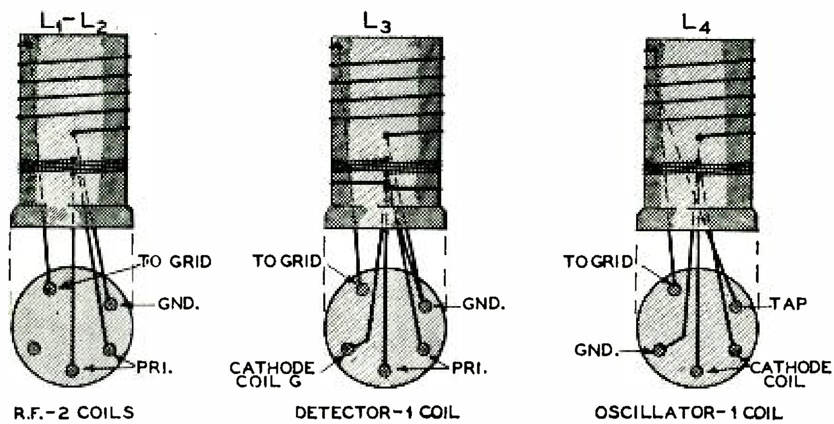
The Power Supply . . . Values Shown Under Main Diagram

Electron coupling provides the feedback for circuit oscillation. Coupling to the mixer is effected by means of the usual small mica capacitor tied between oscillator plate and 6L7 injector grid.

H.f.o. stability is of course something we can ill afford to disregard in a 28 Mc. receiver. Some amateurs might insist upon a high C/L ratio in the oscillator circuit. For ourselves, initial work with a very small L_4 inductance loaded up to desired frequency with a large fixed capacity, seemed to indicate that no greater degree of stability might be obtained over that afforded with the present set-up. The large ventilated cabinet, separate power supply and rigid coil form all work to prevent frequency drift. Also, the oscillator output remains perfectly constant over the tuning range. What more should we require?

Antenna Input

Though the diagram does not show it wired into the circuit, an antenna coupler may be



The Coils are Wound Like This
(See Paragraph 6 of "Construction Notes.")

observed in the under-chassis photo. This is simply a small coil designed to load up the antenna to approximately 28 Mc., and thus afford a better voltage transfer to the r.f. input stage. Coupling to the r.f. coil is effected by means of a short length of twisted pair brought through the chassis and with a two or three turn link at each end. Due to the loose coupling of the link circuit, it is not at all difficult to keep the first r.f. stage in proper alignment.

The I. F. Stages

The two 6K7 i.f. stages are a.v.c. controlled and ferrocart iron-core transformer coupled. Their frequency is 1500 kc., the logical i.f. for 28 Mc. work, as we have previously indicated, and also quite suitable for 14 Mc. The first transformer is especially designed for converter to i.f. input; the next is an interstage job; and the last is especially designed for diode output. These transformers are small, inexpensive and mica-tuned. More costly air-tuned jobs may be substituted if one's pocket will stand the additional drain.

All screens are individually filtered and bypassed, as are the cathodes. The cathode circuits are returned to R_3 for manual volume control. B-plus leads are all filtered by shielded r.f. chokes.

The Second Detector-Noise Silencer

A 6H6 second detector provides audio, a.v.c., and noise suppression voltages. The a.v.c. is filtered and fed back to both i.f. stages. The audio voltage appears across the R_{16} and R_{17} resistor combination from whence it goes to the audio amplifier.

The noise circuit as used in this model and as shown in the wiring diagram represents nothing original. It is essentially the same thing as suggested as a working circuit by James E. Dickert, W9PEI, in his very illuminating article in the March, 1937, issue of the magazine *All-Wave Radio.*

Mr. Dickert's system is simple but none-the-less effective. It calls for no special parts; in fact, very few more than the conventional 6H6 detector requires. It is self-adjusting to carrier level, stable, reasonably distortionless, and it may be designed for good silencing action without the suppression of positive modulation peaks.

The switch, S_3, is introduced into the circuit so that it will be possible to control the amount of noise suppression. With this switch in the "1" position, the silencer is at the proper adjustment for the reception of modulated signals. At position "2," the silencer is disconnected. In the third position the silencing action is at a maximum; all noise impulses above carrier level are suppressed.

The Audio Circuit

Diode biasing of the first a.f. tube, a 6C5 in our case, is recommended with the Dickert system. A pair of paralleled 6F6's is used in the last audio stage.

One pentode might have been eliminated, but the pair were kept in service simply because the power supply was able to provide the additional current required. Also, it is sometimes convenient to have the additional audio available should it be needed.

The Power Supply Circuit

The a.c. input leads to the power transformer are filtered for line-noise suppression and the high voltage leads to the 5Z3 rectifier are by-passed to ground with small mica capacities. The 6.3 volt filament supply is center-tapped to ground at the transformer. CH_1 carries the total current drain of the receiver while CH_2 carries all the drain except that of the 6F6's and the 50 watt voltage divider. Ample filtering capacities at both ends of CH_2 insure humless receiver operation. If the power leads from supply unit to receiver are to be fairly long, a pair of 4 μfd. electrolytics at both B plus supply leads might be added (at the receiver) for low resistance by-passing.

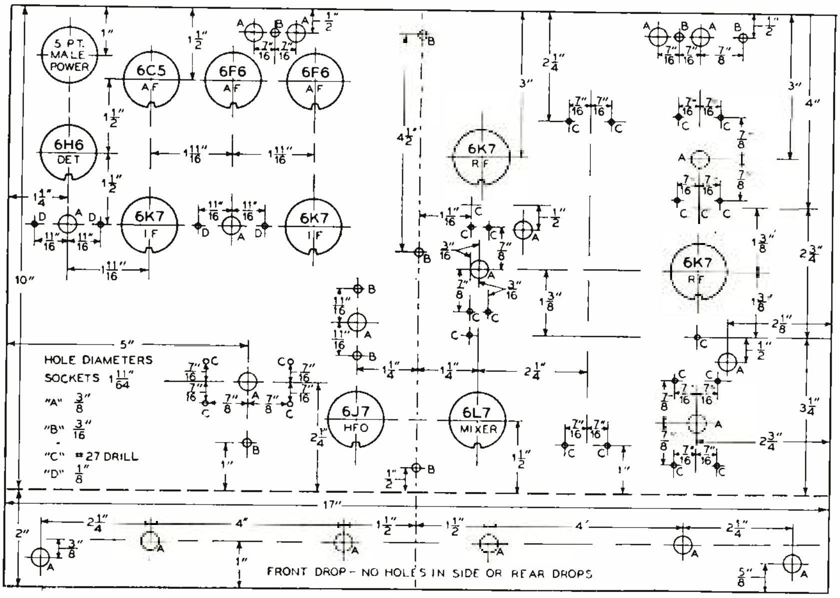
Layout and Design Details

As we have previously noted, the r.f. coils are wound on Hammarlund midget plug-in forms. Their position with respect to tuning condensers and the various tubes is clearly shown in the photos. Note that the layout here is such that coupling leads from one stage to the other are kept quite short and away from all others carrying r.f. Primary-winding trimmers for the first r.f. and detector stages are located at the coil sockets, which are elevated above chassis. The primary trimmer for the second r.f. stage is below chassis. This was done simply because the center r.f. shield section is comparatively narrow in width and the installation of the trimmer right on the coil socket would have been very inconvenient. Band-setting trimmers are all self-supported at the tuning condensers. All coil sockets are supported from the chassis with small stand-offs; similar insulators elevate the r.f. tuning

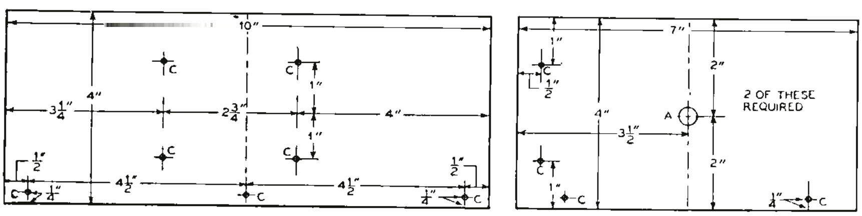
[*Continued on next text page*]

Sheet Metal Constructional 10-Meter Band

1. These layout diagrams are complete as shown and may be relied upon where the parts to be used are the same as those specified. Two chassis will be required; one for the receiver proper and one for the power supply unit. The speaker cabinet is of course optional as is the cabinet for the receiver. Three small pieces of thin steel sheeting, cadmium or wrinkle finish, will be needed for the r.f. shielding compartments.



Chassis-Pan Layout

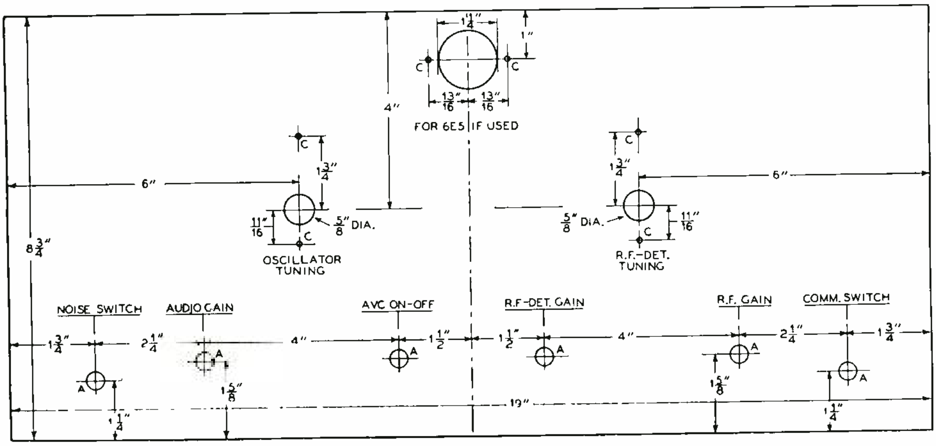


Shield Partitions

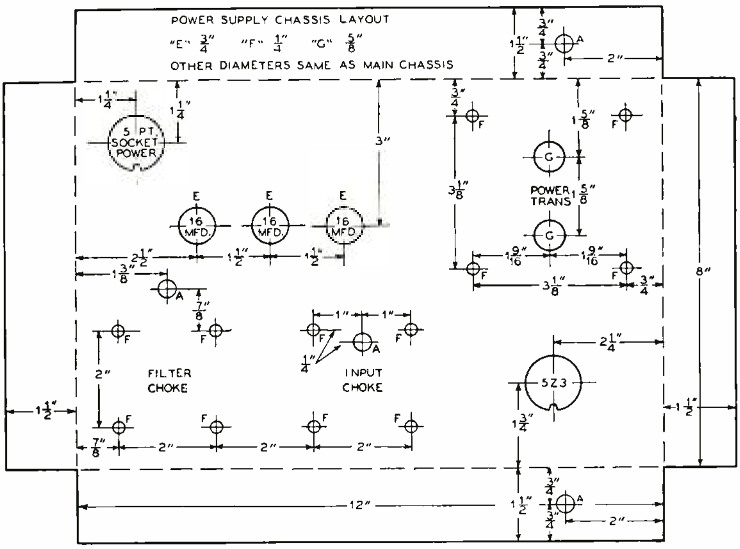
2. The partitions are assembled with spade bolts; the r.f. and detector variable condensers are then mounted and coupled. With all sockets, i.f. transformers and other above-chassis items in place, the shield assembly may then be bolted down to the chassis and the front panel secured by means of the various control nuts. The oscillator tuning condenser can be lowered or raised until it lines up properly with the coupled r.f. tuning condensers, the dials and electric eye holder (or milliammeter) installed, and the various trimmers set in place. R.f. chokes, oscillator plate and filament, should be connected close to socket terminals and right below the r.f. transformers. The i.f. chokes, mounted below chassis, should be near enough to the i.f. transformers to permit extremely short leads. Plenty of tie points should be placed wherever convenient to keep wiring and small items (resistors and by-pass and other capacities) in place and suspended above the chassis.

Layouts and Notes for Phone Receiver

3. The particular cabinet specified has three holes in its back for lead entrance, but they are only about an inch in width and unless enlarged, they will not permit direct access to the antenna posts and the power cable receptacle. We found it convenient to install the 5-prong male receptacle and the three-post antenna assembly on the surface of the chassis as shown in the photograph. Doublet and ground connections then are easily made. The power supply cable has a female plug at the receiver end and a male plug at the end that plugs into the power supply.



Front Panel



Power Supply Chassis

Constructional Notes continued on next page.

assembly at front and rear. The latter assembly, note, has its three condensers ganged with flexible couplers, the center capacity being supported entirely by one shield partition. Real smoothness of the dial movement, by the way, makes additional couplers between controls and condensers more or less unnecessary.

The front panel controls, from left to right, are: noise switch, a.f. level, a.v.c. on-off, first detector screen voltage control, r.f.-i.f. level, communications switch. The circuit diagram shows no connection for the a.v.c. switch: it may be simply a single pole single throw job designed to short the a.v.c. line to ground at the C_{21}-R_{15} point of juncture.

The receiver described uses a 6E5 tuning eye conventionally connected, although it is not indicated in the diagram. Individual builders may wish to substitute a 10 ma. meter, connected in some i.f. plate or cathode circuit, to serve as the tuning indicator.

The layout drawings and photographs clearly indicate the position of other components; however, a few pointers on construction and operation will be noted.

Additional Notes On Construction

4. Physically small mica capacities are used wherever possible for r.f. by-pass service. They are returned to one common point for each stage. All but a very few of the resistors are of the half-watt insulated type.

5. Keep leads short and direct. Don't worry too much about how the wiring is going to look. Use low-loss wire if it is available to you, especially on r.f. and a.v.c. leads. In the lab. model no shielding of the wiring was found necessary.

6. All coils are wound on Hammarlund midget isolantite forms (five prong); the oscillator winding has 4¾ turns tapped approximately at the center of the winding for band spread. The cathode feedback winding consists of four turns close wound and placed about a quarter of an inch down on the form. All r.f. secondaries have, similarly, 4¾ turns in one inch of form space, and all r.f. primaries have four turns, close wound: it is positioned, as with the oscillator coil tickler, below the other windings. The detector coil is similar to the r.f. coils in number of turns and general design except that it has a third winding of one turn at the extremity of the form for cathode feedback. Number 22 or 24 d.c.c. wire will be satisfactory for all windings on all coils. Use as little coil dope as you possibly can, but make sure that the oscillator windings will remain securely in place.

7. The voltages to be expected on the completed receiver are as follows:

Parallel 6F6 pentode plates and screens: approx. 300.
First audio plate—about 150.
R.f., i.f. and mixer plate—250.
Mixer screen—100 down to zero.
Oscillator plate—200.
Oscillator screen—160.
Mixer bias—6 negative.
First r.f. screen—100.
First r.f. fixed bias—3 negative.
Second r.f. and first and second i.f. screens—100 with bias control adjusted for maximum conductance.
Second r.f. and first and second i.f. cathodes—3 to 50, negative.

Alignment and Operation

Adjust the i.f. transformers to 1500 kc. by means of a test oscillator. If instability results with the manual r.f. control adjusted for maximum gain, re-check by-pass condensers, plate chokes, wiring, and voltages. Plug in all coils, check continuity and contact resistance. If no test oscillator is available for r.f. alignment, couple an antenna to the first detector coil, and adjust the oscillator trimmer capacity until, with the oscillator tuning condenser set at zero capacity, an amateur signal in the 28 Mc. can be heard. This signal probably will be received with the trimmer set at another point; if so, select that point which is given by the lower of the two capacity adjustments. Leave the trimmer temporarily in that adjustment and tune over the band with the oscillator dial, tracking with the r.f. control if possible. Note how many stations can be tuned in and over what spread of scale, then readjust the trimmer *slightly* until you feel that with the dial at zero you are just above the 28 Mc. ham band in frequency. Preliminary band spread readjustments might now be made, the oscillator tap being moved up or down a turn or less until a full 180 degree spread on the oscillator

Remove the antenna and reconnect it at the proper input terminals. Tune the r.f. stages for maximum noise level and increased signal strength, adjusting secondary trimmers for both alignment and band spotting. Now adjust the r.f. primary trimmers for increased r.f. gain at the approximate center of the amateur 28 Mc. band.

If a local bc. signal rides in over the desired 28 Mc. stuff, the i.f. is probably tuned to the frequency of that signal. Actually with good shielding, ample h.f. oscillator output, and proper r.f.-h.f.o. alignment, nothing at all but ten meter phone should get through. So try out the set in its cabinet before retrimming the i.f. to another and a free frequency near 1500 kc.

It might be noted that the 31 and 25 Mc. broadcasters will make good markers and facilitate alignment. With an i.f. of 1500, signals of both frequencies will tune in approximately

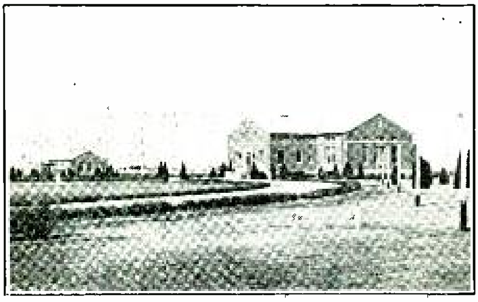
[*Continued on Page 74*]

The Grand Island . . .

MONITORING STATION

• *By* RUFUS P. TURNER,* W1AY

● To the student of American municipalities, Grand Island in the Platte valley is the third city in Nebraska. 1870 feet above sea level and with a population of 23,720 persons, it is the largest city on the Lincoln Highway between the Missouri river and the Rockies. Grand Island is the largest horse and mule market in the world and has the first beet sugar refinery built in the United States Its name is received from the Grand Island on the Platte river, a short distance to the south.



The primary and secondary standards, all receivers, power supplies, monitoring equipment, and offices are housed in the large building. In the small building are located the diesel-electric power plant, water works, machine shop, and garage. During blizzards, emergency quarters are available in the large building for the personnel.

To the radio man, however, the importance of Grand Island rests upon the fact that the Federal Communications Commission has located its central monitoring station in the environs of that town. There, the traffic policemen of the ether lanes have maintained twenty-four hour vigils continuously since 1930 when the station was placed in service. Many a "pink slip" has gone from Grand Island to an amateur operator who inadvertently has slipped outside of the bands allocated for his use. Hence, the very name strikes terror to the amateur's heart.

Off-frequency reports from the monitoring stations give the offender's deviation in *cycles*. This high degree of accuracy has aroused much wonder in amateur circles as to receiving and checking methods used by the Government. In response to inquiries, we are pleased to present on these pages a description of the apparatus and checking systems used at the Central Monitoring Station.

Purpose and Location

"The purpose of the station," the Commission explains, "is constantly to observe the operation and to measure the operating frequency of the various radio stations of all classes, including broadcasters, and in other respects to serve as an aid to the Commission in effectively enforcing the technical and other provisions of the Radio Laws and Regulations. In this manner it contributes toward the preservation of order in the use of the ether by the several thousand United States radio stations in about the same fashion as the traffic policeman keeps automobile traffic in orderly movement at busy street intersections. The confusion resulting without such regulation is the reason for the existence of the station."

Grand Island is the primary monitoring station. It is purely a receiving station and no transmitters are located there. The buildings, located several miles west of the city, enclose a total area of 6800 square feet; and, with the grounds and equipment, the institution is valued at one quarter million dollars. Its many antennas for directive reception from all points of the compass cover much of the surrounding sixty acres of prairie land.

The Nebraska site was chosen because of its freedom from nearby transmitting stations and its central geographical location. Grand Island is approximately 75 miles airline north of the exact geographical center of the United States. The station is able to pick up and monitor American and foreign stations from all directions with a minimum of interference. It is enabled to do this more efficiently than it would be if it were located near either of the coasts.

Present receivers at Grand Island cover the frequency range from 10 to 300,000 kilocycles

*Assistant Editor, RADIO.

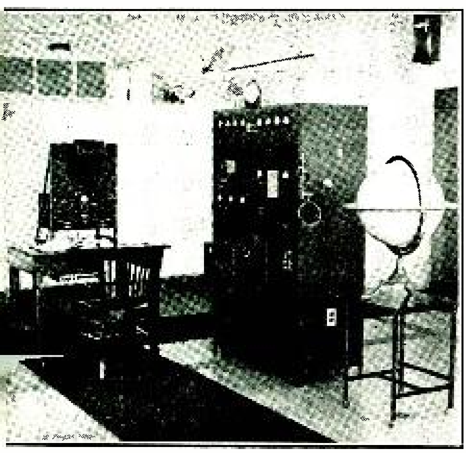
(30,000 meters to 1 meter). Modulation and field intensity measurements may be made with some of the sets. The instrument room houses these receivers, together with the instruments for making the various measurements. Special screened booths may be seen at each end of the room. One of these houses the 100 kc. clock, used to check the primary radio frequency standard; the other houses the primary measuring rack and its associated receivers. Between the two stands the 100 kc. primary standard.

Antenna terminal racks and the several broadcast and high frequency receivers are located on the center of the floor.

The Primary Standard

The primary standard of frequency is made up of two 100 kc. crystal oscillators using low-temperature-coefficient crystals. In these units special precautions are taken to maintain the temperature and pressure constant and to minimize vibration. The use of two oscillators affords a safeguard against breaks in service when one unit is cut out through circuit failures or during periodic adjustments, as well as providing a means of checking the frequency of one unit against the other. The frequency of the primary standard is known to one part in ten million.

The primary standard drives the 100 kc. clock. The synchronous motor of the timepiece in this assembly operates on 50 cycles obtained from the 100 kc. output of the primary standard through a series of frequency dividers, consisting of amplifiers and controlled oscillators. A two-second contactor operated by the clock motor actuates a stylus on a chronograph, tracing a line on a moving tape at two-second intervals. A second stylus, actuated by NAA time signals, inscribes the tape at one-second intervals. The tape moves through the chronograph at the rate of 13 centimeters per second. By comparing the centimeter length of the clock second with that of the NAA second, the operator can work back and compare the clock time against Naval Observatory corrected NAA time and thus determine the frequency drift, if any, of the primary standard. (RADIO has previously described the method of checking the frequency of a primary standard by means of subfundamental driven synchronous clocks[1]).

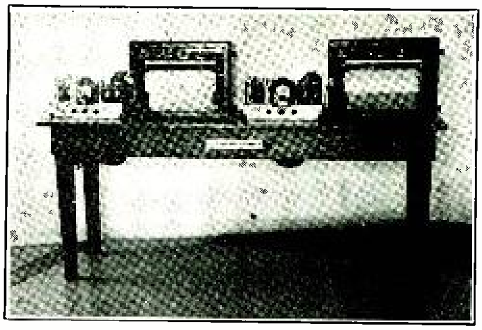


SECONDARY STANDARD

The Primary Measuring Rack

In the primary measuring rack are one low-frequency oscillator; one heterodyne frequency meter; one beat frequency audio oscillator; one harmonic selector; one beat indicator; and four multivibrators controlled by the primary standard, with fundamental frequencies of 100 kc., 10 kc., 1 kc., and 0.1 kc. Useful energy from the 10 kc. multivibrator is available to nearly 30 megacycles. The accuracy of the harmonics from this multivibrator is known to one part in ten million, as with the primary standard.

Selective switching enables the oscillators of the measuring rack to be connected in a number of ways for the purpose of measuring frequencies. The speed and accuracy desired determine the connection used.



Eight of these field intensity recorders are maintained.

Methods

One method which permits measurement of the frequency of a received signal with an overall accuracy of twenty parts in a million consists of setting the heterodyne frequency meter to zero beat with the received signal, obtaining a reading on the meter dial, then obtaining heterodyne frequency meter scale readings of the nearest harmonics from the 10 kc. multivibrator above and below the signal. The frequency of these multivibrator harmonics is known and an interpolation may be performed between the three heterodyne frequency meter

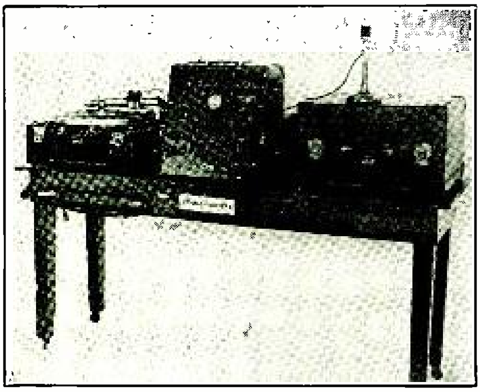
[1]*The Primary Radio Frequency Standard.* Turner. RADIO. Jan. 1937. p. 150.

readings to obtain the frequency of the received signal.

Another method, permitting an accuracy of one part in a million, consists in obtaining a beat note between the received signal and a known harmonic of the 10 kc. multivibrator; measuring the frequency of the beat note by means of the audio oscillator and adding or subtracting, as the case may be, this beat frequency to or from the known 10 kc. harmonic.

The Secondary Standard

The secondary standard, the use of which is similar to that of the primary standard, is composed of one heterodyne frequency meter, one beat frequency audio oscillator, one beat indicator, and a 30 kc. temperature controlled crystal oscillator controlling 30 kc., 10 kc., 1 kc., and 0.1 kc. multivibrators.



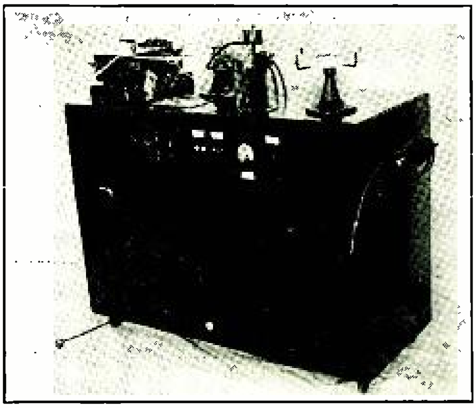
Complete program recording facilities are available for either 33 1/3 or 78 r.p.m. transcriptions.

The crystal oscillator in the secondary standard is maintained at the correct frequency of 30 kc. by means of meter and temperature readings, tri-weekly checks against WWV standard frequency transmissions, and checks thrice daily against the Grand Island primary standard.

Recording Equipment

The three types of recording instruments at this monitoring station permit the recording of (1) field intensities, (2) programs, and (3) code signals.

Eight field intensity recorders are maintained together with associated equipment, each consisting of recorder, receiver, and voltage regulator. Field intensities of eight broadcast stations may be recorded continuously and simultaneously.



500 w.p.m. can be taken down by the code recorder.

"The recorder circuit is similar to a Wheatstone bridge, one of the arms of the bridge being the first r.f. tube in the receiver. As the plate resistance of the tube varies due to a.v.c. action, it throws the galvanometer of the bridge out of the zero position. Every three seconds the bridge is automatically rebalanced. A pen, being connected to the moving element of the balancing resistor, draws a line on a roll of paper that advances at the rate of two inches per hour.

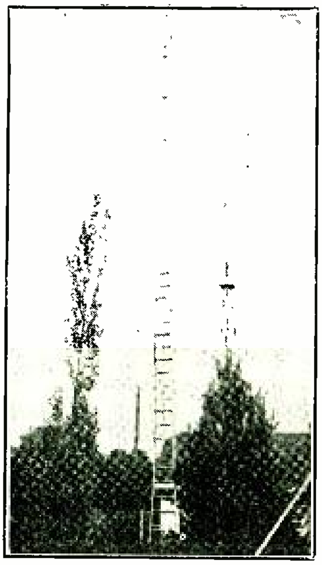
The unit is calibrated in microvolts per meter by means of a signal generator. It is, of course, necessary to know the effective height of the receiving antenna for this calibration."[2]

The program recorder is comprised of two turntables rotating at either 33 1/3 or 78 r.p.m., a preamplifier, recording amplifier, microphone, recording heads, and reproducing heads. A thirty-minute program may be recorded on one record. Programs of any length may be recorded by operating the two turntables in succession.

The Boehme high speed ink recorder is capable of recording code signals on tape up to a speed of 500 words per minute. This instrument is made of a strong electromagnet; a signal coil, similar to the voice coil of a dynamic speaker (to which is connected mechanically a pivoted pen provided with springs to return it to its position of rest); and a tape puller to pull the tape along under the pen. The signal coil is energized by means of a special amplifier.

[*Continued on Page 74*]

[2]Benjamin Wolf, Inspector in Charge, Central Monitoring Station.



● Here is a mast that can be raised or lowered by two people. It requires very little constructional work: its basis is a mail-order house extension ladder.

A Fifty-Foot Extension LADDER MAST

• *By* CARL P. GOETZ,* W8ANB

● The writer was interested in erecting a fifty-foot mast that could readily be lowered occasionally for painting, and which would not be expensive. The resulting mast comes to about $18.00, and can be handled by two men. The major purchase was a complete winding-rope-type 40 foot extension ladder which is listed in a mail order catalog for $12.75 (two 20 foot sections).

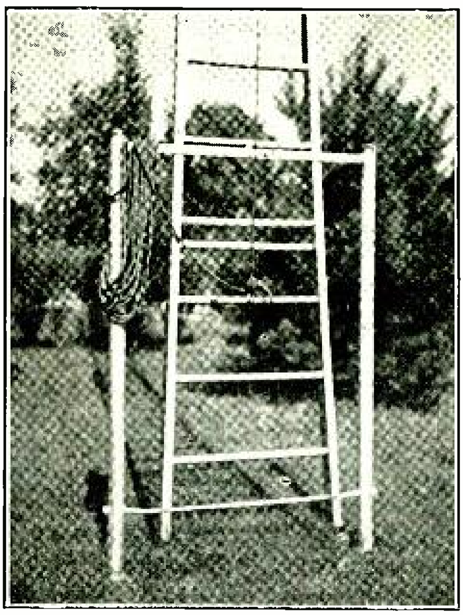
A top section also was purchased; it can be 14 to 16 feet long.

A base was constructed as shown in the illustration, using 2″ iron pipe (conduit because the author is an electrician, although wood can be used if treated to lengthen its life in the ground) which was cemented four feet in the ground. A cross bar of ¾″ rod threaded on each end and provided with nuts was obtained at a hardware store for about 50c. A "stopping bar" also was used, which can be almost any piece of wood or metal on hand.

The fruit-ladder top section was bolted inside of the upper section of the extension ladder with 4⅜″ carriage bolts, two on each side. These two sections slide into the bottom section with the fruit ladder projecting out. Two holes were then drilled in the bottom length and the ¾″ cross bar slipped through and bolted in place, to be used as a pivot and support. The bottom of the second section is lashed just above the bottom of the lowest section to prevent sliding while the ladders are raised to the vertical. Three guy wires were then attached to the top of each section (nine in all). Copper-clad steel wire can be used for guys instead of the usual galvanized wire, for electrical efficiency and longer life.

Now, assuming that a couple of coats of good paint have been applied, and one or two antenna halyards attached, the mast is ready to go up. The helper stands about 50 feet beyond the base ready to pull on the antenna rope or a top guy wire. The other strong-man raises the top end above his head and walks toward the base, the helper relieving the weight somewhat as the top goes up to a point where the rope or guy can be pulled. In a few seconds the mast is erect and the lowest guys can be attached to hold the mast vertically.

All that remains to be done is to wind up the top section with the handle and rope, while letting out the remaining guys. Remove the rope and handle and put them away for use when the mast is lowered.



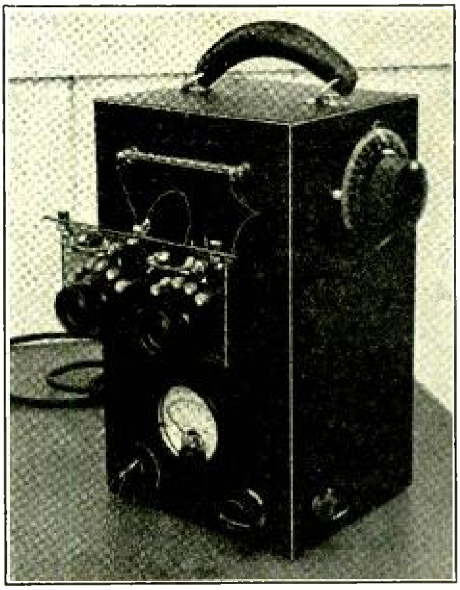
*Springdale, RFD 3, Hamilton, Ohio.

IMPEDANCE MEASURING DEVICE

For High Radio Frequencies

●

By MORTON E. MOORE[1] & F. L. JOHNSON[2]



Front Panel of the Device

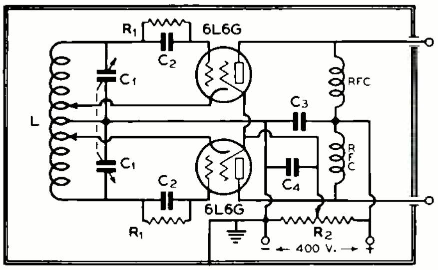
● It is more or less of a mocking absurdity that amateurs who every day speak of and deal with the fundamental parameters of circuit theory should in general have no way of measuring these very parameters. The amateur speaks of circuit resistance and reactance, of impedance and phase angle, yet few have ever bothered to consider the measurement of these very quantities upon which the performance of their equipment so largely depends. Perhaps the reason for this is that the problems associated with making electrical measurements at high frequencies have been held up to us as horrible monsters, quite incapable of being treated satisfactorily without the application of some more or less mysterious technique of which we have been kept in total darkness. The two words *high frequency* bring even the stoutest of us to submission where measurements are concerned.

Were there just some simple method by which impedance measurements might be made at frequencies as high as 30 Mc. with reasonable accuracy, the applications would appear to be limitless for the amateur. The ham is ever concerned with the performance of his antenna and feed line. With a suitable impedance measuring device he would be able to measure the actual antenna impedance and design the transmission line to match it. He would be readily able to adjust the line to the point of best operation. And he would not have to rely on sketchy information as to the values someone else found for the same antenna located over a plane conducting surface and three times as high above the ground as his own. In other words he would *know* instead of being forced to *guess!*

The problems associated with the design of coupling links within the receiver and transmitter would be materially simplified if one knew just what the values of impedance actually were. There are many forms of filter networks suitable for accomplishing a large number of different results. The amateur has made little use of any such networks for he has had no way to adjust them. For instance, it is perfectly possible to design an impedance-matching network for a balanced two wire system which will take the place of the conventional quarter-wave-length line for use as an impedance-matching device, and which will keep the impedances matched *over a wide variation of frequency,* a comment which most certainly cannot be made of the quarter-wave line for such purposes. With a suitable impedance measuring device it would be but a simple matter to adjust and check the performance of such a filter. There are many other applications which would be of considerable interest to the amateur, but space does not permit a detailed list of them.

Before considering the design of an impedance measuring device, let us first consider the requirements which the device must meet if it is to prove satisfactory. To be satisfactory, such a device must be capable of measuring the impedance of balanced and unbalanced circuits alike. It must be capable of measuring impedance over a wide range of variation. It must not disturb the circuit under measurement. It must be accurate and capable of retaining

[1]W6AUX, 1418 N. Spaulding Ave., Hollywood, Cal.
[2]W6CNX, 1418 N. Spaulding Ave., Hollywood, Cal.



• High-Frequency Oscillator.

C_1—200 μμfd. per section split stator
C_2—.0001 μfd. mica
C_3—.002 μfd. mica
C_4—.01 μfd. mica
R_1—25,000 ohms, 1 watt
R_2—40,000 ohm slider-type variable
RFC—2½ mh. r.f. chokes
L—Plug-in inductance cut for desired frequency.

calibration. It must measure both reactances and resistance. To this already imposing list of requirements we must add the following one; it must not be beyond the reach of the average amateur from a financial standpoint.

With these requirements in mind let us turn our attention to the design of a device which will meet the above requirements.

It is at once obvious that to make an electrical measurement there must first of all be a source of energy with which to make the measurement. This means that we must have some form of local oscillator or signal generator which will supply a sufficient amount of energy for the purpose of making the desired measurements and which will meet the following requirements:

1) It must be possible to vary the frequency of the oscillator over the range desired in making the measurement.

2) The oscillator must retain its calibration and possess adequate frequency stability.

We accordingly selected the electron-coupled oscillator as best meeting the requirements. The circuit diagram used is shown in the accompanying diagram.

The circuit is push-pull and incorporates a pair of 6L6G tubes, fed with a plate voltage of 400 volts. This combination has been found in every way ideal for use with the impedance device to be described shortly. The oscillator is shielded for two reasons: first, to obtain stability of operation, and secondly, to obtain mechanical rigidity in construction. A shield can of the size of the "SW-3" box made by National is ideal. Provision should be made for ventilation. Best ventilation will be obtained by slits cut in the sides of the can near the top and near the bottom. Slits are far more effective than holes in obtaining ventilation. The r.f. chokes used have been found ideal over a wide range of frequency, and seem entirely satisfactory.

The next problem which presents itself is the design of the impedance measuring device itself. After much work and experimentation we arrived at the circuit shown as being the one best suited to the problems at hand.

The circuit consists essentially of a vacuum tube voltmeter and a parallel tuned circuit placed across the load and coupled to the oscillator through resistors R and coupling condensers C_2. A variable comparison resistor R_3 is provided which is substituted for the load in order to measure the resistance component of the load impedance (and the reactance as well). The sensitivity of the device depends upon the variation of the voltage impressed upon the grids of the VT voltmeter tubes when a small change in load impedance occurs. The oscillator is essentially a constant voltage source. Hence to secure sensitivity we must provide for series elements in the circuit across which there will be a voltage drop produced by the current flowing in the circuit, determined by the value of the series elements and the load *resistance.*

The purpose of the parallel tuned circuit is to absorb the reactive component of the load impedance and the incidental stray capacities of the circuit so that the resistive component of the load impedance itself may be measured. With change of load resistance, there will be a corresponding change in voltage impressed upon the grids of the v.t. voltmeter tubes, resulting in a corresponding change in their plate current, which is measured by meter M.

To obtain greatest sensitivity of the device there is an optimum value of C_2 and R for each load resistance. The impedance of the series elements represented by C_2 and R is given by:

$$Z_s = R + \frac{1}{j\,\omega\,C_2}$$

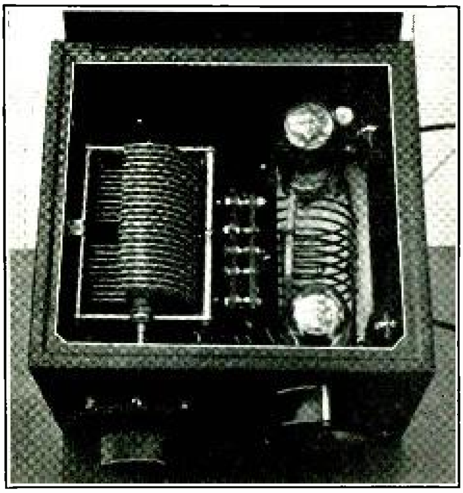
When measuring high values of load impedance, this series impedance must be large. When measuring low values of load impedance, or perhaps load resistance would be the more accurate term to apply here, the value of the series impedance must be low, but not so low that the oscillator is too heavily loaded. A 100 μμfd. midget condenser will have a minimum capacity of slightly less than 10 μμfd. At 14 Mc. this amounts to but 1140 ohms capacitive reactance, while at 28 Mc. the reactance is just half this or a mere 570 ohms. Hence it was found necessary to incorporate the resistors R into the circuit to obtain sensitivity when measuring high values of load resistance and impedance. Owing to capacity effects of carbon resistors at high radio frequencies when the value of resistance is large, there seems to be little sense in using values of R over 40,000 or 50,000 ohms.

When measuring impedances of the order of 1000 ohms resistive component, a value of 10,000 ohms is ideal. For measuring very low values of impedance and resistance, a value of 2500 ohms for R is about the limiting value, as below this value the oscillator becomes too heavily loaded.

When measuring high impedances, if R is small the sensitivity of the instrument is impaired. When measuring low values of impedance, if R is large and C_2 is small (the reactance being inversely proportional to the capacity) the sensitivity will also be low. Hence we must be able to adjust R and C_2 to conform to the impedance under measurement.

The device is constructed in a shielded inclosure. The shielding prevents the effects of extraneous coupling and at the same time provides a means whereby mechanical rigidity of construction may be readily had. The coupling condensers C_1 are for the purpose of isolating the impedance measuring device from the plate voltage of the oscillator so that adjustments may be made upon the variable coupling condensers C_2 without danger of shock to the operator or of damage to the equipment in case of accidental shorts. The purpose of the output coupling condensers C_3 is to isolate the load from the parallel tuned tank circuit so that for d.c. resistance measurements the load is not shorted across the tank coil. The comparison resistor R_3 is for the purpose of directly measuring the load resistance, and indirectly thereby measuring the load reactance.

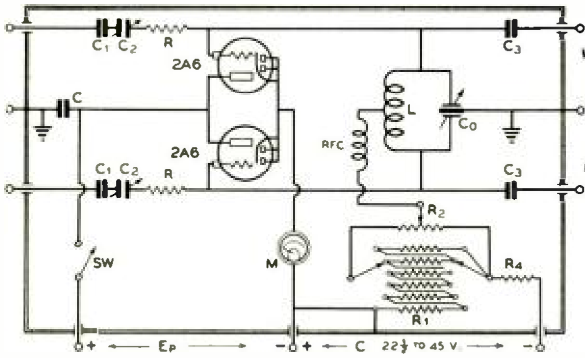
Before passing on to a description of the method of measurement, it would be well at this point that we pause to consider the necessary precautions not already mentioned which must be taken if the device is to operate satisfactorily. In the first place the output of the oscillator must be of the proper value. If the output is too low, the device will be insensitive since the VT voltmeter will be called upon to measure voltages of such small magnitude that its sensitivity will be poor. Upon the other hand, there is also a safe limit of output beyond



• The Electron-Coupled, Push-Pull 6L6G High Frequency Oscillator

which it is not desirable to go. If the output of the oscillator is excessive, the comparison and series resistors will heat, and owing to the temperature coefficient of resistance of the carbon resistors employed (see appendix) and to the delay in making measurements the accuracy of the measurement will be impaired. The oscillator described has been found to be perfectly satisfactory when used with the rest of the equipment herein described. In so much as the parallel tuned circuit is effectively in parallel with the load impedance, and in so much as the impedance of such a parallel tuned circuit at resonance is given by $Z = \frac{L}{CR}$ it will be seen that it is to our advantage to utilize as high an L to C ratio as we can and yet make provision for absorbing into the circuit any considerable reactive component presented by the load impedance. In so much as all stray capacities appear across the tuned circuit, we need not worry in construction about keeping them at an absolute minimum, but upon the other hand one should not set out to see how large the stray capacity can actually be made. Refinement of construction on this point is of no great importance, but reasonable precautions should be exercised.

Let us now turn our attention to the making of the actual measurements. In making the measurements it is first necessary that the local oscillator be calibrated. This can be done once and then re-checked at intervals to make certain



• **Impedance Measuring Unit Schematic**
C—.01 µfd. mica condenser.
C_1—.002 µfd. mica condenser.
C_2—100 µµfd. midget variable.
C_3—.01 µfd. mica condenser.
C_0—100 µµfd. per section midget variable.
L—Plug-in coil cut to resonate at operating frequency.
R—Sensitizing resistor, see text.
R_1—6-5000 ohm resistors mounted on two deck selector switch.
R_2—25,000 ohm potentiometer.
R_3—Comparison resistor, see appendix.

that no error is introduced from inaccurate calibration. The local oscillator may be readily calibrated by use of a 100 kc. oscillator which is tuned to zero beat with a b.c. station operating on some multiple of 100 kc. With the local oscillator connected to the impedance device and with the load to be measured also connected, and with the VT voltmeter also in operation the measurements are made as follows:

1) The oscillator frequency is adjusted to the desired value.

2) The bias of the VT voltmeter is then set at its maximum negative value, and the plate circuit switch closed.

3) The bias is next reduced by adjusting R_1 to the point where plate current of approximately ½ ma. is flowing.

4) The tuned circuit is now tuned for an indication of maximum plate current, which incidentally indicates resonance of the combined circuit. Tuning should be done slowly and, if in the course of tuning the circuit, the plate current approaches the maximum full scale value of the meter, the bias should then be increased to reduce the current before the tuning is completed.

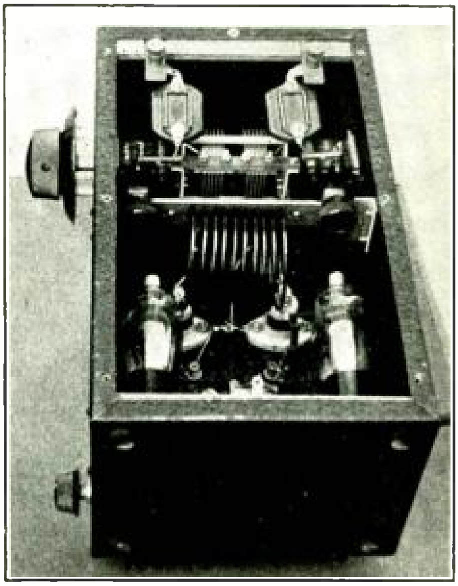
5) The dial reading of the condenser is now taken, and the bias adjusted so that the plate current is approximately 1 to 1.1 ma. The bias adjustment should be made so that the meter needle falls on one of the fine line intermediate divisions instead of one of the heavy line divisions used to mark the numbered values of current. A mental or written note of this value should be made.

6) The load impedance is removed and the comparison resistor substituted. The comparison resistor should be adjusted to a low value when connected across the circuit.

7) The value of the comparison resistor is increased until a sizeable plate current sufficient to give a tuning indication is obtained. The circuit is then again tuned to resonance. The comparison resistor is now adjusted to such a value that the plate current is equal to its former value with the load impedance in place.

8) The d.c. resistance of the comparison resistor is now measured, giving directly the resistance component of the load impedance. From a calibration of the condenser and the dial settings for resonance with the load impedance and the comparison resistor, the reactance of the load circuit is determined. (For information on this determination see appendix.)

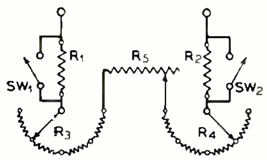
Now as to results. For values of load resistance of the order of 100 ohms to 20,000 ohms, the accuracy which may be had is entirely dependent upon one's ability to make accurate d.c. measurements. The accuracy of the impedance device itself is of the order of 0.3%,



• **Side View of the Impedance Measuring Device. The Two 2A6 Tubes, the Plug-in Tank Coil and the Tuning Condenser Can Be Seen.**

a very satisfactory performance indeed. For higher values of load resistance the accuracy is somewhat less because of the loading which the tuned circuit affords the load resistance. For values of load resistance of less than 100 ohms, the accuracy will become increasingly less until at a very few ohms accuracy is rather destroyed. As to the accuracy of reactance measurements, they will be most accurate when the load resistance is large, i.e., when the tuned circuit is damped the least. When the load resistance becomes low, the reactance measurements will be less accurate but in the measurement of networks and transmission lines this is never of any serious consequence, since under the desired working conditions the load reactance is generally small and great accuracy in its measurement is not necessary. If greater accuracy is desired in reactance measurements made with low values of load impedance, the accuracy may be improved by inserting a pair of resistors of a value of 200 ohms or so apiece in series with either side of the load impedance when making the reactance measurement. These resistors should of course be removed when making the resistance measurements of the load impedance.

APPENDIX 1



• The Comparison Resistor

SW_1 SW_2—Small s.p.s.t. knife switches.
R_1,R_2—Carbon resistors of necessary size mounted for plug-in use, 2 watts each.
R_3—4-200 ohm carbon resistors, 2 watts each, in series on a 5-position tap switch.
R_4—4-5000 ohm carbon resistors, 2 watts each.
R_5—6″ of pencil lead with sliding clip

The impedance device herein described has its design based on a circuit appearing in the January, 1935, IRE proceedings in an article by Bruce, Beck, and Lowry of the Bell Telephone Laboratories. Their circuit utilized a sensitive thermocouple to indicate resonance and equality of resistance. The improvement brought about by the use of a comparison type VT voltmeter and the insertion of the sensitizing resistors should be apparent when one considers the original circuit. In the first place with the VT voltmeter it is possible to obtain an effective "scale length" of several times the actual scale length of the meter through the necessary adjustment of bias when making measurements, whereas with a thermocouple it is not possible effectively to go beyond the length of the meter scale.

If one is not able to obtain the use of a suitable capacity bridge for the purpose of calibrating the condenser, a peak voltmeter and r.f. milliammeter may be quickly constructed and used for making the calibration measurements. See Appendix 2.

The comparison resistor used for the purpose of duplicating the resistance of the load circuit when making measurements must be constructed with some care and thought if the best of results are to be had. Since it is desired to have a non-inductive resistor for this purpose, we are practically forced to use some form of carbon resistor. It is desirable to have this resistance variable over a wide range. It is also desirable to maintain the capacity between the separate units which as a whole comprise the total resistance at as low a value as can be had without at the same time introducing unwanted inductance through long leads. The wiring diagram and specifications for the separate units of this resistor appear below:

The choice of pencil leads for R_5 will of course depend upon the value of resistance measured. Indelible copying leads can be had in rod form without the wood casing, or a wooden pencil can be mutilated to obtain a suitable lead. Indelible copying pencils have been found to have resistances varying from about 75 to 175 ohms for six inches of length or thereabouts depending upon the make. For lower values of resistance the lead of a drawing pencil is most satisfactory. Hard pencil leads have lower resistance than do soft ones. A 7H Venus pencil lead has a resistance of about 35 ohms. From an inspection of the circuit it will be seen that it is readily possible to obtain, by simply cutting in or out various values of resistance, any value of resistance from a few ohms to about 1050 ohms without resorting to the insertion of R_1 or R_2 into the circuit. The pencil leads should be firmly supported at both ends, *free from strain*, and should be handled with care in making adjustments as they are quite fragile. The tap switches are most readily made from old b.c.l. parts of the vintage of 1925 or thereabouts. The whole assembly should be mounted on a small panel of good dielectric and supported on the outside front of the box.

It is at once obvious that the milliammeter in the v.t. voltmeter circuit, together with a suitable trapped resistance of about 6 ohms total (the ratios of the resistances of the sections of which are accurately known) and a 1.5 volt dry cell will prove an excellent means of measuring resistances down to a few hundred ohms. For the sake of accuracy a 1½ ma. meter is to be recommended as its resistance is considerably lower than the usual 0-1 milliammeter. It is suggested that the meter have its connections brought out to insulated binding posts mounted through the shield can.

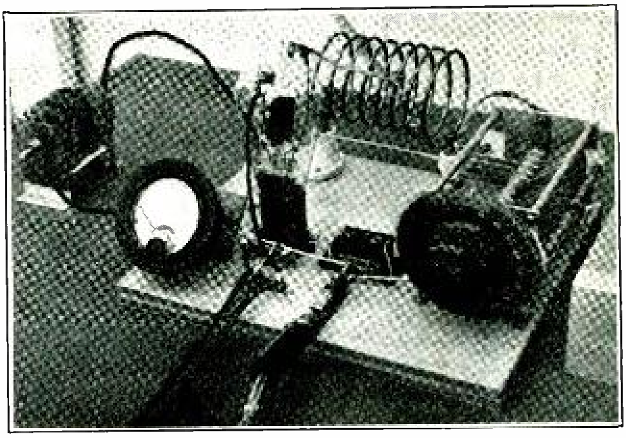
For the v.t. voltmeter 2A6 tubes were used (the triode sections only) as they have about as good a mutual conductance as any other tube and have the grid brought out through the top of the envelope, a point much in their favor as it makes for considerably shorter grid leads and greater simplicity of construction.

When substituting the comparison resistor for the load impedance, it is a good precaution first to remove the plate voltage of the v.t. voltmeter, after which substitution it is of course once more applied to the tubes. This merely saves the meter from pinning itself from an overdose of plate current while the circuit is unloaded during the substitution.

When using the device to measure the impedance of circuits which are not balanced (operated with one side against ground) in order to secure the proper operation of the v.t. voltmeterc, it is necessary that provision be made to remove the grid connection from one tube and to connect the grids of both tubes in parallel across the side of the circuit which is loaded. Otherwise, the sensitivity of the v.t. voltmeter may be somewhat less than the maximum obtainable.

◆

There is a fly, the cephenemyia, which, it is claimed, attains a flying speed of 800 miles per hour. *Pathfinder* says that its wings "vibrate with incredible speed and man-made material would be destroyed by the same vibration." At last our crystals seem to be outclassed. The life of this insect is only three weeks, and this does not surprise us with the poor critter shimmying itself away at such a rate.



The "800-tube" Peak Voltmeter

•

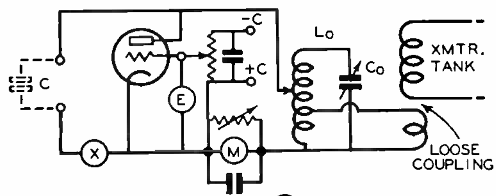
APPENDIX 2

CAPACITY MEASUREMENT:

$Z = \frac{e}{i} = \frac{1}{j\omega C}$ WHEN: i = CURRENT, e = VOLTAGE

$C = \left|\frac{i}{\omega e}\right|$

PEAK VOLTMETER

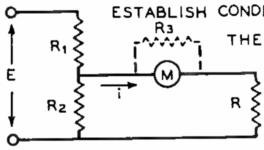


(M) 0-1½ MILS OR SO (E) SUITABLE VOLTMETER

(X) 0-120 MILS R.F.

PURPOSE OF $L_0 - C_0$ IS TO ASSURE SINUSOIDAL EMF FOR MEASUREMENT. CALIBRATION MAY BE MADE AT 60∿ IF DESIRED.

RESISTANCE MEASUREMENT:



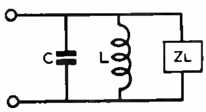
ESTABLISH CONDITION THAT $R+R_3 \ggg R_1+R_2$

THEN:

$R = \frac{E R_2}{(R_1+R_2)i} - R_3$

WHEN R_3 IS THE METER RESISTANCE

MEASUREMENT OF REACTANCE:



LET C & L BE THE VALUES OF CAPACITANCE & INDUCTANCE OF A PARALLEL CIRCUIT TUNED TO RESONANCE AT $\omega = 2\pi f$

IF IN PARALLEL WITH THIS CIRCUIT A LOAD WITH REACTANCE X IS CONNECTED AND THE CIRCUIT RETUNED TO RESONANCE, C′ BEING THE NEW CAPACITY REQUIRED TO TUNE TO RESONANCE, THEN:

$X = \frac{1}{\omega \Delta C}$ WHEN $\Delta C = |C - C'|$

APPENDIX 2

FORMULAS FOR CALCULATION OF REACTANCE ETC.

ASSUME $e = E_0 \sin(\omega t + \psi)$

LET

Z_0 = "NET" IMPEDANCE

Z = IMPEDANCE (OF INDIVIDUAL UNITS)

R_0 = "NET" RESISTANCE

R = RESISTANCE

X_0 = "NET" REACTANCE

X = REACTANCE

L = INDUCTANCE

C = CAPACITANCE

$\omega = 2\pi f$ (ANGULAR VELOCITY IN ELECTRICAL DEGREES/SEC)

f = FREQ (∿ SEC)

$j = \sqrt{-1}$

ψ = DISPLACEMENT ANGLE

ϕ = PHASE ANGLE

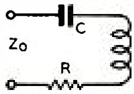
FOR A SERIES CIRCUIT:

$$Z_0 = R + jX = R + j\omega L + \frac{1}{j\omega C} = R_0 + jX_0$$

$X_L = +\omega L$

$X_C = -\frac{1}{\omega C}$

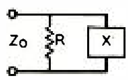
$\phi = \tan^{-1}\frac{\phi}{R}$



$X_0 = \omega L - \frac{1}{\omega C}$

FOR A PARALLEL CIRCUIT:

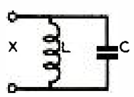
$$Z_0 = \frac{X^2R + jXR^2}{X^2 + R^2} = R_0 + jX_0$$



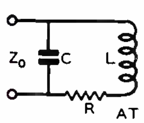
CAPACITY AND INDUCTANCE IN PARALLEL:

$$\frac{1}{Z_0} = \frac{1}{j\omega L} + j\frac{\omega C}{1}$$

$$Z_0 = j\frac{\omega L}{1 - \omega^2 LC} = 0 + jX_0$$



L AND R IN SERIES, C IN PARALLEL AS:



$$\frac{1}{Z_0} = \frac{1}{R + j\omega L} + j\frac{\omega C}{1}$$

$$Z_0 = \frac{R + j\omega L}{1 - \omega^2 LC + j\omega CR}$$

AT RESONANCE $\omega^2 LC = 1$
AND NEGLECTING R IN COMPARISON
TC $j\omega L$

$$Z_0 = \frac{L}{CR} + j0$$

◆

The U. S. amateur accupies two per cent of the entire radio spectrum. This does not include the frequencies in the ultra-high region which are shared with the experimental services. 16 frequences in the ham's two per cent are shared with the government.

"Multiple Unit Steerable Antenna"

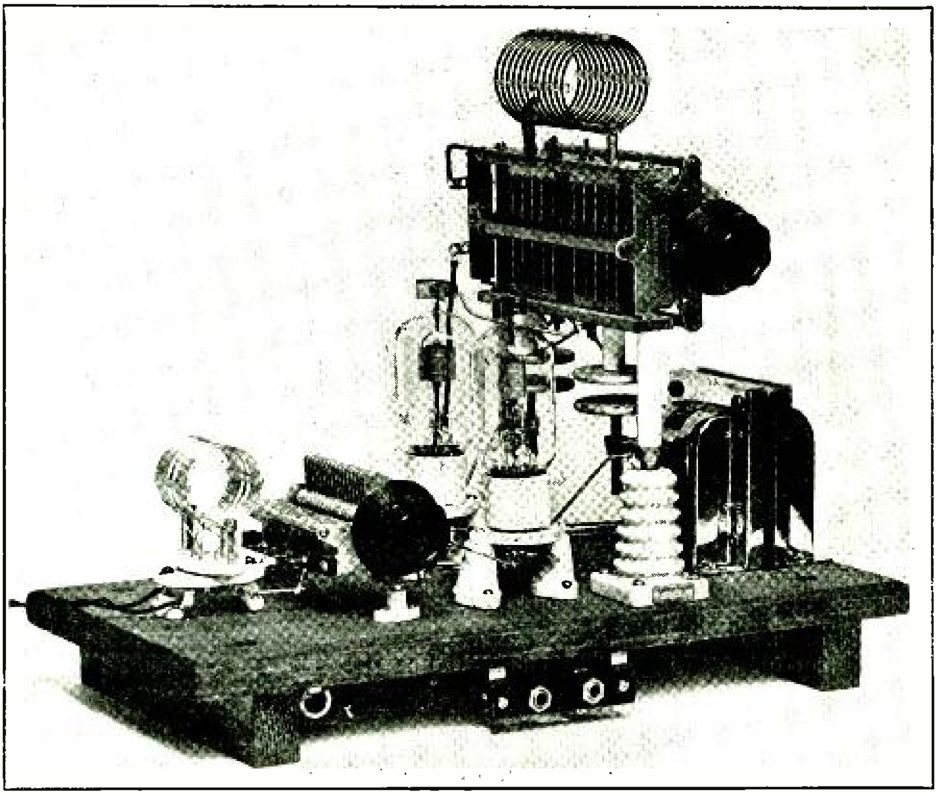
The Bell Telephone Laboratories recently have been experimenting with a large receiving antenna installation, "The Multiple Unit Steerable Antenna," at their receiving location in Holmdel, N. J. The installation consists of six rhombic antennas, each approximately 550 feet in length, arranged in a line approximately ¾ mile long that follows the great circle path between Holmdel and England. The energy from each antenna is carried to the receiving station by means of a separate concentric transmission line, especially constructed for the purpose.

At the tuning house the energies of the various antennas are fed to a series of superheterodyne receivers and the outputs of the intermediate amplifiers are mixed together. By an ingenious method of i.f. phase shifting in the different superhets, the vertical angle of reception of the entire antenna array can be varied between quite wide limits. Also, by using a different set of receivers, though they may be operating from the same antenna, the angle of reception of each may be different.

A number of interesting and worthwhile facts have been uncovered. Selective fading and fast flutter fading both may be greatly reduced through the use of a receiving antenna that has sharp directivity in the vertical plane. It seems that a great deal of this type of fade is caused by the arrival of the signal at the receiving location in a number of differently phased components. Since these signals have taken different paths between the transmitter and the receiving location, their angle of arrival will be different in each case. Thus, by selecting only those signals arriving at a certain angle (the most favorable angle under those particular receiving conditions), fading may be greatly attenuated.

Another advantage of the sharply selective receiving antenna is that there is an improvement in the signal-to-noise ratio proportional to the selectivity of the antenna. This is true because only the noise arriving at the particular angle of reception of the antenna will be received. This is in contrast to the non-selective antenna which will receive noise arriving at any angle.

For those desiring more information on the system, a complete discussion was published in the July, 1937, Bell Laboratories Technical Journal. The Proceedings of the I.R.E., July, 1937, also carried the story.



Compact 500 Watt H. F. AMPLIFIER

• *By* RAY L. DAWLEY,* W6DHG

The ease with which a pair of "800-type" neutralizing condenser could be mounted, by removing their bases, on the side of a Cardwell XG50KD condenser suggested the push-pull amplifier layout shown on this page. It so happens that the spacing between the two porcelain pillars on one of these neutralizing condensers is practically the same as the spacing between the outside stator connection and the end insulator bolt on this particular Cardwell condenser. By removing the metal base from the neutralizing condensers and by replacing the end bolt of the tuning condenser with a length of threaded 6-32 brass rod, the two neutralizing condensers may be mounted as an integral part of the tuning assembly.

Similarly, by placing a pair of tapped "standoff" bushings upon the more widely separated stator connections of the opposite side of the tuning condenser, the plate coil also may be mounted as an integral part of the extremely compact tuning assembly. Then, the large bolts are removed from two porcelain stand-off insulators and the tuning assembly is mounted upon these insulators by means of the top bolts in the neutralizing condensers.

The r.f. choke is supported from the opposite end of the tuning condenser and the plate supply lead is brought down through the chassis.

All this sounds very complicated but the old saying that "a picture is better than 1000 words" is literally true in this case. The accompanying photograph clearly shows the final result of the foregoing steps.

The circuit itself is entirely conventional; the balance of the mechanical layout also is conventional. The split-stator grid condenser and plug-in coil are mounted at one end of the baseboard and the filament transformer for the amplifier tubes is mounted at the other end.

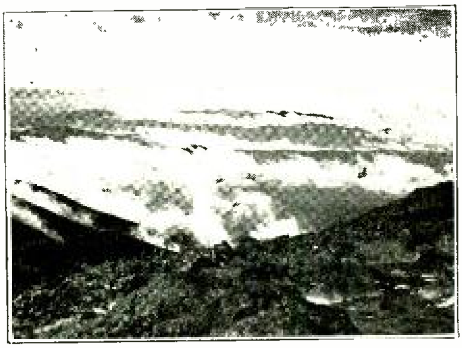
One word of caution with reference to the connecting-up of the tuning unit. There is almost no wiring to be done within it but what

(Continued on Page 78)

*Technical Editor, RADIO

FIVE METERS

---Altitude 6300 Feet



• Cloud banks over the valley below as seen from the operating position atop Mt. Washington.

By **ARNOLD J. ELY, W8IPD**

● For a number of months George S. Henderson, VE3AP, and the author planned to make a trip to Mt. Washington in New Hampshire, 6300 feet above sea level. The idea was to enjoy five meter dx beyond that experienced around Niagara Falls where the ground is comparatively flat.

We left Niagara Falls at noon on Saturday, August 14, expecting to hold the first schedule from the mountain on the evening of the 16th. After spending considerable time in Franconia Notch, a point en route, we arrived at the summit of the mountain at about six o'clock on the evening of the 16th. We were met at the end of the toll road by Alexander A. McKenzie, W1BPI, of Blue Hill Observatory, formerly of Mt. Washington Observatory and at present temporarily stationed there in connection with experiments in the study of air currents. He showed us all around and enabled us to find a satisfactory location for our equipment.

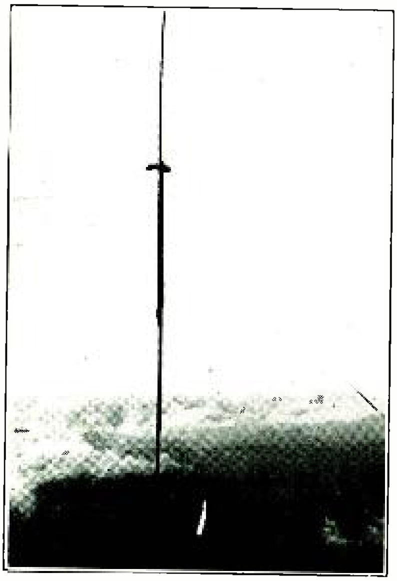
• The author poses with the power plant which was placed under the end of the cog railroad trestle, 175 feet from operating position.

Before leaving home, we had sent over a hundred mimeographed copies of our schedules to stations mentioned in the five meter story in July RADIO and to a number of first district amateurs known to be interested in five meters. The men at W1XR, the Mount Washington Observatory station on 53 Mc., read the letter over the air every night before we arrived. W1COO of Brentwood, New Hampshire, mentioned the matter daily in his transmissions on 56 Mc., and the Worcester (Mass.) *Telegram* carried the complete schedule in its issue of August 15, thanks to F. H. Ricker, W1JQJ, Shrewsbury, Mass. Consequently, the first district was out *en masse* to welcome us.

We were unable at first to maintain all published schedules due to trouble with our power plant, a 300-watt, gasoline driven, 110-volt generator. The generator itself refused to deliver power. After a day of fiddling with the thing, sometimes with results and sometimes without, McKenzie showed us a trick whereby he connected a flashlight cell across the field until the field magnetism built up. Thereafter, schedules were maintained without difficulty.

Usually all that was necessary was one CQ for each operating period. At the conclusion of each contact, we had only to look over the band to find anywhere from one to twenty stations calling. We were on the air hours at a time, talking until we were hoarse, turning the mike over to each other as fast as we became played out. We kept a file of the complete details of equipment, including antennae polarization, height above sea level, and distance from the mountain, for all stations worked.

The first station worked was W1COO, Arthur Bent of Brentwood, N. H., secretary of the Mount Washington Observatory. He lives ninety miles away, and runs 300 watts to a pair



• The two-half-waves-in-phase antenna.

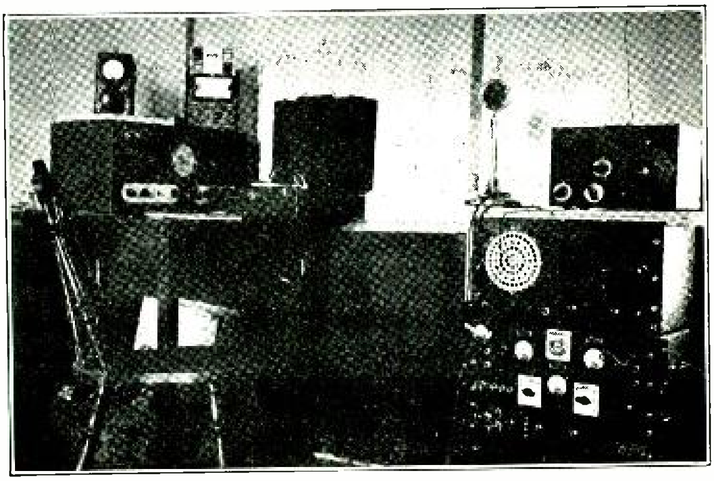
of Taylor T55's, producing one of the outstanding signals on the band. Other good signals were those of W1ZE, Mattapoisett, Mass., who puts 650 watts into a parallel rod oscillator, and W1BCR of Scituate, R. I., who has a 750-watt crystal controlled job. However, other stations at distances comparable to W1ZE and W1BCR, about 190 miles, were able to put signals almost as strong onto the mountain even though they were using considerably less power.

We had quite a lesson in receiving antennae. When we first moved into the Mt. Washington stage office, we were unable to get up a good receiving antenna as darkness had set in and it became very foggy. So we merely hooked up an eight-foot piece of wire from the ceiling of the room to the receiver at a 45 degree angle. A number of our calls were unanswered. The following morning we received a postal card from J. D. Larkin, III, of Buffalo who was summering at Ogonquit, Maine. He said he was receiving us R9 at his location and that dozens of stations all up and down the coast were calling us but apparently we were not hearing them. Accordingly, we got out the thermo-galvanometer and tuned up two half waves in phase with a quarter-wave phasing section, using our transmitter as an exciter. This antenna was suspended so that the lower end was about ten feet above ground. We attached a sixteen foot resonant lead into it and thereafter the signals came in like a house afire. It would perhaps have been better to use a two wire matched impedance transmission line, but inasmuch as we had no facilities for matching this line to the input of our receivers, the sixteen foot resonant lead-in was tried and worked very satisfactorily.

One interesting item was in connection with our contact with W1BCR. A terrific thunder storm was in progress on the mountain at the time and the rain was coming down by the bucket full. Naturally, the transmitter was out in the midst of it all, suspended from the pole and completely unprotected from the elements. W1BCR told us that our frequency was drifting. We were unable to do anything about it at the time as the mast would have to be taken down to tune the transmitter. On the next transmission he told us that we were out of the band and on the following transmission said, "Stand by, boys, until I put the next set of coils in my receiver so I can keep up with you!"

The first district gave us a very enthusiastic welcome. We never imagined that such a fine spirit of coöperation and such enthusiasm could exist merely because a station from another district happened into that section of the country. When we were off the air to enable W1XR to maintain its schedules, we did a great deal of listening and heard ourselves talked about almost continually. Everyone seemed to be doing his level best to make contact with the portable station on the mountain. To illustrate the enthusiasm which existed, we mention the case of W1GXY of Bath, Maine, 75 miles away, who worked us with a transceiver using a 76 and a 41. He said he had been calling us all week. After calling us for quite a length of time he put up a different antenna, and after trying a number of antennae, he finally raised us on a vertical J with a 100% readable signal, R6 to 7, giving us QSA5 R9. The very next contact was W1ISJ in Portland, Maine, 65 miles away, using a transceiver in his car. He sat in his back yard for three days calling us every time he heard us. Sensing that there might be something in a location, he moved to downtown Portland and raised us with a QSA5 R6 to 7 signal.

As to unusual conditions on the band, we noticed very few. During the day the signals were appreciably weaker but still 100% readable. As night came on, increases in signal strength generally were noticeable. During the first evening of operation, we contacted W1JQJ



• The operating position of W8IPD BT1 in the Mt. Washington Stage Co. offices at the summit.

of Shrewsbury, Mass. This was about 140 miles, and the hour was 10 p.m. After his first transmission, he did not come back. We later heard him talking to W1BCR at which time he was fading in and out very rapidly; sometimes he would not be heard for a quarter of a minute and then again he would be R9. He told W1BCR that we had completely faded out, but W1BCR (in Rhode Island) replied that he had heard our entire transmission without difficulty. On the evening of August 19 the band went completely dead at 11:45 p.m., Eastern daylight time. Several stations were calling us at the time and were fading, finally disappearing altogether, after which we were unable to raise anyone. Another item of interest is that we worked no one to the north or west, except comparative locals.

Although we used only from 12 to 16 watts, depending on the weather, the rain detuning the transmitter, fully 80% of the reports on our transmissions were R9. We had several reports of R7 and R8 with one R6. These for the most part were from stations comparatively nearby. A number of the stations worked were not in the optical path. A letter from Bill Conklin, W9FM, had stated that we might find the mountain of great help in the case of 100 mile dx but not necessarily 1000 mile dx. This fact was substantiated in great measure by our experience except that the range seemed to be 200 miles. To date, no reports have been received from points at distances greater than 200 miles.[1] Although VE3ADO in Toronto, W8GU in Erie, Pa., and W8RV in Buffalo transmitted automatically on schedule at 10:20 a.m. and at ten minutes to the hour during the evening, they had comparatively little chance of being heard even if their signals had come through to the mountain due to the extraordinary activity in the first district.

W1XR, the observatory station, is on 53 Mc. on which it has contacted W1XW, the Blue Hill Observatory, Milton, Mass., 60.3 Mc., 142.5 miles, three times daily for transmission of weather reports and other business for more than four years with increasingly reliable results. We believe that this is the longest consistent ultra-high-frequency circuit in use. W1XR is entirely battery operated with an estimated carrier power of three watts. The transmitter is a self-excited job, push-pull 71A's modulated by a 79 in class B, and operating into a Pickard antenna. The antenna is comparatively enclosed to protect it from sleet, frost, and snow which accumulate during the winter.

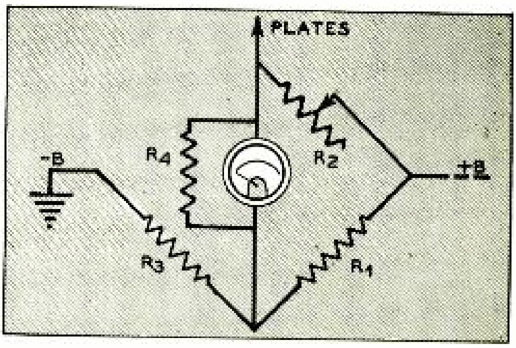
Our own transmitter consisted of an RK-34 in a spiral-wound parallel rod oscillator, mounted on a twenty-four foot mast. Two eight foot sticks, one above and one below, offset from the mast, supported two eight-foot antennae. The antenna is thus two half-waves, and the plate tank inductance is used as the phase-correction unit. The system was made to pivot on a bolt right at the oscillator, making it rotatable in the vertical plane by pulling two ropes. We intended to swing the antenna from the vertical to the horizontal position during every contact to ascertain if possible whether the horizontal was better at certain distances. However, due to the high winds on the mountain, we were doubtful as to the stability of the set-up and finally lashed the antenna supports in the vertical position and left them that way. The filament supply and modulated plate cur-

[Continued on Page 80]

[1]The 56 Mc. band was open for 500-1000 mile dx on the evening of August 16, the morning of the 17th, and afternoon on the 18th according to reports received by RADIO.

A Forward Reading "R" METER

By R. C. HIGGY,* W8LFE



The "R" meter described as a part of the receiver article, "Performance, Economy, Simplicity, Inc." in the April, 1937, issue of RADIO, provoked a lot of interest in this type of meter. It seems, therefore, that additional information is desired.

Perhaps, before entering into the direct discussion, this is a good place to speculate a little on what an "R" unit should be. If we made R1 a signal just strong enough to produce a given audio output with a 400 cycle, 80 per cent modulated signal, and R units above R1 corresponding to, say, five decibels in applied signal voltage, wouldn't we have a logical system? Some more exact definition of an R1 signal would be in order to make R1 on all receivers alike. R1 should be a signal not good enough to be completely readable, but still one just detectable on our receiver. A one-microvolt input signal, on most present day receivers, will produce a just detectable output. A standard value of audio output of lower than usual value should be selected, say ten milliwatts. Units of five decibels would be reasonable as such an increase is one of noticeable volume difference, as observed by ear. With such a system adopted generally, our "R" reports would be more useful and certainly more accurate than with present-day practice.

Many practical difficulties, of course, arise in such a definite system: varying receiver sensitivity, changing tube characteristics with age, and many other things can result in different overall gain. Most of these could be overcome by including some method of varying the "R" meter sensitivity, either with the band change switch or manually. Certainly it would be worth the effort to have a definite system if we must use "R" units. No doubt the real solution would be to forget "R" units and calibrate our receivers directly in microvolts input voltage. But even then the signal input to the receiver would depend upon the antenna used, which still leaves a wide open question as to what the actual signal intensity is at the receiving point. A measurement of the signal in microvolts per meter will provide the only complete answer.

However, accepting conditions as they are until such time as a new standard is generally accepted, we turn now to the "R" meter itself.

Most of us have placed a milliammeter in the plate supply circuit of the stages of a superheterodyne receiver that are controlled by a.v.c. and found the meter indicating relative received carrier intensities. Such a meter reads backwards—a strong signal causes the plates to take less current due to the increase in bias by the a.v.c. system—also, unfortunately, such a meter does not have a very long effective scale. Not many of us like to stand on our heads to make the meter read upwards as the carrier strength increases; consequently, a simple system where the meter reads upward with an increase in signal strength is very much in order, particularly when the sensitivity or pointer travel can be lengthened.

Such a meter easily can be installed on any receiver using a.v.c. by the addition of three resistors and a milliammeter in a simple Wheatstone bridge circuit. With varying bias voltages applied to the r.f. and i.f. tubes through the a.v.c. system, the resistance of the plate circuits will vary, increasing with signal strength. A bridge circuit arranged to measure this plate resistance of one or of a group of tubes hence will provide a satisfactory upward reading "R" meter. It also will have a good scale with widely spaced R divisions.

The accompanying diagram shows such a circuit, R_1 and R_2 being the familiar ratio arms of the bridge, R_3 being the "standard" or comparison resistor and R_p the unknown plate re-

[Continued on Page 80]

*2032 Indianola Ave., Columbus, Ohio.

Something About VOLUME INDICATORS

•

Four simple and inexpensive methods of installing a volume indicator on a transmitter are outlined.

•

Despite the general acceptance of the volume indicator as a useful, almost a necessary adjunct to a modern phone transmitter, a surprising number of otherwise complete rigs have no means of checking their average modulation level. Possibly the reason for this is the lack of widespread knowledge of the fundamental principles of v.i. operation; or perhaps the expense of the commercially manufactured meters is to blame. At any rate, we attempt here to convey the fundamentals of the volume indicators and, in addition, to outline a few simple, inexpensive methods of installing such a meter on a transmitter that is already operating.

To begin with, a v.i. meter is nothing more than a sensitive a.c. voltmeter that ordinarily is connected across one of the speech circuits of the transmitter as a means of indicating the voltage across that circuit at any instant. In the commercial types, the meter usually can be obtained in any one of three designations: slow speed, standard, and high speed. These designations roughly indicate the period of time over which the meter will integrate the audio pulse readings upon its scale. The slow speed type integrates over the longest period, the high speed over a very much shorter interval of time, and the standard is between the other two.

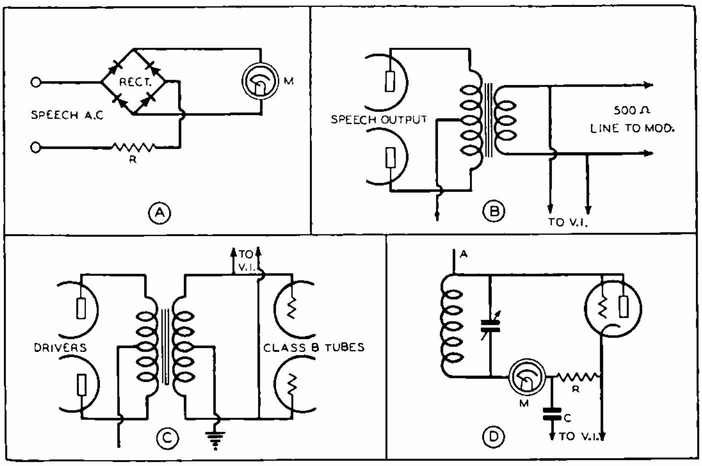
Until recently the standard type was used universally in monitoring. This type was quite undamped, however, and had a tendency to overshoot on certain types of signals and to lag far behind on certain other types. With the introduction of the highly damped but extremely active high speed type it became very much easier to ride gain properly on a speech circuit. In addition, the new slow speed type was found to be more effective in holding the average level of a program to a predetermined standard.

All this has very little to do with the amateur except that it indicates the commercial aspect of the v.i. problem. All that is wanted in a ham shack is something that will indicate the approximate speech level being fed to the transmitter with respect to that required for 100% modulation. By law one should have some type of an indicator to show when the modulation percentage exceeds 100%, but in addition to this it is very convenient to have an auxiliary indicator to gauge whether the average voice level is too high or too low.

The best type of v.i., of course, is one of the commercial variety, properly installed across a speech line of the correct impedance. But when our poor diminutive little chum enters the radio store to price one, he usually is very unpleasantly surprised to find that it is priced between $12.00 and $20.00, making him indeed unhappy. Of course this is for a precision instrument suitable for use in the broadcast or motion picture industry. But it seems that "unprecision" instruments, applicable to radio amateur use, are not manufactured.

An inspection of these commercial v.i.'s indicates that the best ones consist of a very highly damped but very short period instrument of about 0.5 ma. full scale, a rectifier (almost invariably one of the full-wave copper oxide bridge type) and a series resistor to bring the total resistance of the unit up to a predetermined value. These meters are made in two additional types, one with zero-level on the scale actually at -10 db or 0.546 volts across a 500 ohm line, and the other with the zero-level actually indicating zero or 1.73 volts across the 500 ohm line. The main difference between these two types is in the values of the respective dropping resistors used to scale and calibrate the instruments. The total resistance of the zero-level mid-scale meter is 5000 ohms, that of the -10 mid-scale type is 1581 ohms.

Knowing this, we can improvise on the commercial designs and construct a less expensive meter: one, however, that is suitable for radio amateur or for p.a. or "remote" use. The first requirement is a late design milliammeter (for better damping) of about 0-0.5 to 0-2 ma. full



scale. A rectifier is then needed. It may be a diode, a power detector, or some type of metallic contact rectifier. By far the most satisfactory type of rectifier, as the commercials have found, is the full-wave bridge, copper-oxide type. It is best to use one of them if you can afford it or already have one.

These little rectifiers are quite expensive (considering their size) but if they are compared in cost to any of the tube or other systems of rectification, they are relatively inexpensive. It should be remembered in connection with these CuO rectifiers not to overload them under any conditions and to exercise care when soldering to one, so that it does not become overheated. Either heat or overload can damage permanently one of these units. One thing more in connection with them, one manufacturer in particular puts out two of these small full-wave units. One type is designed to go inside the case of the meter and is very small, the other is somewhat larger and can be placed best outside the meter case. Since both sell for about the same amount, the larger one is the better buy since it probably will last longer and will be less easily damaged.

The proper method of connection of the meter, the rectifier, and the series resistor is indicated in "A" of the circuit diagram. The various leads of the rectifier usually are marked conveniently so that no difficulty should be experienced in connecting it properly. The a.c. leads usually are unmarked; of the remaining, the one with the red dot goes to the positive side of the meter and the one with the black dot goes to the negative. The value of the dropping resistor, R, will depend upon the average a.c. speech voltage appearing across the input terminals. This will depend, of course, upon the position where the speech voltage is taken to feed the v.i. Since it will be difficult to calculate, in most cases, it will be best to place a 100,000 ohm variable resistor in this position and to adjust it until the proper deflection is obtained. The maximum value of this resistor will be sufficiently high in a majority of cases.

A number of positions where the v.i. voltage may be obtained from the speech circuit are shown in B, C, and D. The source shown in B probably is the best, since it is the most flexible and entails the least change in the speech amplifier.

The value of the resistor in this case will be dependent upon the impedance of the line and upon the level at which the line is operating. For example, if there are a pair of 2A3's in the output of the speech operating at approximately 10 watts output, this represents a maximum level of approximately plus 32 db. Then, assuming a line impedance of 500 ohms (it could just as well be 50, 200, 600, etc.); 10 watts will produce an r.m.s. voltage of approximately 70 volts across this impedence. If the indicating meter is 0-1 ma. full scale, a dropping resistor of about 75,000 ohms will give a good deflection at a maximum output.

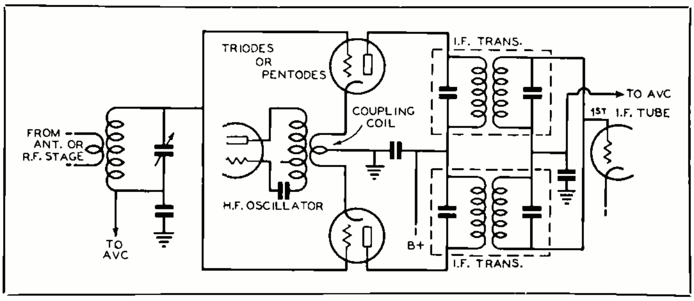
C indicates an arrangement whereby the speech voltage is taken from the grids of the class B modulators. For that matter it could be taken from the secondary of the modulation transformer when grid modulation is being used. A similar application will present itself for almost any system of modulation.

In figure D is shown an entirely different

[*Continued on Page 82*]

CURING I. F. Receiver QRM

• *By* E. H. CONKLIN,* W9FM



There is, however, another method available which requires neither preselection nor the use of a very high intermediate frequency. But it does require the use of a special first-detector high-frequency oscillator. Existing receivers could be adapted to the improved arrangement but its chief advantage lies in the possibility of its application in the design of new high-frequency receivers.

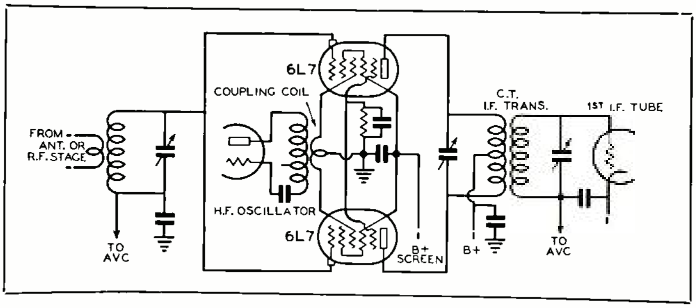
● One of the most discouraging types of interference noticed on superheterodyne receivers is the kind that can be heard all over the dial completely independent of tuning. In poorly shielded receivers, this might be due to direct reception of signals transmitted at the intermediate frequency, in which case the situation often can be improved by using a slightly different intermediate frequency. However, more generally it is the result of interference from two signals differing by the intermediate frequency, both approximately in the range of the receiver's first detector circuit. This trouble is encountered mainly by those who are located near broadcast or h.f. commercial stations. The interference if between two code stations is unreadable except for occasional letters; if between code and phone station, is readable in the form of keyed music or voice; or if between two phone stations it is a mess composed of both programs.

With manufactured receivers provided with insufficient preselection to reject at least one of the two unwanted signals, the quickest solution is generally to obtain a good preselector stage to be used in front of the receiver. Those who "roll their own" also can consider the use of a much higher intermediate frequency than the usual 465 kc.—3 to 6 Mc. for instance. This higher frequency will reduce i.f. interference and will effect a sizable improvement in the image suppression, except for transmissions which may be at the intermediate frequency.

* Assistant Editor, RADIO

Note that there is no great improvement made in *image* frequency suppression, image in this case meaning an h.f. oscillator-*minus*-i.f. signal as compared to the desired signal at h.f. osc.-*plus*-i.f., this being the accepted definition. All other types of i.f. interference, as mentioned at the outset, are attenuated so greatly as to be negligible.

The accompanying diagrams indicate two suggested circuit arrangements. They are immediately recognizable as the familiar balanced modulator of single-sideband usage. The effectiveness of the circuit is obvious; with no oscillator injection voltage being fed to the modulator, all signals appearing on the paralleled control grids of the two tubes are cancelled out by the push-pull plate connection. Now, if we turn on the h.f. oscillator, equal r.f. voltages, 180° out of phase with each other, are injected into the two modulator tubes. Two sidebands are produced in the output, one at the sum of the h.f. osc. and the incoming frequency and the other at the difference between the two.



[1]H. T. Friis and C. B. Feldman, "A Multiple Unit Steerable Antenna for Short Wave Reception," Proc. I.R.E., July, 1937.

The first, of course, would be at a comparatively high frequency and would be rejected; the second would be at the intermediate frequency and would be impressed on the grid of the first i.f. tube.

It will be seen by reference to the diagrams that in both cases the h.f. oscillator voltage is fed in push-pull to the two first detector tubes[2]. In one case it is injected into the cathodes and in the other case into the "injector" grids of the tubes. Both circuit arrangements require a method of coupling the h.f. voltage from the oscillator into the first detector circuit that is somewhat different from common practice. In the conventional single-ended first detector circuit almost any system of coupling from the h.f.o. that will give sufficient drive to the first detector is satisfactory. In this arrangement, if the full benefits of the circuit are to be realized, it is important that the two modulator tubes obtain exactly equal exciting voltages and it is equally important that these two voltages be 180° out of phase. Luckily this is not so difficult to accomplish as it might at first seem. The most satisfactory way of obtaining this voltage is to use a small, accurately center-tapped coupling coil mounted on the h.f.o. inductance. The coil can better consist of a few turns, tightly coupled to the oscillator inductance, than of a large coil, loosely coupled. Also, the center-tap of the coupling coil should be returned directly to ground and the leads to the respective modulator grids or cathodes should be short and of the same length. In addition, care must be taken to insure that the capacity to ground of the two leads will be closely the same. These conditions must be met to insure that the injection voltages will properly be supplied to the modulator stage.

The plate circuits of the modulator tubes may be coupled into the first i.f. amplifier by means of two i.f. transformers connected as indicated in the first diagram, or a single i.f. that has a center tapped winding may be used as shown in the second. The first method is better, as a more accurate balance will be obtained between the two modulator tubes and the first i.f. grid. The second is quite satisfactory and is just one i.f. transformer less expensive. The c.t. transformer is a standard crystal-filter-input unit, of the c.t. secondary type, with the windings reversed. The plates of the two modulator tubes are connected to the two outside leads of the c.t. winding, the c.t. is returned to plate voltage, and the single ended winding is used to couple into the first i.f. grid.

All other considerations, magnitude of oscillator injection voltage; oscillator, r.f. stage, and modulator tracking; and the balance of the i.f. amplifier, are conventional and can be treated as such in the receiver design.

[2]W. A. Harris, "Superheterodyne Frequency Conversion Systems," Proc. I.R.E., April, 1935.

◆

Home-Made Celluloid Labels

We would all like to have neat, professional appearing labels on the various controls, switches, etc., around the station. Commercially-made metal plates are available for use in some of the positions but in the majority of cases they do not have just exactly the wording desired. ZL4FR, Geoff. Howard, suggests a very ingenious solution to the problem in the August, 1937, issue of the New Zealand amateur magazine, *Break-in*.

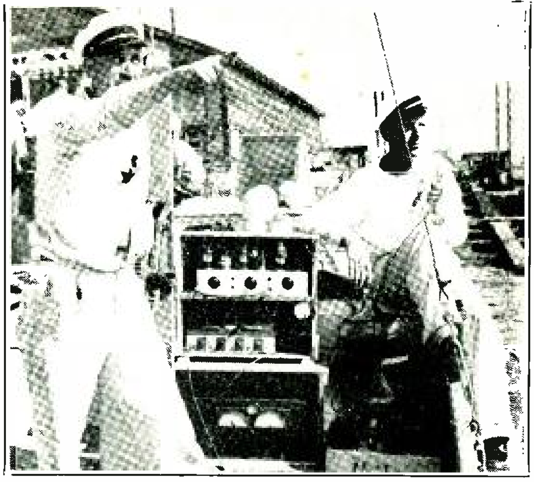
"The label is first typed, or preferably ***neatly*** printed with India Ink, on thin cards of the type used in a card index. A piece of celluloid is cut slightly larger than the size of the finished label. Then wet one side of the celluloid with amyl acetate or acetone. Make sure that one side of the celluloid is evenly wet and be very careful not to get any fluid on the other side. If the amyl acetate or acetone is allowed to come in contact with the upper side of the celluloid, the glaze will be destroyed. Acetone will give slightly better results as the moistening agent than amyl acetate. Now wet the printed side of the card and press the treated surfaces of both card and celluloid together, squeezing out all air bubbles. Allow to dry for an hour or so and then trim to the desired size. Finish the edges of the completed label with fine sandpaper.

The card used should have a very smooth surface and it is an advantage to use thicker card and celluloid for larger labels such as tuning graphs for receivers. The inks on some typewriter ribbons tend to run slightly with the solvent but water-proof India Ink is quite fast. Celluloid of the thickness known as "thirty-thousandths" is sufficiently thick for small labels."

◆

We thought there was a surplus of radio ops. But one b.c. station has been granted authority to remain silent until an operator can be secured.

● Here's the honorable editor of RADIO's Dx department—Herb Becker, W6QD. The man with mike in hand is W6CUH—yes, Charlie's actually on phone! They are making preliminary checks with the mainland on a 9½ meter modulated Bi-Push while tied up at Avalon, Catalina Island. The installation was used to broadcast this year's Catalina-Manhattan Beach aquaplane race en route. In order to be able to keep up with the leaders, it was necessary to install the gear, along with gasoline driven generator, on a small and fast power boat. Perhaps you heard the rebroadcast over the Mutual network.



DEPARTMENTS

- **Dx**
- **Postscripts & Announcements**
- **Calls Heard**
- **56 Megacycles**
- **Open Forum**
- **Question Box**
- **Reviewing Radio Literature**

DX

By HERB. BECKER, W6QD

Readers are invited to send monthly contributions for publication in these columns direct to Mr. Becker, 1117 West 45th Street, Los Angeles, California.

DX, dx, dx. Where have we heard of that before? Here we are back to the grind again, and up to our old tricks. During the past two months, plenty of dx has flowed "under the bridge." The mail bag is really full and after this mill gets through with it, and you wade through it . . . we'll both really know it. Of course there has been a lull in activity during the summer, but even so the gang has had time to sit down and do some brasspounding . . . Oh yes, we must not forget the "mighty men of the mike" . . . because they, too, have been out gunning for dx. What's more they have been getting it. The first thing I want to get off my chest is the following, which is the result of many requests from dx men during the last couple of months.

40 Meters in December

What has happened to the 40 meter band? There are many theories in answer to this such as, "The 40 meter band has just folded up and until another cycle rolls around it won't be any good." Then another answer might be, "The 40 meter band is just as good as ever and the only trouble is the gang just is not on the band . . . that is, not enough of the gang to insure good QSO's consistently." They point out that different contests show that 40 is OK if enough of the dx'ers will get up there. One other thing . . . there probably isn't a dx man who wouldn't like to pound brass on 40 again if he could be sure that when he got on the band he would find someone to work. We all know that what stuff we did work on "good ol' 40" really sounded good and it had more consistency than any of the higher frequency bands.

Now then . . . that brings us to this point. Let's set aside the month of *December* for the month to specialize on *40 meter dx*. It will not be a contest; there will be no points, no certificates, and no one is sponsoring it. It will be just "old home month" on 40 meters, and results will be given publicity through these columns. So get out those 40 meter tank coils and during the month of December let's all get on at the time when dx is supposed to come through on that band. For example, a couple of years ago on the Pacific Coast the VK's and ZL's would start coming through around 10 p.m. and last all night until around 7 or 8 a.m. The J's came in around midnight and 5 to 7 in the morning. The ZS, ZE and other South African stations from 6 to 8 a.m. Then every once in a while the other Europeans would pop through from 10 p.m. to 1 a.m. and sometimes earlier.

It should be a lot of fun inasmuch as it will be a sort of a survey and test for 40 meters covering an entire month and we all should be able to get a good cross-section of how conditions are on that band. We may all be in for a surprise and turn in some wonderful dx.

To make this a success at all we must tell the other guy about it, because the more stations that can get on the better the chance will be for a good night's siege of dx. So . . . to all of the dx stations we hook up with on 20 or 10 meters, let's just say . . . "Well, I'll see you on 40 in December." Pass the word around and we'll all have a good time. Of course, there will be no law against working W's on 40 . . . In fact I'm looking forward to some of those nifty QSO's of a few years back on that ex-rip-snortin' 40 meter band. Spread the word around fellows, and "I'll see ya on 40 in December."

Globe Girdling

A very nice letter from G2LB and G5BJ informs us that 2LB has 37 zones and 111 countries and 5BJ has 38 zones with 120 countries. G2LB uses a T55 in the final and is link coupled to either a 14 Mc. Windom N. & S. or a 14 Mc. Zepp E. & W. . . . VK3EO, whose picture is on the next page, is now in the Australian Navy and will not be on the air as much during the next few months . . . and now in a letter from ZU1D, who, by the way, is a dental surgeon, asks me if I still beat my wife (hi) . . . think he'd better yank another tooth. VK2ABG has worked 25 zones on phone (including W6QD). If you should happen to want to send a card to HS1PJ, HS1RJ, HS1BJ which is all the same guy, you just address it thusly: Sangiem Powtongsook, Saladeng Radio Transmitting Station, Bangkok, Siam.

I just received my card from AC4YN in Tibet. It's a pip. Have you received yours? Oh, I should have mentioned I didn't work him; it was a sort of complimentary card (d*#@? it anyway). In a letter from the fellows who were operating AC4YN they give some information. Originally the station was operated by Lieuts. E. Y. Nepean and S. J. Dagg, of the Royal Signal Corps, and Mr. R. W. Fox. Well, it seems that Dagg and Nepean have been recalled to the Frontier to help settle a little dispute that is going on and Fox is the only operator left at AC4YN. This means that the station will not be on as much as before. They bring out that all QSO's with AC4YN, as far as they know, have been genuine. Here's wishing the fellows Dagg, Nepean and Fox luck and hope they will get together again . . . soon. We would like to hear more from them.

"Ham" Whyte, G6WY. Lives there a dx man who hasn't worked him?

"WAZ" HONOR ROLL

	Zones	Countries
ON4AU	40	
G2ZQ	40	116
W6ADP	39	119
W8CRA	39	135
G6VP	39	
W8BTI	39	
W7BB	39	
W3SI	39	
W6CXW	39	114
W4DHZ	39	
W6GRL	39	110
W3ANH	39	
G6WY	39	
G2UX	36	83
W6AM	38	
W6CUH	38	120
W8BKP	38	132
XE1BT	38	69
W9TJ	38	
G5BJ	38	120
G5YH	38	
W8HWE	38	
W9ALV	38	101
G2LB	37	111
W6LYM	37	82
W6GAL	37	107
W9PTC	37	103
W6HX	37	100
W6FZY	37	98
W6QD	37	100
W7AMX	37	100
W8KPB	37	100
VE4RO	37	
W2BSR	37	
W2GW	37	
W8DFH	37	
W2GWE	37	
W8OSL	37	
G6NJ	37	
W2DTB	37	
LY1J	37	
W8LEC	37	
W4AH	37	
W2HHF	37	95
W6VB	36	
W3EXB	36	83
W1CC	36	99
W1ZB	36	102
W4AJX	36	
W8AU	36	83
W2AAL	36	91
W8KKG	36	
G6RB	36	
W2GTZ	36	
W9AFN	36	105
W9ARL	36	
W9PTC	36	
W9KG	36	
W3EDP	36	
W2OA	36	
W6KBD	36	
ZL1HY	36	95
W8OQF	35	89
W6DOB	35	71
W2BJ	35	105
W6KIP	35	95
K6AKP	35	
W6NHC	35	
W6GRX	35	
W8CJJ	35	98
W2AIW	35	
G6QX	35	
W3BBB	35	
VK3EO	35	
W9EF	35	94
W3AYS	34	
W3EVW	34	95
W6FZL	34	87
W9KA	34	
W8JK	34	
W3EMM	34	
W3EGO	34	
W2FAR	34	
W9PK	34	
W1AQT	34	
W7BYW	34	
W6BAM	34	86
W8AAT	34	
W6TI	34	
W1GDY	34	
W8CNZ	34	
LU7AZ	34	
W8LDR	33	
W2IOP	33	
W9CWW	33	66
K6JPD	33	
W6GHU	33	
W6LDJ	33	
W9LBB	33	
W5AFX	33	
G6CL	33	
W9LQ	33	84
W2GVZ	33	91
OK2HX	33	66
W6FKZ	32	74
W6JBO	32	81
W8HYC	32	
W3TR	32	76
W3GAP	32	70
W6KZL	32	67
W8BTK	32	
W5EHM	32	
VE2EE	32	
G6GH	32	
W9UBB	32	66
W9FLH	32	80
W6ITH	31	60
W1TKM	31	
K6CGK	31	
W3DCG	31	
W5CUJ	31	
W8DWV	31	
W3CIC	31	
W6HXU	31	
W6KRM	31	
W9LW	31	82
W3UVA	30	76
W4MR	30	90
W6HEW	30	
W2BXA	30	
W8MAH	30	
W7AVL	30	
ON4VU	30	
W7AYO	30	
W9PGS	30	63
W6KWA	30	
W8DED	30	
W9IWE	30	
W6DIO	30	
W1APU	30	
W6KEV	30	58
VE4LX	30	63
W4DTR	30	68
W8PHD	30	57

PHONE

W6ITH	33	53
W6AM	31	
W4AH	31	
W6LLQ	30	60
W6NNR	28	51
W2HUQ	27	
W5BDB	27	
W6OCH	27	
W9BBU	27	45
W9ARA	27	53
VE2EE	26	
W6BGH	26	
W6MLG	26	45
VK2ABG	25	
W3SI	25	
W8JK	24	
W3EMM	24	
W6FTU	24	35
W9NLP	24	
W1BLO	24	50
W4DSY	23	
VE5OT	23	
W6AAR	23	
W2IXY	22	55
W7AO	22	
XE1BT	22	
W9QI	21	
W3FAM	21	36
W6MVK	21	22
W1COJ	20	
W6GRX	20	

If you have worked 30 or more zones and are ready to produce confirmation on demand, send in your score of zones and official countries (see Jan. issue) on a postcard.

Phone stations need work but 20 zones, but stations must be raised on phone. Stations worked may be either c.w. or phone.

Revisions and additions to the bonor roll will be made every other month.

G2ZQ shoots in some swell stuff. This whole paragraph. FN1C is a Scotsman and is licensed by the French authorities who control about a quarter of an acre 10 miles from Calcutta in Chandernagore . . . uses about 14 watts and plumps a good healthy signal into G on 14,200 kc. and listens from the low freq. edge. G6KP is the first G to work UPOL at the North Pole and G5RI also worked him, . . . freq. about 14,400 kc. There are three boys licensed in Khartoum, Egyptian Sudan, these days, ST2BN, ST2CM and ST2LR . . . in Palestine there is ZC6AQ, while Transjordan is dead. Y15KG is owned by the crown prince of Iraq, SU1AM by an Egyptian prince, OE3AH is Archduke Anton von Hapsburg, FR8VX is the exiled hereditary heir to the throne of Indo China, and VS3AE is the son of the Sultan of Johore. G2ZQ says his card to TA1CC bounced back. Now . . . here's the latest version on OS1BR. He originally came from the Channel Islands and G5OU, whose QRA is there, knows him. Claims the QRA of OS1BR is definitely Egypt and nowhere else. It's pretty old news but the prefix of Wales is now GW.

Here's our old friend Van Hool, ON4FE, with 39 zones and 107 countries on c.w. Says he has 14 zones on fone but is not on fone much. G6WY, "HAM" Whyte, says that apparently all U9M stations in Sverdlovsk, Ural, Siberia, will receive cards if sent to Box 48 at that address. Speaking of addresses . . . here are changes of ZS6AM and ZS6C, G. J. Dent and A.M. Clapp, 70, First Avenue, Alberton, Transvaal, South Africa. Both the same QRA.

Dave Duff, VK3EO, one of the best known VK's.

G2UX has 36 zones to his credit with 83 countries and is hot after the other four zones which are 6, 23, 29, 31. F8EO has been busy with military obligations as he is a reserve officer in the heavy artillery. He says the Pacific stations still come through in the mornings over there, and very rarely in the afternoons. VS7RF and the regular J's come

● **W6ITH, the "mighty man of Berkeley" who heads the phone w.a.z. column, sends us the following list for the benefit of the phone men gunning for dx.**

Time p.s.t.	*Station*	*Frequency (kc.)*
7:00 a.m.	KA1ME	14148
6:30 a.m.	KA1DT	14210
7:00 a.m.	KA1HS	14244
7:15 a.m.	ON4VK	14050
5:00 a.m.	FB8AB	14280
7:00 a.m.	ZU6N	14110
7:30 a.m.	ZU6P	14060
6:30 a.m.	VS1AD	14245
6:00 a.m.	J2NG	14060
6:35 a.m.	KA1AP	14060
4:00 p.m.	FT4AN	14275
4:20 p.m.	CN8AJ	14127
4:30 p.m.	EA9AH	14000
4:40 p.m.	CT1AY	14115
5:30 a.m.	XZ2EH	14040
5:50 a.m.	XZ2DY	14340
6:00 a.m.	XZ2BZ	14330
9:30 p.m.	CE3DG	14206
7:25 a.m.	VS1AI	14042
8:00 p.m.	OQ5AA	14065
9:50 p.m.	LU4BH	
7:47 a.m.	XU8HW	14050
9:50 p.m.	K7VA	14222
5:35 p.m.	PY1FR	14304
8:00 a.m.	KA1JR	14254
7:24 a.m.	ZS6AJ	14140
6:43 a.m.	ZS2X	14038
7:02 a.m.	PK2WL	14220
6:42 a.m.	PK1RI	14018
7:34 a.m.	VS2AK	14260
5:15 p.m.	K7FST	14220
10:00 a.m.	TG1AX	14108, 14096
9:14 p.m.	OA4N	14256
7:00 p.m.	OA4AL	14020
9:00 p.m.	VP5PZ	14136
6:00 a.m.	ZT2G	14265

through in the evenings and the W's on the Atlantic but not so good. The PY's and LU's etc., come through on c.w. and are very numerous. F8EO has had a few fone QSO's with W, VE. K4SA, VP5PZ. PY, LU and CE. Regular skeds are kept with FM8AD, 14,305, FQ8AB 14,295, and he is gunning for a QSO with FNIC, FP8PX. FI8AD in French Indo China and FK8AA. They are all on skeds for the Colonial Emergency Network. On 7 Mc. he says QRM is too great from the Spanish fones. All in all, Francois claims that the very fine weather drives the boys to vacations and the bands are not very much occupied.

Here's something that is not so good to the fellows who have worked ZK1RG supposedly in the Cook Islands. This comes direct from ZL1HY whose parents live in the Cook Islands, and there are 15 in the group. Anyway, according to their knowledge, there have only been two hams active there, ZK1AA (who left two years ago) and ZK1AB, W. G. Woods, who left a few months ago for ZL. ZL1HY says he expects to take a trip to Cook Islands soon and will investigate the situation. For years South Africa has been the hard spot for ZL's to work into but now ZL1HY has worked 15 of them and feels pretty good about it. He has 36 zones and 95 countries. Says he is still single and so is ZL1GX but feels that 1GX is tottering. Ho hum.

W8OE in Bad Accident

Can you beat it . . . that old boy Doc Leighner, W8OE, almost took the count in a bad automobile accident. Before making any more comments I'm going to quote part of his letter which will best explain things.

". . . Just 6 weeks ago she happened. I guess I told you that I had a crushed leg from the knee up 4 inches to my hip. Also caved in my chest and broke my nose. The old chest feels pretty nearly normal altho my lung is still sore. The schnozzle is ok too, now. Six weeks so far flat on my back and possibly a couple to go before I can pedal myself around in a wheelchair. They are going to straighten my leg by two bi-lateral casts, if you know what I mean. Like straightening a 60 foot mast by two guys in the middle. Hope to be on crutches by October 1st. Ye Gawds, but I itch to get going on 7, 14 and 28 Mc. again. Guess things can't be rushed though . . ."

Then Doc went on to tell me of the new rig he has planned and of his new antenna setup that he's going to get after as soon as he is able. We all hope Doc gets up and around in a hurry and in the meantime, Doc, polish up that ol' key.

W9EF writes that now good dx weather is here he can quit playing rummy and get after a little dx. He hooked a peach the other night . . . LX1AF T7 14,045 kc. in Luxembourg. Other good ones for him are VS7RF, VQ8AA, FB8AD, UK1CC, UK3AH, U9MI, YR5KW, LY1KK, J2IN. J2LU, SU1EQ. W9EF received a letter from VP7NA returning his card that he sent to VP7NI. Apparently VP7NI is not a legal station and any cards sent to him, of course, cannot be delivered. W9EF has 36 zones and 94 countries, and U9AW in No. 18 was his last one. W8PHD is a new one to this column, and he puts in his nickel's worth. 8PHD has 30 zones and 57 countries and says VU7FY is on 14,388 kc. and usually comes in between 1130 and 1300 G.m.t. W8PHD goes on to say that PK6HR T7 14,300 kc. comes through nicely and that YI2BA changes his frequency faster than the price of copper. W8LDR is up to 77 countries by hooking HP1C and TI2RC . . . W8HWE is busting par instead of the ether, also that he is taking candid pictures principally of fan dancers, which of course is the very peak of informality . . . W8DFH worked UX1CR at the North Pole, and W8CRA is quitting radio, but is putting up a couple of diamonds for Europe and Asia. Speaking of diamond beams . . . W8OSL says his is swell . . . 'cause it works all directions. Ho hum.

W9UBB worked VQ3FAR T9 14,150 kc. and HS1BJ 14,074 for his 31st and 32nd zones. Also hooked up with UPOL 13,075 kc. and the station was located 21 miles south of the North Pole . . . and W10XDA who was in northwest Greenland. W9UBB finally worked OK2HX after chasing him for about a year. Incidentally, OK2HX is looking for Nevada and while I'm thinking of it, OE3AH is also after a Nevada contact. G2ZQ suggests that some ham who is going to get a divorce go to Reno,

● **Here is W6OCH's list that will come in handy for all of you phone men out after dx. It ought to keep you busy for a while.**

Time p.s.t.	*Station*	*Frequency (kc.)*
10:00 p.m.	HH2B	14130
11:50 p.m.	J3FK	14250
8:30 p.m.	HI1C	14080
6:00 p.m.	CX1CC	14450
8:00 p.m.	HK1GK	14260
9:00 p.m.	VE5OA	14270
7:00 a.m.	VS2AO	14180
7:50 p.m.	CE1AO	14060
10:30 p.m.	YV5AP	14120
5:30 p.m.	CE3DW	14120
10:00 p.m.	OA4AK	14260
Early a.m.	KA1KY	14250
9:30 p.m.	OA4AB	14050
10:00 p.m.	G2XV	14140
10:30 p.m.	CE1AH	14120
9:30 p.m.	LU5CZ	14080
9:55 p.m.	LU4BL	14270
6:00 a.m.	KA1AP	14050
6:30 a.m.	PK3WI	14030
6:30 a.m.	PK1VM	14105
6:30 a.m.	VS6AB	14030
6:30 a.m.	KA1MD	14200
1:00 a.m.	J2MI	14280
7:00 a.m.	XU8HW	14100
6:00 a.m.	KA1ER	14270
6:00 a.m.	VS6AG	14100
7:00 a.m.	VS4CS	14260
9:00 p.m.	LU6KE	14080
9:00 p.m.	NY2AE	14170
7:00 a.m.	KA1MM	14090
8:00 p.m.	YV5AK	
8:00 p.m.	OA4AF	14130
10:00 p.m.	VP5PZ	14300
11:30 p.m.	HB9AB	14120
7:00 a.m.	VK6MW	14110
7:00 a.m.	HR2A[illegible]	14400
11:30 p.m.	J2KJ	14260
9:00 p.m.	TI1AF	14110
7:00 a.m.	PK6CI	14110
1:00 a.m.	J8CF	14270
7:00 p.m.	TG1AX	14105
7:00 p.m.	CE4AI	14350
10:30 p.m.	LA1G	14140
10:30 p.m.	G6LK	14115
7:00 a.m.	KA1DL	
9:00 p.m.	VQ1AB	14250
7:30 a.m.	CT3AP	14000
7:00 p.m.	CP1AA	14000
7:00 p.m.	VP3BG	14110
7:00 a.m.	VS2AK	14260
10:00 p.m.	VP2BC	14050
9:00 p.m.	ZU6P	14110
7:00 a.m.	VE5TV	14115
9:30 p.m.	OA4AL	14260
6:00 p.m.	LU7AG	14090
8:15 p.m.	EA9AH	14005
9:30 p.m.	F3JD	14130
9:30 p.m.	HC1FG	14010

Nevada, take a portable rig along and then become famous.

XW6A and KA1QL

Two popular W6's at this moment are enroute to the Philippines to live and set up their station. While on their way they are on the air signing XW6A. They will answer all cards sent them from QSO's while on this trip. However, by the time you read this they will be in the P. I. and possibly be signing KA1QL. These fellows have a swell kw. phone and c.w. job with them which they will put on the air as soon as they get settled.

HO2U is another station on a ship. This one is on a round-the-world cruise and will be in operation for the next six or seven months. Will be on phone and c.w. and the rig uses a single 35T with 100 watts of carrier. Frequency is 14,140 kc. He will QSL all stations worked giving his location for zones and country. For all of you fellows who wish to have him receive your cards, please address them as follows:

Amateur Radio Station HO2U,
P.O. Box 181,
El Cerrito, Calif.

HO2U plans to be on every day at 1400 and 0800 G.m.t.

Dashing Around U.S.A.

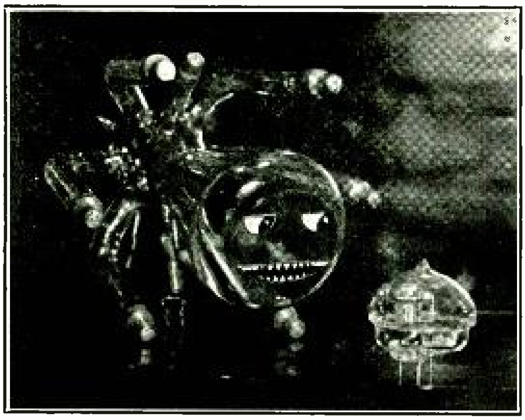
W3TR works VE5AAY at Ranken Inlet, Keewatin Province, zone 2. He is on phone and c.w. at 14,275 kc. Sends cards c/o VE4RO. Time worked 2300 G.m.t. W3TR also worked YV5AE, VR4OC and K6OJK (Guam). This makes him 32 zones and 76 countries. VR4OC is in the Solomon Islands and is on 14,075 kc. T9. Forward cards to VK2OC. W2GVZ hooked up with OY1B on Faroe Island and that was his 88th country. Frequency was 14,425 kc. T8. Time 2420 G.m.t. However, since then he has landed three other countries: YS2B in Salvador 14,420 T8; PK1MF 13,390 T7; and HZ5NI 14,415 T6. QRA of HZ5NI is given as Yves Murat Pasni, Sana, Yemen, Saudi Arabia. That makes 33 zones for W2GVZ.

W6OCH, of Oakland, Calif., has increased his zones on phone to 27, by working VS7GJ on 14,130 kc. Time 1600 G.m.t. . . . W4EPT runs 20 watts to a 6L6 tritet and needs Asia for w.a.c. . . . W6HZT hooked FB8AB for his 33rd zone.

W8DOD worked UX1CR at the North Pole, who was on 14,410 kc. . . . W1BLO, one of the phone boys, is doing very well . . . has 24 zones and 50 countries and they were all two way phone contacts. . . . W6BAM is still at it and now it is TG1S in Zacapa, Guatemala, on 14,380 kc. T6. BAM also got VS7RF for his 34th zone and 86th country . . . W4DTR down Florida way has been using tens in p.p. and never more than 100 watts. He has 30 zones and 68 countries to his credit, and new ones for him are FB8AB, YI2BA, VS7RF, VQ8AB, FP8PX and J2MU . . . W6GNZ has 29 zones and 68 countries and says that W6ADP is trying to revive 28 Mc. dx (wonder if ADP uses smelling salts or what?).

W6GNZ gives FM8AA as 14,255 T9x, VR4AD 14,040 T9x, and VR4OC 14,100, VS6AO 14,090

[*Continued on page 74*]



• "Mercury arctopus" about to descend upon an unsuspecting 316-A. (Photography: W6VR; Props., W6FFF.)

POSTSCRIPTS...

and Announcements

The Royal City Amateur Radio Association, New Westminster, B. C., is attempting to establish a national society, dominion wide, in Canada. The obvious need for such an organization to protect the interests of VE hams makes this a laudable undertaking.

In conjunction with this drive to organize Canadian ham radio, the association desires the addresses of all radio clubs in that country in order that communications with amateurs throughout Canada will be possible. Canadian radiomen should communicate with the association.

•

Second annual convention of the southwest division of the A. R. R. L. is slated for October 23 and 24 in Tempe, Ariz., located just 9 miles from Phoenix. A desert barbecue is one of the social highlights planned. Headquarters are in the State Theatre Building, Tempe.

•

In San Diego amateurs will entertain at a hamfest in October. The U. S. Grant Hotel will be the scene of the meeting.

•

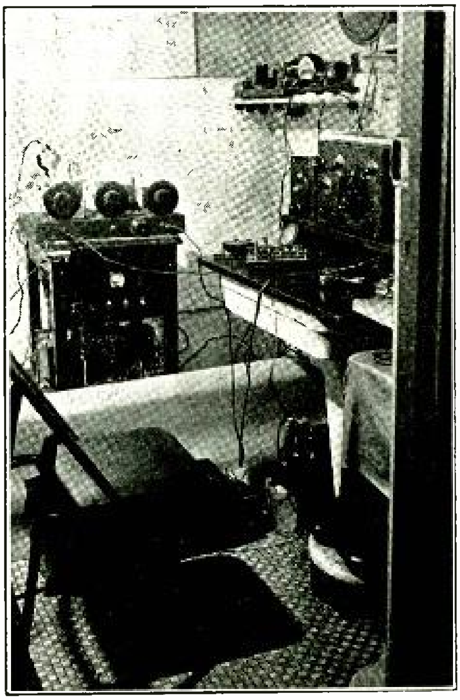
We swipe the following gem from the advertising department letterhead of a well-known radio magazine:

"The codfish lays a million eggs
While the faithful hen lays one
But the codfish does not cackle
To inform us what she's done.
So we disregard the codfish
While the faithful hen we prize.
Which only goes to prove
It pays to advertise."

•

Correction

In Radio for March we published in the 28 and 56 Mc. activity section a list of European stations heard on five meters. This was credited to G2HG though we find that Swain actually was relaying to us the list for CN8MQ, and the dx was even better than we thought.



QTH Contest Winner

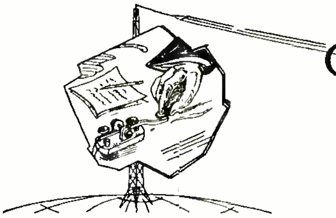
A. W. Holmes, VE3IK, was adjudged winner of the recent "Unusual QTH" contest.

In addition to being an amateur, Holmes is an operator at CRCW. The studios are located in a hotel, and about two years ago when the studios were being installed, walls between bedrooms were ripped down to make room. When the job was completed, there was quite a surplus of bathrooms. Holmes grabbed onto one for a location for his ham rig and has been operating there for the last two years. He says that the rig seems to get out a little better on Saturday nights.

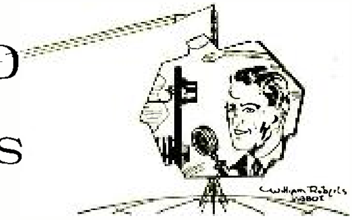
•

More Competition

Pages 92 and 97 carry announcements of interest to amateur photographers and writers.



CALLS HEARD AND DX DEPARTMENTS



Numeral suffix indicates "R" strength. Send Calls Heard to Calls Heard Editor, not to Los Angeles.*

H. Frank Jordan, W5EDX, 831 W. Lullwood Ave., San Antonio, Texas.
March 19 to 28
(14 Mc. phone)

CE3DW; CP1AA; CT1AY; EA2BH; HC1DG; HI60; HI7G; HK1GK; HK1JW; HK1RL; HK3JA; HK3RC; K4ENY; LU1DY; LU2CA; LU4AB; LU4AW; LU5CZ; LU7AZ; LU7AX; LU9HX; LU9KA; OA4A; OA4AB; OA4AK; OA4AS; PK1MX; PY2AC; PY2BA; PY5AQ; PY3AB; PY8AH; SU1CH; TI2DC; TI2LR; TI2RT; VK2ADV; VK3LA; VK3MR; VK3MX; VK3RW; VK3VW; VK3ZL; VK7JB; VQ1I; VO4A; VP2BC; VP2DG; VP3BG; VP4CQ; VP5AL; VP6YB; VP7HA; VP9G; VP9R; VU2CQ; YN1HS; YV1AC; YV1AK; YV1AP; YV4AM; YV5AA; YV5ABE; YV5CQ; YV5YS; ZE1JR; ZU6P.

S. J. Chrzanowski, 327 Walnut St., Waterbury, Conn.
June 3 to June 10
(14 Mc. phone)

CO2EG; CO2HY; CO2JG; CO2JM; CO2MT; CO2WW; CO8YZ; CT1AY; CT1CV; EA8AH; F8KW; G5BJ; G5ML; G6JF; G6XR; G8LP; GM6RG; HI1FG; HI7G; HK1JM; HK4AG; K6JLV; LU7AC; LU7AP; OA4AN; OA4N; TI2RC; VO1P; VP5PZ; VP6YB; VP7R; YV5ABE; YV5AK; XE1HA; XE2AH; XE3W.

(14 Mc.)

D4XVF; F3CY; F3MN; F8FK; F8WK — G 2DL; 2HF; 2KU; 2LK; 5VA; 6CJ; 6YR; 8FZ; 8I1; 8IK; 8ND. GI6TK; GM6NX; GM6SR; GM6XI; K4EJB; K5OG; LA2W; LU4DJD; PY8AG; VK2HP; VK5HD; VP5AE.

J. G. Juespert, W9WCE, 706 29th St., South Bend, Ind.
April
(14 Mc. phone)

CO2LY; CO8YB; HK4AB; VP2BC; VP3BG.

(7 Mc.)

HR1AA; K6GQF; K6ILT; K6NLD; K6NWF; ZL2KY.

(14 Mc.)

CM2CB; CM2EA; CM2WW; CM7AE; CM8BY; CN8MI; D4FND; D4KMG; D4SNP; DI7L; EI8B; F3KH; F8EO; F8LG; F8NR; F8ZU; G—2BK; 2DH; 2LC; 2WP; 2YK; 2ZK; 5MS; 5SS; 5WP; 5YH; 6BQ; 6GH; 6JW; 6LU; 6NM; 6PD; 6RK; 6UI; 6WY; 8BD; 8HH; 8I1. GM6XI; HK4EA; K5AA; K5AG; K5AM; K5AY; K6AKP; K6ENR; K6MXM; LA1H; LU8EN; OA4AQ; OK2MM; ON4BR; ON4FT; ON4MD; ON4PA; ON4VU; OZ2B; PA0KV; PA0MQ; PA0FLX; PY3AW; PY3CP; VO3P; VP5AF; VP6MY; VK—2ADE; 2AEK; 2CI; 2DK; 2DO; 2EX; 2GV; 2HI; 2LD; 2NO; 2OQ; 2QE; 2UB; 2UU; 2VL; 2VV; 2XD; 3BL; 3CV; 3EO; 3HG; 3LX; 3PA; 3QR; 3SG; 3ZB; 3ZR; 4CG; 4EL; 4HR; 4JB; 4RF; 4SD; 4WL; 5FL; 5JU; 5WR; 6SA; XE2CB; XE2OE; XX2JJ (SHIP) YV5AN. — ZL 1FE; 1KE; 1JC; 1JY; 1LY; 1LZ; 2DS; 2FA; 2FS; 2GN; 2KY; 2LB; 2MM; 2MN; 2OK; 2OQ; 2OU; 2QM; 2SM; 2BN; 3GR; 3IA; 3IW; 3JA; 3JR; 3KG; 4CS.

May
(14 Mc. phone)

PY1FR; VP6YB; XE2AH.

(14 Mc.)

CM2AD; CM2OP; CM6AJ; CM7AC; CM7AE; D3BXK; D3CDK; F3KH; D8EO; FB8AD; FY8A; G2ZY; G6JW; G6WB; GM5TY; HB9J; — K 4BU; 4EJF; 5AA; 5AC; 5AG; 6DV; 6MXM; 6NXD; 6OEP; 6OLX; 7FRU; LU3EV; LU4DJD; OA4AK; OA4AQ; ON4NO; ON4SS; ON4SPN; PY1ADN; PY1BR; PY1DK; PY2CW; PY2DN; PY5BO; PY7AB. — VK 2AEZ; 2CP; 2CK; 2DO; 2LD; 2TF; 2TT; 2XJ; 2YW; 3QK; 3XU; 4EL; 4HR; 4KH; 5AI; 5LL; 5WG; 6SA; VO3O; VO8ARE; VP1RB; XE1FS; XE3AR; ZL2GO; ZL2HR; ZL2MN; ZL2NJ; ZL2SX; ZL3GR; XP2AC.

*George Walker, Assistant Editor of RADIO, Box 355, Winston-Salem, N.C., U.S.A.

D. A. G. Edwards, 2ANT, Selwyn House, Pilkington Ave., Sutton Coldfield, Warwickshire, Eng.
Feb. 9 to June 2
(14 Mc. phone)

W—5AHJ; 5AKZ; 5AWP; 5BEE; 5DLM; 5DQ; 5DVM; 5EBP; 5FDI; 5FFA; 5FFG; 5FFM; 5GIB; 5JS; 5PV; 5TV; 5YW; 6AH; 6AL; 6AM; 6BAY; 6BGH; 6BYB; 6CON; 6CGI; 6DJK; 6EJC; 6FGU; 6FYV; 6GRT; 6IFH; 6ITH; 6IXJ; 6KSO; 6LEE; 6LKG; 6LR; 6MNR; 6MWD; 6MWO; 6MXD; 6NKF; 6NNR; 6NTX; 6NWI; 6QH; 6YU; 7AXS; 7CEO; 7DNE; CE1AO; CE3CP; CE3DW; CN8AG; CN8MB; — CO 2BY; 2EG; 2JJ; 2KC; 2KL; 2LH; 2LY; 2WW; 2WZ; 6LY; 7CX; 7VP; 8OG. CT2AB; EA9AH; FA3JY; FA3LY; FA8CF; FA8GT; FA8LC; FM4AI; HA1M; HA1P; HA8M; HA8N; HC1CE; HC1JW; HI4I; HI7I; HK1BM; HK1Z; HK3JA; HK3OG; HK4AG; HP1A; I1EE; I1IT; I1RK; I1SR. — K 6BAZ; 6CMC; 6DTT; 6JLV; 6MUL; 6MVV; 6NTV; 7FST; 7FVV; LA1G; LA4A; LA4R; LA6B; LY1AA; LU2CA; LU4AW; LU4BL; LU5AG; LU6KE; LU8AB; LU8BR; NY2AU; OA4AK; OA4AL; OZ3U; PZ9R; PK1AZ; PK1MX; PK1VM; PK4DG; PK4VR; PY2AK; PY2BA; PY2BC; PY4EA; SM6GP; SM7WR; SP1HH; SU1SG; SU1WM; SV1CA; SV1KE; SV1NK; TI2KP; TI2RC; TI2RH; TI3AV; U3BC. — VE 3ABD; 3AEX; 3GK; 3GS; 3LC; 3MD; 3MS; 3OJ; 3AV; 3QZ; 3WV; 4EA; 4MO; 5EF; 5FY; 5JK; 5OC; VO1K; VO1P; VO1X; VO2Z; VO6L; VP5PZ; VP9R. — VK 2ABD; 2FY; 2HF; 2HX; 2NO; 2OQ; 2RW; 2TI; 2XU; 2YW; 3AL; 3ER; 3FT; 3MR; 3KX; 3XD; 4JU; 4VB; 5AI; 5AW. YI2BA; YT7KP; YV2OP; YV5AE; YV5AY; XE3W.

Feb. 1 to April 7
(28 Mc.)

W—5ASG; 5BMM; 5BSK; 5BXM; 5CHG; 5CQJ; 5DNV; 5EB; 5EKF; 5EME; 5ERV; 5EZH; 5FAC; 5FDE; 5FNH; 5FPC; 5FVA; 5GAR; 5GW; 5QQ; 5VA; 6CUU; 6CKR; 6CJJ; 6FQY; 6GCX; 6ITH; 6JJU; 6KEI; 6LHT; 6MBC; 6MDN; 6MNT; 6MWD; 6NLS; 6NWQ; 6QF; 7GEE; 9ACU; 9AGO; 9AUO; 9AZE; 9BYW; 9CET; 9DDF; 9DHK; 9DN; 9DUH; 9EKD; 9EOZ; 9EYD; 9EYM; 9FAA; 9FDL; 9FWI; 9FZG; 9FZH; 9GHY; 9GWM; 9GZK; 9HVL; 9IHL; 9IWF; 9IWX; 9JBO; 9JOL; 9JWI; 9KUD; 9LKI; 9LQ; 9MCD; 9MCH; 9MIK; 9NVE; 9OFL; 9PBY; 9PEO; 9RSJ; 9RSQ; 9SIE; 9SYH; 9THR; 9TMP; 9TTB; 9TTS; 9ULJ; 9UPX; 9UQX; 9UWV; 9UYD; 9VUH; 9VXZ; 9WSB; 9YHQ; 9YQN. CO2HY; K4DDH; K4EJF; K4EPO. — VE 1AM; 1BR; 1DT; 1IF; 2AB; 2ER; 2KX; 2KZ; 3ADA; 3AIB; 3KL; 3TY; 4BD; VP5PZ; YL2BB; YR5AA; ZS6AJ.

R. (Bob) Everard, "Oakdene" Lower Sheering Road, Sawbridgeworth, Herts, Eng.
March 18 to April 18
(14 Mc. phone)

W—6BAY; 6BJB; 6BKY; 6BPM; 6CIN; 6CKR; 6CNE; 6CQG; 6DDA; 6EBJ; 6EJC; 6FGU; 6FYJ; 6HJT; 6IDV; 6ISH; 6ITH; 6JMG; 6KUW; 6LEN; 6LFG; 6LKQ; 6LYP; 6MDY; 6MLG; 6MWD; 6MXD; 6NKX; 6NNR; 6SJ; 7AA; 7APD; 7BL; 7QC. CE1AD; CN8AA; CN8MB; CO2LY; CO8EC; CO8YB; CT2AB; CX1AA; CX2AK; EA8AF; EA9AB; FT4AA; FT4AG; FT4AR; HC1JW; HH2B; HK1ABM; K6BAZ; K6CMC; K6NTV; K6OQE; LU1UA; LU4BL; LU4AW; LU5CZ; LU6KE; LU9BV; NY2AE; OA4AI; OA4AK; PK1MX; PK1VM; PK4DG; SP1HH; SV1KE; SV1NK; TI2LR; TI3OV; U3BC;—VE 3AG; 3GZ; 4AW; 4BD; 4EA; 4GO; 4JJ; 4QV; 4OS; 4VD; 5DK; 5ES; 5JK; 5OT. — VK 2ABG; 2ADN; 2ADV; 2AP; 2BG; 2BZ; 2CP; 2HF; 2NY; 2OQ; 2QH; 2TC; 2VV; 2XU; 2XV; 3ES; 3HF; 3HK; 3KR; 3MR; 3XJ; 3ZZ; 4CG; 4GG; 4JU; 4JX; 5AI; 5AW; 7CL; 7JB; 7YL; — VO2CQ; VO2Z; XE2N; ZB1H; ZS6AJ; XS6Q.

(28 Mc. phone)

W—1ADM; 1DJS; 1AML; 1BBM; 1BJE; 1CAA; 1CJH; 1CKF; 1DJN; 1DQQ; 1ELR; 1GGV; 1HLH; 1HRS; 1HSF; 1HUH; 1IDU; 1IPV; 1IXP; 1JAR; 1JQA; 1KA; 1KC; 1KJJ; 1KLD; 1TW; 1WV; 2ADI; 2AHX; 2AIF; 2AMJ; 2BHI; 2BYP; 2CPA; 2DKJ; 2DLF; 2DVV; 2FIN; 2FQK; 2GJK; 2GJW; 2GMR;

2HTG; 2IKS; 2ILA; 2INX; 2IQO; 2IUO; 2IUR; 2JAB; 2JHS; 2JIR; 2JNP; 2JXZ; 2JZQ; 2KBG; 2KDD; 2KHR; 2TP; 2UK; 2VH; 3AIR; 3AKX; 3AVR; 3BSY; 3CBT; 3CRY; 3CYK; 3DI; 3ENM; 3FAR; 3FGJ; 3FVO; 3FXC; 3GIV; 3GIZ; 3GKF; 3LD; 3WA; 4AGB; 4AP; 4ANS; 4BYA; 4CBY; 4CPG; 4CYU; 4CYV; 4DGS; 4DPS; 4DRZ; 4DUS; 4EEV; 4EI; 4ELV; 4EVD; 4LT; 4MV; 4PD; 4QN; 4ZF; 5BB; 5BEE; 5CHG; 5CQJ; 5DDP; 5EKF; 5EMC; 5EYV; 5FDW; 5FNH; 5FPI; 5FRA; 6AM; 6CKR; 6DMN; 6DZB; 6ERT; 6GUQ; 6KEI; 6LYM; 6NLP; 6NLS; 6YU; 7ALZ; 7AXS; 7BQX; 7EMP; 7FDL; 8ANN; 8ANO; 8AU; 8BIQ; 8BMH; 8BSM; 8CFD; 8CFU; 8CHB; 8CHQ; 8CLG; 8CUY; 8CYT; 8DHM; 8DLU; 8DRJ; 8EBS; 8ENO; 8FC; 8FJL; 8GLJ; 8GLY; 8GRX; 8HER; 8HC; 8HSP; 8IRC; 8ISC; 8IWA; 8IWG; 8JFC; 8JMM; 8JMP; 8JRL; 8KPU; 8KSR; 8LAC; 8LHM; 8MAH; 8MAP; 8MBC; 8MWL; 8NE; 8NSV; 8NJP; 8NKY; 8NOL; 8NSC; 8NYD; 8NYU; 8ODX; 8OGU; 8OKC; 8OSF; 8OXM; 8PBV; 8PGV; 8PZX; 8QBO; 8QDU; 8QIN; 8QJT; 8QKI; 9AAG; 9ARA; 9AYA; 9DZE; 9BBU; 9BHT; 9BOF; 9BU; 9BYW; 9CCI; 9CLH; 9CSI; 9DDF; 9DFL; 9DN; 9DRQ; 9EKD; 9ELK; 9EOZ; 9EW; 9FRF; 9FZG; 9GIC; 9GZK; 9HYL; 9IGZ; 9IJX; 9IU; 9IUJ; 9JDD; 9JHO; 9JOL; 9KPD; 9LBR; 9LKI; 9LQT; 9MCD; 9MDF; 9MHM; 9ODZ; 9OSO; 9PGC; 9PQH; 9PWU; 9PXS; 9PZZ; 9PZI; 9RBI; 9RBM; 9RNX; 9RSJ; 9RSQ; 9SJV; 9TFY; 9TMP; 9TTH; 9TXX; 9ULJ; 9UOR; 9UYD; 9VBK; 9VER; 9VTD; 9VZL; 9WAL; 9WOA; 9WR; 9WSB; 9YGC; 9HYQ; 9YKX; CO2AU; HI7G; K4EPO; K6MVV; LU7AV; LU9BV; PY2AC. — VE 1DT; 1F; 3ADM; 3AEL; 3AQ; 3ER; 3KF; 3KW; 3NH; YR5AA; ZE1JR; ZE6AJ; ZE6P.

Donald W. Morgan, 2CBG, 15 Grange Road, Kenton, Middlesex, Eng.
May 1 to June 1
(14 Mc.)

W — 1AXA; 1BTH; 1DFY; 1EH; 1JQA; 2ALL; 2EJO; 2JRP; 2KD; 2KDA; 3CNP; 3ECY; 4DNG; 6BAX; 8BTI; 8EBR; CN8NI; CT1AQ; CT1NS; CT2AB; CX1BX; CX2AA. — D 3DXF; 4BEN; 4CBM; 4CTV; 4DHC; 4DHY; 4HWG; 4SNP; 4YUM; EI7J; ES5D; F8NP; F8NV; F8PX; F8WK; FA8RC; FT4AB; FT4AG; FT4AK; FT4AN. — G 2BY; 2JU; 2LA; 2QY; 2UV; 5CV; 5JA; 5LY; 5SR; 5UR; 6GR; 6LJ; 6QN; 6UP; 6XP; 6YP; 6ZA; 8AP; 8DV; 8FZ; 8GD; 8IL; 8KW. — HA 1G; 1P; 2B; 2D; 2K; 2R; 3J; 3P; 4H; 4N; 5C; 5D; 5P; 7V; 8A; 8C; 8D; 8G; 8I; HB9BL; HB9BQ; HB9BX. — I 1GA; 1IT; 1IV; 1KK; 1KN; 1LD; 1MH; 1MV; 1TKM; 1ZZ. — LA 1Y; 2X; 3A; 3I; 3Y; 4R; 5Q; 5R; 6U; 7J; 7K; LU4BH; LU5AN; LU6BV; LU6JB; LU7AZ; LU7BH; LY1AA; LY1KK; LY1KN; OE1EK; OE1OK; OE3AH; OE3FL. — OH 1NL; 1NM; 1NR; 1NV; 1NY; 2NE; 2OB; 2OG; 2PS; 2PW; 5CA; 5OD; 5ZA; 6NQ; 6NS; 8NH. — OK 1CX; 1DJ; 1LX; 1RR; 1XA; 2FD; 2FA; 2MM; 2OP; 2PN; 2RS; OQ5RM; PY1DK; PY1MP; PY2AJ; PY2AP; PY2DC; PY2HM; SM2TF; SM5QO; SM5RH; SM5TB; SM5VW; SM5YB; SM6UA; SM7WI. — SP 1AE; 1AI; 1AT; 1AU; 1BX; 1CM; 1DB; 1DE; 1EB; 1FE; 1FL; 1FU; 1GZ; 1HA; 1HJ; 1HN; 1HR; 1IE; 1IU; 1JB; 1KE; 1KZ; 1LM; 1LW; 1LX; 1MD; 1MF; 1OL; 1PM; 1VA; — SU1DX; SU1EQ; TF5A. — U 1AB; 1BC; 2NC; 3AN; 3BX; 3DX; 5HE; 8ID; 9AW; 9ME; 9MF; 9MN; 9NE; UE1FK; UE1UE; UK3AA; UK3CC; UK3L; VE3AH; VE3AK; VE3AH; YI2BA; YL2BB; YL2BQ; YL2CG; YL3FQ; YR5AA; YR5CD; YR5CF; YR5IG; YR5LJ; YR5TP; YT7KP; ZB1E; ZB1H.

•

"Radio" Scores Again

A hastily conducted yet fairly representative recent survey indicates the following regarding directive antenna systems.

There are far more Flat Top Beam antennas in use by amateurs on the 10 and 20 meter bands than any other single directive type.

There are considerably more Signal Squishers in use on the 10 and 20 meter bands than any other type of rotatable transmitting antenna.

And this in spite of the fact that both of these antennas were described for the first time in RADIO only recently. The reason for their immediate widespread popularity is the simple fact that they really *work*.

If you have "lots" of room (pun), two or three Flat Top Beams will do wonders for your signal and, by proper orientation, cover everything you want to work. If you are cramped for space, as many city hams are, a single Signal Squisher will do the job.

56 Mc. . . . The New Dx Band

By E. H. CONKLIN,* W9FM

Twenty-two dx stations contacted in a single day! Five districts worked, with signals getting into three more! Band open eighteen days in three months! Such are the results of the five meter work at W5EHM this summer during which various stations in the U. S. and Canada reported the band open twenty-nine days. But others beside J. C. Patterson of W5EHM participated in these records; so let us turn back to the reports of last spring and review the work as it happened.

There are several reports which deserve mention even at this late date. One is from Dick Sampson of W6OFU, who is an engineer at broadcast station KCRJ in Jerome, Arizona. On February 10, 1937, he heard several weak carriers on 2½ meters at around 8:40 p. m. At 9:22 he heard a 56 Mc. phone which he copied as W9GHY. Signals were fading very rapidly and deeply. On March 24th at 7:07 p. m. he heard the five meter harmonic of W1ISH who was testing for b.c.l. interference. Just after this, Dick heard LU1BU call CQ, strength 4 to 5. This signal faded out at 7:14 p. m.

The previously published report of hearing W6GFI in Maine was from W1IPV on April 20 at noon Eastern time, strength 4 to 6. Carl Kamline was using unmodulated code at the time. Carl also mentioned that a listener in Bakersfield, California, heard the fundamental or a harmonic of W2TP at 4:45 p. m. Pacific time around April 25 but didn't keep any record of the date.

Most of the above work may have taken place via the high F_2 layer of the ionosphere rather than the low, sporadic E layer which has apparently been the cause of the 400-1100 mile work.

Reports for May

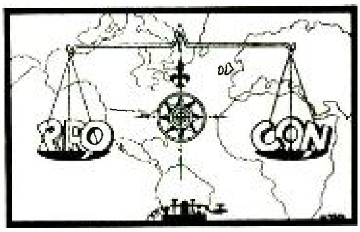
In the July issue of RADIO we reviewed a good share of the May 14 and 15 work over a path roughly from Boston to the midwest. Additional confirming reports have been received from W1ESI and W1JQJ. The latter writes that he heard G5BY using c.w. at noon Eastern time on May 15. We have not attempted to obtain a confirmation of this because G5BY was scheduled to transmit at about that time and we did not have a word-for-word copy of what W1JQJ heard. We questioned the several reports of hearing and working G5XP on May 22 because the time was definitely unfavorable for 28 Mc. or higher frequency work. We learn from G2HG and G2YL that G5XP has not been on the air and in fact isn't licensed at all now. Nelly Corry says, "It was obviously a pirate who was heard. Pretty poor sort of joke really, and it has caused G5XP a lot of trouble too—answering cables from the A.R.R.L. and goodness knows what else!"

On the 14th, W6OFU heard W1IXA at 6:28 p. m. R2 to 5 at best, fading out about each five seconds. Later, six stations were heard without any

[*Continued on page 72*]

*Associate Editor, RADIO.

THE OPEN FORUM



Ham Band Police?

Kewaunee, Wisconsin.

Sirs:

Don B. Knock, VK2NO, has shown American amateurs the way out of 90% of their QRM troubles,* and I'll bet my ticket that "W" hams won't have the gumption to try out the VK method.

I keep a first rate log, if I do say it myself, and I jot down observations about my DX QSO's. I find that over a period of five months, 20% of my DX contacts were spoiled by QRM, and in 72% of those instances the QRM was done by some dizzy bat holding down his key while tuning his rig.

Just a week ago two hams in Philadelphia spent exactly an hour and ten minutes tuning their rigs without using a dummy antenna, and during that time they held their keys down for intervals of 50 seconds to 1¼ minutes! They broke it up now and then to ask each other "Is my sig still wobbly, om?" One of them was smack on my pet frequency, and I waited until he called CQ and got his call.

That is a rotten, deplorable practice, and if policing the bands will put some of those "channel hogs" in their places amateur radio will have made a tremendous improvement. It's funny. Such practice is clearly a violation of the regulations, and why don't amateurs want to step in on their own hook and clean this situation up? I believe they do! The ARRL could organize a "band police" force very easily.

Clearly, the only ones who could be opposed to band policing would be the offenders. I believe that the average amateur is law-abiding and wants his bands cleaned up. The VK's have shown us a simple, thorough and satisfactory system. Who's holding up the parade?

C. F. Temby, W9VOV.

*July issue, page 8.

•

Also Relished by B.C.L.'s

Wheeling, West Va.

Sirs:

I believe the experience and information which I have obtained in the past two days will be of interest to all hams:

Several hams have told me that they had been in my town over night on a trip, and wanted to look me up for one of those personal rag chews and a look at the rig. As usually happens, they forgot the name but not the call and all the places they might ask (radio stores) had closed for the evening.

So, I decided to get a listing in the phone book for W8BOW. I went to the phone company and contacted the man for that specific purpose. The phone company couldn't see it my way—radio was a business and I wanted it listed for a residential telephone. No, sir, we can't do it. But we'll be glad to sell you a business phone . . . .

But I explained to the gentleman that amateur radio was *not* a business and that the Federal Communications Commission saw to it that it wasn't. The man in charge didn't know what to say as this was the first time it had been mentioned, to his knowledge, and wanted not to set a precedent.

So he called the capitol of the state where the main office is located. They didn't know what to say either and didn't want to be quoted. But they called the head office of the A. T. & T. in New York, and here is the decision:

All amateur radio stations located in a residence having residential service may have a listing in the phone books of any A. T. & T. company, subject to the regular rules as to insertions, as follows:

Radio Amateur W8BOW   Maple Tree Lane   Woodsdale 633

Note that the listing is apart from the commercial radio stations, being located in the "R"s instead of "W"s. Any amateur listings at present will be changed to conform in the new phone books.

Here in Wheeling a private line may have two insertions in the phone book at no extra cost. So if you only have one insertion and have a private line, put in a listing of your radio station! The resulting convenience is obvious.

William W. McLain, W8BOW.

•

"Tighten Up on 'em?"

Wood Ridge, N. J.

Sirz:

I have been reeding in ur magazeen about this bizness of lid operators. The mane reazan for all this lid operating as I see it is thet the examinashun has been to eazy in the past. Ten wpm is a very slo spead. Now they are katching wize to themselvez, these R. I.'s, and have steepped up the spead to 13 words per min. I can't cee how the heck som of theze birds got thar tickets. Thay ought to frisk theze birds for license manuls evree time. The kind of operating thay do is teribl and intolrable. Sum of theze lidz wouud sooner have a copye of *Police Gazette* or some other magazeen, instead of a copy of RADIO or *QST*. I no sum of these geyez. Wy not clean them up at one strok of the broom? Wy not get up a black list of theez birds in ur magazeen and make it notised. Maybe this will waeke them up to facks.

KID DOPEY

•

SWL on QSL'ing

5031 W. 21st Street,
Los Angeles, Calif.

Sirs:

I wonder if amateurs realize what a lot of work is involved in sending accurate reports on signals heard? Do you realize the expense of maintaining good communication receivers, printing attractive SWL cards, envelopes, stamps and return postage? Perhaps not, but we SWL's do!

In many cases my reports are sent to those stations who have called the west coast and have been unable to raise an answer. I believe that in many instances the operator would not know that his signals were being heard out here without these SWL reports. Don't these cards have any value to you? Of course, we all realize that the station cannot furnish stamps for us but where self-addressed and stamped envelopes are included, shouldn't we get something back? Even a penny post card would show common courtesy. Many times these reports have been sent to stations testing. I'm sure they must have some technical value but still I have found that I get no reply to even these.

Perhaps this may be the solution for both sides. If those amateurs who do not care for SWL reports would mention this on their transmissions, it would save them a lot of unnecessary mail. Be assured that it would save us a great deal of time and expense in the future. Let me, as a self-imposed spokesman for a host of DX'ers, assure RADIO and all amateurs that our reports are sent with a spirit of helpfulness as well as a desire to exchange cards and make friendships with unseen radio enthusiasts. After all, a great number of us have hopes of some day going on the air and many of us will.

If any of the readers of RADIO have an idea in mind that will help both sides of this situation, may I offer my help and assurance that all correspondence will be answered. I really believe that if the DX'er and the amateur will give this a little thought and co-operation, an unpleasant condition can be cleared up to the satisfaction of everyone and make amateur radio a much more pleasant means of forming friendships.

HARRY O. JONES

•

Coming or Going?

Atwater, Calif.

Sirs:

May I ask a question? What is "ham" radio coming to?

It would seem as if we are in a state of civil war among ourselves. We are so quick to call each other "lids" and other unnecessary names, all of which leads to where?

After all, it is my opinion that bad signals, such as key clicks, chirps and other evils, do not always come from the "lid", as we are often tempted to call the new amateur, but from the class A hams as well. I have heard them myself. So, let us respect each other to the extent that a barrier will not arise between the old timer and the newcomer. Let's keep the spirit of fraternalism that has so long been prominent in the circles of amateur radio from fading. It is the finest thing in amateur radio.

RAULINO SILVEIRA, W6OHB

•

"Not So Worse"

Champlin, Minn.

Sirs:

"QRM!" "What are the bands coming to?" "It's terrible!" "The ham bands are going to ——."

How often such petty peeves are expressed by hams from every direction. Some of you old timers, remember back six or even five years ago when supers were coming in and you had to have the bucks to buy them? Why there wasn't a band you could tune in on and not hear half the fellows taking up over 25 kc. on the band with signals that sounded like a cross

[*Continued on page 93*]

NEW BOOKS

AND REVIEWS OF CATALOGS

TELEVISION CYCLOPEDIA, A. T. Witts, A.M.I.E.E. Published by D. Van Nostrand Co., Inc., 250 Fourth Avenue, New York, 152 pages; illustrated; $2.25 in U.S.A.

A comprehensive though concise treatment of all the terms commonly encountered in television work. The author does not stop with a discussion of only the electrical terms used in the field; television optics, chemistry, and photography are thoroughly covered under the various headings in which they fall. This book is not a mere compilation of a number of definitions; the writer has attempted to make it as complete as possible though the matter under each heading has been limited to a maximum of two pages.

This book should be a valuable aid to anyone interested in the technical side of the new art, and it should be found a worthwhile addition to the reference library of all persons connected with the field.

•

A GUIDE TO AMATEUR RADIO; editor, John Clarricoats, G6CL. Published by The Radio Society of Great Britain, 53 Victoria Street, London, S. W. 1, England. 162 pages, adequately illustrated; price 9d. postpaid anywhere.

A complete handbook on amateur radio, similar to the RADIO and A.R.R.L. handbooks as published in this country, although considerably smaller in editorial content. The entire field is covered after an outline similar to the ones used in the above mentioned books, the main difference being that the subject is discussed from the European standpoint. A quite comprehensive chapter is devoted to television from the modern standpoint, iconoscope image dissection, cathode ray reproduction, etc., and another chapter to the useful data and formulae that may be used in amateur radio work.

A number of transmitters and receivers are described that use American tubes or can easily be adapted to use them. Directional antennas for both transmitting and receiving are comprehensively treated in the chapter devoted to antennas.

The book is a thoroughly worthwhile work and should prove of great interest to the American amateur who is interested in amateur radio from the British point of view.

•

"Hamanual", the newest catalog of the Standard Transformer Corporation, will be available from Stancor and from your favorite parts supply house about the first of October. It is a combination amateur catalog and construction manual and contains 16 new and tested transmitter designs covering a power range from 5 watts to one kw. The booklet also contains information on the revised and improved line of transformers produced by Stancor. The catalog may be obtained by writing to 850 Blackhawk St., Chicago, Ill.

•

The Jefferson Electric Company, Bellwood, Ill., announces a new catalog, No. 371-MT, which contains illustrations and descriptions of the company's line of ferro-tube mercury contacts. In addition to the new catalog, a bulletin is now available in which a generalized discussion of the fundamental principles of the Jefferson automatic biasing system for class "B" modulation is included. The bulletin is complete with all necessary circuit diagrams and instructions.

•

The release of its new 1938 catalog has been announced by the Allied Radio Corporation, 833 W. Jackson Blvd., Chicago, Ill. The catalog contains complete individual descriptions of each of the corporation's various products, and is conveniently arranged so as to facilitate locating of any particular article or section.

•

The recently announced 1938 catalog of the Supreme Instruments Corporation, Greenwood, Miss., contains eight pages of illustrations and discussions of the features of the corporation's set testers, analyzers, signal generators, multimeters, frequency modulators, and cathode ray oscilloscopes. In addition to descriptions of the various instruments, a page of testimonials from several prominent radio houses is included.

Question Box

Can you explain to me the relationship and the differences between the peak, r.m.s., effective, and average values of current or voltage in an alternating current wave?

The peak value of a wave also can be called the maximum or crest value; it is the maximum value of current or voltage reached at either the most negative or most positive crest of the cycle. It is rather difficult to measure the peak values of an a.c. cycle; an oscilloscope, vacuum tube voltmeter, or some other type of an extremely high resistance peak voltmeter usually is used.

The r.m.s. (root-mean-square) or effective value of the wave is just what would be indicated by the term "effective" as compared with a d.c. voltage or current of the same magnitude. It is commonly called the heating value of the a.c. wave. If the waveform considered follows the simple sine law $e = E_{max} \sin \omega t$, the r.m.s. value of the wave will be equal to 0.707 times the peak value. An ordinary a.c. voltmeter or ammeter indicates in r.m.s. values.

The average value of a complete cycle of either alternating current or voltage of sine-wave form is zero. However, the average of either the positive or negative half cycle is equal to 0.636 times the peak value of that cycle. The average value of either voltage or current will be indicated by a d.c. voltmeter when operating in a pulsating d.c. circuit

I am experiencing serious trouble with a back-wave from my transmitter. I have tried to track it down but so far have not been successful. What are some of the likely causes and how can they be eliminated?

The existence of a back-wave on a transmitted signal simply means that power is being transmitted when the key is up as well as when it is down. If the difficulty is approached from this angle, the trouble may be more easily ascertained and corrected.

Obviously, if all stages of the transmitter are being

[*Continued on page 83*]

28 Mc. Phone Band IS SHIFTED

Acting on the suggestion of the A.R.R.L., the F.C.C. is shifting that part of the 28 Mc. band allocated for phone from the old assignment of 28,000 kc.—28,500 kc. to 28,500—30,000 kc. In other words, the phone and c.w. portions of the 28 Mc. band will be shifted with respect to each other (provided no objections are filed with the Commission in the prescribed manner).

"*It is ordered,* that Rule 376 of the Rules and Regulations of the Federal Communications Commission be and the same is hereby repealed and the following substituted in lieu thereof:

> 376. Frequency bands for telephony.—The following bands of frequencies are allocated for use by amateur stations using radio telephony, type A-3 emission: 1,800 to 2,000 kilocycles. 56,000 to 60,000 kilocycles. 28,500 to 30,000 kilocycles. 400,000 to 401,000 kilocycles. "

No other change was made in the class B phone privileges; class A assignments remain as before. This revision in the 28 Mc. allocation tentatively became effective September 17, 1937.

New Crystals

The crystal manufacturers will undoubtedly become very happy over the change as no phone crystal now in use will be usable in the new band. Some of the gang, however, will have c.w. crystals whose harmonics will fall in the band. Crystals in the high frequency half of the 20 meter c.w. band (14,250 to 14,400) and crystals from 7125 to 7300 will fall in the lower frequency portions of the new phone band. A number of 80 meter c.w. crystals also will be usable.

To be of assistance to the hams that contemplate the purchase of a new crystal for operation in the band, the following chart will indicate the more important sub-harmonics of the upper and lower frequency limits.

3,562.5	to	3,750
4,750	"	5,000
7,125	"	7,500
9,500	"	10,000
14,250	"	15,000
28,500	"	30,000

The chart is self explanatory with the exception of the 6th and 3rd subharmonic regions just below 5000 and 10,000 kc. These frequencies are shown to indicate the feasibility of using frequency triplers to arrive in the 28 Mc. band. Inasmuch as the crystals will not, in a majority of cases, be usable in any other ham band, they may as well be ground to some frequency that will allow tripling instead of quadrupling. The increase in output of a tripler as compared to a quadrupler makes its use highly desirable in this case. Also, two tubes in push-pull make a very convenient and quite efficient arrangement since the harmonic outputs of the two tubes are added in the output circuit. A high power push-pull amplifier will operate quite efficiently as a push-pull *tripler* from some frequency in the vicinity of 10,000 kc.

Another suggestion: whenever possible use an AT or some other type of low-drift cut crystal. Just a small change on the fundamental will produce quite a large variation in frequency when multiplied down to 30 Mc. Low drift crystals are now available up to 10,000 kc. One of these would fit in admirably with a tripler as suggested.

◆

Humless Speech on Car Transmitter

Inasmuch as four amateurs have written in about the same trouble in the last three months, perhaps dozens are having the same difficulty.

It is regarding the use of the same 6 volt car battery to supply both vibrator power supply and microphone voltage. The vibrator imposes on the battery an intermittent load, which, due to the resistance of the connecting wires and internal resistance of the battery, causes a small amount of a.c. at the vibrator frequency to be superimposed on the 6 volts fed to the mike. Although this a.c. component is very small, it is enough to cause quite a bad hum on the carrier after it is stepped up by the mike transformer and amplified by the speech system.

The cure is simple. Either use a separate battery for microphone voltage, or resort to the filtering arrangement incorporated in the small 7½ watt emergency phone transmitter described elsewhere in this issue. The choke should have very low d.c. resistance or the voltage reaching the mike will be low. A single button mike of the telephone variety pulls considerable current at 6 volts, a good reason for utilizing the car battery for mike voltage where this much voltage is required.

56 Mc.

[*Continued from page 66*]

being identified. The band closed at 7:25. Reception of a W1 by a W6 might ordinarily be expected to take place via the high F_2 layer, but in this instance may have been due to several hops via the low sporadic E layer which was known to exist over the eastern part of the country.

On May 16, W5EHM opened his dx season by working four stations in Ohio, commencing at 7:15 p. m. Central time: W8KAY, W8ANN, W8IZJ, and bootleg B4UR. Signals were QSA5 R6 to 9 both ways. He also logged W8QUH, W8WPU (not yet issued), W8NYD (2½ watt mobile transmitter), W9ERL, W8TCR (not yet issued but heard calling W9ERL), and a call sounding like W9TCY. The band closed down for him at 9:10. He was heard by W9ZJB in Kansas City at 7:45 p. m.; also by W9SKE in Indiana, W8NYD and Louis Barker, Jr., in Ohio. At that time, Pat was using a super-regenerative receiver, 76 detector with 76 and 42 audio stages. The antenna was a vertical half wave with a reflector and director. A diamond antenna was also tried with an apparent reduction in fading. The transmitter used a pair of '10's driving a pair of T20's with 150 watts input, feeding a vertical J antenna. Later, the receiver was changed to 6C5G detector, 6C5 and 6F6 audio with some improvement. W8KAY, the first dx station worked, was putting 40 watts into a 6L6 doubler biased to 400 volts with a 0.1 megohm leak; he reports that on ten meters only one station was coming through (and that in Dallas) while "five" was open.

Things were so quiet until the 23d when W5EHM raised W9LVK in Kenosha, Wisconsin, at 11:55 a. m. with R8 reports both ways. He also heard W9CLH testing on phone and calling CQ on i.c.w. at 11:30 and 12:05. Four reports were received from Detroit timed 12:30 p. m. W9ZJB in Kansas City says that the band was open for him from 9 a. m. to 1 p. m., with many 10 and 20 meter phone and code harmonics causing interference. Two calls, W8EGR (mail returned from callbook address) and W8CXG were logged calling VE3ADO. W9ZD heard a number of W2, W3 and W8 stations but received a verification only from W3AXR, who was R7 to 9 at about 10:30 a. m. VE3ADO fading R2 to 9 was heard by Paul Behning in Tulsa, Oklahoma, at 2:45 p. m. according to W8IPD and 12:07 Central time according to QST; W8OPO and W8CXG were also heard. At around noon Central time, Bill Martin, Jr., W3GLV, using a regenerative (not super) 1-10 receiver heard harmonics of W9YRX and W9UWV, as well as the i.c.w. five meter signal of W9WAL. The 10 meter fundamentals of the above were also audible.

On the very next day, May 24, W5EHM worked W9LVK again, adding W9MIK and W9HPP of Chicago, all close to noon. W9LVK was R9 plus. W9MIK was putting 22 watts into a single 45 ultra-audion oscillator, doing his receiving on an inside antenna. W8QMF in Newaygo, Michigan, using a four foot indoor antenna, heard W5EHM R5 during these contacts, using a four tube super-regenerative receiver. W8QMG also logged him at about 1:45 p. m. Eastern time. At the time only W5 and W9 districts were coming through in Michigan on ten meters, sugegsting that the sporadic E layer was largely localized in the Mississippi Valley states.

At 9:42 a. m. on the 25th, W6OFU heard signals on the band, called CQ but raised no one and rushed off to work without logging any calls. On the 30th, W5EHM shifted to "five" during a ten meter contact with W6OFU, got a QSA5 R9 report at 1:45 p. m. Central time, and had a half hour duplex contact. At this time, 28 Mc. signals from El Paso and W6's in Arizona, were getting into Dallas.

June

The only report for June 12 is the reception of W8OPO in Kent, Ohio, by W1JQA at 11:07 to 11:58 a. m. Eastern time, confirmed at both ends. W8OPO was testing and putting an R8 to 9 signal into Randolph, Mass., but no contact resulted. W8OPO puts 40 watts into a modulated 210 oscillator.

Patterson was at it again on the 13th, working W8OPO twice, W8ANN for the second time, and W8HCL of Warren, Ohio, who (according to W8HAR) promptly gave up his theories on weather conditions. Signals were again R8 to 9 for over an hour following 12:25 p. m. W8PVR and W8IZO were heard.

The band opened both morning and evening on the 14th. W8GJM in Pittsburgh heard W5EHM R8 at 11:45 a. m. and 12:10 p. m. Eastern time. "Pat" worked W8LHU and W8OQJ, both in Ohio, at 10:15 and 10:25 p. m. Central time with R7 to 8 reports. He also heard W9FP in Chicago at 8:25 during a local QSO with W9GPR and was heard in Ohio and Wisconsin. The band opened up in Dallas on the 15th between 8:30 and 11:00 p. m. during a local electrical storm which prevented identifying any calls.

Al Porter of W1ESI gives us a single report for June 19. He heard W8DAL of Cincinnati QSA4 R5 at 8:30 p. m.

The biggest day in Dallas was June 27 when W5EHM worked 22 stations out of 24 fundamentals logged among the 50 or 75 stations coming through between 11:35 a. m. and 1:40 p. m. During this time the skip was short on ten meters also. The calls heard were W8IZO and W8QGU on "five" and a harmonic of W8ANO. Those worked were:

W8HAR; W8OQE; W8QYY; W8YBF; W8QXO; W8KAY; W8BGX; W8NJE; W8QDD; W8OPO; W8IQW; W8GU; W8VB; W8LZN; W8AZZ; W9ZMG; W9ZHM; W9UUG; W8QMF; W9SO; W9YMG; W9ZTU.

Most of these have been confirmed but one call is not yet issued and mail addressed to W9UUG has been returned from the Kansas address. These stations are located in Pennsylvania, Ohio, Michigan, Wisconsin and Illinois. Eleven QSL cards were received from these states plus Indiana and New York. The farthest QSL was from Donald Buck of N. Tonawanda, N. Y. The band was apparently open over a large area, for W9ZMG reported hearing W1DZE, W1IYE, and W4BGE (Atlanta, Georgia) at 10:30 a. m. W9SO in Milwaukee was also heard by W. H. Simcox in Tulsa, Oklahoma, at 2:07 p. m. W8VB in Michigan called W5DYH

[*Continued on page 75*]

10-Meter Phone Receiver

[*Continued from Page 38*]

3000 kc. below or above the desired 28 Mc. point. 3000 kc. is twice our intermediate frequency, and by noting repeat spots we can make some pretty fair approximations as to just where 28 Mc. should come in on both dials.

Shifting Frequency

As we have once or twice explained, this job is primarily a single band receiver. Be that as it may, the use of the plug-in coils does permit a change to other than the 28 Mc. band if and when conditions require it. With an i.f. of 1500 kc., twenty-meter operation will be quite satisfactory, especially in view of the fact that two r.f. stages are employed to raise the level of the signal before mixing. There is no good reason, for that matter, why the set-up as given will not work out well for 80-meter phone communication with the proper coils substituted for those presently employed.

Grand Island

[*Continued from Page 41*]

Ten persons, appointed by selection from the civil service list of eligibles, operate the central monitoring station. In addition, we are informed, a group of three to six horticulturists and landscape attendants are seasonably engaged in the maintenance of the landscaped section about the station buildings covering an area the size of several city blocks.

The writer is indebted to Mr. Benjamin Wolf, inspector in charge of the Central Monitoring Station, who furnished considerable information concerning the institution together with the photographs used in this article and who answered many questions with a great deal of patience.

In addition to the Central Monitoring Station, the Federal Communications Commission also maintains smaller monitoring stations at other points throughout the country.

Dx

[*Continued from Page 63*]

and PK1VX 14,130 T9x. W9KJQ and W9WDU of Grand Island, Nebraska (Boy oh boy, where have I heard of that place before????) reports that in a QSO with CR7AP in Mozambique he asked that all hams send their QSL cards via the R.E.P. Lisbon, Portugal. CR7AP's frequency was 14,4[illegible] kc. W6LOY worked ZU6P on 28 Mc. fone around the middle of July and from all reports that was the first ZU heard on 10 for some time.

W6MHH says that W6MEN has left San Pedro for Jugoslavia and is taking along a bunch of radio gear. Will probably be on over there anytime now signing . . . possibly YT6MEN or YU6MEN. As for W6MHH, he is having a heck of a time getting cards from the zones that he needs . . . W8NBK has 25 zones and 46 countries . . . Keat Crockett, W9ALV, is still using his p.p. tens and has worked 38 zones and 101 countries. Some of the better stuff includes TF5C, VR4AD, XU8XQ, XU8FK, VP3BG, J6DP, VP2LA, FP8PX, J7CR, U6AN, U6SE, YI2BA, PK1RI, PK3LC, PK6HR, CT2BO, PK3WI, PK4KO, PK4MK and PK1HP.

[*Continued on Page 90*]

56 Mc.

[*Continued from Page 73*]

just after working Patterson, and mentions having heard stations in Erie, Pennsylvania; Atlanta, Georgia; and Chicago on the same date, though not giving us the times and calls heard. W9YMG in Milwaukee received a report that W2JXE heard him R7 to 8 at 1:15 p. m. Eastern daylight time. W9YMG was putting 26 watts into a pair of 45's. While trying to raise Patterson, W8QMF heard two W9's but was too excited over the better dx to log the calls; at the same time, W1, W3, W4 and W5 stations were coming through on ten meters but when W5EHM went to 28 Mc. he couldn't be heard until evening, though the W9 he was talking with was coming through. W8KAY says that ten meter signals from Kansas City and Omaha were coming through while "five" was open. W5DYH in Dallas also worked a number of stations around noon.

Pat found the band open again in the evening at eight o'clock, hearing W9SO in Milwaukee again during a local QSO and W8PDV R8 while testing. After five minutes Pat called it a day with 22 stations worked.

Without making any contacts, Patterson on June 30 logged the calls W9VAP, W9VPS and W9DRK, all R7 to 9, in five minutes following 8:15 p.m. He received a card from Earl Walker of Chicago reporting his signals at 9:05 (Chicago was on daylight saving time so this may have been ten minutes before the above reports).

July

W8VB in Detroit says that he and W5DYH have often heard each other. They managed a ten minute contact on July 3 at 6:40 p.m. Eastern time. W8VB faded from R9 to R2, then W5DYH faded completely out. W8VB uses a 6K7 electron coupled detector, 6C6 separate quench oscillator and 6F6 audio stage. His transmitter uses a pair of 2A3's, 46 watts input, with an "organ pipe" grid circuit.

On the 4th at 8:50 p.m. W5EHM logged a phone apparently signing W8MED. This same station was heard at 11:30 p.m. on the 6th. W9SLF in Milwaukee was worked at 12:40 p.m. on the 11th, peak signal strength R9 both ways. W9ELH (W9CLH?) and W9PKB were heard.

On the 13th, a new district was worked to bring Pat's total to five. During a 28 Mc. contact he asked W4EDD of Coral Gables, Florida, who uses a 1-10 receiver, to listen on 56 Mc. and he continued the contact on "five" getting an R6 to 7 report. This was at six p.m. It was overheard at only R4 by W8KAY. At 7:50, W4AKA in Clearwater, Florida, was raised, both ends on five meters.

Next day, the 14th, Pat worked three Wisconsin stations just after six o'clock: W9YMG, W9NRP and W9RH. Up until 7:50 he heard five meter signals of W9YGZ, W8NJE, W9PQH, and harmonics of W8NYU, W9IJX and W9AGS (Omaha). Cards were received from four Akron, Ohio, stations all timed between 6:20 and 7:20 p.m. Central time. W9YMG during his contact was heard R8 by W1HXE, and shortly thereafter he heard W2JAX in Schenectady. At 7 o'clock Charles Baily and Bruce Long of Tulsa, Oklahoma, heard W9LFT operating W9ZMG in Chicago, while calling a W3.

At 6:45 p.m. on the 15th, W5EHM logged W9UBC, the only report for this day.

W1KHO in New Hampshire reported hearing W9CLH R8 to 9 at 8 p.m. July 19 on a one tube super-regenerative receiver. W1HXE heard W9DMI R8 at 9 o'clock Eastern daylight time, mentioning that the call might be bootleg. In spite of the good strength, we have received no other reports of five meter dx that day. But we may not hear about all of it!

On the 20th, W5EHM reports a station signing W9LSX at 9:00 p.m., and an N.B.C. station signing W2XCH on about 53 Mc. with an R9 plus signal. The latter was heard at the same time on the 27th, though no amateur signals came through on 56 Mc. On the same date, the 27th, W9ZJB in Kansas City heard a W8 whose call sounded like W8CWH (also heard by W9AHZ), from 7 to 7:30 p.m. during which time he signed only once. Then W5FHT in Beaumont, Texas, came through R7, audible again around 9:15 when he was heard to say, "OK, W5FHT back. Your name is Al Burgess in Edwardsville, N.Y. Please QSL. W5FHT by for confirmation." W5FHT was heard again R4 the next evening, July 28, at 7:17 p.m.

August

On August 5th at 9:30 p.m. W1ESI heard an R3 signal from Ohio signing a W8 call and apparently ending in a W. Just after midnight the same night, W1JPM heard W8GHA in Battle Creek, Michigan, and W8BHJ in Parma, Ohio, both R4. These calls rhyme so well that they may be the same station! W8BHJ called CQ on "five" that night, though mail for W8GHA was returned to us.

W9CLH in Elgin conducted some tests with a number of Michigan stations for about a week, then worked W8CVQ in Kalamazoo on the 9th, no doubt via low-atmosphere bending of the Ross Hull variety. This QSO was overheard by W5EHM R9 though off the nose of the beams, and W8CVQ contacted W5EHM at 9:25 p.m. Eastern time. The latter's signals had a peculiar hollow effect and were only R5. W8QUF of Delton, Michigan, was hearing Pat and six W1's, so W8CVQ called CQ with his beam still 15° south of west. W8QUF heard a station on 59 Mc. answering. W1SS in Arlington, Mass., was worked, his signals reaching R9 plus on swells. When the beam was turned around to the east, he faded out. W1KBM at Quincy answered a CQ with R7 to 8 signals and a rapid fade. W8CVQ was then called by W1JNX and several others who were not identified. W8CVR in Marshall, Michigan, also reported hearing a number of first district stations until 10:45.

On the same night, W5EHM called W8QMF in Newaygo, Michigan, on 28 Mc. to say that the band was open to that district. The latter heard Pat on 56 Mc. at 9:12 Eastern time. Several other dx signals were heard but they didn't sign.

After hearing W8CVQ on the 9th, W1JQA in Randolph, Mass., heard a station reported to be in El Paso, Texas, as apparently signing W5F?H that replied to a W1 after a long CQ. Both W5FOH and W5FSH are in El Paso, but neither has been on five meters.

Brewster says, "Those long CQ's sure do burn me up when they announce their call every fifteen CQ's!" W1HXE overheard both ends of the W9CLH-W8CVQ contact but reported the latter as W8PDQ! He says that he has heard numerous W8 and W9 calls in the past but figured they were bootleg. As well as working W8CVQ, W1KBM heard W9CLH, and W8TUX (not yet issued) in Michigan, but says that the band was open for him only about 20 minutes at 11:25 p.m. Eastern daylight time. W8EHM and several weak unidentified W1 and W2 stations were reported heard in Chicago.

As we close for our deadline, W9WLX of Ft. Thomas, Ky., writes that he was heard on August 11 at 11:20 p.m. by "W9SWL" in Beloit, Wisconsin. This call is issued in St. Paul, so possibly it is from an "S.W.L." who prints his card this way.

Foreign Work

A fairly large scale 56 Mc. test was run on May

1 and 2. G2HG says that it was not productive of anything unless the unmodulated carrier on about 56.500 heard by F8JG was dx. However, W2HXD called us and said that he and W2JCY heard between 12:55 and 1 p.m. Eastern daylight time a long call that faded down on every occasional sign, but it was a G2, apparently with an F in the call. The signal was heard again on the 2nd.

On May 17, G6DH heard dx signals up to 52 Mc. at 0900 G.m.t. YL2CD heard G6DH R 5 at 0805 on June 3. G2KI said that on June 11 he heard commercial harmonics up to 56 Mc. from 2200 B.s.t. onward, then heard a CQ in the band that faded before the station signed. The band was being "churned up" with various signals appearing for a fraction of a second. At 2320 he heard a CQ on about 57 Mc., then on 57.3 Mc. heard an OH station call CQ but bad fading prevented identifications. On the 20th, G2MV heard F8JT call CQ at 2115.

G6DH heard many commercial harmonics above 40 Mc. during July. The more important items appear to be these: IBD and IBT on 48 and 49 Mc. on the 4th, together with a modulated carrier on 56.5 Mc. and a 1000 cycle carrier believed to be I1IRA. On the 6th and 15th, an a.c. carrier was heard on 50 Mc. Carriers and commercials were heard on the 17th up to 49 Mc., with R9 plus signals from the Berlin television on 42 and 44 Mc. On the 18th a tone modulated code station was heard R7 on 61 Mc., the highest frequency yet heard; I1TKM on 58 Mc. was heard R2 for about 2 minutes. Commercials up to 48 Mc. were heard on the 20th.

W2HXD, who has moved to Chicago, has given us some of the data on reports he and W2JCY have had on 56 Mc. transatlantic transmission. Because the log book was not at hand, the exact data was not

[Continued on Page 79]

5 and 10 Meter Exciter

[*Continued from Page 20*]

screen modulation still may be obtained by supplying the screen voltage through a dropping resistor from the high side of the secondary of the modulation transformer. A 10,000 or 15,000 ohm 20 watt resistor will be satisfactory; this resistor should *not* be by-passed. This system is less satisfactory than the tapped transformer method as there is quite a sizeable loss in audio power.

For operation of the unit on the 56 Mc. band, the plates of the RK-39's must be connected in push-push instead of push-pull. This change-over may be accomplished by means of a switch, or better, by means of additional paralleling connections on the 56 Mc. coil. The small diagram alongside the complete circuit schematic illustrates the method of connection for this coil. When the 5-meter coil is inserted, the plates of the two RK's are paralleled and connected to one side and the other side goes to plate voltage. A .002 μfd. by-pass condenser is attached to the B plus lead of the coil and should be connected to a ground on the tank condenser. The 56 Mc. coil is also wound of no. 8 bare wire; it is 1" in diameter, 1" long, and has 7 turns.

Compact 500 Watt H. F. Amplifier

[*Continued from Page 50*]

there is must be done correctly (as we found out by experience). The top plates of the neutralizing condensers must be connected to the stator lug directly above them; if this is not done, the full plate-to-plate r.f. swing appears across the smaller porcelain insulators of the neutralizing condensers. The insulators will break down under this voltage; however, if the connections are made as described instead of cross connected, no trouble will be experienced.

Almost any tubes with the plate out the top and the grid out the side or bottom may be used in this amplifier. If 808's, 35-T's, or similarly short tubes are used, the plate connections should be made as shown, to the bottom of the tuning condenser. However, if longer tubes such as T-125's, 100-TH's, etc., are employed in the amplifier, the plate connection can best be made to the lugs at the top of the tuning condenser. The grid connections in either case would be made to the bottom plates of the neutralizing condensers and to the grid tuning circuit.

Several different tube combinations have been tried; all have neutralized perfectly and operated very efficiently on the bands from 14 Mc. on up. At present a pair of 35T's are being used with 500 watts input on 14 and 28 Mc. phone.

56 Mc.

[*Continued from Page 77*]

available, but we shall review as much of it as possible.

Some time ago we reported the reception of G5BY by W2HXD on December 27, 1936. One or both G5BY and G6DH were heard on the subsequent two Sundays, and also on February 21 and 28. The reception of G6DH was at 7 a.m. Eastern time on the 21st, and 10 a.m. for G5BY. Nothing more was heard until the May reports mentioned above.

We are told that W2JCY has 14 reports from Great Britain on reception of his five meter signals between August 9, 1936 and June 14, 1937. We do not have details other than those published in RADIO for June.

Comments

Outstanding in the letters we have received about 56 Mc. dx is the suggestion that all stations sign their calls more often and more clearly. This should be true not only during a CQ but also in local work which may happen to be just as loud 1000 miles away. One misleading practice on this and other phone bands is the use of the names of cities and stations in making the call letters clear. When the signal is weak or fading, that practice complicates distinguishing between the call and the location. Why not use the Western Union or the Navy method. It is easier to say, "William Nine Fox Mike" than to say, "W 9 F Florida M Maine."

As to equipment used by stations doing dx work, we feel unable to comply with the request for de-

[*Continued on Page 84*]

A Forward Reading "R" Meter

[*Continued from Page 54*]

sistance of the tubes whose grids are controlled by the a.v.c. system. R_1 and R_3 may be one watt carbon resistors and R_2 a volume control potentiometer. R_2 provides a method of setting the meter on zero for changing plate voltages or ageing tubes and can be arranged for occasional adjustment from the back of the chassis. The values indicated will serve in almost any receiver from five to twelve tubes. A 0 to 1 d.c. milliammeter shunted to let an R9 signal read about 0.6 milliamperes will serve nicely for the meter. The shunt resistor will vary with the particular receiver being used, but usually will be between 30 and 50 ohms, a value making the full scale reading of the meter actually two to three milliamperes.

As has been discussed before, there seems to be no standard for calibration of an "R" meter. Nearly all manufacturers have a different system. One uses an "R" scale with uniform 3 decibel divisions, while another uses "R" divisions quite unequally spaced. Until we have some standardization as to what an "R" unit should be, perhaps the best way to calibrate the meter is to set R9 as a signal rarely exceeded, and equal to a deflection of about six-tenths of full scale. Dividing the scale between zero and R9 into nine equally spaced divisions will give "R" units that sound and look quite well. One or two divisions beyond R9 will serve to give the other fellow with a real signal, an R9 plus on occasions when that seems necessary.

5 Meters—Altitude 6300 Feet

[*Continued from Page 53*]

rent were fed to the oscillator through a fifty foot cable. The oscillator portion of the transmitter was designed, built and adjusted by VE3ADO of Toronto, Canadian five-meter pioneer. He experimented with the spacing of the rods until he got the no-load plate current down to twelve mils with a 430 volt supply, which is something!

We contacted fifty-four stations, all in the first district. Such a variety of equipment! It seems that no two had exactly the same transmitter. Comparatively few used transmitting arrays. Most transmitting antennae were half wave verticals, many of which were on high towers and fed with every kind of transmission line. W1ZE uses two hundred feet of copper tubing concentric line. The RK-34 was the most popular 56 Mc. transmitting tube we encountered. However, 45, 71, 30, 806, T55, 35T, 354 and other types were much in evidence. The most popular receiver was the two tube super-regenerator, although a number of 1-10 receivers and Frank Jones 7 tube supers with resistance coupled i.f. stages were in use.

We are deeply grateful to Alexander McKenzie, W1BPI; Wendell Lees, W1FMG; John Dick, W1KAZ, and Aubrey Heustead, all of the Mt. Washington Observatory, and to Elliot Libby, manager of the Glen & Mt. Washington Stage Company, for their suggestions, assistance, and moral support. Without their coöperation, the expedition would have been impossible.

•

RADIO's list of stamp-collecting hams is enlarged by the addition of the following names. If you are philatelic-minded, send us your name and call.

George W. Manning, VK3XJ, Newstead St., Maribyrnong W. 3, Victoria, Australia.

Franklin H. Barnes, W7DTV, 5308 Admiral Way, Seattle, Wash.

A. H. Blevis, VE3IJ, 263 Fairlawn Ave., Toronto, Ont., Canada.

Marvin E. Lowe, W6NBF, 518 La Paloma Ave., Alhambra, Calif.

H. Norman Capen, W1IAQ, 22 Morse Ave., Norwood, Mass.

H. J. Hunt, G5HH, 29, Newcastle Road, Reading Berks., England.

J. A. W. Bate, G6WB, Lyneal Lodge, Ellesmere, Shropshire, Eng.

Incidentally, ZU1T writes that he collects stamps of the *British Empire* only.

Something About Volume Indicators

[*Continued from Page 56*]

method of obtaining the speech voltage. In this case a portion of the carrier is picked up, rectified, and the audio component fed to the v.i. meter. The tuned circuit, of course, is tuned to the operating frequency of the transmitter. The small antenna, A, can be a piece of wire in the vicinity of the transmitter lead-in or it can be a separate antenna so adjusted in length as to give about a half-scale deflection on the *carrier-shift* meter M. The resistor R_1 should be about 10,000 ohms. In other words, this much of the unit is a simple carrier shift meter. The audio voltage then is taken from this resistor R_1, the d.c. is isolated by C, and this voltage is impressed on the primary of the transformer or fed directly into the v.i. meter. If the v.i. meter has a full-scale reading of 0-1 ma. or less, no transformer will be needed. The value of the series resistor in this case probably will be somewhat smaller than with the previous arrangements. The correct value will be found to be from 5000 to 20,000 ohms.

The latter arrangement shown in "D" is very convenient for monitoring a transmitter that is some distance from the operating position. The carrier-shift meter gives a continuous check upon the carrier of the rig and the v.i. constantly monitors the audio. The rectifier tube can be one of almost any of the common types. It can be one designed for use as a rectifier such as the 1-V or 84; it can be a 30 with the grid and the plate paralleled and the filament operated from the battery; or it can be a 56, 6C5, 76, etc., with the filament operating from a transformer.

The Question Box

[*Continued from Page 69*]

keyed, no back-wave can exist. This is one sure way of curing the condition. The newer types of crystal oscillators, when used with an active crystal, will follow a "bug" at any speed you desire to send. They do, however, require the use of cutoff bias on all succeeding r.f. amplifiers.

If it is not feasible to key the crystal stage, the next best solution is to key the final and the buffer or doubler preceding it. This procedure will eliminate any r.f. coupling that may have existed from the final grid or the buffer plate circuit to the antenna. Primary keying, with both the buffer and the final running from the supply that is being keyed, fits in admirably in a case such as this.

However, if only the final is being keyed, especial precautions must be taken to insure that it is accurately neutralized and that no energy is being coupled from the grid circuit into the antenna. One excellent procedure when link coupling is employed from the buffer to the final, is to open the link circuit, with another relay or by another contact on the keying relay, at the same time that the plate voltage is removed from the final.

Why is it that the tank coil in an amplifier stage will heat most severely when the load has been removed; it would seem to me that the opposite would be true, that the coil would heat when it is carrying the power from the tubes to the antenna circuit.

The tank coil will heat the most when the circulating current flowing through it is the greatest. The effective *series* impedance of a tank circuit is lowest when no external load is coupled to it. Thus the circulating current is highest at this time. When a load is coupled to the amplifier, in effect it couples an additional impedance into the circuit. The circulating current becomes lower, and, due to the mutual impedance between the tank and the external circuit, power is transferred to the load circuit.

•

W3USA on the Air

In case any of you have heard W3USA on the air and have wondered where it was and what was the occasion, here's the answer: the Boy Scouts of America have been assigned the call for use at their jamboree in Washington, D. C. The transmitter, a one k.w. affair, was loaned by the United States Coast Guard for use during the occasion. More than 1000 messages were handled to and from the convening Scouts during the affair.

56 Mc.

[*Continued from Page 79*]

scriptions due to the wide variety. Most transmitters are still self-excited, using 210's, 45's or 2A3's singly or push-pull. Most receivers are still super-regenerative, with or without separate quench tube and controls; a few straight regenerative receivers and super-heterodynes are being used, which have the advantage of being able to pick out weak carriers and unmodulated c.w. W5EHM says that he has ordered five meter coils for his HRO, such as are being used successfully by W2JCY according to the news that reaches us.

Antennas are generally simple and not as likely to be high, or high-gain beams, as in the case of the 100-300 mile work. Transmission over low hills has been found possible for the longer distance work, but W6OFU, who is located against a mountainside with an angle of about 24 degrees above the horizontal, through the pass at the lowest point, says that no 56 nor 28 Mc. signals from the west, south, or north-west have been heard, and that 14 Mc. signals from the west are rare. This tends to confirm the idea that 56 Mc. dx travels at about 3 to 10 degrees from horizontal, and even with 14 Mc., seldom above 20 degrees.

W8QMF, who is confined to his room, is arranging a very slow motor drive for his receiver so that it can constantly tune over the band without more than subconscious attention on his part. He is calling CQ regularly on both five and ten meters by hand, while W9SO has been putting an automatically keyed signal on 56 Mc. flat.

Next summer, it will be a help if more 56 Mc. stations west of the Mississippi and in the south and southeastern states join in the 56 Mc. dx work.

Reports Desired

We are anxious to obtain as complete a record as possible of 56 Mc. reports for distances of perhaps 400 miles and beyond. We hope to check these with the ionosphere records of the National Bureau of Standards in order to demonstrate conclusively that the transmission over such long distances is via the ionosphere. Then it may be possible to arrive at some conclusions as to when this dx is possible, and about how often it can be expected to occur. We shall probably find that such transmission has been possible over some path much more often than it has actually been reported.

The National Bureau of Standards writes us as follows:

"The reason we requested reports of transmission on 56 Mc. the year round and 28 Mc. during the summer is that we observe no regularly ionized layer capable of supporting these transmissions at these times. However, there are certain sporadic conditions especially during the summer which would account for such transmissions, and we should like to compare the long-distance transmissions at these frequencies with the sporadic conditions of the ionosphere. The advantages of amateur reports are the large number of aggregate hours of observation and the widespread geographical distribution. The 28 Mc. transmissions are regularly propagated by the F_2 layer during the winter at this part of the sun-spot cycle and regular observations of these transmissions may easily be obtained by us."

The above will emphasize the importance of complete and accurate reports. Mention of a few contacts on five meters may be interesting for its news value, but something of scientific value can be accomplished during the period up to the supposed sun-spot maximum in 1939 and possibly a few years beyond if the data is properly assembled.

The comment made by W1HXE about having heard W8 and W9 stations before but thinking them bootleg, is quite interesting. All such reception should be reported and verification attempted. Bootleg operation should not be tolerated, and such unlicensed stations should be informed of the misleading data that might result from illegal use of a call actually or supposedly licensed elsewhere.

What Next?

The summer work apparently involved contacts over various distances between 400 and 1100 miles except for the 100 to 300 mile low-atmosphere-bending communication. Taking the distance between Chicago and Boston as roughly 800 miles, we calculate that zero angle radiation would require an ionosphere layer at 21 miles or 34 kilometers for one-hop transmission. The fact that it is one-hop transmission is usually apparent in that Ohio and Pennsylvania stations are not at the same time heard by the W9 and W1 stations. In order to obtain required E layer heights of from 100 to 300 kilometers, one must assume radiation at an angle of about 7° above the horizontal, which seems in line with expectations.

This suggests that 56 Mc. antennas should concentrate their radiation at angles of around 3° to 10°, which can be done by stacking antennas one above another and feeding them in phase. This gives gain without horizontal directivity. There is likely to be little difference between horizontal and vertical antennas, we believe, as indicated by commercial experiments and the use of horizontals on the R.C.A. high-frequency link and the Empire State television antenna. W9CLH and VE3ADO use horizontals and are successful both over 50 and 500 mile or longer paths.

High antennas appear generally useful, though a number of stations in valleys have participated in the long distance work this summer even though they are unable to work stations a few miles away at any time due to intervening hills. High antennas have "nuls", due to ground reflections, which could occur at exactly the angle at which the signal is arriving and thus occasionally explain why someone doesn't hear the dx known to be coming through. Having a second antenna available will enable one to check on this possibility.

Present Theory

We are astonished to find at this date a widespread lack of ideas on the theory of five meter transmission beyond the horizon. Even QST for August, 1937 states: "The information is invaluable, not only to let the rest of the gang know what is happening, but because it may lead to some correlation with conditions on other frequencies." At the risk of boring with repetition, we shall summarize comments along this line made in RADIO and *R/9* during the past several years.

Transmission out to a maximum distance of 100 to 300 miles appears to be reasonably consistent if the lower atmosphere is favorable to bending. This, as far as we know, involves no skip within the maximum range unless caused by shadows. It seems hardly necessary to correlate it with conditions on other bands though it might be noticed in the form of long "ground waves" on 28 Mc. We understand that it occurs mainly in the late evening and early morning, more often in summer than winter.

Next comes ionosphere work. The National Bureau of Standards has checked a number of cases of 600 to 800 mile dx on five meters and feels reasonably certain that it is due to ionosphere reflections from the E region when ionization is particularly heavy. This is what we mean by "Sporadic E layer." The layer height is usually 100 to 130 kilometers. The sporadic condition usually occurs in the late morning or around noon, and also in the evening. It is noted that practically all of the 800 mile dx has taken place at these local times for the midpoint of the path. This sporadic condition occurs more often in summer than winter, and is more intense in the active period of the 11-year sunspot cycle. The correlation between 800 mile work and the presence of a sporadic E layer is almost perfect, as far as it has been checked, but this work is not complete. We believe that the sporadic E layer is considered unpredictable at present by ionosphere workers except that its probability of occurence follows the rules outlined above. We can expect more 56 Mc. dx work of this type over the next several years. Incidentally, sporadic E layer reflection seems to produce the worst fading.

The sporadic E layer is not generally world-wide, but is somewhat localized geographically. Two-hop transmission may have occurred but is the exception. Transmission distances for one hop via this layer are limited to a maximum distance determined by the lowest effective vertical angle of radiation, and at the maximum by the ability of the layer to reflect a ray of slightly higher angle, for a given layer height. The band over which reception is possible may be only a few score miles deep, though it may be as broad as several states and may move so as to include new areas to the north (or south) and to the west of the station, over a period of two hours or so.

This sporadic condition will of course control lower frequency transmission as well. Records show that often 56 Mc. and 28 Mc. signals come through at one point, but it is the closer edge (just outside the "skip") of the band of reception on the higher frequency, and the farther edge for the lower frequency. When 14 Mc. is open for 300 miles, 28 Mc. is usually open in the same direction at perhaps 600 miles. When "five" is open 800 miles, ten meters is usually open from there in to perhaps 500 miles or closer, while "twenty" may be good at 250 miles.

It remains necessary to explain the transatlantic and transcontinental signals. These are via the higher F or F_2 layer on the lower frequencies, and apparently also on five meters. The distance for one hop may be much longer. The condition is normal and two or three hop transmission may be experienced. The layer favors higher frequency work in the half year centered on December, while sporadic E work favors the half centered on June. Winter communication is most likely when it is early afternoon at the midpoint of the path—a fact well known on ten meters—assuming F_2 layer transmissions. Almost everyone expects Europeans to come through on "ten" in the morning in winter, and Aussies and J's in the evening. Somewhat later times are found in summer—if any east-west transmission takes place.

North-south contacts can usually be accomplished on higher frequencies than east-west work, with but little seasonal effect over long distances.

The F_2 layer type of transmission will depend upon the critical frequency, which is likely to be high over the next several years (at the daily maximum), and which must be high enough to bend down 56 Mc. waves if any really long distance contacts are to be completed.

We have tabulated the dates between May 14 and August 11 on which five meter dx in the U.S. has been reported to us, in order to present a picture of conditions. The most significant concentrations appear to be on week-ends in May and June—when more stations were likely to be active—and during the several days around the 14th of each month. The moon was at its first quarter at that time, not full. More likely, if there is some correlation, it will be found in a comparison with magnetic activity or solar rotation and radiation.

	May	June	July	August
1				
2				
3			3	
4			4	
5				5
6			6	
7				
8				
9				
10				
11			11	11
12		12		
13		13	13	
14	14	14	14	
15	15	15	15	
16	16			
17			17	
18				
19		19	19	
20			20	
21				
22				
23	23			
24	24			
25	25			
26				
27		27	27	
28			28	
29				
30	30	30		

We wish to express our appreciation of the help of the following in obtaining and verifying this material:

G2HG; G2YL; VE3ADO; VE3AP; W1ESI; W1GUY; W1HXE; W1IUQ; W1IXA; W1JIS; W1JPM; W1JQA; W1JQJ; W1JRN; W1KBM; W1VL; W3GLV; W3RL; W4EDD; W5EHM; W5FCH; W6GEI; W6OFU; W8BHJ; W8CVQ; W8HAR; W8IPD; W8KAY; W8NJE; W8OPO; W8QDD; W8QMF; W8QXO; W8VB; W9CLH; W9MIK; W9PPB; W9SO; W9UAQ; W9VHR; W9WLX; W9YMG; W9YSV; W9ZD; W9ZJB; W9ZMG; Buck, N. Tonawanda, N.Y.; Simcox, Tulsa, Okla.

Dx

[*Continued from Page 74*]

Just a little explanation of the station of Mrs. "Lu" Mida, W9LW, shown on page 16. To the right of Lu is the big c.w. rig using two 250T's with a kw. and switching to all bands. The lineup is 6L6, RK20, 203A, 250T's. On the left is a small 350 watt c.w. and phone rig whose lineup is 6A6, RK25, RK25, p.p. RK20's. This transmitter can be used on all bands by changing coils. Lu was somewhat limited for space so the equipment had to be laid out quite carefully as you can see in the picture. W9LW plays a lot of golf and from what I can gather is quite a whizz at it. However, she generally finds time to keep up with her brasspounding and boy, I mean she really keeps up with the best of them. Lu likes to work W's as well as dx, and just to give you an idea she has 31 zones and 82 countries chalked up.

Another prominent yl op, or I should say xyl, is Dorothy Hall, W2IXY. The photograph on page 17 shows Dorothy with her dx hound and of course the radio equipment in the background is of little consequence. Ahem. Anyway, W2IXY is on 14 Mc. fone and has worked and verified 22 zones and 51 countries, and has not been on the air a year yet. She is w.a.c. and WBE, getting her w.a.c. last December, and up to the present time has made w.a.c. 26 times which is really something for phone.

W9ARA has 27 zones on phone to his credit and one queer thing regarding his record is that in spite of the 45,000 points he scored in the phone contest he not once heard an Asiatic station, although he contacted a dozen PK and KA phone stations.

W8ASI comes to the rescue with the info on XOH2FJ mentioned in July RADIO. It is a Finnish oil tanker M/S *Josefina Thorden* and the operator was Goran Moliis . . . QRA: Mustio Station, Finland. W8ASI recently worked YI2BA, FB8AD, and ON4DIT (where is he?) . . . W1ZB snagged VR4AD and VP2LB which makes him 102 countries now . . . The QRA of VR4AD is A. W. Dickes, The Treasury, Tulage, British Solomon Island.

W6DOB has a list of good ones that he has worked during July and August. Here they are . . . VP7NS 14,080 T9x; HC1PC 14,130 T9; VP6MR 14,345 T9; ZP2AC 14,360 T9; K6OJG 14,280 T9; HS1BJ 14,080 T9; VO8ARE 14,330 T7; PK6HR 14,360 T7; VP2CD 14,260 T9; VS8AA 14,425 T9; VS4JS 14,260 T6; FP8PX 14,300 T7; PJ2C 14,320 T9; VP5JB 14,360 T7; VS3AE 14,370 T9; J9PA 14,450 to 14,350 T7; VR4AD 174,040 T9; VR4OC 14,040 T9; YR5EV 14,000 T9; PK4MK 14,210 T9; VS6AO 14,350 T8.

VK4KC has been a government printer at Moresby, Papua, for 25 years. W7EJD gives this . . . W7BB still on the road for his firm . . . W7DL gets on now and then, golf and city lights take up most of his time . . . W7FD works the police outfit all day and dx-es all night . . . W7MB back in Seattle and is on sometimes . . . W7RT now a K7 at Good News Bay with 250 watts fone and c.w. . . . four bands . . . W7TD has fone bug . . . W7BL also on fone and looks for cards only, and dodges the BCL neighbors . . . W7EJD's shack is next door to his y.l.'s so only goes after dx when she says okey doke.

W8OQF has worked 35 zones and 89 countries. New ones for him are VU7FY, VE5AAY, VS7RF, K6OJG and VK4KC in Papua . . . W6JWT has hooked up with LY1J PK1RL, OK1CX, CX2AJ, ON4GK, G8CF, XZ2EH, ZS1AN, HS1BJ and a flock of others on 20 . . . W6KEV with 30 zones has connected CR7GF twice lately (around 14,450 kc., unsteady d.c.).

W6FHE uses a little rig with a single 6L6 with 15 watts input and has worked 30 European stations, and is w.a.c. . . . and now another QRP station, W6MHB, uses 40 watts into a ten and has hooked up with VR4AD, HS1BJ, ZS4U, ZU5AQ, K5AG, ZU5Q, ZS2P, ZS1AH and XU8XQ.

This is about as good a place as any for this ham humor and you can thank W6KW in San Diego . . . it's his donation.

"Hi"

W6QD once admitted that he had gotten across the hi-voltage of his rig . . . and landed in the middle of the next county! That's *one* time, sez W6KW, that QD had "amps in his pants!"

W6OBD, down San Diego way, suggests organizing a bunch of radio amateurs who are musicians into a "ham band." Sort of a "jam session" as it were, like "40."

W6ANU caught W6OAN shooting at his 6T5 (target tuning eye) with a BB-gun. ANU says paper targets are cheaper . . . more lasting!

And who was the XE1—heard on 20 meter fone like this: "'Alo . . . 'alo . . . 'alo . . . calling say koo . . . say koo . . . say koo . . . 'ere is de Mexican stayshone AXE . . . E . . . 1 . . ." And later, when no one answered him, same voice, same frequency, same accent, heard like this: "'Alo . . . 'alo . . . 'alo . . . calling say koo . . . say koo . . . say koo . . 'ere is de Awstraylyun stayshone . . . Vee Kye 2 —· —!" Cambio . . . Cambio!

"Ham" Shanks, W6BZE . . . recently located another amateur in Oceanside, California, named Bacon, and when they met, became close friends. Now both of them are looking for some amateur named Egges, so as to make the combination perfect!!

W9BBU is a new one to this column and starts off by shouting from Elgin, Ill., that he has 27 zones and 45 countries . . . on phone. Nice going, Blacky, and you just wait 'till I get the r.f. feedback outa my heap.

F3JD shoots a message through W2IXY that he made a w.a.c. on fone in 3 hours . . . July 29, 1937, and here are the stations, VU2CQ, HB9CB, W3EWW, PY2DK, CN8AJ (Oceania?). Failed to mention this last continent but guess it was an oversight.

OK2HX says his first QSO with USA was on 80 meters in January, 1935, and is lacking cards from two W3s. Then he goes on to say that if he sent all cards direct it would mean 9c a card or about $39.00 for the 412 cards he would have to send . . . and this would be quite an item for his check book. So he sends them through the regular channel but everyone will get one. OK2HX has 33 zones and 66 countries. He uses an SW3 receiver, and really goes out after dx in a big way.

56 Mc. Dx

Look what we've run into now. If it isn't ol' W7AMX himself on 5 meters. Now look what he's done . . . on July 4th at 2:40 p.m. p.s.t. he had a 5 meter fone QSO with W6EDN in Huntington Beach, Calif., which is 40 miles south of L. A. W7AMX is in Portland and the distance is roughly 1000 miles. He said their sigs would run from R9 to R0 in very fast fades. On that same afternoon he heard three other W6's but could not distinguish the letters in their calls . . . and on top of this he received a heard card from an SWL in Long Beach who heard him while QSO W6EDN. W7ERA and W7ABZ also in Portland heard W6EDN during the QSO. That really cross checks and Art wasn't taking any chances, Hi. That really is an accomplishment and even more so because of daylight. Art says that on June 7th, W7AQJ in Vancouver, Wash., had a 5 meter QSO with W6KBN in Long Beach at 8:05 p.m. This same SWL whose name is Louis White heard that one, too. The same night AQJ heard a W5 and a W9. July 24th W6KLN in Los Angeles heard W7AQJ. Going back again to July 4th in the afternoon W7FDJ in Houlton, Oregon, heard a W9 in Colorado working portable. W7ABZ was heard near Casper, Wyoming, and Denver, Colorado, about 8:30 p.m. on July 14th. Ol' W7AMX says he got more thrill out of hooking up with that W6EDN on July 4th than he did when he worked his first European on 28 Mc. for w.a.c. I don't blame him. Art is using an 80 meter Xtal in a 6L6G tritet quadrupler, 6L6G doubler, 211 buffer, and HK-354 doubler final with 160 watts input. For an antenna he was using a 200 foot end fed Hertz. The receiver was his 6 tube home-brew super. W7AQJ uses a pair of 45's and a 3 tube blooper, while W6EDN was using a pair of 45's self excited.

ON4AU is anxious for 56 Mc. contacts and will be on each Saturday and Sunday from October until February on the following times: Saturday, 1400 to 1700 g.m.t.; Sunday, 0900 to 1000 and 1400 to 1700 g.m.t. The frequency will be 56080 kc. Jacques says he is also on 14116 and 14400 kc. with his new rig using p.p. 804's in the final.

J3FJ is now using a W6DOB 56 Mc. super, running 50 watts xtal and is looking for 5 meter dx. So far he only hears a few J commercial harmonics.

A station bearing a little watching is W8GU in Erie, Pa., as they are using around 300 watts . . . crystal controlled of course, and for an antenna a four element beam is used. OM Bliley is the op and from all indications he is getting all fired up and getting back on the air again.

Assuming that there are a few readers left after wading through to this point I will begin my "well that's the dope on that" paragraph. It should be a scoop but we won't call it that . . . but W6CUH and the xyl have acquired a new dx nest in Hermosa Beach. It looks as though things will begin to happen soon, as he has lots of room for his antenna to get sunburned, and too, the dx cycles will start turning again. As for W6QD . . . and the W9 dx this summer . . . I work 'em, meet 'em in person and write about 'em . . . what more could ya want? These were here for a visit here this summer, and it was a pleasure to meet them . . . W9RFA, W9DTH, W9EKY, W9KEH, W9BPN, W9VLY, W9WRQ, W9SNO, W9AWP, W9BFH, W8OIZ, VE4PH and W8ZY. Karl, W8ZY, had quite a stay out in California and when he shoved off for home he was all fired up, with ideas for changing his station. Ye Gods, an Ohio kw. I guess. Well gang, get after some of those elusive ones, check up on those zones and fire in all the news you can scrape together. In the meantime I'll have one for you at the next convention and see you as usual next month.

•

The Eitel-McCullough Organization has recently made available constant current charts on the 100TH and the 250TH Eimac tubes. Amateurs desiring to obtain these charts on the late type tubes should write direct to Eitel-McCullough, Inc., at San Bruno, Calif.

•

W3BUI takes exception to the stray which made tattooed call letters non-existent. He has had his call tattooed in red and blue on his right forearm for a number of years. Furthermore, when he returned to the third call area after having served an enlistment as a W8, the old W3BUI was reassigned to him. Personally, we believe he was a lucky chap not to be wearing somebody else's call around.

PHOTO "CONTEST" IN "RADIO"

Nothing enhances a magazine as much as good photographs of interesting and varied subject matter. Unfortunately, photographically interesting radio items are rare, though they do exist. We keep a weather eye peeled for them around here, but must depend upon you for likely items from your neck of the woods.

Acceptable snapshots average a $2.50 payment; some run to $5.00; $1.00 is minimum.

Pictures which tell a story are especially good. Radio scenery and apparatus are in order. Many "personality shots" can be used as well as some larger portraits of prominent radio personalities and decorative feminine hams.

Open Forum

[Continued from Page 68]

between a buzz saw and a prehistoric spark gap. I never kicked. I can remember when over half my QSO's were ruined by chirpy or buzz saw notes. We didn't gripe. You listen now and hear a crystal note that doesn't absolutely sing with crystal virginity, and you write in and ask what's going to become of you!

Why, I used to spend half my time trying to get a power supply on a pair of tens that wouldn't make chirps, but I didn't run over and tell my neighbor what a low down skunk he was because his note didn't sound like an angel on a visit down here. I don't like an indecent note and no one should, but the griping some of you fellows do is uncalled for. Conditions have improved a thousand per cent.

W. B. GUIMONT, W9JID.

•

Still Out of Our Hands

Wilmington, N. C.

Sirs:

Upon reading Mr. G. H. Kraft's article in the June issue of RADIO headed, "Out of Our Hands," I could not wait till my hands were upon the typewriter. He says, "Most of us will admit that the unions have done much to help us."

I write this article because I don't want to see unionism weed its way into the sacred bounds of ham radio. Ham radio has always been, to me, something to take my mind off my work but if it is coming to where it will be cluttered up with any of the many *isms* that have been formed in this country today, I want out.

All that I hope for is that we don't let our ham bands become impregnated with any kind of *Ites* or *Isms* so long as we can help ourselves!

S. D. DUDLEY, W9YPJ.

INDEX TO ADVERTISERS

New RCA Tubes Listed

Three new transmitting tube types recently have been announced by RCA. All are small or medium power tubes and they should find wide application among the amateur fraternity.

1608

The first, the RCA-1608 probably will be the most interesting and widely applicable of the three. To describe the tube with reference to present types, it might be said that the tube is intermediate in power capabilities between the 46 and the 801. The tube is a triode and is primarily designed to give high output at comparatively low plate voltages. As an r.f. amplifier the tube is capable of about 27 (rated) watts output at all frequencies up to and including 45 Mc. This output is at an applied plate voltage of only 425 volts, easily obtainable from a receiving-type power supply. The tube has a ceramic base and fairly low interelectrode capacities, which make it very suitable for high-frequency use.

Two of these tubes also are well suited for use in a class B modulator. A pair of them, operating at 425 volts, are capable of an undistorted output of 50 (rated) watts with a driving power of only 2.2 watts, more rated output than a pair of 801's at less plate voltage and with less driving power. The tube, at present, is listed at just slightly more than the 801.

1609

The second, the RCA-1609, will be of little interest to the amateur fraternity. It is an amplifier pentode with a 1.1 volt 0.25 ampere filament. It was designed to act as a low level amplifier where freedom from microphonic disturbances is very important.

1610

The third, the RCA-1610, will be of more interest. It is a pentode designed for use as a crystal oscillator or frequency doubler. According to the listed characteristics the tube is almost interchangeable with the 47 both electrically and with respect to socket connections. It is, however, specifically designed for use as an oscillator or doubler and undoubtedly would give better and longer service than the older tube when operated at its maximum rating of 400 volts.

•

A news item blames the navy with the discovery that carrier pigeons are affected by radio waves.

•

A recent newspaper wedding photo was captioned, "With this *rig* I thee wed."

The Marketplace

(a) Commercial rate: 10c per word, cash with order; minimum, $1.00. Capitals: 13c per word. For consecutive advertising, 15% discount for 3d, 4th, and 5th insertions; 25% thereafter. Break in continuity restores full rate. Copy may be changed often as desired.

(b) Non-commercial rate: 5c per word, cash with order; minimum, 50c. Available only to licensed amateurs not trading for profit; our judgment as to character of advertisement must be accepted as final.

(c) Closing date (for classified forms only): 25th of month; e.g., forms for March issue, published in February, close January 25th.

(d) No display permitted except capitals.

(e) Used, reclaimed, defective, surplus, and like material must be so described.

(f) Ads not relating to radio or radiomen are acceptable but will be grouped separately.

(g) No commissions nor further discounts allowed. No proofs, free copies, nor reprints sent.

(h) Send all Marketplace ads direct to Los Angeles accompanied by remittance in full payable to the order of Radio, Ltd.

(i) We reserve the right to reject part or all of any ad without assigning reasons therefor. Rates and conditions are subject to change without notice.

BIDS WANTED on large quantity of receiving and transmitting equipment, technical books and magazines. Send me a stamp for list and make a bid. Also pair of RCA 852s. W. Cox, 2030 N. Pennsylvania Street, Indianapolis, Ind.

METER Repair—Accurate and dependable service. Standard types of meters repaired in 24 hours. Repairs priced so that anyone can afford them. Write for price quotations. Braden Engineering Company, 305 Park Drive, Dayton, Ohio.

STEEL shield cans, cabinets, racks, cases. Built to your dimensions. Prices reasonable. We have built hundreds of them. R. H. Lynch, 970 Camulos, Los Angeles, Calif.

QSL's—HIGHEST QUALITY—LOWEST PRICES. RADIO HEADQUARTERS, FORT WAYNE, INDIANA.

RADIO's classified ads brings results. Rates are low—only 5c a word for licensed amateurs not trading for profit. Commercial rate, 10c a word.

RADIO will pay you for acceptable articles about your pet antenna, amplifier, transmitter, or receiver. Write 7460 Beverly Blvd., Los Angeles, for details.

COMPLETE training for all Amateur and Professional Radio licenses. New York Wireless School, 1123 Broadway, New York.

RADIO Engineering, broadcasting, aviation and police radio, servicing, marine and Morse telegraphy taught thoroughly. All expenses low. Catalog free. Dodge's Institute, Polk Street, Valparaiso, Ind.

GET an R9 crystal in our new air gap holder near your frequency in 80 and 160-meter bands. $1.25. R9 Crystals, 338 Murray Ave., Arnold, Pa.

$89 cash—RME 69—Rack mounting, noise silencer. Five months from factory. W6NYB, Box 1512, Station D, Los Angeles.

BEST cash offer takes 1937 Super-Skyrider, complete with speaker and crystal. Former net price, $115. F. R. Gonsett, Box 3, 7460 Beverly Blvd., Los Angeles

---

GENERATORS 110 volt a.c., 500-watt, $20. 700-watt, $30. Want PR-16 cabinet. Leo Larkin, NDP, Federal Bldg., Sioux City, Ia.

SACRIFICE: Complete 150-watt fone or c.w. transmitter, standard rack type. First $150.00 takes it. Write or call W4BN, 23 N. W. 12 Ave., Miami, Fla.

CRYSTALS: Complete stock Eidson "T9", 40 and 80 meters, $1.60. Genuine X-cut, fully guaranteed. Ceramic holders, $1.10. Prices postpaid. Eidson's, Temple, Texas.

TRADE ham equipment for photographic equipment. Send details. F. R. Gonsett, Box 3, 7460 Beverly Blvd., Los Angeles.

VARIABLE Condenser Calibrated: Ten-point calibration against General Radio precision condenser. For limited time only $1.25. W8MYB, Kiamesha Lake, N. Y.

WANTED: SW receiver. Must be cheap. Write description. H. H. Clewett, San Dimas, Calif.

MUST sell 700 watt c.w., 100-watt fone, four-band switching, rack and panel xmitter, modulator and mike, ready to use. 80 m. xtal, 53, 53, RK23; pr. 801s; 150 T final, five pwr. supplies; 80 to 10 meters. change bands in 30 seconds. A buy. W6KEC, 1505 Drake Avenue, Burlingame, Calif.

AMATEUR FREQUENCY MEASUREMENT, $1.25 per measurement. Write for details. AIR RADIO, Municipal Airport, Chicago, Ill.

FOR SALE: Two phone transmitters and one 5 and 10 meter receiver built by Frank C. Jones for purpose of description in *1937 RADIO Handbook Supplement* and in *Amateur Telephony*. ***HK-154 push-pull grid modulated phone . . . complete with all tubes and coils for 75, 40, 20 and 10 meter bands . . . built-in power supply . . . no crystals or microphone . . . Price $135, f.o.b. Berkeley, Calif.
***800-watt phone transmitter . . . complete plate-modulated transmitter with heavy duty Inca power units . . . Eimac 100TH tubes in modulator and final r.f. amplifier . . . relay rack and separate metal housing for power supply . . . coils for 75, 20 and 10 meters . . . no crystals or microphone but otherwise complete with tubes, etc. . . . Price $350, f.o.b. Berkeley, Calif.
***5 and 10 meter superheterodyne . . . complete with new metal tubes and coils for 5 and 10 meter operation . . . metal cabinet, as illustrated in the *Supplement* . . . Price: $55, complete and ready to operate.
***Write to Frank C. Jones, 2037 Durant Avenue, Berkeley, California.

NEWEST QSL's-SWL's! Really different! Fritz, 203 Mason Avenue, Joliet, Illinois.

SELL or trade large oil-filled Westinghouse condensers, $12.00, weight 50 lbs., handles 3000 volts ok. W5KD, 215 West 19, Oklahoma City.

THE best QSL's are made by Keith LaBar, W6KX, 1123 North Bronson, Hollywood. Telephone: HOllywood 9220.

QSL's. 300 one-color cards, $1.00. Samples. 2143 Indiana Avenue, Columbus, Ohio.

OUR 75c crystals for 160 and 80 meters are fine. Letters of praise arrive daily. Faberadio, Sandwich, Illinois.

FOR SALE: C. B. oscilloscope and frequency modulated oscillator. Slightly used but in perfect condition. $95. W6FIO, Box 51, Armona, California.

SELL: Two 830-B's, like new, $5.00 each. W9OYF, Oswego, Kansas.

BUYER'S GUIDE

Where to Buy It

PARTS REQUIRED FOR BUILDING EQUIPMENT SHOWN IN THIS ISSUE

The parts listed are the components of the models built by the author or by "Radio's" Laboratory staff. Other parts of equal merit and equivalent electrical characteristics usually may be substituted without materially affecting the performance of the unit.

"MAYDAY"

Transmitter

R_1, R_2—Aerovox resistors
C_1—Hammarlund Star
C_2—Aerovox midget mica
C_3 — Aerovox MM25 25 μfd.
C_4, C_5 — Aerovox PBS 5 8-8 μfd.
C_6—Aerovox PB25 25 μfd.
CH_1, CH_2—Thordarson T-5752
Vibrapak—Mallory 552

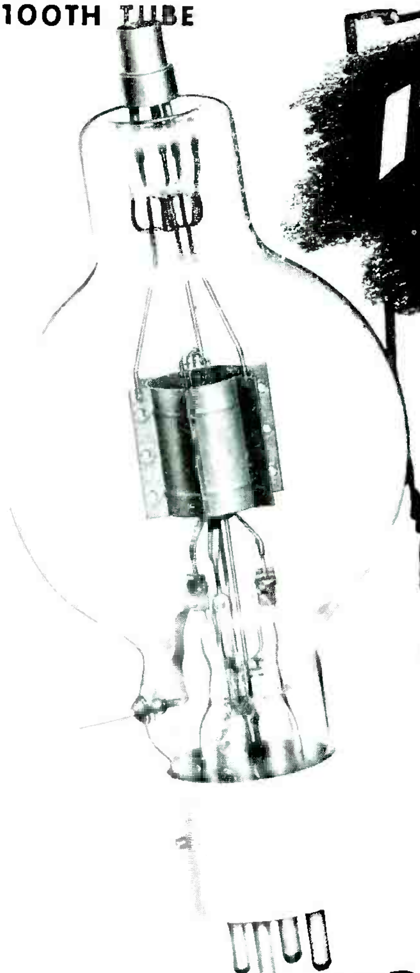
Receiver

C_1—Hammarlund MEX
C_2, C_3—Hammarlund Star Midgets
C_4,C_5—Aerovox 1467 mica
Resistors—Aerovox carbon
Bias cell—Mallory

ADAMS 28 Mc. RECEIVER

Resistors—Except as otherwise indicated, are Continental M-5 ½ watt insulated
R_{19}—Electrad C-250 with slider
R_3—Electrad 573 potentiometer
R_6—Electrad 205 potentiometer
R_{10}—Electrad 242 potentiometer
All 400 volt tubular condensers — Aerovox type 484; 600 volt, Aerovox 684
C_{36}, C_{37}, C_{38}—Aerovox GL5 8-8 μfd. electrolytics
C_5, C_{14}, C_{43}, C_{44}—Aerovox 1450 mica
C_3, C_4, C_{10}, C_{12}, C_{15}, C_{18}, C_{45}, C_{46}, C_{34}, C_{35}—Aerovox 1467 mica
C_{30}, C_{41}, C_{42} — Aerovox 1468 mica.
C_{50} — Aerovox PR25 25 μfd.
C_{52}—Aerovox PR5 4 μfd.
C_1, C_6, C_8, C_{13}, C_{16}, C_{40}—Hammarlund MEX trimmers
C_2, C_9, C_{17}—Hammarlund MC-20-S midget variables
C_{39} — Hammarlund HF-15 midget variable
$RFC_{1, 2, 6}$ — Hammarlund CH-X
$RFC_{3, 4, 5}$ — Hammarlund CH-10-S
$RFC_{7, 8}$ — Meissner 4656 filament chokes
I.F. transformers — Meissner, 1500 kc.; input, no. 8091; interstage, no. 8095; output (to diode) 8099
T_1 — Jefferson 463-361 power transformer
T_2—Jefferson 467-171 output transformer
CH_1 — Jefferson 466-200 choke
CH_2 — Jefferson 466-290 choke
Sockets and plugs — Amphenol
Coil forms—Hammarlund CF-M
Chassis—Hadley CB-105-B
Cabinet—Hadley RB-18
Power supply chassis — Hadley CB-84-B

THE EIMAC 100TH TUBE



IT'S A SECRET!

Some years ago a brilliant scientist achieved success in producing a perfect synthetic imitation of a hen's egg. The texture, color and chemical components of the white, yolk and shell were perfect. But the egg wouldn't hatch. The chemist could never know the hidden secret—the way to make an egg fertile, to give it that magic spark of life. Eimac Tubes (like the egg) cannot be duplicated.

OFTEN COPIED . . . *never duplicated*

No less than six manufacturers have tried in vain to duplicate their performance. They have copied the physical appearance of Eimac Tubes. Some are using tantalum, too, but not one can duplicate the Eimac application of this superior metal. The hidden values — the invisible features of Eimac Tubes are what give them the power to stand up under intense heat, carry an unusually heavy extra load and allow you to "sock" the ether waves with terrific jolts.

The success of Eimac is notable in the industry. Introduced only three years ago, thousands of "Hams" in every part of the United States and abroad, are enthusiastic users of Eimac Tubes. If a nearby distributor cannot supply you, write us for information.

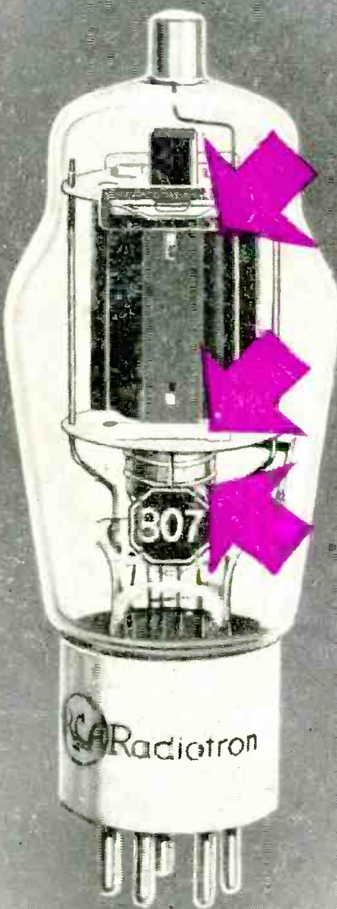
PLAY SAFE . . . INSIST ON

EIMAC TUBES

EITEL & McCULLOUGH, INC. • San Bruno, California

Now! An Even Greater

RCA-807



HIGHER RATINGS
IMPROVED PERFORMANCE
MORE OUTPUT

The maximum rated plate voltage is now increased to 600 volts for Class C telegraph service. This higher rating, made possible by a new electrode structure using ceramic insulation to isolate the plate, provides for a 50% greater input and an increasingly larger output.

New shielding gives greater stability and further lessens need for neutralization in those borderline cases. With the new 807, it is easier to avoid parasitics and self-oscillation.

These improvements in the RCA-807 are examples of the consistent RCA policy of improving existing tube types as well as introducing advanced new designs. The 807 is now an even better tube, yet the price remains the same . . . $3.90 amateur's net.

RCA *for Amateur Radio*

A Service of the Radio Corporation of America
RCA MANUFACTURING CO., INC., CAMDEN, N. J.