HOW TELEVISION TUBES ARE MADE

PAGE 32

RADIO NEWS

Cross-Country
BROADCAST
PAGE 6

A DeLuxe
KILOWATT TRANSMITTER
PAGE 46

MODERN SERVICE PROBLEMS
PAGE 39

WO-TUBE SUPER
PAGE 59

WEST COAST DX FLASHES
PAGE 54

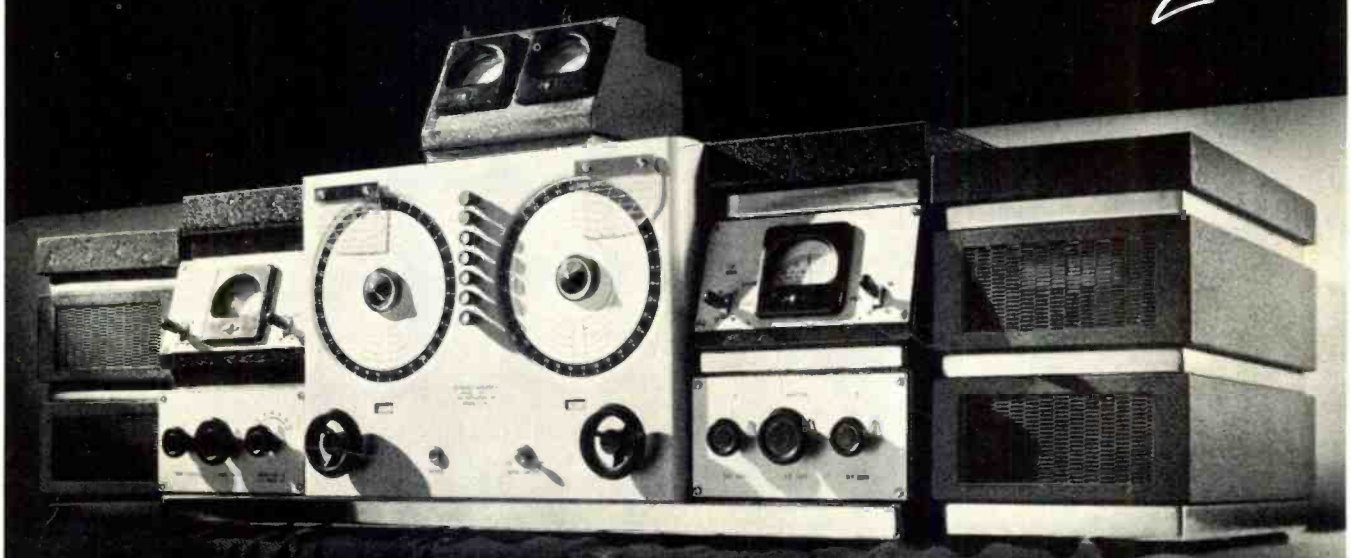
JULY, 25c

The "Beer Mug" Xmtr
SEE PAGE 44

diversity reception for the amateur

the skyrider Diversity

Model DD-1



A Dual Diversity Receiving System

Students of modern radio are familiar with diversity reception as used by the larger commercial stations. Receiving Systems based on the diversity principle have been built at great expense. Designed to provide better short wave reception, they have been highly successful in eliminating fading and have effected remarkable improvement in the quality of reception.

In an attempt to bring this same quality of reception in practical form to the amateur operator and short wave listener, Mr. James L. Lamb*, Mr. J. L. A. McLaughlin** and Mr. Karl W. Miles**, engineers notable for their activity in the amateur radio field, have made an intensive study of Diversity Reception.*** The SKYRIDER DIVERSITY represents the culmination of several years' work by these engineers. The principal advantages of Diversity Reception, as provided by this Dual Diversity Receiving System, may be summed up as follows: 1. The reduction of fading to negligible proportions. • 2. An Increase of Signal Strength over that of any single receiver. • 3. Improvement of Signal-to-Noise ratio over any single receiver. • 4. Reduction of heterodyne beat note interference.

The principles of functional design have been followed throughout the construction of the SKYRIDER DIVERSITY. Every single component has had especial attention from the designing engineers, and no expense or effort has been spared to bring the SKYRIDER DIVERSITY to a high standard of electrical and mechanical perfection worthy of so advanced a receiving system.

In the SKYRIDER DIVERSITY, the Hallicrafters offer the advantages of Diversity Reception to the amateur and short wave listener for the first time, in easily operable form, and at a price within reach of the average purse. See the New SKYRIDER DIVERSITY at your dealer's today!

* Technical Editor—QST ** the hallicrafters, inc. *** QST—May, 1936, QST—November, December, 1937

All Hallicrafters Receivers available at liberal Time Payments

the hallicrafters inc.

2603 INDIANA AVE., CHICAGO, U. S. A. • CABLE ADDRESS: "HALLICRAFT," CHICAGO

world's largest builders of amateur communications receivers

A FREE LESSON SHOWED BILL HOW HE COULD MAKE GOOD PAY IN RADIO

I will send you a Lesson on Radio Servicing Tips FREE

TO SHOW HOW PRACTICAL IT IS TO TRAIN AT HOME FOR

GOOD JOBS IN RADIO

J. E. SMITH
President
National Radio Institute
Established 1914

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

Do you want to make more money? I'm sure I can train you at home in your spare time for a good Radio Job and for opportunities coming in Television. I'll send you a sample lesson FREE. Examine it, read it, see for yourself how easy it is to understand even if you have no knowledge of Radio or Electricity.

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

Radio broadcasting stations employ engineers, operators, station managers and pay up to $5,000 a year. Spare time Radio set servicing pays as much as $200 to $500 a year. Full time Radio servicing jobs pay as much as $30, $50, $75 a week. Many Radio Experts operate their own full time or part time Radio sales and service businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, paying up to $6,000 a year. Radio operators on ships get good pay, see the world besides. Automobile, police, aviation, commercial Radio, and loud speaker systems offer good opportunities now and for the future. Television promises many good jobs soon. Men I trained have good jobs in these branches of Radio.

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

Almost every neighborhood needs a good spare time serviceman. The day you enroll I start sending you Extra Money Job Sheets. They show you how to do Radio repair jobs, how to cash in quickly. Throughout your training I send you plans and ideas that have made good spare time money—from $200 to $500 a year—for hundreds of fellows. I send you special Radio equipment, show you how to conduct experiments, build circuits illustrating important Radio principles. My training gives you practical Radio experience while learning.

I Also Give You a Professional Servicing Instrument

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

Get My Book on Radio and Television—Also Sample Lesson Free

In addition to my Sample Lesson, I will send you my 64-page Book, "Rich Rewards in Radio." Both are free to any fellow over 16 years old. My book points out Radio's spare time and full time opportunities and those coming in Television; tells about my Training in Radio and Television; shows my Money Back Agreement; shows you letters from men I trained, telling what they are doing, earning. Find out what Radio offers YOU! MAIL THE COUPON in an envelope, or paste it on a penny postcard—NOW!

J. E. Smith, Pres., National Radio Institute
Dept. 8GR Washington, D.C.

J. E. SMITH, President, Dept. 8GR
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligation, send me a sample lesson and your free book which points out spare time and full time Radio opportunities, and shows how I can train for them at home in spare time—about the N.R.I. Set Servicing Instrument you give. (Please write plainly.)

Name ..... *Age* .....

Address .....

City ..... *State* .....

14X-1

WE are in receipt of a great number of letters from our readers commending RADIO NEWS on its stand in current ARRL matters. We wish to make our position entirely clear. We are not opposed to the ARRL (as the American Radio Relay League is known), but we believe that there is plenty of room for improvement, and a general housecleaning, which should really be undertaken by this body itself. As far as we know, all attempts to have the ARRL clean its own house have failed, although we are unable to find out just exactly why.

As we see it, the ARRL is the property of the members who compose that association. They should have the complete say in its management and in the control of the funds which come to headquarters in the form of membership dues and subscriptions to their magazine. In spite of all attempts by various members to have explained to them the various items of the reoccurring accounts as filed quarterly, the officers have failed to give this information. Not only is this contrary to all tenets of good business, but it seems a rather unusual manner in which to run a radio club. We think it an entirely reasonable request that the officers and the American Radio Relay League be prepared at all reasonable times to reveal to the members what, exactly, is being done with their money. We think the members should be informed that if they are paying a certain amount for the printing of their magazine, that this is the *most reasonable* price which can be obtained commensurate with the job required. If certain officials are receiving certain salaries, that this is the *least salary* which could be paid to any other qualified person in a similar job. We are not prepared to say whether or not the figures as we have seen them were fair;—that is something for the membership to discover for itself, but we do think an entirely healthy condition would result if the members were informed of the fact that the prices paid for various parts of the production of the book, and the salaries of the officers, were the *very best obtainable under the circumstances.*

* * *

JUST wondering! Are all the ARRL directors licensed hams? We wonder!

* * *

WHY does a certain local midwest radio magazine feature so much stuff concerning a certain person who is professionally connected with the sale of radio, so that the greatest part of their book is made up of items concerning him only.

* * *

THE Chicago Area Radio Club Council in the April issue of *Harmonics*, their publication, set forth that they are in no sense of the word a dictatorial product. If this is true, we wonder why they are so anxious that every club which is a member of the Club Council should belong to the ARRL? It states further that "it in no way attempts to dictate policies or control in any manner the action or activities of any club. Its (the CARCC) actions are entirely governed by the vote of the delegates from the various affiliated clubs, and those *votes in turn are governed by your vote* on all matters which may come before the Council."

Oh, if this were only true! Strictly speaking, the Chicago Area Radio Club Council is in a fine position to promote amateur radio in and around Chicago. It has fallen somewhat short of this goal in permitting a number of clubs to become affiliated with it which do not even follow the accepted American form of self-government in drawing up their various constitutions. There are some of these which are associated with the Chicago Area Council which are founded on entirely un-American principles and run as much dictated to as any one of the foreign countries presently under a dictator.

RADIO NEWS CRASHES THROUGH!

Due directly to the heavy pressure by RADIO NEWS in bringing into national prominence the expected refusal of the ARRL Board of Directors to sponsor a National ARRL Chicago Convention, on May 13, 1938 the ARRL Board voted to amend the by-laws to authorize the holding of the National ARRL Convention in Chicago, Ill., on September 3rd to 5th. The vote was 14 to 2. Apparently the two votes mentioned in the June issue of RN were the only two who held out against the proposition. RADIO NEWS will always fight the amateurs' battles for them, fairly, honestly, and in the open. To R. H. G. Mathews, W9ZN, director from Chicago, our compliments on a grand fight well won!

* * *

HUSH-HUSH DEPARTMENT! What receiver manufacturer is bringing out a set based on such a new principle, with such advanced circuit refinements and conveniences that it will leave the ham fraternity "hanging on the ropes"?

Eddie Bergen and his Charlie McCarthy give the NEW RADIO NEWS a going over. How are you on the ARRL, Charlie?

And we do mean you, and *you,* and YOU! More about it here.

What amateur has a rig which his boss operates with the amateur's call, since the boss paid for the rig,—and even does the operating when the op is not around?

What amateur, now an official of a radio association, will shortly ask his ham bosses to raise his salary 100% in face of opposition to his present pay which many think too high?

* * *

The following new Q signals have been adopted by the Cairo Conference as being official:

QSZ—1 indicates fairly perceptible
QSA—2 weak
QSA—3 fairly good
QSA—4 good
QSA—5 very good
QRK—1 unreadable
QRK—2 readable occasionally
QRK—3 readable with difficulty
QRK—4 readable
QRK—5 perfectly readable

* * *

IT IS interesting to note that the radio telegraph conference in Cairo has changed the continental Morse Code so that a comma is now the exclamation point signal. No provision has been made for an exclamation point to be transmitted over radio in the future.

* * *

AS TO how our broadcasting friends are faring, Columbia Broadcasting System released a statement which showed that the April 1938 time sale was the second largest April volume sale in Columbia's history, and that it will bring that month's total to 12.8% above 1937. The actual figures involved for the first quarter of 1938 are $9,766,131 in 1937, against $11,018,777. The reason these are quoted here is to show those of the amateurs who think that the broadcast industry is easily disposed of, what they are up against. In its best days amateur radio has not averaged more than $4,000,000 a year, expended by the amateurs. This will certainly not make any showing against the $11,000,000 spent with one chain for a total period of four months.

* * *

HEIGHT OF SOMETHINGOROTHER DEPT. What two hams living across the street from each other are fighting it out on 1 KW each in the same band with "rubber xtals," so that neither has been able to hear anything for weeks and weeks? Hi!

* * *

A GREAT number of our readers have written in requesting information as to what is going to be done with the Sprayberry Lessons on Television. We wish definitely to assure these readers that these lessons will be reinstated and continued with the fall numbers. We believe that will be in keeping with the average reader's desire, as the more difficult instructional material should be limited to the cooler months.

* * *

IT IS of interest to every American that WCAU of Philadelphia has banned the playing of that "new and streamlined version" of *The Star Spangled Banner.* In a news release from that Station it

(*Continued on page 69*)

RADIO NEWS

JULY
1938

VOLUME 20
Number 1

The Magazine for the Radio Amateur, Experimenter, Serviceman & Dealer!

The Contents

Within Earshot of the Editor	4
The Life Stream of Broadcast Networks	6
Rural Wits from the Ozarks	9
The Coast Guard Stands By	10
DeMille's Radio Technique	12
Border Patrol	15
Landing Blind	16
Black Night	19
Personalities	20
Gag Men of Radio	22
Frequency Control	25
Screaming Meemies	27
The Commander Speaks Upstairs	29
Television by Resonance	31
How Television Tubes Are Made	32
Studio Briefs	34
Low Level Modulation Transmitter	35
Not For Rebroadcast	38
Modern Service Problems	39
Crystal Control on 56 MC	42
What's New in Radio	44
This Month's Cover	44
Ham Shack	45
DeLuxe Kilowatt Transmitter	46
The ABC of Antenna Design	49
Radio Gadgets	50
Low Power Transmitter	51
Short Wave Time Table	52
Short Wave Flashes	54
Serviceman's Experiences	55
A Compact P. A. Amplifier	56
How to Make a Pitchfork Antenna	58
A Two Tube Superhet Tuner	59
Something New in Radio	60
Special DX Programs	62
Questions & Answers	63
Letters to the Editor	64
Radio Physics Course	73

We believe that ham shacks make interesting pictures. Watch for one in full colors on the cover of next month's RADIO NEWS. Above view shows ham rig operated entirely from DC mains by use of genemotors.

PUBLISHED MONTHLY BY
ZIFF-DAVIS PUBLISHING COMPANY
at 608 So. Dearborn St., Chicago, Ill.
New York Office, 381 Fourth Ave., New York City
William B. Ziff, Publisher; B. G. Davis, Editor

Karl A. Kopetzky, W9QEA, Managing Editor
E. Stanton Brown, Associate Editor
Herman R. Bollin, Art Director

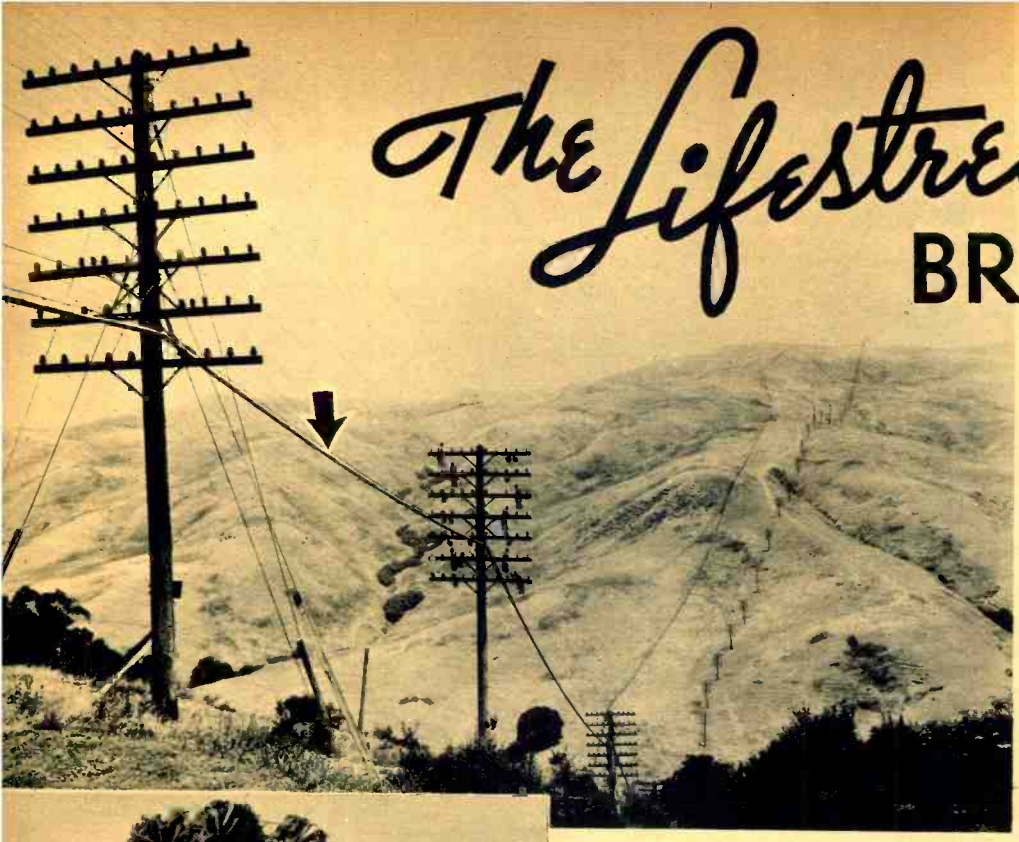
CONTRIBUTIONS: Contributors are advised to retain a copy of their manuscripts and illustrations and to include return postage. Contributions will be handled with reasonable care, but this magazine assumes no responsibility for their safety. Any copy accepted is subject to revision or changes to meet the requirements of this publication. Payment for manuscript and photographs will be made at our current rates. In making payment illustrations will be considered part of the manuscript unless otherwise specified. All manuscripts must be accompanied by return postage and self-addressed envelope in order for them to be returned if not found suitable for publication. If no return postage accompanies the manuscript, and it is found unsuitable, it will be destroyed. RADIO NEWS accepts no responsibility for lost manuscripts due to improper packaging or addressing.

SUBSCRIPTION RATES: $2.50 per year, single copies 25 cents; foreign postage $1.00 per year extra, except Canada. Entered as second-class matter March 9, 1938 at the Post Office, Chicago, Ill., under the act of March 3, 1879.

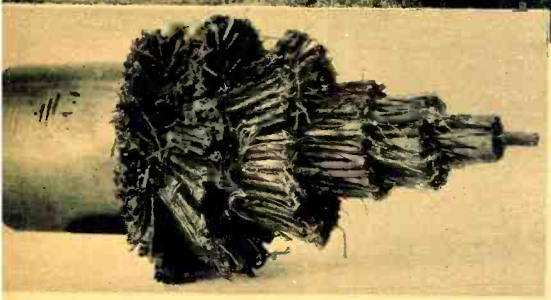
The Lifestream of BROADCAST

by ALFRED W. DAVIS

A coast-to-coast radio program is not all wireless. 90,000 miles of telephone wire are sometimes involved in bringing it to you.



Across Wildcat Canyon, Berkeley, Calif., swings the cable (arrow) which carries that Hollywood show to you in N. Y.



A portion of the lead sheath stripped away on the transcontinental cable. Some of the conductors are for radio use only; others for telephone purposes.

RADIO listeners in general do not know about, or give thought to, the great technical facilities which bring them their favorite programs with clock-like regularity. It is fairly safe to state that the public pictures little beyond the studio and microphones, in visualizing the wizardry that has made their radio entertainment possible. Without the "life stream," as these communication facilities can well be termed, broadcasting chains, or systems, could not exist. Our selection of programs in that event would be very definitely limited to the nearest local stations.

Lacking its present value as an advertising medium to reach millions of people with simultaneous programs originating in one studio, radio could never have grown into the giant industry it represents today. It is the *life stream* of the broadcasting net work service that meets the coverage needs of sponsored commercial programs, and brings down the production costs of this great advertising media to reasonable and profitable levels.

Stripped of technical verbiage, the life stream is a combination of radio science and telephone operations. The latter, with which we are concerned in revealing how our nation-wide programs are made possible, can best be described as representing a gigantic pipe line system covering the entire nation, through which electric impulses flow like a stream of water to individual broadcasting stations, and which like a water line can be turned on or off at will. This service of facilities for program transmission is furnished to the broadcasting companies by the "Long Lines Department" of the American Telephone and Telegraph Company.

The magnitude of this service becomes apparent when it is revealed that the company's investment in network service is well over $20,000,000, and that nearly a dozen basic networks regularly use 90,000 miles of wire, not including circuit mileage held in reserve for protection.

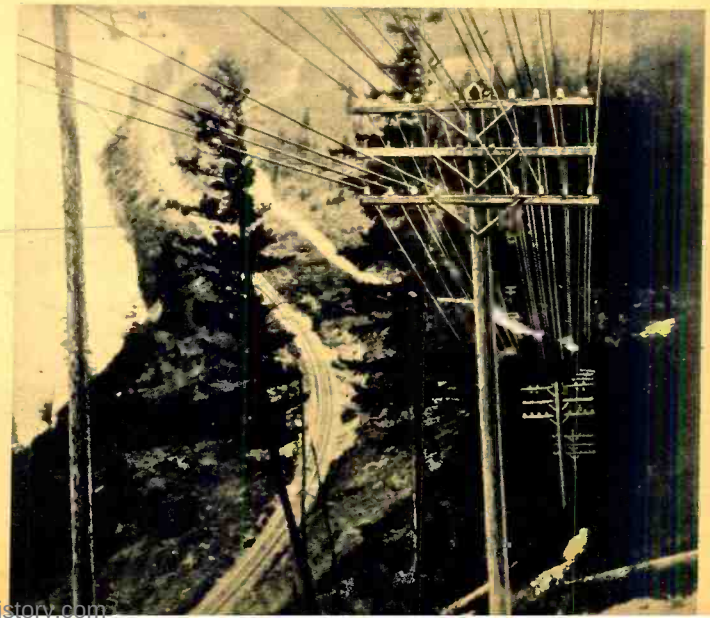
The radio program, a concert for example, is rehearsed and is finally ready for broadcast. The music is picked up by microphones in a New York City studio, converted to electrical impulses of audio (sound) frequency and is carried on wires to a nearby room. As it passes through certain equipment there, the broadcasting company's engineer adjusts these electrical impulses to a certain degree of loudness [This adjustment is in terms of power or DB. Ed.] before they enter the telephone cable. At that point begins the telephone company's responsibility for "express service."

Under the streets of New York the electrical impulses pass through the telephone cable downtown to the Long Distance Building at 32 Sixth Avenue. Here the General Control Office serves all the major networks. It receives complete daily program schedules from the broadcasting companies and relays them to a dozen telephone company control offices located throughout the nation.

When the concert has passed through this control room its journey has only begun. It goes simultaneously to broadcasting stations in New England, Canada, the West, and South, travelling along the wire pipe lines at a speed of 186,000 miles per second.

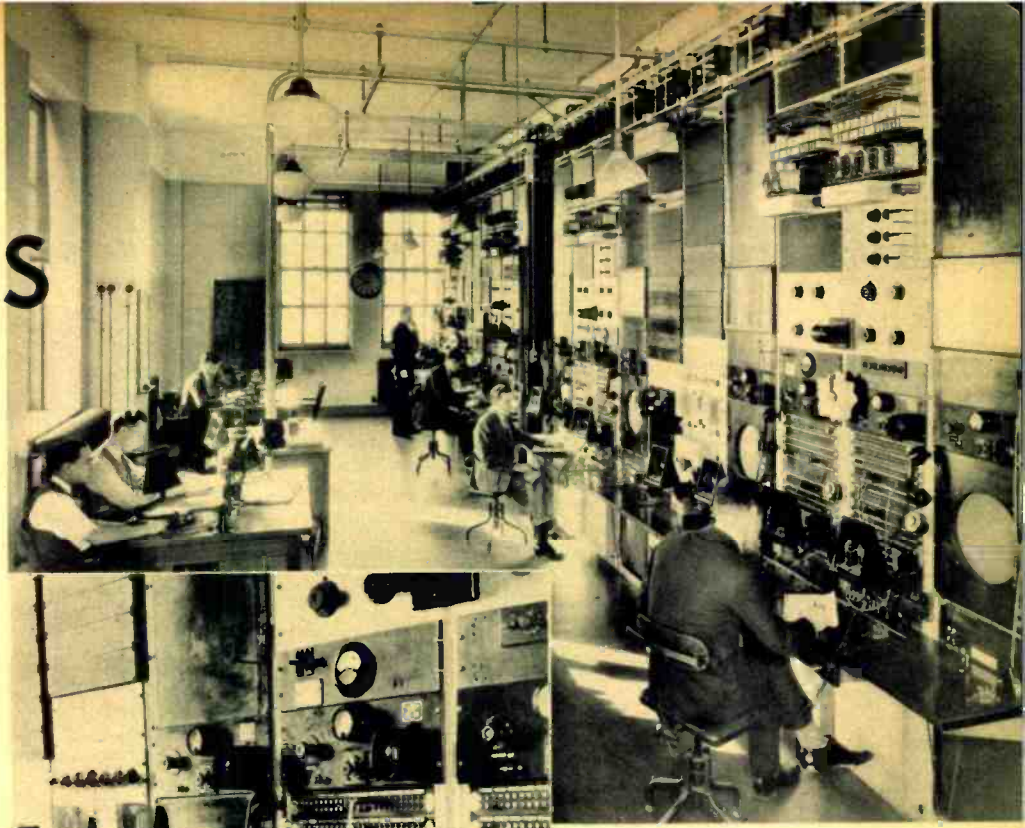
The electrical currents bearing sound waves have considerably more speed than strength. They become weaker the farther they go. At the same time the waves often become distorted due to a variety of intricate causes. When weakness and distortion happens to music, the notes coming from our loudspeaker give an effect of *fuzziness,* hollowness of tone, and other displeasing variations from the original presentation.

Consequently, at intervals of about fifty miles along the long distance cable routes, the program passes through telephone company offices which are equipped to amplify the *weak* electrical currents and send them along, invigorated and restored to exactly

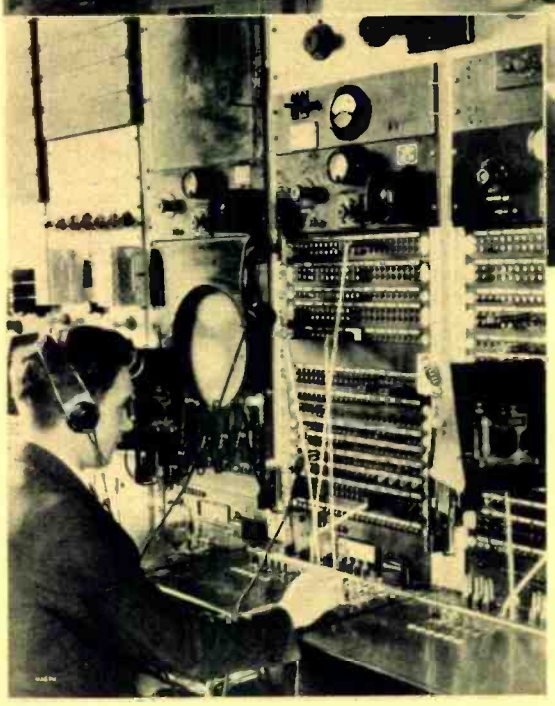


Clark River, Mont., section of the Minneapolis-Seattle link of Long Lines Department.

NETWORKS



(Above) General Control Office in New York City. View shows only the broadcast network equipment.



(Left) Control switchboard with monitoring operator. Morse instrument gives orders, while ear phones let him hear program transmitted.

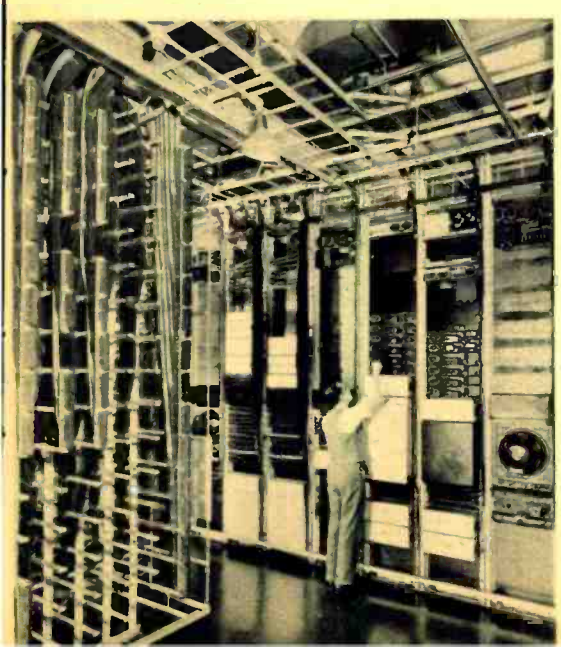
the strength and form they had when they left the studio.

At several points throughout the country there are control offices where equipment is installed to enable programs to be redistributed in various geographical directions over separate routes to still other radio stations.

In recent years it has become an increasing practice on the part of broadcasters toward supplying certain sections of the country with selected types of programs, largely those of commercial sponsorship. There is also a growing trend toward picking up programs from studios at widely scattered points by other studios. All this complexity of the time element and geographical separation of stations involves swift reversals of the networks, as to the flow of the sound waves, and number of tie-ups on the one hand, and on the other the quick shifting of group stations from one network (or section of network) to another at frequent intervals.

At Cleveland it may well happen that our particular program may be *turned off* on circuits serving six Midwest stations, because of local commercial broadcast commitments for the first half hour of the concert, but it may be *turned on* over these circuits for the last half hour as a sustaining program. In the case of a Southwest group the exact opposite may be the case, and they will put the first half hour of the concert on the air, and broadcast other programs during the last half hour period. The desires of both groups were of course known in advance, but the necessary switches and circuit arrangements must be made with split-second accuracy at the scheduled time.

Meanwhile technical men at Cleveland and other telephone offices concerned are on the alert for any possible impairment in service. They check by *listening in* over earphones, and are ready to switch to alternate routes always held available for any and all emergencies.



Rear view of panels in General Control Office in New York. At left is the interconnection frame; right, a speaker unit.

Most of the routes east of the Mississippi are carried in cables which afford security against weather and other hazards, thereby meeting a most important requirement in network service.

A long distance telephone cable incidentally is about the thickness of a wrist. Within its lead sheath are several hundred individual wires, each wrapped in wax paper to insulate it from the others. For radio program transmission purposes, since 1926, all such cables have been constructed to include several pairs of wires twice the size of those provided normally for telephone service. About 60,000 miles of such radio program wired-cable today serve the broadcasting companies. In addition there are many thousands of miles available for service when provided with amplifiers and other equipment.

In the vicinity of Omaha the program leaves the cables and proceeds over aerial wires supported by poles and cross arms. Ahead lay wide prairies, deserts, broad rivers, and high mountain ranges. Geography presents another problem to be solved by men, mechanisms, and money, before wire communication can be achieved.

Four different long distance telephone routes cross that part of the continent lying between the Mississippi Valley and the West Coast. *The Northern Transcontinental Line*, through Minneapolis, Fargo, Billings, and Spokane parallels the Canadian Border. *The Central Route* runs via Omaha, Denver, and Salt Lake City, to San Francisco. Near the Mexican Border, the *Southern Route* passes through Dallas, El Paso, Tucson, and Yuma on its way to Los Angeles. A few hundreds of miles north of it is a fourth path to Los Angeles through Oklahoma City, Amarillo, Albuquerque, and Whitewater, California.

All these routes carry broadcasting programs, as well as telephone conversations, and all are interconnected by North and South lines, making in combination a complicated pattern.

After a journey of more than 3,000 miles the concert reaches a California broadcasting station exactly as it left Radio City, N. Y. At the same time the West Coast station sends it out into the ether, it is also being broadcast by scores of other stations in the nation. Simultaneously, too,

The program order for one day sent to all telephone company offices from New York. It carries all network information for all services and is sent by teletype.

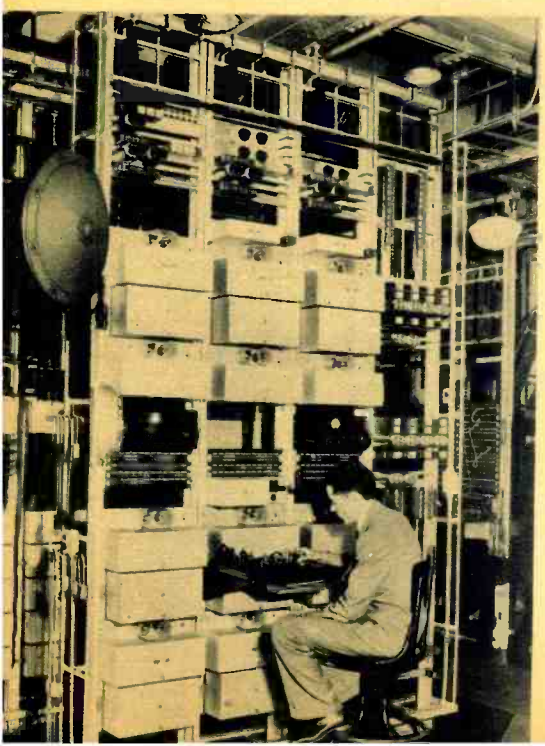
other programs on other networks are being delivered to more broadcasting stations without any appreciable loss in fidelity and tone.

To operate the circuits required for radio program transmission demands the specialized knowledge of hundreds of telephone employees. It requires that this manpower be stragetically located on a nation-wide front. Finally is demanded—both in spirit and in fact—the finest cooperation and coordination between all these individuals.

Today, in our so-called mechanized age, it is often difficult for us to visualize the human equation. For our present purpose perhaps an outline in tabloid of a typical network day will serve to reveal the human side involved in this piping.

Under normal operation the various networks are in service sixteen hours daily, from 8:00 a.m. to 12 midnight, with overtime for early morning programs, or after midnight dance music. However, the network day of the personnel is 24 hours in length, starting at 1:30 a.m. Preparation for the start of service for another day must be completed prior to 7:00 a.m., at which time, let us say, a program must be transmitted over network B to 9 stations located in New England, New York, Ohio, Pennsylvania, Ontario and the District of Columbia. Before the circuit line-up and routine testing can start, certain general maintenance work must be done. For example amplifier tube tests are to be made at all offices between New York and Chicago from 1:30 a.m. to 2:30 a.m., and the various networks have been released for that period.

The Danville, Illinois, repeater station. At regular intervals along the telephone wires, these stations restore the audio signal to its original studio strength.



When all such necessary preventive maintenance has been completed, each control office measures its section to be sure that the volume and fidelity of transmission is satisfactory. Similarly all the reserve transmission circuits in each section are tested by each control office.

This completed, New York transmits testing power at various tones or frequencies over the entire network. The terminals and specified intermediate offices measure the amount of received power. Adjustments may be needed.

During this midnight-to-morning period, each control office uses a teletypewriter circuit to report the service furnished, troubles experienced, and station comments for the preceeding day.

At 6:45 a.m. the New York studios are transmitting a test program for B network. During the next fifteen minutes, by means of a control telegraph wire, New York determines from each office feeding a radio station that satisfactory volume and quality is being received. At 7:00 a.m. the program begins *all o.k.* to each of the nine scheduled stations. Final arrangements are next made for the start of the day's service at 8:00 a.m. on the remainder of "B" network and the "A" network.

Every day the broadcasting companies' schedules of operations showing switching cues, and program priority, for the following day are sent to each switching office. From this, each office prepares its switching schedule. Further to insure no slip-up in program switches, or priority placements, and to provide information on any change that may be suddenly made in the day's program, one broadcasting company furnishes a schedule covering the next three hours of program over the teletypewriter circuit at the beginning of each successive three hour period. With both mediums of information secured in advance the telephone company is fortified to meet almost any situation that may arise.

Now let us follow through on some of the day's operations. At 8:00 a.m. *Morning Meditations* on network "A" starts the day, while during the same period, *Morning Melodies* is scheduled for the "B" network. Both programs, running for 30 minutes, and originating in New York. Since all the switching offices involved in handling both programs have had several hours to set-up the hookups to the individual stations broadcasting these programs, they receive no special attention.

But what happens at 8:30 a.m.? *International News* is scheduled for the entire "B" network over a nation-wide hook-up, coming from New York, while the "A" network with an equally wide distribution is carrying an *Organ Recital* program originating in Chicago.

At the close of the 8:00 a.m. programs, pre-advised word cues are transmitted over both networks, by two broadcast announcers from the New York studios. Switchmen at four telephone company offices—Cleveland, Washington, Cincinnati and Kansas City—are listening on each network for these cues. In this case the cues come simultaneously. The coordination of the two programs by the broadcaster is perfect.

As each switchman hears the cues, he notes the time to the second. They listen to the theme music following the closing announcement. It gradually fades. Twenty seconds after the cue they perform a switching operation which discontinues the former one-way, East-West routing of the programs on both net works. Next a second switching operation is performed by which the proper circuit connections are made to route both new programs, on one network flowing East-West, on the other West-East, direct to each station carrying these programs all over the country. All is ready for the programs to start. Now the switchmen stand-by for the opening announcements, for it still remains their duty to double-check that the switch has been properly executed.

And so it goes for each following fifteen minutes or half-hour-switching from one network to the other, realigning hookups, and coordinating all the wire facilities to the needs of the nation's broadcasting stations. So far the morning has been uneventful. But at 10:13 a.m., Cleveland flashes New York, "Network 'A' just failed." One man at New York aided by a telegraph wire, starts to locate the trouble, while another quickly substitutes a spare program circuit. Service is restored to all points west of Cleveland at 10:15:29 a.m.

Chicago at 11:15 a.m. is advised by Denver that freezing weather prevails on the *Central Transcontinental Route* around Truckee Pass, Nevada. Rain is turning to sleet, ice is forming on the wires. and the wind velocity is increasing. This word is passed on to New York. There may be trouble ahead, so notices are sent to offices along northern and southern transcontinental routes (routes which will not be affected by the severe weather) to be ready to line up program circuits at short notice.

At 11:18 a.m. from a broadcaster's control room comes an emergency message stating that a flash political news story has just broken of great national importance, and service is desired to put it on the air from the Washington studio at 11:30 a.m. Every switching point involved is telegraphed this information and instructions at once. Promptly at 11:30 all the stations of the country on this chain receive this program satisfactorly, but by a slim margin, and at least ten telephone men in seven widely separated cities have worked with speed and perfect coordination to set up the required circuits.

(*Continued on page* 75)

Rural Wits FROM THE OZARKS

by AUBREY RODMAN

Hot Springs, Ark., is responsible for the two lovable characters known to millions as Lum and Abner. Their homely philosophy has become a national indulgence.

Dressed in the costumes they depict, Chester Lauck and Norris Goff have made Lum and Abner lifelike in every detail. Their broadcasts have truly been "Party wire" stuff.

A STRANGE sight would have greeted the eyes of anyone entering the board of directors' room of the Quaker Oats Company on a Summer morning of 1931. On one side of the room you would have found all the staid and dignified business men, who were directors of the company, seated with their faces to the wall. On the other side you would have seen two young men talking hill billy dialect to a broom handle!

That was the turning point in the career of the two boys who have become famous in radioland as Lum and Abner, the Ozark hill billy philosophers. The boys, Chester Lauck and Norris Goff, had gone to Chicago for their vacation. They had been doing their Lum and Abner show down at Radio Station KTHS, Hot Springs, Arkansas.

While they were in Chicago they decided they'd make a try at big time radio. So they went over to the National Broadcasting Company studios in the Merchandise Mart for an audition. They didn't know much about auditions but they'd heard others speak of such things and so they guessed they'd try one, too.

The boys really look like this, and it is difficult to conceive two such as these having the insight into the rather old men they characterize on their air show.

And so to NBC where they met Sen Kaney. In Sen's office they watched and listened while he tuned in auditions from the various studios. Singers, both men and women, speakers, announcers, sports reporters, newscasters — the whole gamut passed through that loudspeaker in a parade of aspiring young talent. They noticed that Sen would listen only to a minute or two of each person and then turn back to continue talking to them.

Finally they got their chance. Sen promised to listen. So they got up before the microphone without a script, without anything in fact except their deft young minds and a long memory of childhoods spent in a rural district.

They did about fifteen minutes and then hurried back to Sen's office. He didn't say a word as they entered. For a long moment he sat there looking at them. Then he spoke.

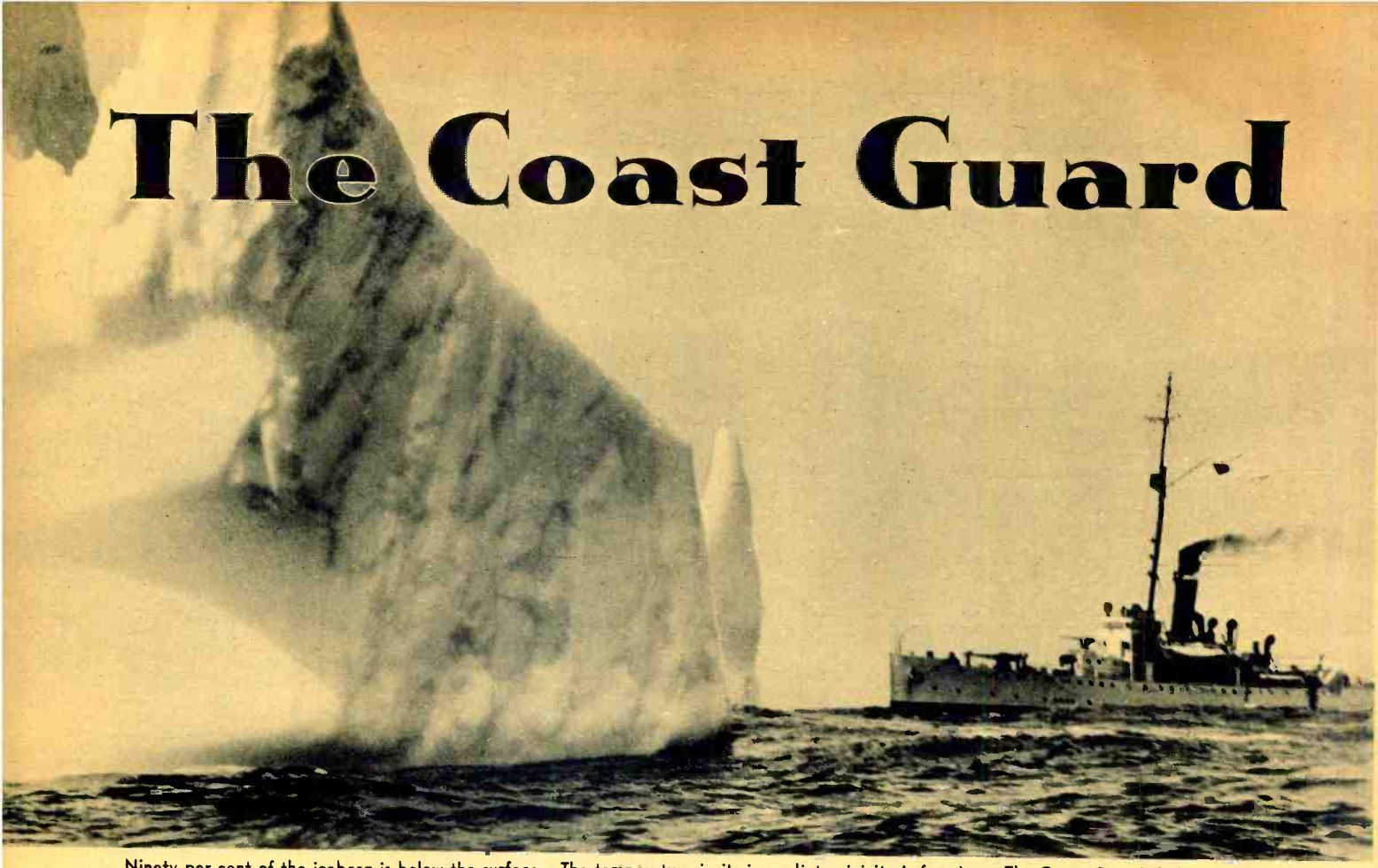
"Well, boys, you've got something—but darned if I know what! You used that word 'thar' twenty-seven times in fifteen minutes."

Goff turned to Lauck and grinned. If Kaney knew they had used that word twenty-seven times that proved he had listened to a lot more than just a minute or two of their work. At least he'd listened a lot more to them than he had of the others who had been on while they had sat in Kaney's office before their turn came.

Kaney offered them $150 a week as sustaining (non-commercial) artists. They had been working at KTHS in Hot Springs for nothing—for the fun of it—but they suddenly decided that if they were good enough to go on an NBC network they

(*Continued on page 79*)

The Coast Guard



Ninety per cent of the iceberg is below the surface. The temperature in its immediate vicinity is freezing. The Coast Guard daily runs over the usual routes of these demons of the seas and plots their course and location. The C.G. destroys those it can by gun fire and dynamite.

ICEBERGS in the steamer lanes! Hurricane on the coast of Florida! Floods in the Ohio Valley! Ship in distress!! Seal poachers in the Bering Sea!

The Coast Guard goes into action, accompanied by that scientific handmaid and invisible but useful ally—the radio. As Lieutenant D. E. McKay, of the Radio Division, expressed it, "There is no peacetime for the Coast Guard. It is constantly at war, not only against smugglers and law breakers, but against the mighty forces of nature, which seem only too often to be in arms against man."

The Coast Guard cutters *Tahoe, Pontchartrain* and *General Greene* are even now in the Grand Banks off Newfoundland, constituting the International Ice Patrol force for the season of 1938. Of these vessels, the *Tahoe* and *Pontchartrain* are each 250 feet in length; displace 1,983 tons; carry a crew of approximately 102 officers and men; have a cruising radius of about 8,000 miles; and use a radio, designated T16, which operates on a frequency of from 4,000 to 18,100 kilocycles with a power of 500 watts.

The *General Greene* is a smaller boat and is used primarily in oceanographic survey work, basing at Newfoundland. Floyd M. Soule, Senior Physical Oceanographer, is on board for the purpose of supplying the patrol vessels with information of value in predicting ice movements and of making scientific studies of conditions affecting the travel of icebergs, for future reference in ice patrol work.

Basing temporarily at Halifax, N. S., the *Tahoe* and *Pontchartrain* await news of the breaking up of the ice floes and the movement of the bergs southward to start a constant patrol. The chief object of the Ice Patrol is to locate the icebergs and ice fields nearest to and menacing the North Atlantic steamship lanes. This is done both through scouting and through radio information from other ships. The Coast Guard is looking forward to the day, not too far distant, when transatlantic airplane service shall be definitely established, since the planes will be of great value to the Ice Patrol. Through radio communication, the planes will be able to inform the Coast Guard vessels of the course and presence of the bergs from the air, where breadth of vision and speed in covering territory are so much greater. At the same time, the Ice Patrol will constitute a safeguard for the transatlantic planes.

By means of four daily radio broadcasts, the patrol informs shipping of the course of the bergs. The patrol vessels determine the southerly, easterly, and westerly limits of the ice and watch it as it moves southward. After the patrol starts, the communications between the Ice Patrol and the United States are handled directly through the Coast Guard Radio station at Fort Hunt, Va., near Washington.

If the messages are of any length, they are punched out on tape and put in the automatic keying device, which brings them down at high speed, over ultra-high frequency radio. They are received on a record of the dictaphone type. This saves time and effort at both ends, since it keeps the sender from having to repeat messages and allows the receiver to slow up the reception and go over the message as often as is desired.

Another Coast Guard vessel, the *Sebago*, a ship of the *Tahoe* type and size, is being used as a standby vessel for the Ice Patrol. It will aid the regular patrol cutters in times of emergency, keeping in touch with the other vessels by radio at all times.

The position of radio in this work is made clear in the following paragraph, quoted from a bulletin issued by the Coast Guard Headquarters:

"Radio communication is the most important thing on Ice Patrol; more important than the finding and trailing of ice, the navigation work, and the scientific work. Without radio the patrol vessel could not receive ice reports or broadcast ice information to anyone outside of visual signal distance."

The traffic is heavy in radio work on the Ice Patrol vessels, and twice during the day and once at night the watch must be doubled to copy weather. The ice report broadcasts must be precisely on time and all other traffic is subordinated to this work and to the collection of ice and water-temperature reports. Owing to the fact that the intermediate-frequency transmitters operate almost continuously while on patrol, tube trouble is frequently encountered; and sufficient spare parts for a four-months' cruise are always carried.

Besides the T16 radio used by the Ice Patrol, the Coast Guard vessels also use the T10, which covers 2,250 to 4,100 kilocycles powered at 200 watts; and the T14, which covers 125 to 500 kilocycles powered at 750 watts.

Every spring, when the seals start gathering, bound for the Pribilof Islands, the Coast Guards sends out the Bering Sea Patrol. This patrol follows the seal herd north until they reach their destination, in

Stands By

by S. R. WINTERS

Every spring the icebergs make their annual trek southward. The Coast Guard comes out to meet them. From that time on, shipping is kept advised of the 'bergs location. Without this service the disaster of the Titanic might become an annual occurrence.

The radio shack aboard a Coast Guard Cutter, showing the very latest in equipment. C.G. operators are among the finest trained personnel in radio.

order to protect them from piracy. The shooting of seals at sea is forbidden by an international agreement between the United States, Great Britain, Japan, and Russia. After reaching the Pribilofs, the Coast Guard patrols the islands for seal poachers, keeping in touch with each other and with their base headquarters by means of radio.

In the North the radio has been instrumental in the saving of untold hundreds of lives. Many times it has sent the Coast Guard to the aid of fishermen in the cod-fishing schooners. These schooners spend four or five months in Bristol Bay with only radio communication. Often medical aid is urgently needed on these ships, and frequently the small fishing smacks become separated from their mother ships and the Coast Guard is called in to help search for them. In the Bristol Bay region, where there are few aids to navigation and it is difficult to gage the position of the ships, owing to the lack of sunshine, the cutters rely almost entirely on the use of the radio direction-finder in locating the vessels in need of help.

The natives of the islands off the coast of Alaska also owe a great deal to radio's use by the Coast Guard. Prior to the installation of radio on the islands and on the cutters, these people had to rely on the occasional visits of the ships for medical assistance and for news. Now, because of constant communication between the Coast Guard and the islands, the cutters are able to render much valuable service, which was formerly beyond their power to give.

Another important service rendered by the Coast Guard is the broadcasting of storm warnings to mariners and small vessels or yachts by radio-telephone. These warnings, broadcast twice daily, are sent out on a frequency of 2,662 kilocycles and have proved beneficial to small ships, many of which carry only a small two-band broadcast receiver on board.

When a flood hit the Ohio Valley in

(*Continued on page 82*)

Radio equipment aboard the C.G. plane. Compact and complete, it represents the very latest type apparatus. Below, the C.G. plane rescues two marooned by a ship's fire.

De Mille's

by CHARLES H. GILCHREST

The master director of the movies and radio gives an exclusive interview for RADIO NEWS readers. The methods he uses have made the "Lux Radio Theater" one of the most popular radio programs on the air.

IN THE world of motion pictures, the name of De Mille immediately calls to mind a long chain of super-colossal pictures dating from *The Birth of A Nation*. The genius that brought him international acclaim is now being successfully turned to account in producing one of the most popular radio programs on the air, the *Lux Radio Theater* on Monday nights.

Therefore, it is logical that we should call upon him for information regarding the technique of broadcasting. His fundamental theory of radio entertainment is that it is a stimulus to the imagination more powerful than any other yet conceived.

"In the hurly burly of getting a program on the air," Mr. De Mille says, "we don't have much time to think about the abstract theories behind what we do. In the early days of the movies it was the same way, always a rush against time. In those early days of silent pictures we had only action. People seeing a silent picture had to imagine the sound that accompanied the action we portrayed upon the screen. In radio we have the reverse. We have only sound to give the listeners and they must imagine the action which accompanies that sound.

"And therein lies the real psychological reason for radio's mass appeal. People *want* to use their imaginations and radio gives them the opportunity. Just what effect this mass stimulation of the imagination will have on our social and economic development it is impossible to foretell."

De Mille believes that the radio audience wants to cut through the make-believe and know the real people behind the parts they portray on the other side of the microphone. They want to be entertained, he thinks, but they also want to feel that they personally know the people who are entertaining them. That is the reason why the real Clark Gable, Robert Taylor, or Myrna Loy is revealed in an interview at the close.

He introduces his stars first of all in the character of the parts they play in his show and then as the people they really

Top: The author (left) interviews Cecil B. De Mille in Hollywood for RADIO NEWS.

Above: Douglas Fairbanks, Jr., and Ginger Rogers are as popular in a De Mille "Lux Radio Theater" production as they are on the silver screen.

Right: Director De Mille (right) coaches Edward Arnold and Anne Shirley in the delivery of their lines. His easy, friendly manner with players helps them to produce their very best work.

Radio Technique

The De Mille "sandwich"—lights, actors, and music. The simulation of an actual stage performance helps the players to present their roles more convincingly. This scene was shot at the dress rehearsal on the afternoon before the regular performance went on the air.

are. But he doesn't want the general public backstage during his broadcasts or during rehearsals. We wants them to keep the illusion of the play rather than become interested in trying to understand the inner workings—the machinations by which various effects are achieved.

One of the technical tricks he has worked out for broadcasting is what he calls the Lux "sandwich." He uses floodlights and footlights just as he would in a stage play. The lights are in front of the actors and the music, instead of being in a pit before them, is behind them, hidden by a curtain. This is his "sandwich." He thinks proper lighting and music help the actors and actresses to get into the proper mood to play their parts convincingly.

Another of Cecil B. De Mille's theories of showmanship is largely responsible for the program's success. Too often, when big name stars are contracted for appearances upon radio programs, they are introduced with super-colossal adjectives, permitted to struggle through a few words of "how-happy-I-am-to-meet-my-many-fans" and that's all, for which they may get $5,000.

When De Mille hires an actor to do a broadcast, no matter how much or little that actor is paid, or whether he is a star or not, he has been hired to do the best dramatic work he can. And the best dramatic work he can do is the best dramatic work De Mille can drag out of him. These stars aren't presented as the famous people the radio fans want to meet, whose voices they want to hear, but actually as artists. That I think is the main formula Cecil has for the success of his broadcasts.

The contracts they sign with De Mille force the stars to do twenty-five hours of rehearsal if the producer wants that much. Actually, most of the shows are put together in about twelve or fifteen hours. But if De Mille thinks there are still rough or weak spots then he can and will demand the full twenty-five hours. Wallace Beery actually rehearsed more than thirty hours because he was determined to turn in the best job he possibly could. Robert Taylor, too, was surprised at how long and hard he had to work before his broadcast, but when it was over he was elated with the job and thoroughly sold on radio. That was because De Mille literally dragged out of him his best dramatic work. And an actor doesn't mind how hard he has to work if that work shows him to his public in a better and more artistic light. That's the psychology of an actor.

The Lux Radio Theater is rehearsed five days a week. On Thursdays the artists are gathered together for what they call *table*

The rather weary expressions on the faces of Clark Gable and Virginia Bruce (right) indicate how gruelling is the twelve to twenty-five hours of rehearsal De Mille demands of all players in "Radio Theater" shows.

work. They all get their scripts, sit around the studio and go through their lines. Rough and awkward spots in the scripts are corrected or smoothed out. On Fridays they go through the scripts before the microphone. Saturday, sound effects are added and on Sunday they work through the whole show with the orchestra. They have their dress rehearsal Monday afternoons when they go through the whole show just as it is to be broadcast that night. In addition to all this, if anyone is weak De Mille will make special appointments with that person and work alone until the trouble has been eliminated.

That's how they get such perfection of timing and coloring in this radio series. And the credit goes to De Mille himself. He calls it his technique of broadcasting.

When I first visited *The Lux Radio Theatre* in Hollywood, I was surprised to discover that although the studio can seat only 1,000 people each Monday night they have a waiting list regularly of about 20,000. That night Robert Taylor was starring and De Mille and his assistants were worrying about the audience. More than 500 people were refused admittance to the studio. They didn't have any tickets and all the seats were taken. But they were too ardent Robert Taylor fans to see reason and mob violence resulted.

They organized before the doors of the theatre and fifteen minutes after the broadcast started there was a crash.

The mob had burst in the doors and were streaming into the theatre. They exploded in with the usual clamor of a mob and De Mille's men were horrified at the resultant confusion. Only five policemen were on duty. Being well-seasoned veterans of former broadcasts they tried to quell the mob quietly. Finally, one of them summoned enough courage to blow his whistle softly despite the fact an echo of that whistle might get on the coast-to-coast network. The ushers, who had retired backstage after seating the audience, heard that whistle as may have millions of radio fans. I don't know what the audience thought it meant but the ushers understood immediately.

The dozen ushers joined the police and finally the mob was quieted so that there was nothing more serious than some unexplained crowd noises and a police whistle to bother the listeners. Little things like that add gray hairs to De Mille's head. Frankly, I think he'd rather broadcast with no studio audience at all if they'd let him. His interest is in the millions of radio listeners, not in the one thousand who can crowd into the studio. And his determination not to destroy the illusion suffers from that studio audience. For how can an average mortal look upon average people in ordinary clothes reading adventurous or romantic lines from script and not suffer from disillusionment?

Stars who perform on the *Lux Radio Theatre* have to be escorted to and from the studio by cordons of police to avoid being mobbed by autograph seekers. And one odd fact is that the autograph seekers who do the mobbing usually are Hollywood citizens rather than out-of-town visitors. The same people go to the same broadcast week-after-week to watch their favorite film stars. The odd fact is that although they

(*Continued on page* 81)

Let's Listen for MARS

by R. D. Hutchens

MARS isn't very far from here. In 1924 it was only 35 million miles away. Compared with other astronomical distances, this is tantamount to snuggling.

Radio signals have traveled farther than that. Scientist Jorgen Hals of Oslo, Norway, on February 2, 1929, received one that was missing for *four minutes and twenty seconds* after he sent it. During the interval it was going 186,000 miles per second, without being struck in etherial mud, so that its journey covered nearly 50 millions of long miles. If you heard the Philippines last week, don't claim the world's DX record! Of course, you can be cynical and say the signal never reached another planet, but then you must be visualizing a concave reflecting surface 25 million miles from here—a ball with an inside circumference more than 150 million miles.

If you can imagine that, it's but a step backward to admit communication with other planets is possible. Mars, being the closest, is the most probable. If it isn't, why did the French Academy of Science post notice of a cash award for the first person to establish two-way signaling with any heavenly body, *except Mars?*

Consider this red planet, and its similarity to ours: we know from spectra that its chemical, and hence molecular, composition is much the same as that of the earth. The U. S. Naval Research Laboratory, in an investigation of Mars' inosphere, found skip distances during the Martian summer were best suited for communication on waves between 50 and 100 meters, and showed that nothing below 47 meters would be suitable for long distance contact between points on its surface. As on our planet, ether phenomena have existed since creation. Let's turn on our set; perhaps—?

The canals of Mars suggest, by their geometrical pattern, an artificial formation. Mother Nature, here or there, seldom chooses such angular design.

There—the short wave set is warmed up; let's start tuning. The background noise you hear isn't from a planet—it's smoke static. Our antenna is directly over a chimney, and when the furnace is cleaned, charged particles of soot bump against the wires. We hear rapid random clicks as they discharge through the set to ground. It isn't very loud, but you should hear the same thing on a coal-burning ship, when the chief engineer is making extra steam so the skipper can blow the whistle! Stand by a moment, until they finish with the furnace, and we'll try something else.

March 15th's on Mars are 687 days apart, in spite of anything the Department of Internal Revenue can do about it. Their orbit in the solar system is slightly greater than ours; their day is 24½ hours; their diameter, a third of ours. So it's a small world, after all.

Listen to this—sounds like a plane in flight. It's a code transmitter, running idle between message groups. Too fast to read because it's automatic, running at 200 words per minute. The record for aural reception is at one-third that speed. You hear 80 dots per second, and the swinging note is caused by slight fading when the signals are reflected to us by a billowing Heaviside layer.

Of course, everything sounds like Mars if you don't know what the sources are. Reports of signals from the voids come in surges. Four years ago, as a result of many such reports, a group of psuedo-scientists in England, broadminded but sleepy, sat up all night before the controls of a specially-designed 24-tube receiver, listening for planets. They reported funny noises, which, considering the possible gain of such a rig, might well have been the swish of electrons between the cathode and plate of the first tube. Or perhaps they were head noises.

Hear those clicks? No use trying to tune them out; they aren't on any particular wave. Reminds you of a telegraph sounder; the spacing is what suggests it. Something like this: ·· ·· ·· ·· ·· ·· In International Code, it means nothing; in Landline Morse, "IYYI." It occurs at regular intervals during the day and night in some locations. Some subway and "L" trains announce their approach by lights or bells in the next station. The sound you hear is caused by contacts under the track; when they operate by wheel pressure, the set picks up untuned waves from the sparks. Divide the number of clicks by four to find the number of coaches in the train.

Some years ago, a person with deep imagination and shallow background stated that, as working range was proportional to wavelength, we could reach Mars by use of wavelength 30 million meters long. One reason for not sending a wave of that size on a stellar jump is that its frequency would be ten cycles per second; a bit low for radio frequencies, which do not become worthy of their name unless they oscillate at two or three thousand times that rate. Credit must be given, however, for the selection of a clear channel.

That hum? It took the best equipment, in the hands of the best of the country's radio engineers, considerable time to locate the source. They traced it by directional aerials, rotating in two planes; they made phonographic recordings; they made careful logs of its times of appearance, and the point at which it struck. For a while it was quite common on many short wave bands. Because of its furtive, irregular raids into various channels, it was named *The Shadow*. Some thought it was intentional interference, radiated to hash up rival propaganda; others guessed it was the work of a crackpot scientist. As usual, other loose thinkers said it came from Mars. A serviceman might mistake it for "tuneable hum."

It was finally cornered and identified by the U. S. Navy. It came from diathermy apparatus. Hospitals use the machines to produce artificial fever in weak patients, so as to relieve heart strain which accompanies ordinary fever. The apparatus is, in receiver effect, a radio oscillator; it was found to be feeding energy back into power lines, which acted as radio transmitting antennas. The hum never disrupted communi-

(*Continued on page* 77)

The contraband liquor shown in this photograph is only a small part of the seizures made by U. S. Customs Agents through the use of radio in patroling the country's borders.

BORDER PATROL

by LAWRENCE WHITE

The author gives a vivid description of the important part radio plays in aiding federal agents.

THE mobile units of the United States Immigration Border Patrol afford some of the most colorful incidents in the development of the use of radio in running down smugglers and aliens trying to enter the country illegally. Radio-equipped observation towers along the borders maintain two-way communication between patrol cars and boats. At El Paso, Texas, the greatest single land border-port of illegal entry in the country, one tower alone has accomplished approximately 500 arrests in the 1½ years it has been in operation.

The headquarters tower is 125 feet high with an observation house 75 feet above the ground. Six new towers, built of steel, have observation houses 75 and 85 feet above the ground. These are all metal and insulated against both heat and cold. An agent or observer can drive his car into the garage at the base of the tower and ascend through the metal encased tube-steps, designed for rifle resistance and concealment against *spotters*. The observer, from his tower room, then communicates directly with patrol cars operating in the zone.

The speed and facility with which aliens entering by these *back door* methods are apprehended can be pictured from a recent case directed entirely by radio from one of the observation towers on the Texas-Mexico border.

Tower Man: "Calling car 26! Proceed cautiously to the foot of Oregon Street. Four men are crossing the river in the standpipe area. . . . You'll have to hurry! . . . Car 26! Pull back from the line. They have seen you and are going back across the river. . . . Pull away a few blocks and I will advise you later. . . . They have recrossed the river. One is coming up the drainage ditch. He is wearing black trousers and a straw hat. . . . They have seen you again and are hiding in the brush near the river. Proceed there. The brush is thick and about ten feet high."

(The Border Patrol car in the meantime pulled up on the river bank and the instructions continued.)

Tower Man: "Be careful; They are armed! . . . They are dividing up . . . going in different directions. . . . Don't get excited! I have them all spotted. . . . Be careful! There is one directly ahead of you in that clump of brush!"

(The man was seized by the patrolman.)

Tower Man: "One is hiding in the bridge pillars near the water's edge."

(This alient was taken into custody.)

Tower Man: "Now there is one away over near the Stanton Street Bridge in that last clump of brush."

(The third man was taken into custody.)

Tower Man: "The last one is over there on your left, hiding in the brush. . . . He is over on your left. . . . Further over! That's him . . . in the bush in front of you . . . right there!"

The four aliens apprehended were taken into headquarters and found to be deportable.

Numerous instances of the use of radio in capturing smugglers on the northern border have not only proved its efficiency but in many cases radio communication has resulted in apprehensions that otherwise would have been humanly impossible. The capture of Bernard Bick and William Dubrofsky with their jointly owned White tractor-trailer truck last October was the result of having the information relayed quickly by radio.

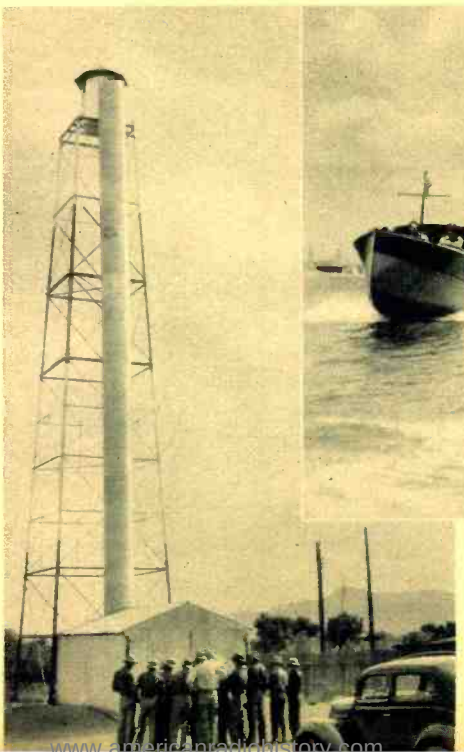
The message was broadcast that the large tractor-trailer truck had "run the border" at Jamison's Line after the customs inspector had gone off duty. The Senior Patrol Inspector was working at the line near Churubusco on a "hot lookout" for aliens, but the call was picked up by patrolmen in the vicinity, who moved immediately to intercept the truck.

The truck was located near the lake and the two aliens, Bick and Dubrofsky, told the inspectors that a third man had offered them $150 to transport 15,000 pounds of frozen white fish from Montreal to New York. The man was known to them only as "Eddie." He had left the truck, they said, just a few minutes before they were apprehended.

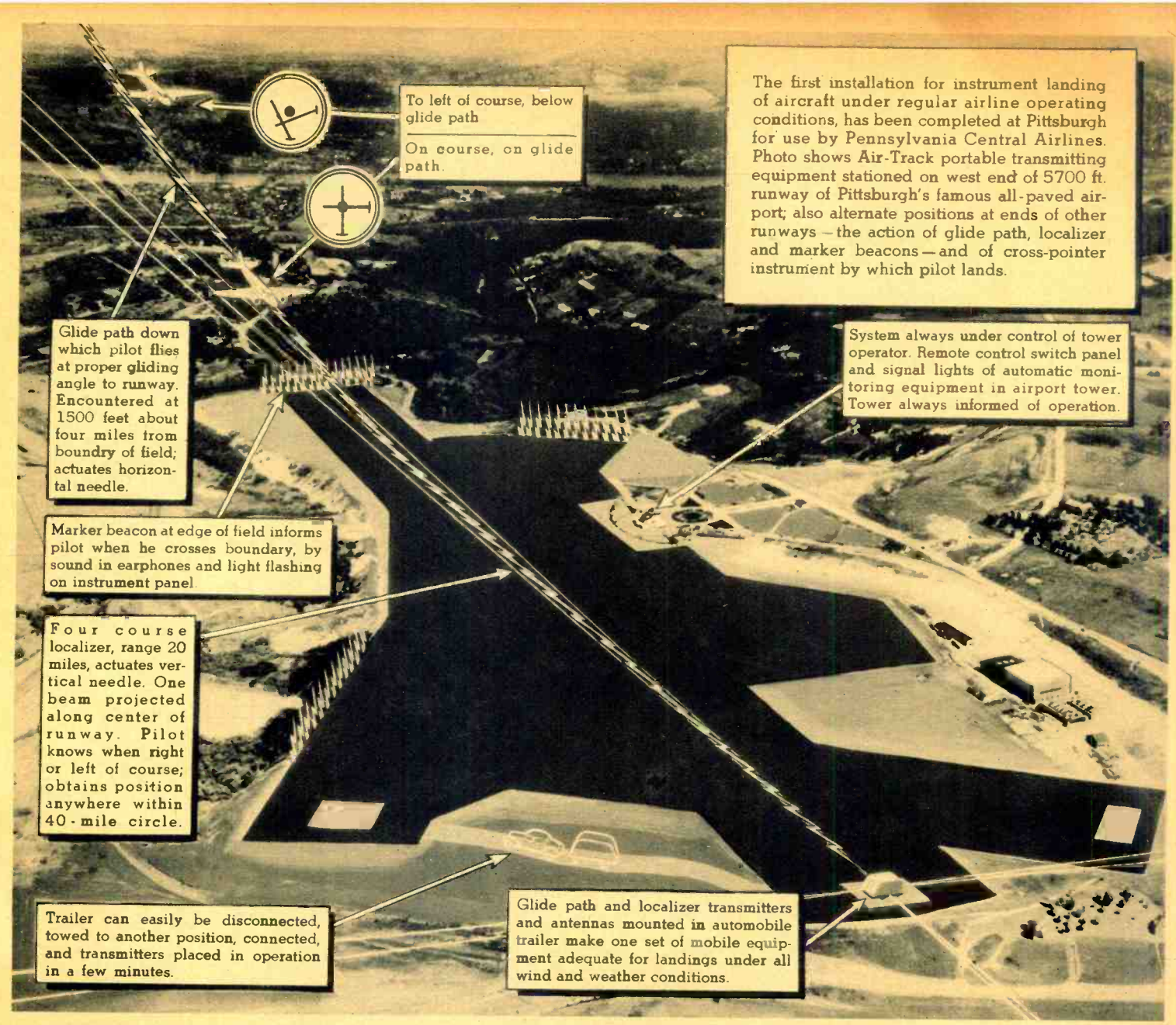
The truck and trailer were new and shining, and had a conservative Canadian valuation of $6,000. The thought occurred to the patrol officers that two men would hardly risk a valuable truck just to escape duty on ordinary white fish. They, therefore, examined and unloaded the truck.

It was found that the fish were inadmissible, having been taken from contaminated waters in Canada. Although on inspection they were found to be badly infected, the

(*Continued on page* 75)

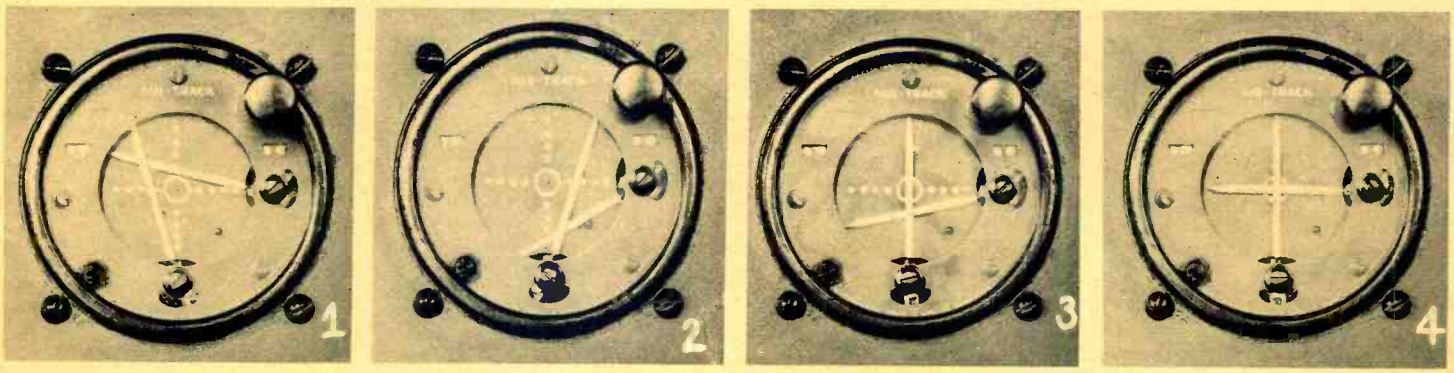


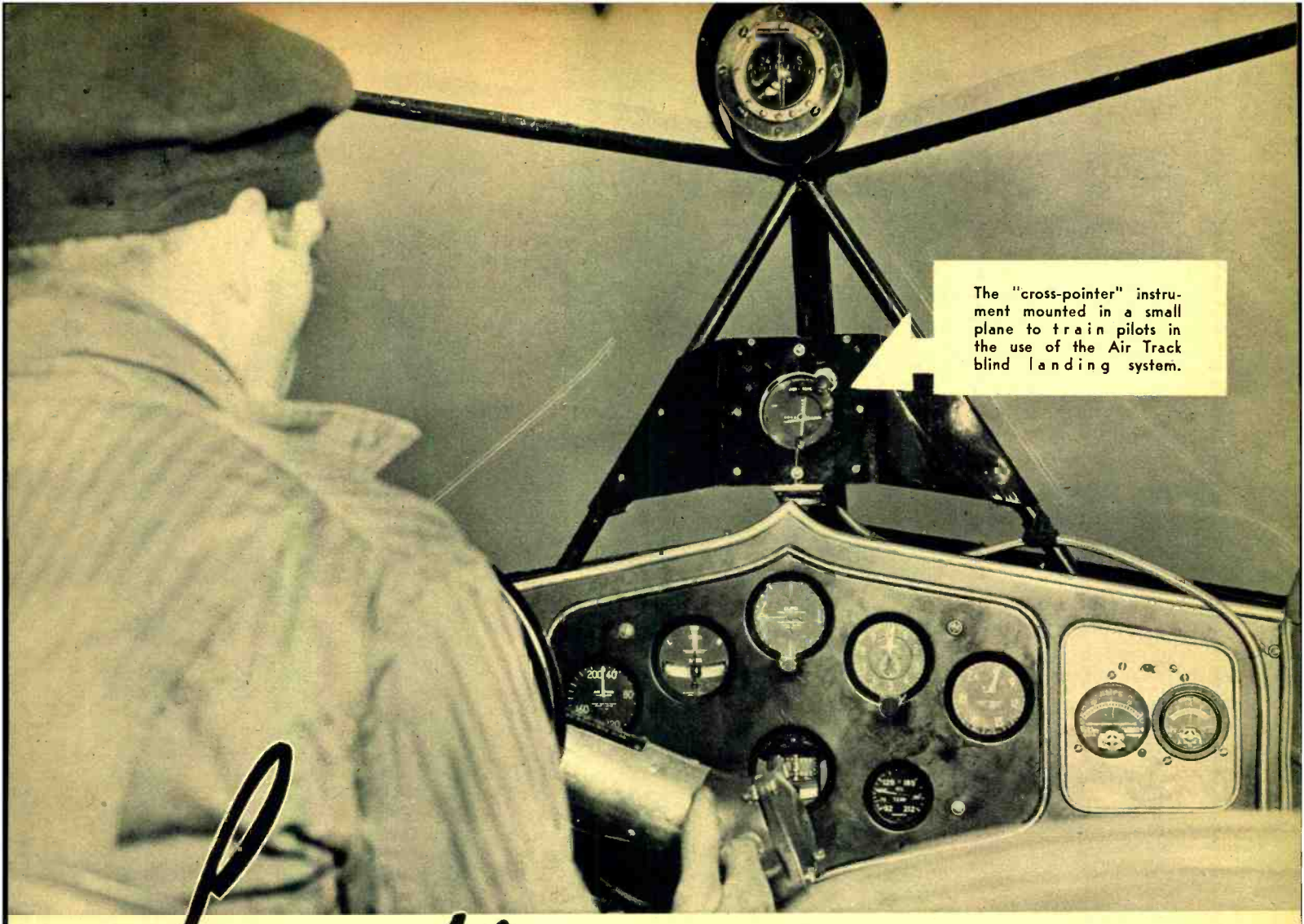
(Above) Radio equipped patrol boats of the U. S. Customs. (Left) Border Patrol tower of the Immigration Service at El Paso.



The photo-schematic diagram above shows how the Air Track blind landing system functions for Pennsylvania Central Airlines at the Municipal Airport at Pittsburgh. Marker beacons are installed at the ends of all runways. The transmitter trailer may be towed to the opposite end of any runway it is necessary for the incoming plane to use (due to the direction from which the wind is blowing), plug in on the power line, and send forth its localizer and glide-path beams. By the use of the "cross-pointer" instrument the pilot can then guide his plane down to a safe landing, even though visibility be limited to a short distance in front of his ship.

The "cross-pointer" instrument illustrated below keeps the pilot informed at all times of his plane's position in relation to the glide-path beam. (1) Indicator shows that plane is to the left of the course beam which marks the center of the runway, and above the glide-path beam which brings the ship gently to earth along a curved track. (2) Indicator shows plane is to the right of the course and below glide-path. (3) The incoming plane is now on course but is below the glide-path. (4) The pilot now has the plane on course and on the glide-path. By keeping the needles in this position the pilot can bring his plane down to a safe landing with its cargo of passengers, air mail and express.





The "cross-pointer" instrument mounted in a small plane to train pilots in the use of the Air Track blind landing system.

Landing BLIND

by C. S. VAN DRESSER

Radio eliminates one of the great hazards of aviation by making possible a safe landing in "zero-zero" weather.

FOR years it has been the dream of aviation experts throughout the world to perfect a blind landing device that works. Not that several of the inventions in the past do not offer some degree of exactness and reliability and are a distinct aid to aviation; but what was wanted was a device that would function perfectly—that would guide the pilot to an absolutely safe landing even if the field were blanketed by dense fog and not a floodlight would work.

A difficult task to develop such a device, but not an impossible one, for it appears at last that this dream of aviation has become a reality.

The story started ten years ago in the National Bureau of Standards, Uncle Sam's great scientific laboratory in Washington. In 1928 this vital work was undertaken by a group of brilliant young scientists of the Bureau and carried to partial completion in 1933. Then the necessary appropriations ran out, and the Washington Institute of Technology took over, engaged the same scientists, and carried on.

For four more weary years the painstaking work continued, until today it can be announced that the job at last has been successfully completed. With new developments perfected at the Institute, for the first time in the history of the world a blind landing device is in actual commercial operation. It is being used daily by Pennsylvania Central Airlines at the municipal airport in Pittsburgh.

The equipment consists of three radio transmitters and antennae located on the ground and the necessary equipment in the plane to indicate signals from them. The ground antennae actually produce a so-called *curved beam,* or *radio track* down which the plane glides to land gently and securely on the runway.

Two of the ground transmitters and antennae are housed in an automobile trailer. These give the incoming pilot vertical and

This trailer houses the radio equipment for the localizer and glide path beams.

horizontal guidance. The third transmitter and antenna are located at the approach end of the runway and throw up a vertical radio "curtain" through which the plane passes.

To receive the signals the plane is equipped with a *cross pointer instrument* which is a dial with two needles, one to indicate whether it is to the right or left of the air track, and the other to tell if it is too high or too low. One of the radio beams is projected in a straight line down the center of the runway on which the plane will land.

The horizontal guidance transmitter, or *localizer* as it is called, is in effect a miniature range beacon with four distinct courses, each separate course with a range of twenty miles or better. When the pilot approaches the airport, the vertical needle informs him whether he is aiming his ship correctly on this particular beam. When this needle points directly up, the plane is headed precisely for the runway, and the pilot is in a position to receive signals as to his altitude.

This is where the horizontal needle on the cross pointer instrument comes in. All the pilot has to do is maneuver his ship until the two needles are at exact right angles and he will come out of the sky in a gentle glide to make a safe and easy landing.

The transmitter, located at the approach end of the runway, which sends up the vertical *curtain,* referred to previously, is known as the *marker beacon.* As the plane passes through this *curtain,* the pilot receives a signal in his earphones and a light flashes on his instrument panel. Thus he knows he is crossing the boundary of the field at a known altitude, at which point he cuts the throttle and simply follows the glide-path which leads him gently to the ground.

Two-way radio communication between the pilot and the operator of the airport control tower is not interrupted at any time during the landing procedure.

As a further check in safety, the complete operation of the entire air track system is constantly under the observation of the operator of the control tower. An ingenious montoring device, with lights to correspond to the various air track radio beams, instantly informs the tower control man of the operation of all ground equipment.

One of the most amazing properties of the curved beam set-up is its complete maneuverability. As we know, planes must land into the wind. Landing in a violent cross wind might prove fatal to these leviathans of the air.

Suppose, for instance, a 30 mile gale is blowing from North to South which is directly in line with the long runway of an airport. That would mean that the plane must land facing North, or into the wind. Half-an-hour before the ship arrives, the wind changes direction, blowing from East to West. With stationary equipment, Air Track would be of no avail, and the pilot would be forced to land in the regular manner, either by sight in the daytime, or floodlights at night. (Naturally if visibility was too poor, the plane would have been grounded.)

However, with this new system the trailer with necessary ground equipment can be shifted at a moment's notice. All that has to be done it to hitch a tractor to it and tow it to any position desired and plug in to the airport's electrical system. It is ready then to guide the plane to the field on a different runway.

Another advantage of the new system is that it presents practically no obstruction to departing or arriving transports. Some landing fields are menaced by dangerous obstructions such as radio towers, high tension wires and the like. The trailer, situated at one end of the field, is but eight feet in height. The beam insures any incoming plane plenty of clearance, while a ship taking off, which might be headed directly at it, has the entire length of the field to clear eight feet. If a pilot can't make that altitude in a half-mile runway, he's in trouble already.

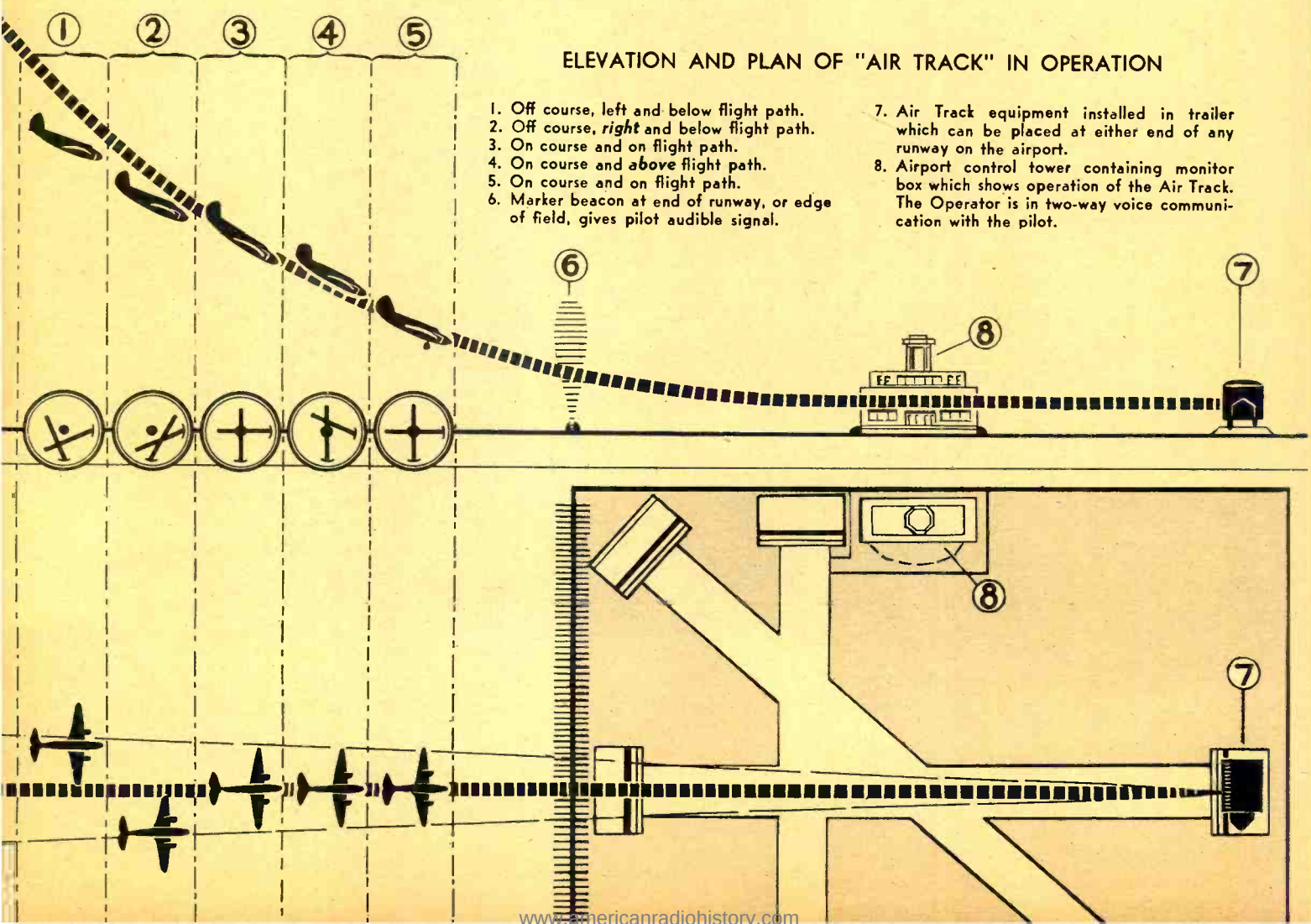
Officials and scientists of the Washington Institute of Technology point out positively that the flights and landings now taking place at the Pittsburgh airport are not experiments, not demonstrations, and not tests of any nature. As Dr. Frank G. Kear of the Institute states: "This is the emergence of instrument landing from the demonstration stage to that of pilot training during scheduled airline operations. The air track system has been developed over a period of nine years. It is now in actual service."

During the nine years of development, many hazardous experiments were under-

(*Continued on page* 74)

ELEVATION AND PLAN OF "AIR TRACK" IN OPERATION

1. Off course, left and below flight path.
2. Off course, *right* and below flight path.
3. On course and on flight path.
4. On course and *above* flight path.
5. On course and on flight path.
6. Marker beacon at end of runway, or edge of field, gives pilot audible signal.
7. Air Track equipment installed in trailer which can be placed at either end of any runway on the airport.
8. Airport control tower containing monitor box which shows operation of the Air Track. The Operator is in two-way voice communication with the pilot.



BLACK NIGHT

by ELBERT HALING
WBAP, Ft. Worth, Texas

Horror dramas are among the most popular of radio programs. The author tells how such a presentation is conceived and portrayed over the air.

Production director Ken Douglass, actor Nelson Olmsted, and sound effects man A. M. Woodford gather around Virginia Wiltten as she pounds out another "Black Night" spine chiller.

THE studios of station WBAP, Fort Worth, Texas, are the scene of grisly murders every Monday evening from 11 to 11:30 o'clock. Human bodies are dissected with meat cleavers. Slimy octopi rise from the dreary depths and choke off the terrified screams of the unfortunate heroine. Rats scurry across the unconscious hero's face as he remains chambered in a dank dungeon somewhere in the bowels of the earth. And although *Black Night* listeners call for the smelling salts, then beg for more grisly stories, the cast suffers not one single scratch.

Two words settle the mystery—*sound effects!* A. M. Woodford, WBAP's sound effects man, supplies the where-with to scare *Black Night* listeners from coast-to-coast. And when WBAP planned its series of horror dramas prior to November, 1937, many said an independent station couldn't produce such a show. They maintained that being as the horrible borders on the ridiculous, one incorrect sound effect would throw the audience into convulsions.

However, with the assistance of Production Director Ken Douglass, the energetic sound effects man went to work and after the presentation of Edgar Allen Poe's *The Tell Tale Heart*, November 5, 1937, audience mail from ten states indicated that the Black Nighters would have the last laugh.

In fact, after the 20th show an announcement was made to the effect that so many horror dramas were being soundly criticized by radio dialers that it might become necessary to discontinue *Black Night's* weekly visits. The results are history! Letters came in with a rush resembling the sudden onslaught of a famous Texas norther. Several thousand irate dialers poured out their hearts in favor of the eerie kilocycle tales. "Your *Black Night* dramas have supplied me with sermon topics," one minister of the gospel wrote. "Where just retribution against the wicked is so vividly pictured, then I say, go ahead," wrote a teacher.

Authored by Virginia Wiltten, most of the dramas are of original origin and every one probably owes its successful reception by the radio audience to the retribution angle which enters the plot and sees that the villains receive their just deserts. Miss Wiltten has scribbled scripts before for such notables as Billy Rose and Paul Whiteman and is a master at wielding a vivid typewriter ribbon in the preparation of colorful radio drama.

In producing certain sound effects it has been necessary to develop particular sounds hitherto missing from the sound effects man's bible. Of course, sound records are used to great advantage but these must, in many instances, be augmented by manually operated effects operated by Woodford and his bustling assistants.

When listeners hear a human body being hacked into small sections by a local Frankenstein and grandma calls for her smelling salts, don't go dialing in search of a symphony. Simply picture Woodford viciously plunging a dull knife into a firm head of cabbage.

On a recent show an octopus suffering with bad digestion and acid on the stomach decided to take its spite out on the hero. He clutched that unfortunate gentleman with all eight arms and began to squeeze in non-too-gentle fashion. It was a simple problem to get sound from the hero but how to simulate the sound of the octopus and his ungentlemanly actions was somewhat of a problem. It was solved by moistening several feet of microphone cord and rubbing it together before a live mike. When the naughty old cuttle-fish blew bubbles *a la* Shep Fields into the hero's manly countenance it was Woodford's assistant releasing air from a toy balloon into a pan of water. Although several blood-thirsty listeners admitted that they fainted in sheer delight, Woodford merely mopped the perspiration from his brow after the show and congratulated the "victim."

Woodford once spent three days seeking a certain necessary squeek for a closing door. On the third day he heard an announcer open the studio door and admitted that "there it was!"

Scurrying rats dashing across a brick floor in Poe's *Pit and the Pendulum* were imitated for radio sound purposes by a technician scratching his finger nails across a flat rock held near the mike. The swish of the death-dealing pendulum as it swung above the unfortunate prisoner's torso, was created by waving an ordinary feather

(*Continued on page* 74)

Listeners shudder at the sound of a human body being hacked to pieces but it is only a dull knife being thrust into a head of cabbage.

Van Buren's Robin Burns, proud poppa of Barbara Ann, slicks up a bunny for her. The comedian bids fair to take the place of the beloved Will Rogers as the national philosopher. (Above) Linton Wells, Magic Key roving reporter discusses a tour with Dr. Leo S. Rowe, director-general of Pan American Union. Wells was there 3 months.

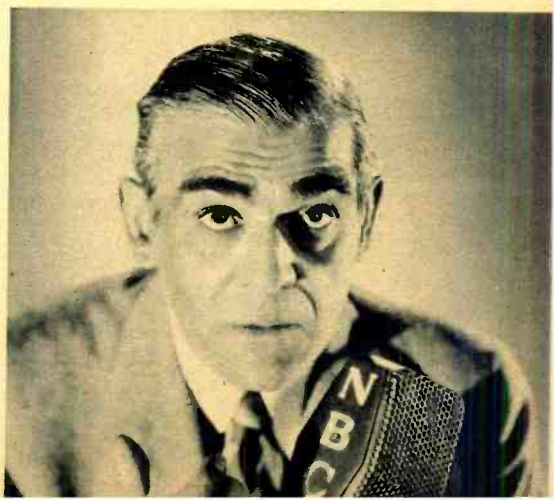
PERSONALITIES

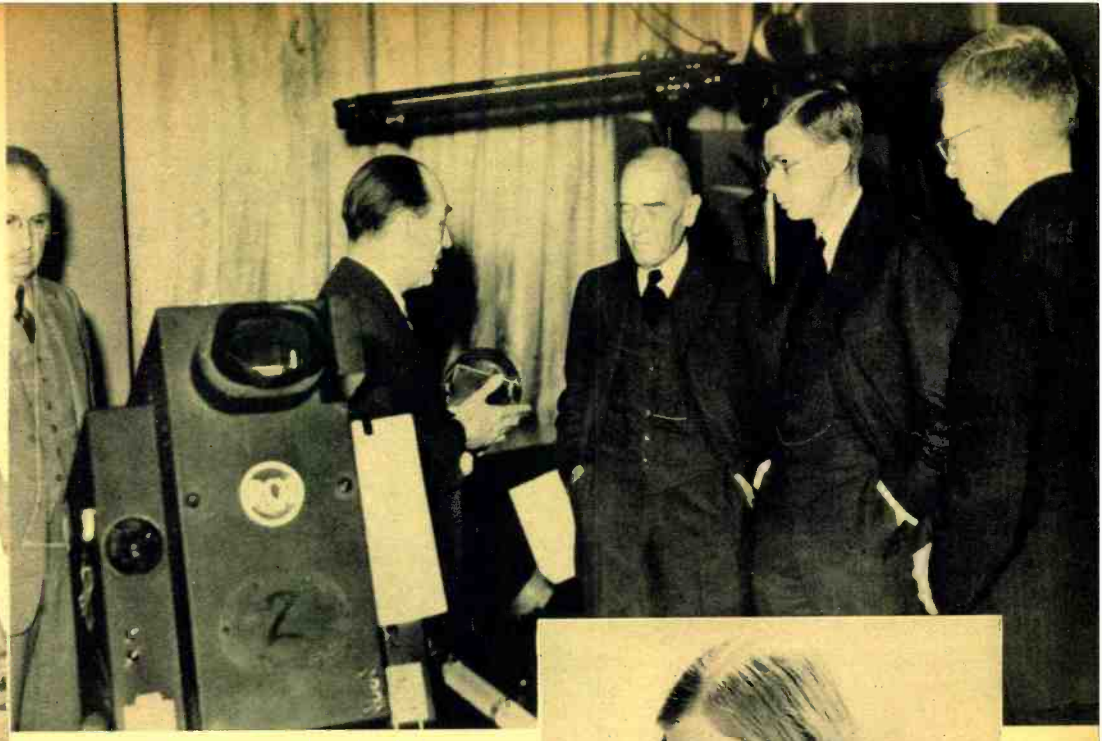
K. Vilper, Amateur radio station operator of U.S.S.R. ↑ Note peculiar hand mike, and precision dials. American QSL cards seem to be quite absent.

Pat Barrett, the Uncle Ezra of the "powerful little 5 watter in Rosedale County" is well known and beloved my many listeners. ↓

The first meeting of the Columbia Broadcasting System's Adult Education Board. A group of the nation's leading educators and civic leaders get together. Standing (L to R) Edward Klauber, vice-pres. CBS; Thomas V. Smith, University of Chicago; Pres. Robert I. Gannon, Fordham University; Wm. Benton, vice-pres. University of Chicago; George Edgar Vincent, former president Rockefeller Foundation; Henry R. Luce, president of "Time"; Pres. Wm. S. Paley of CBS; Alvin S. Johnson, Director of New School for Social Research. Sitting (L to R) Dean Joseph H. Willits, Wharton School of Finance; Chancellor Harry Woodburn Chase, of New York University; Prof. Lyman Bryson of Teachers College; Ruth B. Rohde, former U. S. Minister to Denmark; Pres. Stringfellow Barr of St. John's College.

Temporarily on the networks, Boris Karloff, of the "horror" screen, has turned in a superlative performance. He was heard in the blood-curdling "Lights Out" series.





Education goes television. Lenox R. Lohr, Pres. of NBC, demonstrates the new equipment. Left to right, Pres. Lohr, Dr. Livingstone Farrand, President Emeritus of Cornell, Pres. James Conant of Harvard, and Pres. Harold Dodds of Princeton.

This dazzling beauty who "made" the Paradise Restaurant, N.Y.C., Show Line is Jackie Gately, champion hog caller of Yell County, Ark. She was on Ripley's B.I.O.N. program.

Sayre M. Ramsdell, Vice-president of the Philco Radio & Television Corporation.

Radie Harris, first female Hollywood commentator, started original radio-screen show 5 years ago.

Howard J. Tyzzer, chief engineer of the Household Radio Div. Crosley Radio Corp.

Harry Humphrey, children's idol, and veteran stage actor, is "The Old Ranger."

Sunday evening favorite is John Carter. He won Metropolitan Opera Auditions.

The Old Maestro Ben Bernie discusses his jokes with joksters Albert Miller, P. Levy, and A. Lipscott.

GAG

by HAL TATE
"Broadcasting Magazine"

When a comedian puts over a laugh it usually is a combination of his delivery and the writing of a little known "Gag-Man." The latter are a highly paid select group of specialists in their field.

IN gag-writing you're top-man today and just another writer tomorrow. The exception is Don Quinn, the Gibraltar of the Gag-Writers. He celebrated his third anniversary in May as author of *Fibber McGee & Molly*, having written it since its inception, has a contract until 1942, and will receive a salary increase next fall. Usually, however, a comedian tries out a gag-writer for a few weeks. If the writer clicks he's usually given a 13 weeks contract, as that is the way radio shows are contracted for. If at the end of 13 weeks the comedian is satisfied he usually gives the writer a year's contract with options. However, these contracts usually are cancellable with two weeks' notice, so that the gag-writer, while well paid, never knows from one day till the next for what comedian he'll be churning out material.

Naturally, you'll find all gag-writers in two large radio centers, as far as comedy shows are concerned—Hollywood and New York. In past years all the gag-writers were in New York perched atop New York's penthouses, where they pounded out their material for the comics. The past two years many have migrated to Hollywood with the comedians and have taken bungalows out there. Again the sole exception is Don Quinn, who pounds out his stuff in Chicago. But even he plans on going west soon and has already bought and paid for a beautiful home in Monterey, Cal.

Although Bing Crosby is not strictly a comedian, his entire Kraft Music Hall program is delivered in such a clever comic-sophisticated vein that his author, Carroll Carroll, can be classified correctly as a gag-writer. The double-named gagster, who was 36 last April, has been writing lines for radio personalities for nearly seven years. Born in New York and schooled in Chicago, he was well on his way to a career in the advertising field when radio nabbed him. In his spare moments he used to write for the lighter publications such as *Judge*, *The New Yorker*, and the original *Life*. His first radio program was the *Burns & Allen* series with Guy Lombardo's band. It was also their first air show. Since then he has turned out radio scripts for Bert Lahr, Lou Holtz, Joe Penner, Walter O'Keefe, Rudy Vallee, and Nils T. Granlund.

Carroll Carroll, who has been writing Crosby's material now for two years, interviews the guests who are to appear on the program, catching their personality and adapting it to Crosby's questions and their answers. He writes all of the program except Bob Burns' monologue.

Incidentally, Burns writes all of his own material, or rather he does not write any of his own stuff. He goes to the mike with no script at all—simply a word or two on a piece of scratch paper—and then expounds about his relatives, using the word or two he has jotted down as a theme. Burns is the only comedian on the air who is permitted to go to the mike without a script.

Billy K. Wells, Dean of the Gag-Writers, now 54 years old, has been writing comedy material of one sort or another now for 35 years. He wrote all of Jack Pearl's material as well as material for Ed Wynn and other radio comedians. He keeps no file of jokes and never refers to a book. Coined such phrases as "Vas you dere, Sharlie?" for Jack Pearl and "Says you, says me," for Victor McLaglen. He is now writing an autobiography which he will title *Violets and Sauerkraut*. A bit eccentric now, he keeps pads and pencils all over his New York penthouse; never sleeps more than two hours at one time, and even when he's sleeping soundly can wake up instantly and within 90 seconds can be at his desk working at an idea.

Wells always stays in the control room during a broadcast and always keeps track of the number of laughs during a program. The best reception for one of his scripts was 122 laughs and 26 rounds of applause in 16 minutes of "running time." By running time is meant the actual number of minutes the comic is broadcasting. Another of his programs garnered 141 laughs in 20 minutes. He keeps playbacks of all his programs, checking them for errors of script or delivery. (A playback is an actual

Georgie Jessel, the man who always calls his "momma" (at the Left), is only telling the funny stories carefully written and rehearsed for him by Sam Carlton, gag-specialist.

MEN OF RADIO

As mad a scene as the program, Medbury under the ice bag, seeks a good gag for Burns & Allen.

transcription of the program as it is heard over the air.) Wells told me that some things which he doesn't think are funny at all get the best results, while some material which he thinks is sure-fire will sometimes fall flat. Delivery has a great deal to do with the success of the program. "For instance, when I wrote the word 'hello,'" Wells said, "it wasn't funny, but the way Jack Pearl delivered it over the air made it sound very funny."

Second in point of age in the gag-writing business is Sam Carlton, who at 45 is not only writing George Jessel's show with the comedian himself but also produces the entire program. Carlton, like Jessel, is a product of New York's east side. He went to grammar school and never finished—turning to a course in bookkeeping when he reached the sixth grade. "All I can remember about figures now," he says, "are the ones in the front row of Ziegfeld's Follies."

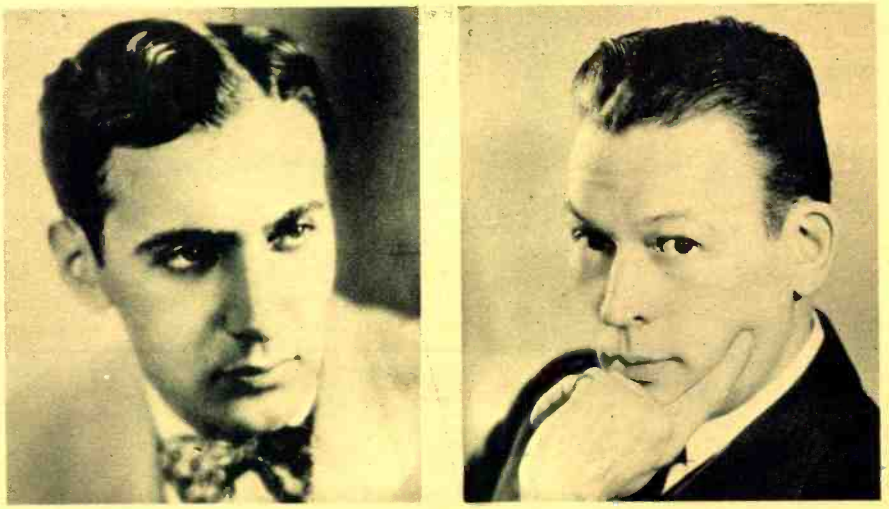
When America entered the war in 1917, Carlton joined the infantry, took part in the battles of St. Mihiel and Argonne, and returned to the United States to enter vaudeville. Seen by Gene Bedini, he was given a place in burlesque and then wandered into vaudeville at three times the figure he was receiving from Bedini. Writing, producing, and acting on the Orpheum and Keith-Albee circuits, Sam continued as a headliner until vaudeville circuits faded from the boards of the American theaters. Then his attention turned to radio, where he has become not only a leading gag-writer but a top-notch producer as well.

Unlike Wells and Carlton, the two oldsters in the gag business, Jack Benny's two writers, Bill Morrow and Ed Beloin, are the infants of the gagsters, being only 28 and 27 years old, respectively. It is these two youngsters who are filling the shoes of Harry Conn, who had written all of Benny's stuff until March, 1936, and whose quarrel with Benny at that date led the wise boys in the show business to say that without Conn, Benny was through. That Benny is still the top-notch comedian on a half hour show today is ample proof of the capabilities of both Benny and those two clever, hard-working youngsters of his.

Morrow is a Chicagoan and, after graduating from Northwestern University, became a press agent. He met Benny in Chicago during one of the comedian's personal appearances there and submitted some excellent comedy material to him. Benny promptly made him a contributing gag-man. In March, 1936, when Benny needed a regular gag-writer badly, he had Morrow come to Hollywood where he was introduced to Beloin and the two teamed up as the Benny Gag Staff. Benny likes their material so well that he has placed them under contract until 1940 to do not only his radio scripts but all motion picture dialogue for both him and Mary Livingston.

Beloin, the other half of the Benny staff, during his college days at Columbia University submitted humorous bits to such magazines as the old *Life* and *College Humor*. He submitted a script to Fred Allen, who couldn't use it at the time, so being a friend of Benny's the sour-faced comic sent Beloin to Benny. Benny told him he would get in touch with him later if he could use him and, true to his word, the Jello comic told Beloin to come to Detroit where Benny was on a personal appearance tour. From there he took Beloin to Hollywood so the youngster could watch the comic work and see his style of comedy. At the same time Benny had sent for Beloin and, after spending three months in California, Morrow and Beloin were given a three year contract to write exclusively for Jack Benny.

Collaborating with Rev. Rubel on Joe Penner's material is Don Prindle, who has been writing for Penner since January, 1937. A writer and radio producer for years, Prindle was called to Hollywood in September, 1936, by Charles Vanda of Station KNX, who assigned him the job of writing the KNX Almanac show. The show which gave Prindle his break was an audition program for the Sunset Oil Co. which was to star Eddie Stanley. The program wasn't sold and the script was left lying on Vanda's desk. One day Joe Penner dropped in to visit Vanda and he picked up



Although one of the most versatile ad-libbers on the air, Fred Allen (right) occasionally makes use of the wits of Al Morey (left), who can write material suitable for him.

Few jokesters write gags for an entire program entailing many different characters as does Harry Lawrence for "Kaltenmeyer's Kindergarten." A children's favorite.

the script, read it, and liked it so well that he asked for the writer and promptly hired him. Besides writing material for Penner's radio program, Prindle also wrote the comic's material for Penner's pictures, *Life of the Party* and *New Faces*.

Like Don Quinn and Harry Lawrence, Phil Rapp, author of Fannie Brice's *Baby Snooks* sketches, and writer of some of the material used by Tommy Riggs and *Betty Lou*, is also a cartoonist. He started in the dizzy business of jest-writing by churning out some of Cantor's stuff.

Al Morey tells an interesting story on how he broke into gag-writing. A popular m.c. and orchestra leader before 1929, the depression came along and left him jobless. He wrote Fred Allen "cold," enclosing some material, eventually contributing material regularly to Fred Allen. Allen is ever the comedian, as the following excerpt from his letter written to Morey after the m.c. had asked him about joining Allen's staff: "Unfortunately, my assistant author left me to go on relief and better himself a few weeks ago. At this time I am obligated to several writers, and have agreed to give them a crack at the program before considering other scriveners."

A later letter from Allen, after the two had become more acquainted, reads in part: "many thanx for the pipe. i didn't want you to start me on the downward path but perhaps your gift will help me to keep the wad of weed out of my mouth part of the day . . . from now on.

"i didn't have any prince albert around the house, when the pipe arrived, but i tore two ads for tobacco road out of the paper and they burned like the mayors in some of those towns the show is trying to play."

Yes, comedians and gag-writers are both in a very funny business. And the funniest part about it is that gag-writing is about the only sanctuary which is uninhabited by women. Of all the gag-men (you never heard of a gag-woman, did you?) there is not a single feminine scribbler. Can the weaker sex laugh that one off?

-30-

Joe Penner, whose laughs are always acceptable for children to hear, has a lot of his material furnished to him by the Rev. Hal Raynor, who also writes Joe's songs.

Television Approaches the Rural Home

THE *Science Committee of the National Resources Committee* lately submitted to President Roosevelt a report, prepared under the direction of Dr. William F. Ogburn of the University of Chicago, presenting a survey on both types of Visual Broadcast Transmission—television and facsimile.

Television will become a reality, the report states when it "is adaptable to continual improvement without rendering existing equipment obsolete and employing the standard system." In addition it will be necessary to have "a sufficient public interest and support to warrant the establishment of stations to broadcast television programs. One of the limitations which exists today in providing a Nation-wide broadcasting service in the United States is the lack of available channels to accommodate television because each station requires a very large portion of the radio spectrum; for example, 600 times that required by the ordinary aural broadcasting station.

"Another limitation lies in the apparent inefficacy of the ultra-high frequencies (where space can more easily be provided) for long-distance transmission and hence, there is some grave doubt as to whether television of high quality can be provided for rural areas in this country at a reasonable cost.

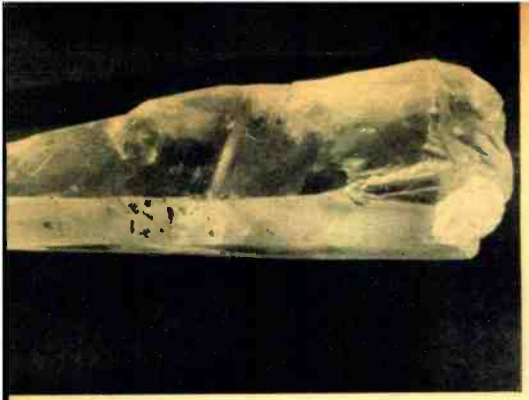
"There is also some doubt as to whether the low frequencies which are already being used by existing services other than television, will be suitable for rendering adequate television service to rural areas even though it be television of low definition. . . . Thus it appears necessary to concentrate on television development or means which will enable the occupancy of smaller space in the ether, cheaper costs and methods enabling the standardization of transmission for both urban and rural areas.

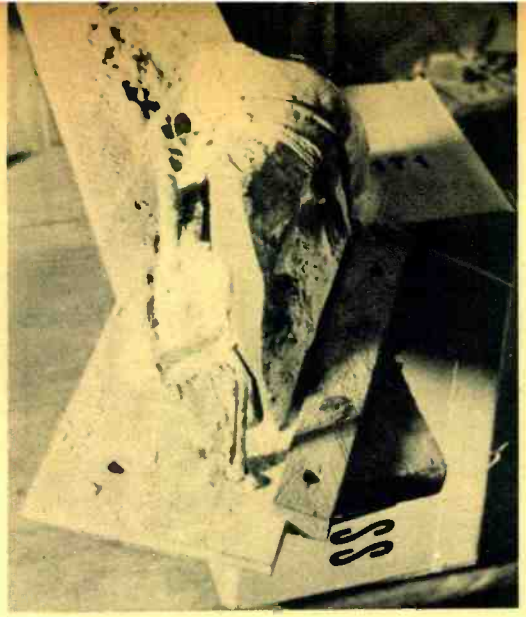
"The development of receivers for television has progressed to the point where a system of transmission and reception should be standardized and public acceptance of television warrant quantity production of receivers. Then they could be marketed at a cost comparable with that of the home refrigerator. Such a receiver would include provision for the reception of the sound associated with the television program.

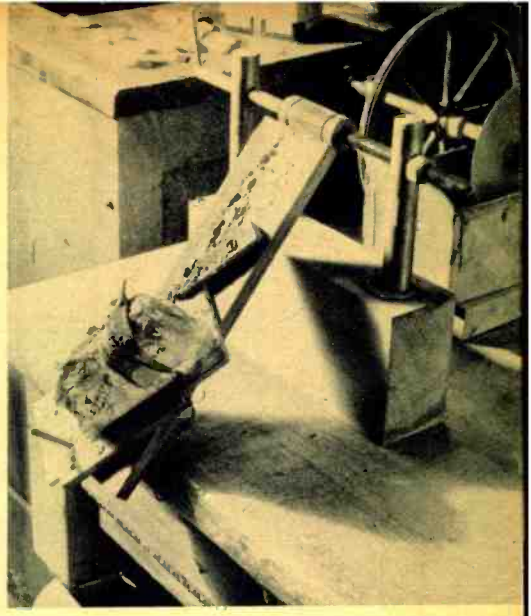
"The transmission and reception of facsimile may be adapted to present-day radio receivers and there are available at the present time facsimile recorders which, when connected to the ordinary broadcast receiver will print a newspaper complete with pictures right in the home, though probably on a limited scale."

In view of the fact that our own and other countries have found television, in addition to aural intelligence, possible, the Science Committee declares that "it is only a matter of refinement in development, reduction in costs, and providing and organizing adequate facilities to extend the available service from a few miles to many thousands of miles."

-30-







Quartz in its natural condition as mined.

(1st right) The rough cutting job is first completed. This cut determines the type.

(2nd right) The muck saw which makes the first and most of the subsequent cuts.

FREQUENCY CONTROL

by FRANK KIRBY

Crystals are used by all broadcasters and many hams to control the frequency of their respective transmitters. The author tells how these vibrating quartzes are made.

PERHAPS the best place to start an article on crystals is with the raw material itself. Quartz crystals are found in the United States and often in large size, but they are usually discolored and contain flaws which make them poor oscillators, hence most of the raw quartz is imported. The larger part of the imported quartz comes from South America. The raw or uncut crystal is sold by the pound; and the larger ones weigh two or three pounds and are seven to eight inches in length. The larger crystals cost more per pound, but they are more economical to use insofar as there is less waste in cutting.

The crystals are hexagon shaped and are tapered, the taper and slope varying considerably among different crystals. It is easier to work with a near perfect crystal because the location of each axis is simplified. For the person inexperienced in crystal cutting it is advisable to coat the various surfaces of the crystal with colored paints in order that they may be readily identified after the crystal has been cut.

The axes in the crystal are as follows: the "Z" axis runs lengthwise through the crystal, the "X" axis bisects any of the corners, and the "Y" axis is perpendicular to any face or side. The sketch shows the various axes and their relation in the crystal. Oscillating crystals are cut primarily on either of two axes, the "X" or the "Y." The blanks for the crystals are cut perpendicular to the axis for the cut of crystal desired, i.e., an X cut crystal would be cut off perpendicular to the X axis.

A few words now about the advantages and disadvantages of the various cuts should be in place. The Y cut isn't used much at present unless means is provided to control its temperature. The frequency of the Y cut crystal changes greatly with temperature (usually in jumps) and sometimes it stops oscillating completely. Unless especially ground the Y cut crystal has two main frequencies of oscillation, which in most cases is a disadvantage, for the frequencies are occasionally close together, thus making the crystal erratic in operation. The X cut has several advantages over the Y. The frequency change with temperature change is less than it is with the Y and the thickness of an X is greater than a Y cut for the same frequency.

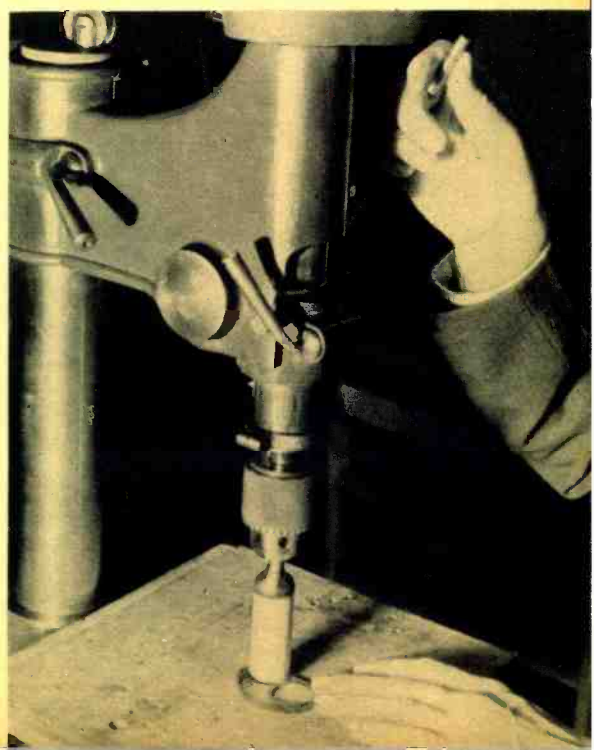
Two variations of the Y cut are the "AC" and "AT" cuts. These cuts are obtained by rotation of the crystal about a line parallel to the X axis either 31 degrees or 35 degrees, depending on whether one desires maximum output or low drift. In this instance thin slabs are obtained from which the round crystals will later be cut. Most of the material to follow will pertain especially to the cutting of round crystals. [So cut because of cheapness of manufacture.—Ed.] However, the principles can easily be applied to square ones as well.

In setting up the crystal to cut AT or 35 degree cuts it is possible to cut either plus or minus 35 degrees from the Z axis, hence it is necessary to test the trial cut before proceeding further. In the absence of a polarized light source to examine the crystal the next best bet is to grind one crystal by hand to determine if the trial cut is the correct one.

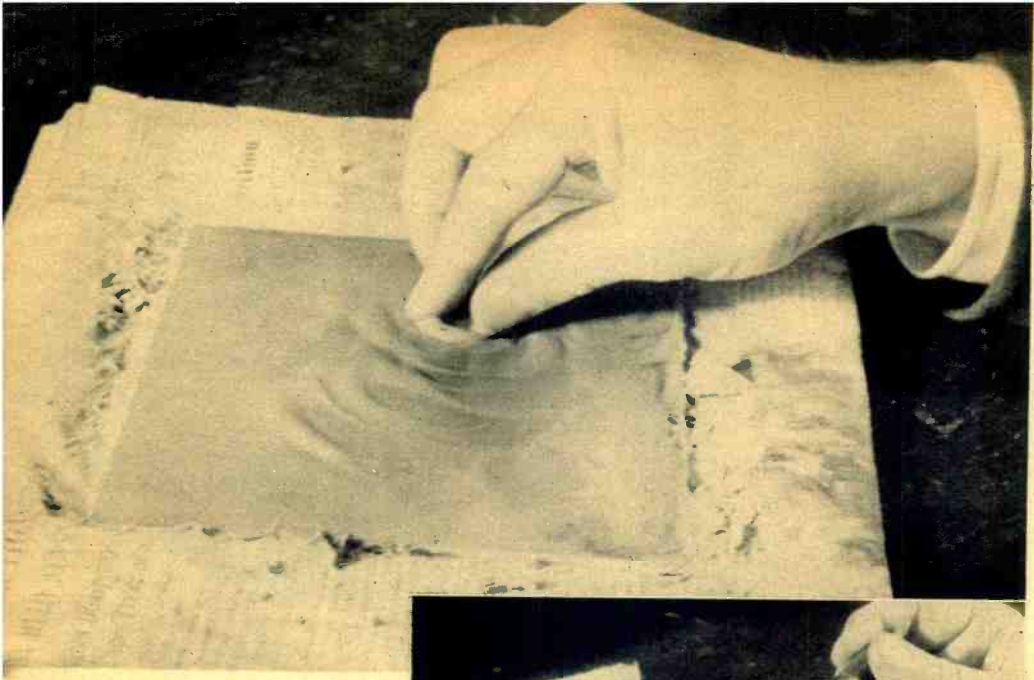
Some AT cut crystals are harmonic oscillators, especially on their third harmonic, that is; with the plate circuit tuned to three times the fundamental of the crystal it will oscillate on its third harmonic. The output with this mode of oscillation is fair but the temperature-frequency coefficient is greater than at the fundamental frequency. The AT cut is the thinniest and the X the thickest of the three mentioned. Hence it is possible to grind a seven megacycle X cut crystal which will stand up well under hard usage, whereas, the Y or the AT cut for the same frequency would be thin and fragile.

The first operation is cutting the blanks from the raw crystal. If the crystals are to be round the cuts are taken lengthwise on the desired axis, i.e., the cuts are parallel to the Z axis for X or Y cuts, the AT cut being an exception. These slabs are later cut into discs with a special cutter. On the other hand, if the usual square crystals are desired the crystal is cut up into blocks. These cuts are made about one inch apart across the crystal perpendicular to the Z axis.

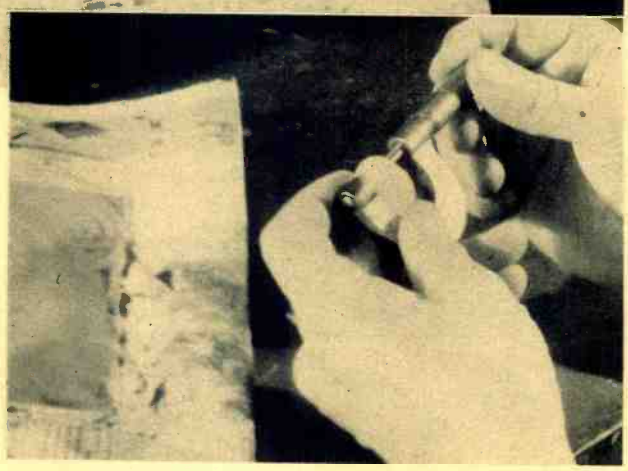
The cutting of the crystal is done with a muck saw. This saw is a copper disc of about 16 to 20 gauge and six to ten inches in diameter. The saw runs between 100 and 300 r.p.m. The last mentioned speed is



Square-cut crystals cost more to produce because a pipe drill cannot be used.



Polishing down high spots on the crystal, by rubbing on plate glass with a mixture of carborundum and water.



Checking crystal frequency by measuring thickness with micrometer. Several readings are taken for average thickness.

perhaps a little too fast, as this will cause the cutting abrasive to be thrown from the cut. The cutting abrasive is a mixture of No. 100 grain corborundum and water, about the consistancy of a thin paste. The paste is thin enough to flow easily into the cut. The soft copper cuts the quartz because the carborundum which becomes embedded in the muck saw rim. The copper saw wears quite well and one disc is enough to cut up several crystals. The saw can also be used for edge grinding crystals. If the saw does not cut well carborundum is fed to the edge of the saw with a paddle or spoon. Making the bottom of the cutting mixture box slope toward the wheel also facilitates feeding the carborundum. Normally when the saw is running it extends down into the cutting mixture about ½ inch. The crystal has to be guided a little until the saw starts to cut.

A board is used to hold the crystal during cutting. If the crystal is of irregular shape and is hard to mount, it is mounted in plaster of paris and fastened to the board with pegs of wood. A feeding mechanism facilitates making the cuts all the same thickness. The threads on the feeding rod are not too fine as to become clogged with carborundum. A thread of 18 or 20 per inch used.

Cutting the crystal in this manner gives slabs about three by four inches and of a thickness determined by the finished frequency. These slabs are next fastened to a flat board with wax or paraffin. This layer of the wax is melted and spread evenly on the surface of the board with a flame, then the slab is pushed down on top of the wax while it is still warm. This gives a good firm base for the slab. The circle cutter consists of a dural cylinder one inch in diameter with about a 1/32 inch wall. Copper or brass could also be used in place of the dural. The cylinder is fastened to a steel hub with machine screws. The hub has a small diameter shaft suitable for the drill press to be used. The circle cutter revolves around 300 r.p.m. or slower. The cutter should be fed slowly and be lifted when it stops cutting to facilitate feeding in the carborundum. The carborundum if stacked up around the cylinder will run in of its own accord when the cylinder is lifted or it can be fed into the cut with a spoon.

Another method to help feed carborundum to the cutter is to slit four cuts parallel to the axis of the cylinder with a hack saw. When the carborundum is fed in, these notches fill up and thus maintain the supply of carborundum in the cut longer.

The next step is edge-grinding. This removes all the cracks and nicks. Although some crystals will oscillate with nicks in the edges it is good practice to remove them, for in strong oscillation the cracks may spread. The cracks are removed by edge-grinding by hand on a piece of flat glass with 300 grain carborundum or, by machine grinding with a revolving disk or muck saw.

Following edge-grinding, a reference face is put on each crystal. This is done by grinding one face of the crystal. Special effort is made to apply pressure evenly over the surface of crystal so that the face being ground will grind flat. The crystal is moved about on the glass in a series of small loops to keep the wear on the plate glass, on which is being ground, even. A reference face is first put on the crystal because it will not bend as easily while it is still thick. Of course, the thinner the crystal the more danger there is of grinding hollows in the reference face. When the reference face is finished, it is identified, either by sloping one edge towards the reference face, or by marking it with india ink. If a large number of crystals are being ground together a reference face is put on each one before going to the next step.

Next the crystals are fastened to the grinding plate. A knob in the middle is used in moving the grinding plate about on the plate glass. The plate is of cast iron ½ inch thick and seven inches in diameter. The plate is heated over a bunsen burner and the beeswax allowed to flow evenly over the surface, then the crystals are pushed firmly down on the plate. This plate is moved about on a large plate glass with No. 300 grain carborundum as abrasive. The motion is the same as with the single crystal i.e., in a series of small loops. After about five minutes grinding the excess carborundum should be washed off, the plate heated to melt the beeswax, and the crystal positions interchanged. Also during this operation each crystal is rotated 180 degrees. Allowing the wax to cool again, the grinding process is repeated. After four or five of such changings examination will show which crystals are thicker, or which ones are not grinding properly, and they can then be shifted to more favorable places on the grinding plate. The arrows are placed on the crystals as a help in rotating and placing them. By careful grinding and placing, and by sufficient changes, the crystals are ground quite flat; in fact, flat enough for many of the crystals to oscillate without further grinding. However, as a general rule, the crystals are usually touched up to secure greater output.

The final touching up and grinding to frequency is done by hand with No. 500 grain carborundum on a fresh piece of plate glass. Care is exercised to see that no larger grain carborundum is carried over to the finishing plate as a large grain rolling under a thin crystal would fracture it while it was being finished with the fine abrasive.

Final grinding is done with the aid of a pair of micrometers, readings being taken in nine or ten points over the surface of the crystal. These readings are written down. It can be seen at this point that a reference face is highly desirable. With thin crystals a cloth is laid on the table under the crystal to prevent accidental breakage should it be dropped. After the readings are written down a circle is drawn around the low spots and a cross put on the high ones, thus indicating at a glance just where grinding is necessary. Overall grinding is accomplished by pressure with two fingers and the thumb. The high places are ground down by pressure on the spot with the tip of one finger.

The Y and AT cuts are ground slightly convex; that is, the edges are about 1% lower than the middle. The X cut is ground flat or for slightly better output

(*Continued on page* 73)

A noted radio actress is Adelaide Klein. She is noted for her characterizations and dynamic radio personality. Her type of delivery is excellent.

SCREAMING MEEMIES

by ROSA REILLY

Why is it that some women's voices seem to be so unpopular with the radio audience? Is it the quality, the delivery or the inflection? The author reveals which are the best liked feminine voices on the air, and the reason therefor.

DO women on the air give you the screaming meemies? Do you feel jittery when you hear: (1) a coloratura chasing a flute up and down the octaves so gaily—and so nerve-wrackingly—off key? (2) The lady commentator who strikingly resembles the cow which gives a pail of good milk and then kicks over the bucket, in that she voices her political news of the day in such *veddy, veddy* clipped tones?

(3) The sweetness and light heroine of the "He, She, and 'It'" dramas, who talks as no regular girl ever spoke on land or sea. In such a *propah, propah mamnah, my deah,* that you long to kick her in the nether part of her lingerie and say: "Be yourself, dearie. Relapse to your native Brooklynese or Oklahoma drawl, but be yourself, pullease!"

Naturally, I don't indict the whole sex on the air. I have many favorites, just as you have. But what I am wondering is why can't the *average* woman do a real, competent, human job of work on the air as the average man does? Why can't the girls impress us with their sincerity, their intelligence, their sensitivity.

To find the answer to this important and topical question I consulted three experts and had reference to a volume which is regarded by experts, as a radio manual.

The first person I interviewed was Miss Helen Sioussat, the young and distinguished assistant to the Director of Talks, at the Columbia Broadcasting Corporation. One of Miss Sioussat's many jobs is the coaching of speakers, most of whom are unfamiliar with radio. She has groomed hundreds of famous women for the air and knows what makes one woman sound pleasant and another screaming meemieish.

"One reason why some women in public life don't sound well on the air," Miss Sioussat began, "is because they pitch their voices too high. Sometimes an octave above normal tones. Another factor is they try too hard. The moment they get before a microphone they start to act. Since they are not actresses, the results are far from satisfactory. If they would relax and be themselves, everything would be fine.

"If a woman would realize that when she is talking on the radio she is going into a person's home, half of the difficulty would be over. Then she would be perfectly relaxed, and would converse in a low, intimate tone. She would get closer to her audience instead of speaking as a lecturer does.

"Women speakers are usually much more cooperative than men. They come to the studio early and work hard on their diction and enunciation. But they often forget what most men always remember—and that is, *what* they have to say is more important than *the way* they say it.

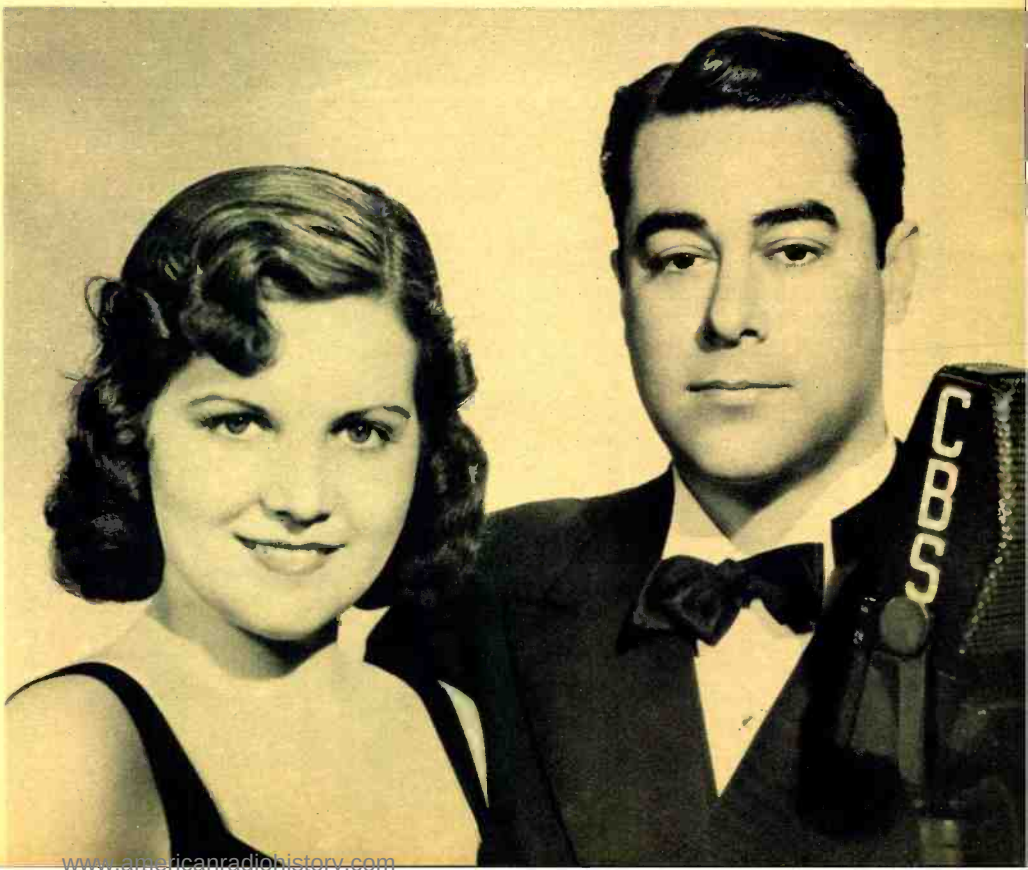
"Frankly, I feel that the average girl on the air would be as good as the average man, if she would stop trying to make her voice sound artificially refined.

My next talk was with Lucile Singleton, Director of Vocal Auditions for CBS, who was able to give me several pointers on what women singers have to face when they sing over the microphone.

"There is no technical reason," Miss Singleton said, "why women shouldn't be as good on the air as men. There is nothing the matter with the technical reproduction of feminine voices in radio. In fact, the dislike for women's voices is mental. There is a mental prejudice against them which goes back to the early days of radio.

"In the first years of broadcasting, microphones were not in as high a state of development as the sensitive instruments we have today. They did not adjust themselves well to unrestrained tones. Many women's voices, as a result, were hard for the mike to take.

"The situation is entirely different now. If a woman has a good voice technique,



Singers, too, must avoid pitfalls if they are to be popular. Mary Eastman and Bill Perry are two whose voices are well liked.

Helen Claire, whose voice was termed "excellent for radio" by casting and dramatic director, Earl McGill, of CBS.

she can use it well anywhere. And further, she can and will make it suit the circumstances under which she is utilizing it. If a girl can master her voice elsewhere, she has nothing to fear from the mike.

"Sometimes very high lyric tones give trouble. They have so many high frequencies that quite often they 'knock the mike.' However, if they are used easily, the singer doesn't have to worry. She can just let her voice ride. She doesn't have to force out a note. Kirsten Flagstad, for instance, can do anything with her voice because she has complete technical mastery over it. That is the secret of good singing."

Miss Singleton emphasized the fact that a singer must avoid mannerisms and affectations on the air. She listed Mary Eastman and Margaret Daum as being two particular examples of such singers.

"They have absolutely no affectation when they sing," she said. "You get the feeling of simple, pure singing, as though this art were as natural to them as breathing."

Miss Singleton also insisted that the emotional quality is extremely necessary in a woman singer.

"The trouble with a great many lyric sopranos," she explained, "is that they lack a variety of tone color. They don't convince you emotionally. They are not responsive. They must convey some inner emotion before their singing can be successful in radio, as well as in other art forms."

Miss Singleton's advice to girls who want to sing over the air is this: "Go to a good teacher and learn a serviceable technique which will stand by you wherever you are. Establish a habit of good singing. Do away with your vocal faults, and don't worry about anything else that may be troubling you.

"Many singers have no technique which will enable them to sing words," she stated. "You must form words with your lips. Vowels must have shape and the consonants must be grouped around them as a frame is around a picture. Most singers have no conception of vowel sounds, and they don't stick to the pure sounds.

"You can't sing consonants. You can't even pronounce a row of consonants. You sing on the vowels in any word. They give you the tone formation. Singing that pure vowel sound goes back to the Italian method of *bel canto*. Often singers are so busy emitting sound they have nothing left with which to pronounce words. You must master your technique, so that it is second nature."

The third authority I consulted was Earl McGill, Casting and Dramatic Director of the Columbia Broadcasting System. He told me how radio actresses and those who hope to become air players can beat the screaming meemies and make their voices pleasant to their audiences.

"The best women's voices on the air," said Mr. McGill, "are voices which have no voice and diction mannerisms. They are good, sturdy, honest, American female voices, without any locality tinge unless the drama calls for it.

"Fine speech in a radio actress," continued Mr. McGill, "can be a torture sometimes. Particularly when every syllable is caressed. Women tend to caress syllables more than men do, and they have to watch out all the time to see that they don't succumb to this temptation.

"My first requirement for a radio actress is that she be able to simulate emotion. This, plus a pleasant voice quality, a clean-cut, direct manner, and the ability to read commas and periods in the script where they belong, will put any girl over on the air. Above all things, an actress must think about *what* she is saying, not *how* she is saying it."

Mr. McGill feels that women must work for vocal variety much harder than men do. Contrary to general opinion, he feels that sopranos, rather than contraltos, have the loveliest voice tones, but even they suffer from a lack of sufficient low frequencies.

"The average male voice moves through three registers," he informed me, "a middle, an upper, and a lower register. A woman's voice usually stays continuously in the high-frequency range. Successful radio actresses, however, have learned to increase their lower tones, just as singers develop their lower range, in order to give variety and freshness to their voices."

Jean King, successful radio actress owes much to her extremely pleasing voice. She does mostly dramatic work.

As an example of a radio actress who has succeeded in doing this, Mr. McGill cited Adelaide Klein of *Columbia Workshop* fame. Agnes Moorehead, Helen Claire, Jean King, and Adele Ronson also have outstandingly pleasing voices.

I interviewed a fourth executive of a large broadcasting chain—a person whose work is devoted solely to grooming men and women for radio broadcasts. Since this individual pronounced news as "noos," I felt he had not yet learned the lessons he is striving to teach, so will not include his findings.

To round out the picture, I looked over a book entitled *Psychology of Radio,* by H. Cantril and G. W. Allport, for the answer to why some women's air voices give us the screaming meemies and why others don't.

The Messrs. Cantril and Allport conducted a research, questioning eighty people on this point. The individuals queried included professors, day laborers, students, housewives, and clerks.

Before the test, ninety-five per cent declared they would rather hear men than women on the air, but they couldn't say why. The results of the research, however, proved that it was *prejudice* rather than *analytical judgment* which caused them to make this statement.

The majority seemed to feel that women give a rather constant impression of affectation, and unnaturalness on the air. They considered men more persuasive, and more interested in the material they read, than women. But for certain work they preferred women to men. They liked women better than men for poetry and other material of a reflective nature.

The net result of the test indicated that we are prejudiced against women for psychological, not physical or mechanical reasons.

Three voices which I unqualifiedly admire—the few times I have heard them on the air—are those of Eleanor Roosevelt, Anne Morrow Lindbergh, and Margaret Bourke-White. They are cultured—not cultivated. Their diction seems to me characteristic of American speech at its best.

My list of radio players who do an excellent, workmanlike job is almost the same as Mr. McGill's. I particularly admire Adelaide Klein, who is a real artist, and Jean King, whose sincere interpretation, of whatever role she is enacting, makes her work outstanding in any program on which she appears.

It would seem that the average American woman, who has perfected herself physically but neglected herself vocally, is waking up. Mrs. Roosevelt announced the other day that she had begun taking lessons, as she felt a constant need to improve her speaking. If a woman whose delivery is so far above the average as Mrs. Roosevelt's finds it expedient to improve her tonal quality, wouldn't it behoove the rest of us to look to our speaking laurels? For who knows at what hour we may be called upon to take the air!

—30—

Note the vertical antennae in front of the pilots' cockpits of this squadron of Boeing P-26 pursuit planes. Orders are given to the fighters via radio phone by officers on the ground and also by the squadron commander from the center plane in the first group.

The Commander Speaks Upstairs

by A. R. GILLIM

The magic of radio now permits Uncle Sam's fighting planes to be commanded in the air as easily as troops on the ground.

THE U. S. Army, always eager to adapt new inventions to the defense of the nation, was interested in radio in connection with its application to the airplane as early as 1910. It was in October of that year, however, at Belmont Park, Long Island, that the employment of wireless to military aviation was brought forcefully to the attention of army officers. During an international air tournament Lieutenant C. C. Culver, now a colonel retired from the Air Corps, and Lieutenant Samuel Reber, observed the spectacle of eleven monoplanes in a single flight. The value of the commander of the squadron being able to speak to ground officers and planes in flight was immediately apparent. They visioned future military airplanes commanded by men able to transmit their orders by radio.

Along with the study of the art of flying and better aircraft design, the Army started delving into the mysteries of wireless in order to make their dream of voice commanded flight a reality. As a result of this study some interesting accomplishments toward their goal soon came to pass.

In 1911 a message from an airplane to the ground was transmitted over a distance of two miles, a feat which was surpassed a year later by forty-eight miles.

Pronouncing the achievements so far good, the Army in 1915 began a definite program of developing the use of wireless at the aviation school in San Diego, California. The air-fan type of driving the genemotor for the wireless was brought about and adopted by the Army. Dictaphones were taken in planes and records of speech were made amid the roar of the motor. The records were studied and the officers were convinced that the idea of the radio telephone was not a phantasy but a truth.

This was a small beginning toward their idea, true, but it was this pioneer work of Colonel Culver which was back of much of the early developments that made airplane radio what it is today. These early tests made it possible for the army in 1916 to achieve radio transmission from an airplane to the ground over a distance of 140 miles. Pilots flying on cross country flights from San Diego to Los Angeles were able to report their observations to the commanding officer of the school.

Anxious to bring about more rapid development in the airplane radio telephone, the Army, in May, 1917, combined its efforts with those of commercial engineers. By means of this cooperation the airplane radio telephone became a fact in six weeks.

After this success further research continued; informal demonstrations were given, and in October, 1917, a long range test was made of the apparatus. The outcome of the test was: telephonic communication was carried on between airplanes in flight up to 25 miles apart, and from airplanes to the ground to a distance of 45 miles.

Voice commanded flight was taken up in earnest at Gerstner Field, Louisiana, in May, 1918. An officer, versed in the knowledge of military tactics and the experience to operate airplane radio telephones, was sent to the field, and drill regulations adapted to flying were worked out. When the regulations were completed an aerial review was staged. The review consisted of two squadrons of eighteen planes, each directed by its commander; the whole by a superior officer, who was also in flight. This flight was excelled a few months later in San Diego when 204 airplanes were commanded by voice control.

By the summer of 1918 the Army had developed a useful two way radio set. The set, meeting the needs of flight at that time, was rushed into production for our air forces to use on reconnaissance planes in France.

The radio telephone was used by the Army to some extent during the World War to conduct fire control missions, but experimental work was somewhat restricted. It was renewed a few years after the close of the conflict.

In order that radio equipment would keep pace with the improvement in war weapons, the Signal Corps-Air Corps laboratories at Wright Field, Dayton, Ohio, with the cooperation of other Government agencies and commercial industries, now conduct considerable research work. Here many tests are made by well qualified engineers so that our army planes will have the best radio installations that brains can conceive. The Army has among its equipment a flying laboratory for the purpose of conducting radio research; and by the tests made in using this plane, reliable sets of various

One of the early experimental "wireless" telephone ground units for contact between airplanes in flight and ground stations. Note the hand-driven generator and the ancient earphone caps.

An experimental airplane wireless installation of 1912. The officers are Lt. Follett Bradley (now Colonel, Air Corps) and Lt. Henry H. Arnold (now Brigadier-General and Assist. Chief of the Air Corps).

This modern ground station at Hamilton Field, California, is part of the vast radio communications system of the Air Corps. Orders to planes in flight issue from this shack.

types have been produced—among them the command set.

So that the aviation arm of the military service will have personnel schooled in the use of radio facilities, a program of instruction was started. This program includes courses at the Air Corps Technical School, Chanute Field, Rantoul, Illinois; the Air Corps Training Center, Randolph Field, Texas, and Kelly Field, Texas; and the Air Corps Tactical School, Maxwell Field, Montgomery, Alabama.

The Technical School informs officers in the subject of communication, and enlisted men to be specialists in operating and repairing radio equipment. The Training Center instructs flying cadets in the art of transmitting and receiving messages, while the Tactical School continues this training by teaching officers to command.

All this work toward producing adequate communication for airplanes has proven its worth. Due to proper radio equipment our military planes are able to operate during air maneuvers in an able manner. The commanders of the various wings, by means of their command radio and other types of radios, can direct their air units in the desired direction.

The practicability of exercising complete and instantaneous command over a large number of airplanes by inter-plane radio telephones was well demonstrated on May 6, 1932, by the Air Corps' 18th Composite Wing in Hawaii. On that day 66 planes met at a designated place, and as each squadron checked in, the command of all was taken over by a single commander. This officer, upon assuming leadership of the unit, issued his orders by radio from his command ship equipped for the purpose. He conducted a series of maneuvers which consisted of theoretical offensive missions, ground bombardment attacks, and photographic flights, all of which were directed by radio. Upon the completion of the exercises the Air Corps personnel located at Wheeler Field, Hawaii, reported favorably upon the use of such tactics in actual combat. Not only have such reports come from Hawaii, but they have come from other Air Corps stations throughout the United States and the Philippines.

The latest experiment demonstrating the advisability of having army planes with good radio installation was the "Good-Will" flight of six Boeing B-17 four-motored bombers to South America. Lieutenant Colonel Robert Olds, the commander of the flight, had several types of radio sets on his command ship and the planes of his fellow aviators, among them a command radio in his own airplane. By the use of this equipment he was able to keep in contact, when necessary, with all six of the "Flying Fortresses" of the Army Air Corps that flew on that record breaking flight from Langley Field, Virginia, to Buenos Aires, and back, in February, 1938. Not only was Lieutenant Colonel Olds able to keep in contact with his fellow pilots by radio but he was able by relayed messages to keep the Air Corps in Washington informed of his progress towards the destination.

Voice commanded flight by a command radio set has not reached its goal, although a few years ago it appeared that it had. This is due to the fact that a command radio set is limited in its range, and has not caught up with the recent increase in range and speed of airplanes. Time and need no doubt will overcome this limitation, for the Army is persistent in finishing what it undertakes. Nevertheless, with the combination of a command radio set and a liaison set, voice control of a number of planes in flight can now be exercised even if the airplanes are not in close formation.

It is in formation flight, however, that voice command reaches its most spectacular achievements. Visualize, for example, a squadron of 13 huge, four-motor "Flying Fortress" bombers, each carrying close to five tons of high-explosive demolition bombs. They circle at a high altitude over a large city. At a word from the commander each plane drops half its load of bombs in salvo, *i.e.*, simultaneously.

A total of *32½ tons* of steel-sheathed death hurtle earthward to land in the heart of the metropolis with a shattering, flaming roar.

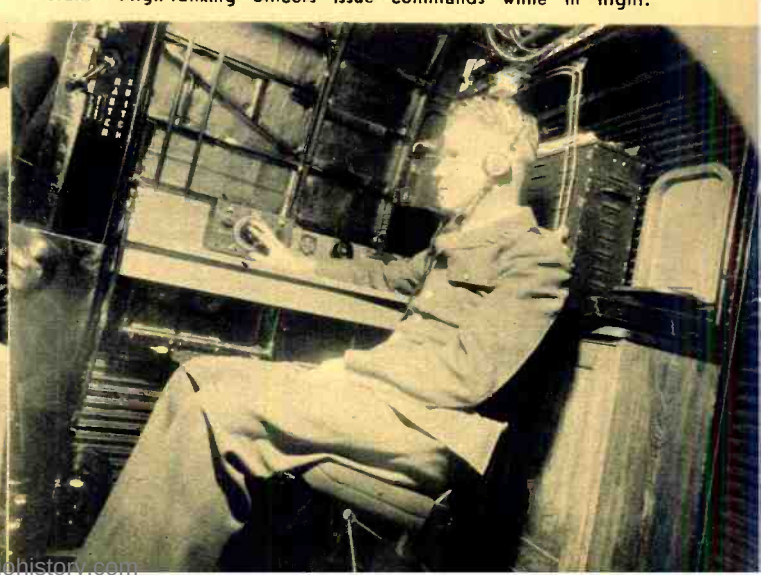
While the bombers' machine gunners protect the great ships from attacking planes, and squadrons of guarding pursuit planes "dog-fight" with enemy fliers, the commander holds his formation together via radio and swings back for another devastating blow. Such may be an ordinary occurrence in the next war.

The pursuit planes are also in contact with their Squadron commanders who are in turn in contact with Wing leaders. The pilots tune to the desired frequency by means of the variometer-tuned verticle aerials on their ships. A sharp word of command and they drop as a unit to the point of attack with the ferocity of hunting falcons. Radio is the invisible hand that binds them together to act as one mighty destructive force under a single control, instead of as deployed units subject to the caprices of individual minds.

—30—

A demonstration of voice commands to planes in flight by Col. C. C. Culver on the White House lawn soon after the World War.

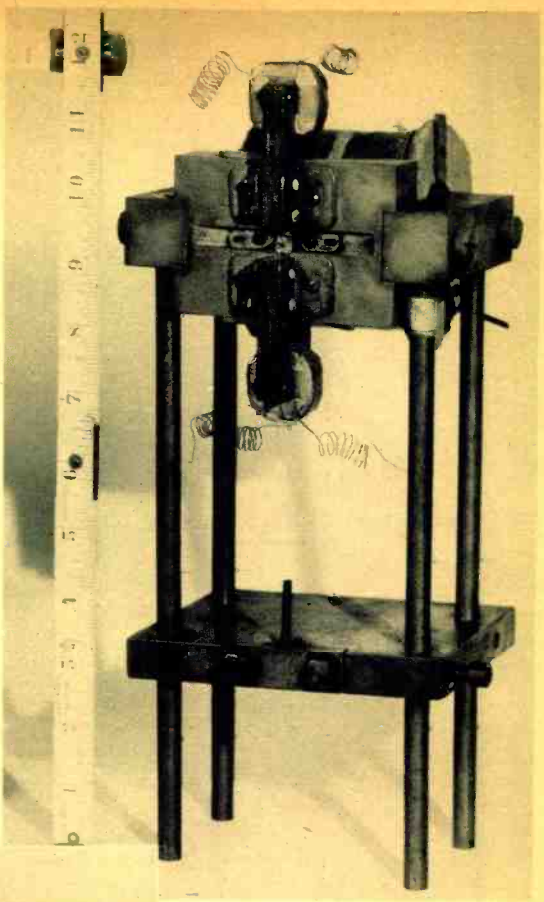
The radio shack in a Douglas DC-2 GHQ office plane used by the staff. High-ranking officers issue commands while in flight.

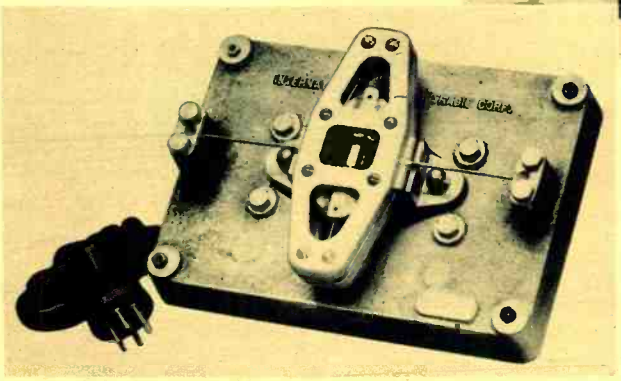


TELEVISION by RESONANCE

by WILLIAM H. PRIESS
President, International Television Radio Corp., Jersey City, N. J.

Whirling disks and Cathode Ray tubes are accepted methods of receiving television signals. Mr. Priess describes a new and unique method by which these may become antiquated because his system is capable of enlargement, and might be much cheaper.





An early experimental model which destroyed mirrors and wire when it reached resonance.

Final Priess model by which large television pictures can be made possible. The mirror welded to the wire can be clearly seen.

SCIENCE is pregnant with oddities that are spectacular. Innocuous observations that loom up to giant proportions with maturity. A mathematical inconsistency, and a new planet is added to our knowledge. A puzzling change in the resistance of selenium, and the photo cell is born. A persistent intelligent curiosity about the nature of the space in an incandescent lamp, and de Forest gave us the "audion," or vacuum tube, with its myriads of wonders which include the long distance telephone, radio broadcasting, talking motion pictures, surgical and therapy devices, and instruments that permit us to delve into the very essence of substance, force, life and time.

And so it is with the simple phenomena of resonance. Possibly it was first noted when a savage listened to the twang of his bow string. A twang that persisted, reproduced itself in successive plucking, and differed in character from the usual noises of nature.

The applications of the principles of resonance have taken long strides since that dawn era day. Electrical resonance is the cornerstone of the radio art. With the expansion of the understanding of the vagaries of resonance, the lonely beat of the crude jungle tom-tom has risen to the glorious majesty of the Wagnerian orchestra. The breath-taking exactness of each second ticked off by the millions of watches we carry with us to measure elusive time is weighed with an astonishing precision by a resonant device of utter simplicity, a device which in my watch makes over seventy million complete oscillations to tick off the thirty-one and a half million odd seconds that it takes the earth to swing about the sun. Resonance is often a most wicked unwanted customer. It may pile up potentials in power networks, working devastation upon insulators, transformers and generators. It may get into machinery and snap shafting, find its way into ships, automobiles, airplanes and railroads to the discomfort of the passengers, and the rapid deterioration of equipment.

Resonance is the heart of the magnetostriction and piezo electric effects, where infinitesimal motions within the bodies of certain materials are used to control the frequency of substantial forces from ranges of a few cycles a second up to several millions a second.

There are, however, wide gaps that remain a blank in our knowledge of resonance. One gap is obvious, namely, the absence of wide amplitude mechanically resonant devices in the frequency range above one hundred cycles a second. The exploration of this uncharted territory was replete with surprise. Steel that acted like a gum under apparently small applied force. Rigid materials that disintegrated under the influence of high frequence mechanical stresses of a low order of magnitude. Glue, and cements for glass, quickly transformed into fluffy masses entirely devoid of adhesive property. This exploration came about in the perfectly logical search for a means to an end.

Television had been demonstrated scientifically. Unfortunately the solutions possessed inherent features that rendered them non-commercial. The Nipkow rotor school was barred by the expense of the receiving set scanner whose cost rose as the cube of the lineage. A satisfactory 60 line scanner at $50 became a curiosity for 240 line scanning, because the $50 jumped to $3,200. The Cathode Ray school developed pictures measured in inches. And even an 8 by 10 inch picture cost about $600. If the pictures were enlarged by projection, the cost mounted about as the ratio of the areas, and the applied voltages reached the dizzy and dangerous heights of 20,000 volts in the home. The obvious conclusion from this state of facts was, that some other principle must be developed for television scanning. We undertook this search. One by one, promising principles were discarded on the results of a first order of magnitude inquiry. There finally remained the principle of the oscillating optical element using either a vibrating lens or mirror. But that element had to travel fast, say 10,000 half swings a second over a wide angle.

Since the driving force varies as the square of the frequency, it would require one hundred million times the force to move the mirror at this frequency, as it would to move it at a frequency of one-half swing a second. The mirror had to have a fair size, for the intensity of the illumination on the screen is directly proportional to the area of the mirror. A calculation showed that the power required to drive a satisfactory mirror over the required angle approximated ten kilowatts. This power would melt the mirror with explosive violence. A model was constructed and from the data obtained on tests at low frequency these calculations were confirmed. Little hope was held out for the helping hand of resonance, for the usual experience with electrical resonance circuits indicated that only an amplitude gain of about fifty to one might be expected. In other words, a power of 200 watts might be used instead of ten kilowatts. This amount of power would fuse the mirror. However, structures were designed, we might say, for the sole purpose of confirming failure, even with the application of the resonance principle.

Then the inexplicable began to happen, and happen fast. Steel wires that had withstood a load of a hundred pounds stretched and broke upon the application of a resonant force of a few ounces. Heavy steel mounting frames developed resonant fre-

(*Continued on page 76*)

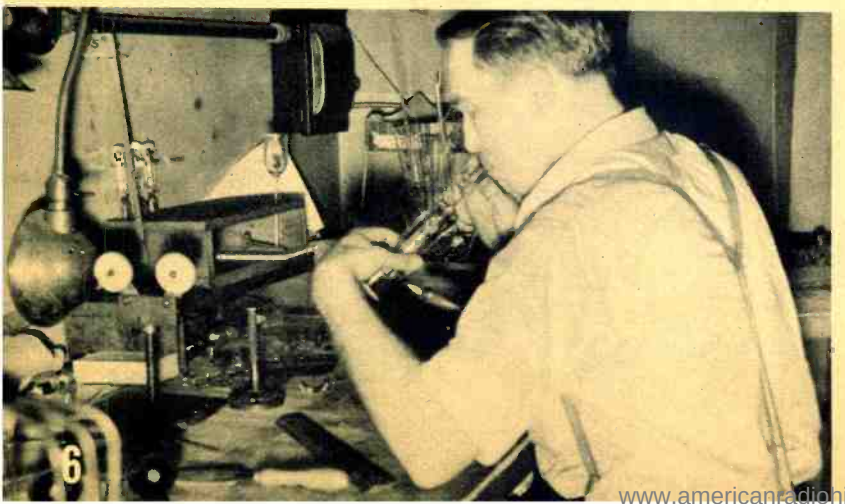
HOW TELEVISION TUBES ARE MADE

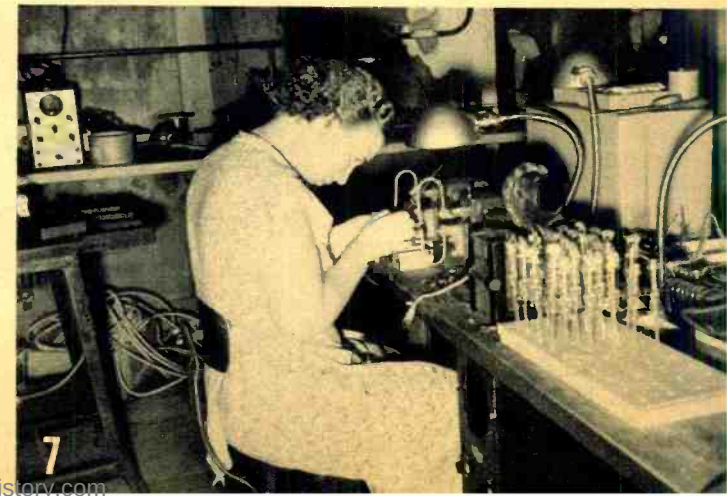
Cathode Ray Tubes are almost universally used in the reception of television signals. How these complicated tubes are manufactured is clearly shown in the series of pictures below. At present the C.R. tubes are used in oscillographs.

(1, 2, and 3) Trimming screens of 2", 9", and 12" tubes. They must be evenly trimmed to insure a perfect picture. Tubes must stand tremendous pressure.

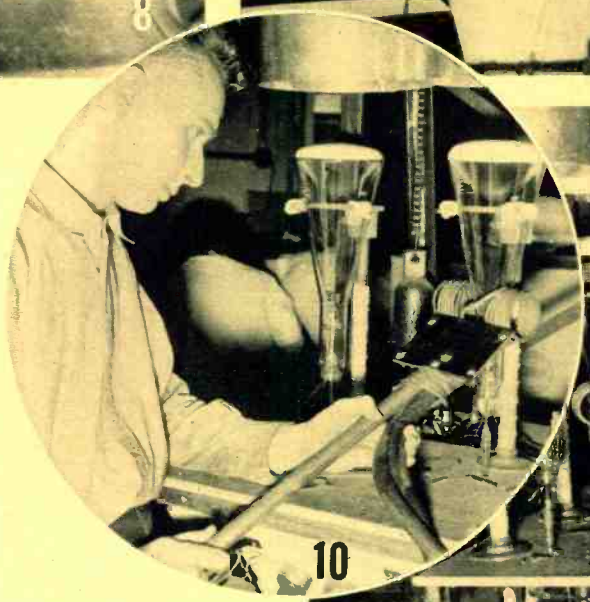
(4.) Annealing tubes. Stress in glass must be minimized or moved to center, out of danger zone. This process shortens and flares blank to prevent any chipping.

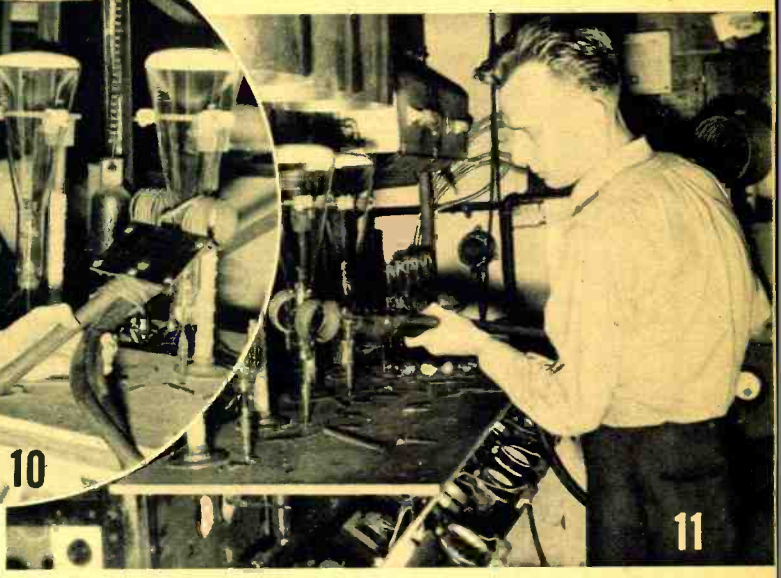
(5.) Assembling stem mounts. Wires are placed between jaws with glass collar. Jaws revolve between flames which heat collar and "cement" it to wires forming stem mount. (6.) The exhaust port of 2" tube is formed by a glass blower. An ancient art for the most modern discovery. (7 and 8.) Stem mounts being assembled prior to insertion in collars. Essentials are spot-welded to insure complete rigidity. Frequent inspections assure early discovery of imperfections.





(9, 10, and 11.) Bombarding tubes. This heats elements of tube to white-hot temperature. Released gases are drawn off by the mercury pump. (12.) The finished tube is examined for stress and strain by means of a polariscope. Variegated hues reflected indicate strain is present.

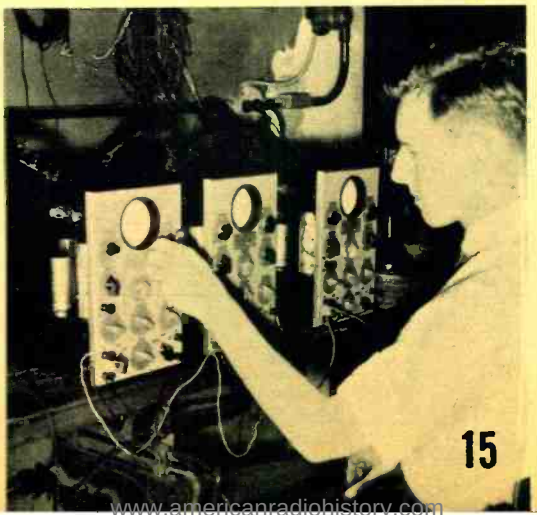




(13, and 14.) Oscillographs on the production line. Here raw parts are wired in and components are properly mounted.

(15.) Testing the action of the completed oscillograph. Long tests are necessary to insure against breakdown in use. Accuracy is essential and tubes are so designed to give this result. Time studies are made to determine deterioration.

(16.) Allen B. DuMont examines a 12 in. Cathode Ray tube. This is one of the largest manufactured. They must be gingerly handled because of the constant danger of an implosion (the opposite of "explosion"). With careful construction and the shifting of the stresses to the center of the tube (See picture No. 4), this occurrence is minimized. The source of the implosion is the external air pressure of 15 lbs. to the square inch to which the tube is constantly subjected. Without the outside air pressure, C.R. tubes could be built to any size and the picture projected could be as large as the ordinary movie.



"STUDIO BRIEFS"

by SAMUEL KAUFMAN

WE hear much fuss and ado from the West Coast where many newspapers are said to be dropping their radio columns in revolt against the large advertising appropriations going to broadcasters at the expense of the newspapers themselves.

But it's our guess that radio columns mean circulation to every newspaper and that no publication that had already built up a radio fan following will dispense permanently with a feature that readers learned to follow religiously.

However, we must concede that some national advertisers have antagonized newspapers on this delicate topic.

Here's a story a prominent Detroit radio editor told me:

He had been boosting a certain radio feature sky high. He thought the program was tops and told his readers so. Then to his great surprise and his paper's business manager's dismay, the sponsor bought large display space in every Detroit paper but his own to call listeners' attention to the program.

"Here I've been boosting your program the limit," he told the sponsor, "and now you advertise the program in every paper but mine. What sort of treatment is that?"

The sponsor told him exactly where he stood.

"You've done our job for us," he said. "There's no reason why we have to call attention to our program in your paper. It's the readers of the other papers—those that didn't give us favorable reviews—that we must get."

And some sponsors wonder why newspapers drop radio columns!

* * *

THE new de luxe studio building recently opened in Hollywood by CBS recalls the plans the network had for a new New York radio center. Ground was acquired and plans drawn for the new Columbia headquarters—a sort of small Radio City—at the busy corner of Park Avenue and Fifty-ninth Street. But it has been a long time since any further mention was made of the project.

One obvious reason for the delay in constructing the New York building was the exodus of stellar programs to the West Coast. But, at the time of this writing, several hit shows are trekking back. Fred Allen, Eddie Cantor, and Phil Baker are a few of the stars once again broadcasting from New York, and Allen, particularly, finds that programs are more successful when presented from the East.

Newest studios opened in New York are those of WMCA, key station of the Inter-City hook-up. The new quarters occupy two block-length floors of the Hollywood Theatre Building—now renamed the WMCA Building—on Broadway. Highlight of the new setup is a round auditorium studio seating 300. The "hatbox" studio offered many acoustical problems because of its unique shape, we are told, but special wall panels set things right. Reason for the round studio is sentiment. Donald Flamm, president of the station, always had a fondness for cylindrical broadcasting chambers since the station was launched in an improvised studio of that shape many years before.

* * *

JOHN T. FLYNN, newspaperman and author, gave sponsored programs with hidden propaganda a lambasting on a recent broadcast of the *America's Town Meeting of the Air* over NBC. The fact that the network permitted Mr. Flynn such latitude is commendable, although there are reports that several previous talks on the series were blue-penciled by the network. But the leeway granted Mr. Flynn does show that NBC doesn't curtail remarks when they stick close to the assigned topic of the broadcast.

Here, in part, is what Mr. Flynn said:

"There is no better time to catch the monster (propaganda) than on Sunday evening. It is relaxed. It is in a benevolent mood. On Sunday evening the family is gathered in the living room when into their midst float the strains of music from a great symphony orchestra. In millions of homes people are listening. This goes on for half an hour. Then as the strains of some well-loved old song fade from the air and the family sits around, thoroughly softened up, there floats into the room and into the unguarded chambers of their minds the voice of the propagandist. For five or ten minutes the carefully planned infection flows into the monster. It tells of the romantic saga of business, the great achievements, the massive wisdom, the matchless courage, the civilizing alchemy of the great business man as distinguished from the selfish and narrow ignorance and wickedness of the Government—the great souled business leader compared with the small-minded and vicious Senator."

Flynn commended such programs as the *Town Meeting of the Air* "where all sides are represented." He rapped the sponsored air shows "where only one side is represented, and it is always the same side because only one side has the money to buy programs."

* * *

NBC has beaten CBS to the draw by launching a regularly scheduled experimental television service.

True, only five hours a week for a one-month period are going out, but it's a big stride.

The studio whisperers hold that CBS is all burned up over NBC's move for more reasons than out-and-out competition.

Columbia contracted with RCA—parent firm of NBC—for the television transmitter that will be on the air eventually from the top of the Chrysler Building, New York. And CBS holds that RCA delayed delivery of the transmitter, thereby—intentionally or otherwise—permitting NBC to start its regularly scheduled service.

* * *

EVERY now and then some local station pulls a scoop that makes the networks sit up and take notice. Right now, WMCA, New York, is gloating over obtaining Mae West for a brief mike appearance—her first air utterances since the much-discussed broadcast she shared with Charlie McCarthy on the *Chase & Sanborn Hour* a few months back. But we doubt if, in this instance, the networks—particularly NBC—would have desired the broadcast. It will be a long time before NBC forgets the repercussions caused by Mae West's now famous *Adam and Eve* radio skit.

WMCA considered its Mae West broadcast a scoop inasmuch as the screen star is reported to have sworn off air appearances since the Chase & Sanborn incident. But when Alan Courtney, conductor of the station's *Inside the Nightclubs* series espied Miss West at a ringside table of New

(*Continued on page* 80)

The beginning of an important era in television. A crowd of notables attend the inauguration of the NBC regularly scheduled television service. (L to R standing) Mrs. Jan Kiepman, Levine, Marjorie Lawrence, Jan Kiepman, Giannini, Gladys Swarthout, L. R. Lohr, Mr. & Mrs. Paul Whiteman, Kirsten Flagstad, and Jean Dickensan. (Kneeling) Misha Levitski, Frank Chapman, Efrem Zimbalist and George Engles. The scheduled service is the first in East.

A Low-Level Modulation Transmitter

by LOUIS J. GAMACHE, W9RGL
Engineer, Standard Transformer Corp.

Many hams would increase power from their 30 watts to 150-200 watts were it not for the expensive modulation equipment required. The author explains how to do it with only a high-power final amplifier and power supply.

The center portion is a complete 30 watt rig.

ABOUT a year ago the author, together with a number of hams in the vicinity, decided to enter the A.R.R.L. Field Day contest. In order to take advantage of the fullest scoring count, a 30 watt transmitter was decided upon to operate in the 20 meter phone band. After much paper work, and after a discussion on various hook-ups, plus an investigation into the portable power available, a transmitter was evolved whose *total* power consumption was not more than 300 watts. Truthfully speaking these figures were arrived at because the highest powered gasoline driven a.c. generator made gave that power and anything of larger power would not be readily transportable without difficulty.

The tube lineup used, was an 89 tritet oscillator with a 40 meter crystal, and an 807 power amplifier. Modulation was by means of a pair of 6L6's in Class A, plus a speech section consisting of a 6C5 resistance coupled to a 6N7 driver, which in turn was transformer coupled to the two 6L6's. A single button high gain microphone was used. Later a 6J7 and a crystal mike was added.

The transmitter was constructed on a single chassis, 17"x3"x10" deep and all of the components were either mounted above or below this pan.

Along the rear of the low powered transmitter chassis, from right to left, were mounted the power transformer, the modulation transformer, the two 6L6 modulator tubes and a transformer which heated all of the filaments.

Directly in front of the filament transformer were located the 6C5's and along the front of the chassis toward the builder, from left to right, were the two crystal tank coils and their associated condensers, the completely shielded 89 crystal tube with its crystal alongside, and the 807 power amplifier and its coil. To the right of the coil was one of the filter chokes.

Between the filter choke and the power transformer the 83 rectifier tube was mounted.

In order to minimize the number of controls which would have to be tuned in a field day set up, the cathode and plate tank circuits of the oscillator were made up of pre-tuned units. These units consisted of a coil and a trimmer condenser mounted within the coil. Tuning of these units was by means of a screw driver. And when the band to be used was hit, small tuning arrangements were all that were necessary to accommodate a change of crystal frequency within that band. The final amplifier was tuned in a conventional manner with a condenser reached from the panel. The choice of the 807, or the RK39 tube, as the final amplifier in the field day rig, was because of the lack of the need of neutralization which this tube features. Jacks were provided to read the various currents. They were mounted on the chassis and were reached by opening the cabinet and changing the plugs from one jack to another. Extreme care was taken to shield all lines from the microphone jack, the microphone transformer and the gain control, and braid suitably grounded at several points of the chassis was used so that audio feed-back was entirely eliminated.

The set was a tremendous success at field day, and after field day was over I installed the set in my home where I operated for quite a period of time with low power. Later, I found it advisable to raise my power so I figured out that the proper way to do this as well as the most inexpensive way, was to use Class B r.f. amplification. A study of all the books and subjects on this matter did little to assist me in figuring out an extremely simple way to accomplish this result; however, construction on the final r.f. amplifier was at once commenced.

A single pair of 100TH's were used in the conventional push-pull amplifier circuit with link coupling from my field day final amplifier set to this stage. A 17"x3"x10" chassis was used and the tube sockets, condensers and a filament transformer for the 100TH's, were all mounted upon this metal. Neutralizing condensers were mounted between the final amplifier plate tank condenser and the tubes themselves. The grid and plate coils were mounted directly upon the condensers, making for short leads.

While this was going on, another amateur was constructing the final power supply which was to furnish the high voltage for this Class B r.f. stage. A power transformer together with the usual 866 rectifiers and a filter choke system, was mounted on 1"x10"x17" heavy iron chassis.

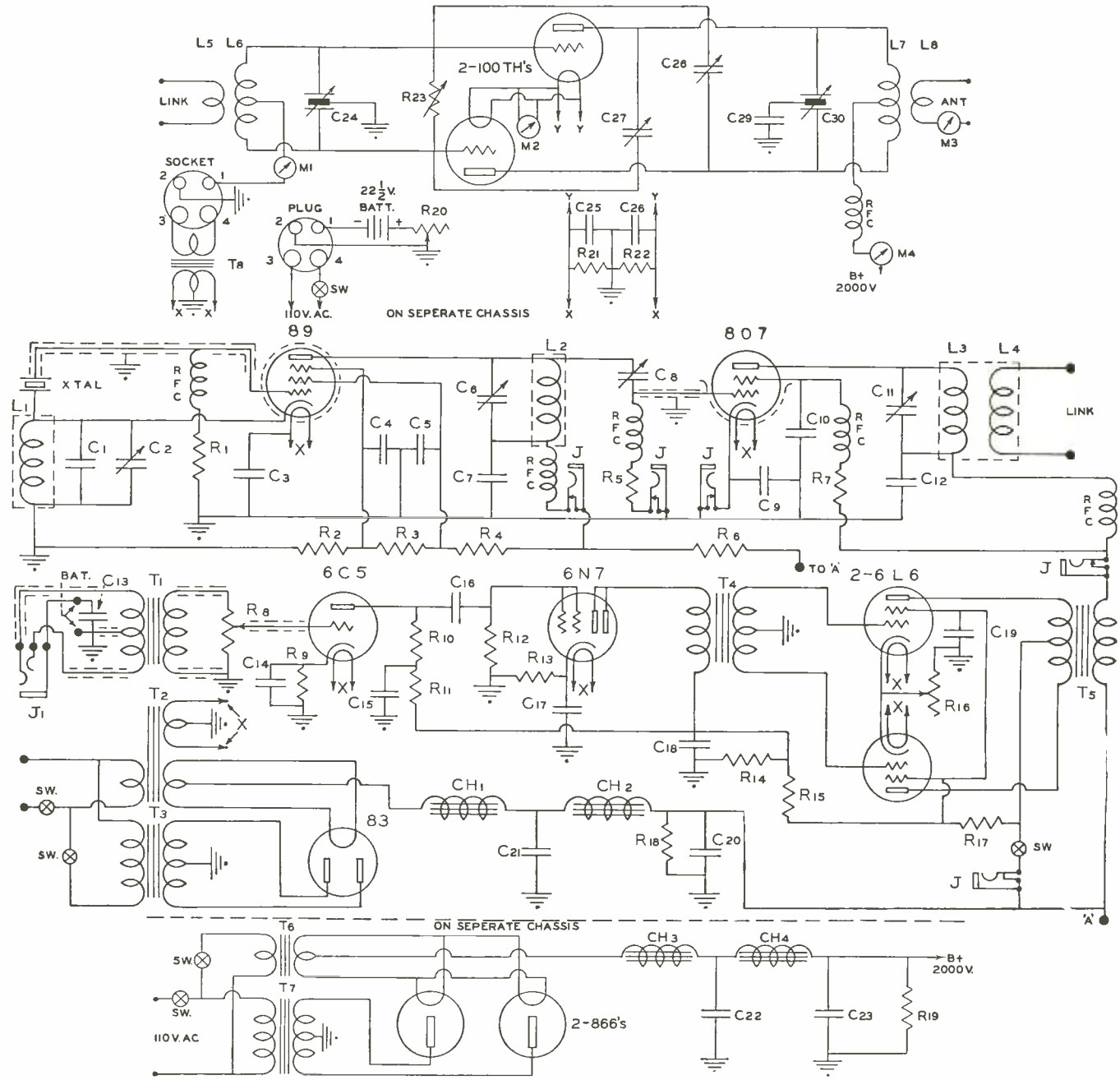
When all was in readiness the three units were assembled on a long table, bread board fashion, for tuning.

The little field day set was first hooked up and the filaments of all of the transmitter chassis were lit, allowing ample time for the 866's to light. When everything seemed in readiness, voltage was applied to the field day set, which was tuned in the conventional manner to the 20 meter crystal which was inserted in the crystal socket. A link was then connected between the output of the 809 and the input to the 100TH's and the tuning procedure in the same manner as a Class C amplifier is tuned, was resorted to.

Tuning Procedure

The grid circuit of the 100TH's is tuned to resonance as indicated by a small neon bulb, or pilot light on a circle of wire, held in the vicinity of the grid coil. The reading on the meter inserted in the grid return the rectified grid current should be in the neighborhood of 100 to 150 ma. As soon as the excitation was maximum at the grid of the 100TH's, and without applying any current whatsoever to the plates of these tubes, the stage was neutralized in the conventional manner, excepting that the neutralization is carried forward until one is positive that there is absolutely no r.f. anyplace in this circuit. Unless this is carried out as described, the Class B r.f. amplifier will not work and lopsided modulation and other discrepancies will result.

Fortunately, and because of the layout, I had little or no trouble in neutralizing the r.f. final amplifier. Once neutralized, reduced power was applied to the plate of the 100TH's by means of placing a 250 watt electric light bulb in series with the line lead to the plate transformer. The stage is then tuned to resonance as indicated by the minimum dip in the plate lead milli-



C_1—100 mmfd. mica 500 v.
C_2—10-70 mmfd. trimmer
C_3—.01 mfd. paper 600 v.
C_4—.01 mfd. paper 600 v.
C_5—.01 mfd. paper 600 v.
C_6—10-70 mmfd. trimmer
C_7—.01 mfd. paper 600 v.
C_8—10-70 mmfd. trimmer
C_9—.002 mfd. mica 500 v.
C_{10}—.005 mfd. mica 500 v.
C_{11}—100 mmfd. var.
C_{12}—.002mfd. mica 500 v.
C_{13}—.002 mfd. mica 500 v.
C_{14}—10 mfd. electro. 25 v.
C_{15}—2 mfd. electro. 450 v.
C_{16}—.01 mfd. paper 600 v.
C_{17}—10 mfd. electro. 50 v.
C_{18}—2 mfd. electro. 450 v.
C_{19}—25 mfd. electro. 50 v.
C_{20}—16 mfd. electro. 450 v.
C_{21}—16 mfd. electro. 450 v.
R_1—50,000 ohms, 2 w.
R_2—10,000 ohms, 2 w.
R_3—25,000 ohms, 2 w.
R_4—25,000 ohms, 2 w.
R_5—50.000 ohms, 2 w.
R_6—3,500 ohms, 10 w.
R_7—12,500 ohms, 10 w.
R_8—500,000 ohms, pot.
R_9—2,000 ohms, ½ w.
R_{10}—50,000 ohms, 1 w.
R_{11}—10,000 ohms, ½ w.
R_{12}—50,000 ohms, ½ w.
R_{13}—1.500 ohms, ½ w.
R_{14}—15,000 ohms, 25 w.
R_{15}—5,000 ohms, 2 w.
R_{16}—200 ohms, var. 25 w.
R_{17}—5,000 ohms, 5 w.
R_{18}—50,000 ohms, 10 w.
J—closed circuit jacks
J_1—double button mike jack
L_1, L_2, L_3—See coil data in text
RFC—midget radio freq. choke
SW—s.p.s.t. toggle switch
T_1—Double or Single button to grid (Stancor A-2056)
T_2—5v-3A; 6.3v-6A (Stancor P-4022)
T_3—400v-300 MA (Stancor P-4024)
T_4—Single pl. to P.P. grids (Stancor A-4700)
T_5—P.P. plate 6L6's Class A, 15 watts (Stancor A-3808)
CH_1—8-30hy. Swg. ch. 250 MA (Stancor C-1402)
CH_2—15hy. Filter ch. 250 MA (Stancor C-1412)
C_{24}—70-70 mmfd. split stat. var.
C_{25}—.002 mfd. mica 500 v.
C_{26}—.002 mfd. mica 500 v.
C_{27}—2-8 mmfd. neut.
C_{28}—2-8 mmfd. neut.
C_{29}—.002 mfd. 5000 v. trans.
C_{30}—70-70 mfd. 6000 v. var.
T_6—5.5v AC-13A. (Stancor P-5011)
C_{22}—2 mfd. 3000 v.
C_{23}—2 mfd. 3000 v.
R_{19}—40,000 ohms, 160 w.
R_{20}—15,000 ohms, 25 w. adj.
R_{21}—50 ohms, 10 w.
R_{22}—50 ohms, 10 w.
R_{23}—10,000 ohms, 25 w. adj.
T_6—2.5 v. AC-10A (Stancor P-3025)
T_7—2000 v. 350 MA (Stancor P-5054)
CH_3—5-25 hy. Swg. ch. 400 MA, (Stancor C-1404)
CH_4—10 hy. Filt. ch. 400 MA, (Stancor C-1414)

ammeter. The bulb was removed and full power applied. Up until this time the resistance across the grid circuit of the 100TH's had not yet been connected. The antenna circuit was now hooked on to the 100TH's and the final amplifier was loaded up by means of the conventional manner until the power input to the final amplifier read 600 watts. A notation was made of the ammeter in the antenna circuit for later reference. It so happened that this meter read 5 amperes.

At this point the resistance across the grids of the 100TH's was introduced into the circuit and the circuit was reneutralized to take care of this additional load, although only a very slight adjustment was found necessary. When high power was applied it was noted that the final current had dropped a bit owing to the fact that some of the excitation on the grids of the 100TH's has been dissipated by the resistor.

If modulation is applied to the 807, it will be noticed that the final modulates downward. This is quite correct as the final is running at too high a bias for upward modulation to take place. As any ham knows, if he is up on his reading, the excitation to the grids of the final Class B r.f. amplifier

must be reduced so that the rig may be correctly modulated. There are many ways which have appeared as to how this may be done, but the method followed by the author was at once the simplest and easiest with the equipment at hand.

Before going into the actual manner in which the excitation is controlled, it might be well to review the fundamentals of the circuit. The final tank circuit of the 807 is furnishing radio frequency current to the grid tank circuit of the 100TH's. Within that latter tank circuit there is a closed oscillating coil and condenser circuit which, when you consider it, is very similar to a wave trap. As long as the coil-condenser assembly is tuned to resonance with the grid of the 100TH's attached, and as long as these tubes are working (the plate juice is connected) the grids draw off the current from this "well." The grids cannot draw more than there is in the coil-assembly because that is the source of their power.

If this is borne in mind, the explanation of how to control the excitation becomes a very simple one. Obviously the tuning of the grid tank is very broad, and so considerable laxity in the resonant circuit is encountered. It is then possible to tune *away* from resonance bit by bit until the grid circuit is *out* of resonance. At this time, with the final biased to cut off, the plate mills will drop to zero because there is not any excitation at the grids.

It occurred to the author, who had watched this phenomenon ever since he was in radio that here was a means of controlling the amount of radio frequency current which the grids of the 100TH's could draw by controlling the amount of current that there was in the grid circuit tank. Therefore he found out that the further he *detuned* the grid tank, the less excitation the grids were receiving and the more was being dissipated in the plate plate-tank-grid tank circuit which the hookup comprised. This is the means that was used in the low-level modulation transmitter.

Knowing this, it became a matter of juggling the antenna coupling (which raises the final plate current the tighter it is coupled), the bias which also changes the plate current, and the grid excitation which also had its effect in the plate current reading.

Going back a bit, it had been noticed that with the final tuned in the conventional Class C manner with double cut off, and the antenna coupled tightly, a reading of 600 watts input had been had. The first step, therefore, was to reduce the bias so that upward modulation could take place.

The Class B r.f. chassis with its components.

As bias was reduced a little at a time the plate meter became of utmost importance, for it was intended to run the final at 600 watts input which would furnish a carrier of 150 watts. Each time the bias was reduced the final amplifier plate current would shoot up a few hundred mills, and quick action was needed to keep the tubes from overheating. The excitation was simultaneously reduced with the bias by detuning the grid tank of the final so that always the plate ended up with 600 watts. Little by little the tubes ran redder and redder in the plate, and the antenna meter showed a consistent drop in current until it reached a figure of just about one-quarter of what it had been at the outset. There were slight adjustments needed from time to time on the antenna coupling but they were minor, and always the final plate tank was kept in resonance.

Finally I arrived at a setting which gave me one-quarter of the antenna current, 600 watts input, and not too red a plate on the final amplifiers. This seemed a good place to test for modulation, and so it was tried. A neon tube was used as an indicator of percentage of modulation. It showed that there was plus modulation. A further check on the oscillograph and with a pilot bulb and circlet of wire, however, showed that there was downward modulation. I was at a loss to understand this difference, until I checked the final *with the plate current off*, and found a plus modulation at the 100TH plates. The answer was apparent at once. This was the 807 modulation that I was measuring coming through the tubes. So I discarded the neon tube as too sensitive and confined my tests with the pilot bulb.

Since the modulation showed downward, I was faced with two choices. Either I had too much bias or too much excitation. I changed the excitation first and "ran out of condenser" without any improvement. It must be the bias. I lowered the bias and tightened the antenna coupling until the plates again drew just 600 watts. Tried it and got an even zero modulation—not up, not down. I was on the right track. I reduced the bias further, and coupled the antenna a little tighter. Still 600 watts, but on modulation, I had upward modulation. The rig was perking.

A few adjustments were now in order so as to get that percentage up, and the amateur will find that the percentage increases very rapidly from that point on with every adjustment, provided only that the adjustment is in the right direction. How to determine what that direction is easy. If the modulation gets poorer, try the "other" thing. Finally a check with the oscillograph showed that the final was being modulated at about 80% and I left it that way.

I noticed that with every spoken word the tubes, previously red, got *cooler*, which was quite O.K., since the 807 was furnishing more excitation with the modulation that was present in its final tank and that in turn was adding bias and excitation.

Rear view of the completed low-level modulated 150 watt-peak 600 watt transmitter.

That's all there is to it. In retrospect, I do not know of any rig I ever built which gave me the thrill of working out as did the Class B one. There is something about trying this rather out-of-the-ordinary type of ham modulation that had the thrill of the old spark days in it.

Later I mounted the four chassis in one cabinet and interconnected them with cables and there I had a first rate 150 watt carrier-600 peak phone.

—30—

Coil Construction Data.

No.				
A—31T	*No. 18EW*	*1½" DI*	*1¼" LG*	
B—14T	*No. 18EW*	*1½" DI*	*1" LG*	
C— 6T	*No. 18EW*	*1½" DI*	*1¼" LG*	
D—55T	*No. 26EW*	*1½" DI*	*1" LG*	
E—18T	*No. 18EW*	*1½" DI*	*¾" LG*	
F— 7T	*No. 18EW*	*1½" DI*	*1" LG*	
G— 9T	*No. 18EW*	*1½" DI*	*1¼" LG*	
H— 6T	*No. 18EW*	*1½" DI*	*1" LG*	
I—40T	*No. 14BW*	*3½" DI*	*5" LG*	
J—40T	*No. 14BW*	*2½" DI*	*5" LG*	
K—14T	*No. 14BW*	*2½" DI*	*3" LG*	
L— 8T	*No. 14BW*	*2½" DI*	*3" LG*	
M—40T	*No. 10BW*	*5" DI*	*3" LG*	
N—26T	*No. 10BW*	*2½" DI*	*3" LG*	
O—14T	*No. 10BW*	*2½" DI*	*3" LG*	
P— 8T	*No. 10BW*	*2½" DI*	*3" LG*	
Q— 6T	*No. 10BW*	*2½" DI*	*3" LG*	

Code: EW—enameled wire, DI—diameter coil, or wire form, LG—length of winding, T—turns, BW—bare copper wire.

Coil placement chart

Coil	*160M*	*80M*	*40M*	*20M*	*10M*
L1	*No. A*	*No. B*	*No. C*	*No. C*	*No. G*
L2	*No. D*	*No. A*	*No. E*	*No. F*	*No. F*
L3	*No. D*	*No. A*	*No. E*	*No. F*	*No. H*
L6	*No. I*	*No. J*	*No. K*	*No. L*	*No. Q*
L7	*No. M*	*No. N*	*No. O*	*No. P*	*No. Q*

L4, L5, L6: From 4 turns to 6 turns as may be needed.

Not For REBROADCAST

by "X-73-88"

The author is one of the best informed men on radio in the country, withholding his identity to maintain complete freedom of comment.

EUROPEAN propaganda is losing to American music on the South American front.

Authority for the opinion is one of radio's best-known announcers. He has just concluded an extended vacation in the *pampas* country and, naturally, considerable of that time was spent browsing around Argentine and Brazil, chatting with station folk and plain listeners.

Brazil's leaning toward North American programs comes as a surprise after the country's alleged shift toward the Fascist-European states. Reason for it is not so much a newborn love for Yankees as it is just plain logic.

Our Latin-American friends tire just as we do from too much national ballyhoo.

And the blackshirts and brown-shirts have surely been injecting it into the megacycles, lately, via their Rome and Berlin stations!

* * *

SPEAKING OF PROPAGANDA:

Some of our own American airbills are also becoming extremely boring. . . . Because of that, this scribe just listened for the last time to *Vic and Sade*.

The Victor Gooks are grand folk. From their little house "half-way up the block" they have brought me and the Mrs. many happy hours of listening.

Rush, we're going to miss him terribly. A human little brat if ever one lived.

But those seven-minute commercials on the fifteen-minute show! They are more than the traffic can bear.

I know others who have voiced the same resentment.

Goodbye, Vic and Sade . . . and Rush!

* * *

THE KU KLUX KLAN emblem might be a neon light, next time its gory rays "illuminate" the countryside.

From LaPorte, Ind., comes word that the Klan's former Grand Dragon, D. C. Stephenson, has invented a lamp which burns from static electricity alone. No less authority than Mayor of LaPorte says so.

It was necessary for the Mayor—Stephenson's attorney—to make the announcement to the world. The ex-Grand Dragon probably found the wardens would take down any dictation. He is spending some time in Indiana State Prison for the brutal gang attack-kidnap-murder of a girl named Madge Oberholtzer.

Stephenson's sudden inventive genius comes on the eve of efforts to get a new trial or a pardon. He isn't particular which. The announcement of this scientific absurdity might or might not be designed to influence the prison board's feelings toward the man who was convicted of having perpetrated one of the vilest crimes against the very thing his organization is supposed to uphold—namely, American Womanhood.

Believing that the Board, as well as all Americans might like a little more "light" on this startling light, your scribe hereby offers $100 in cash for a successful demonstration of the device. All it must do is repeat what the Mayor is quoted as having said it has already done—

Give a useful, continuous light (say, one we can read by) for a period of nine days without aid from any electromotive source known to Man at present. Or in plain language—burn continuously from static in the air.

Even an hour will satisfy yours truly, for I frankly believe the whole thing is poppycock!

* * *

CROSS-COUNTRY:

LOS ANGELES newspapers still withholding radio columns but reported weakening before fan complaints . . . **WASHINGTON:** Fair exchange is no snobbery. After booking agent Mark Hanna signed FDR, Jr., to guest on a commercial show, young FDR had Hanna over to the White House to meet Pop and Mom at dinner.

CHICAGO: Tipster No. 21 asks, "Why don't you check on rumors Kay Kyser is secretly married to Virginia Sims?" . . . **MINNEAPOLIS:** Candid camera enthusiasts, invited to WCCO studios, overran the place. Now they must register ahead of visits! . . . **HOLLYWOOD:** Glamour girl Lamour and her praise agent, Dorothy Gulman (longtime friends) have parted — with words . . . **WASHINGTON:** A. F. of L. chiefs plan to use Federation's WCFL (Chicago, 10 kw.) to fight the CIO in latter's home territory, the heavy dues-producing coal fields of S. Illinois . . . **NEW YORK:** Add to radio queens who look the part: Bristow, Oklahoma's, contribution to the *Swing Fourteen*—Beverley Freeland.

Beverley Freeland whose lovely voice is now heard with the "Swing Fourteen."

* * *

PET PEEVES!

Rudy Vallee's English Importations which are not up to American Amateur Hour standards. . . . What IS the difference between paying a finance company, and paying the regular butcher, baker, and candlestick maker, except that these famed gentry do not ask for interest. . . . Those announcers who talk as if the listeners were devoid of ANY intelligence. . . . That B.C. station which omits to mention the name of a certain announcer, star of his own show, because even though he was picked by the sponsor, the mikeman is a regular on a rival station. . . . The *Lights Out* program fade-in which always uses a wind machine even if the location of the story is indoors. . . . The "spot" news invariably coupled with an advertisement in the same sentence. . . . That Phil Baker program is not given a Chicago outlet. After all, Chicago is the 2nd U. S. city, and as important as the West Coast. . . . *Bei Mir Bist Du Schoen*. . . . And that "Swing vs. Good Music" publicity gag that has turned as sour as last year's milk.

* * *

MUTINY ON THE BOUNTY:

Funniest phase of the Pitcairn Island re-broadcasts was the preparation of them.

From reliable sources, I learn that the Pitcairners really wouldn't give a whoop to be radio stars. NBC schedules meant nothing to them.

There was the time, for example, when a choir made up of the villagers was ready to go on the air in half an hour. NBC stations were to be serviced via the VR6AY link.

Half-hour before mike time, a steamship hove into sight. To islanders isolated for decades, this was a red letter day, so members of the choir all broke into a run for the shoreline. Soon, they were making for the passing steamer in tiny boats.

A distraught "production man-engineer" took another boat, chased the "choir," pleaded with them . . . and finally induced enough to return so the show went on!

Language was no barrier on the Island. Pitcairners speak a perfect—if not sophisticated—English.

One word did stump them, however.

In telling of it, my informant said: "The script that was supposed to be island chief Fletcher Christian's own words was written in New York. . . . In it was the word 'expiate.'

"Now, those Pitcairners aren't dumb people nor are they familiar with dollar words. They learn their English from the Bible. I wasn't sure whether the word 'expiate' appeared in the Bible, so I struck it out!"

* * *

UN-AMERICAN AMATEUR RADIO CLUB?

What amateur radio club composed entirely of—or for the most part, of—licensed radio operators, used to set itself up as an aid to a government military arm, which it was not—and is still doing it in a quasi manner? . . . is run by a man interested in selling transmitters to unlicensed and perhaps even unqualified persons who get the services of an amateur operator with the rig? . . . was involved in a seemingly commercial squabble because of its former qra? . . . had many policies dictated to it by a commercial organization which was *not* a member, and held no license? . . . has a constitution, as required by law, which the Head Man pushes aside whenever he wishes, to accomplish what-

(*Continued on page* 81)

Modern Service Problems

by FRANK A. BRAMLEY

Some of the more unusual servicemen's problems are discussed by the author, and the remedies are set down so that others can profit by his experiences.

The author adjusts a wave trap.

RECENT developments in the broadcasting art, such as the new single tower vertical aerials and automatic volume control devices installed in the audio system of the transmitter have so increased the efficiency of many stations that they have an effective range of from two to four times that previously obtained. This results in much stronger signals in the vicinity of the stations and relatively less at distant points. Both phenomena add to the problems of the serviceman.

High Percentage Modulation makes itself known when you are near the station, as distortion. This fact alone complicates servicing by causing the distortion to be intermittent and dependent upon the carrier level.

Recent trends in receiver design must be given their full share of responsibility for the serviceman's woes. It is the purpose of this article to help the serviceman solve some of the problems caused by the above changes.

Cross Modulation

Although the term "cross modulation" is by definition "a type of intermodulation due to the modulation of the carrier of the desired signal *in a radio apparatus* by an undesired signal," it has come to be necessary to divide the trouble into two distinct types to be known as "External Cross Modulation" and "Internal Cross Modulation." The internal type will be discussed first.

Internal cross modulation then, it will be assumed, is due to something about the design of the set, the way it is connected to its aerial and ground system, the location it is being used in or perhaps the present condition of the tubes or adjustments of the set. Likewise, external modulation is due to external causes, such as defects of the aerial and ground system or of the wiring and piping in or near the location of the radio.

Of course, both types of cross may be present at the same time along with several other troubles.

A—Internal Cross Modulation and Distortion

When there is internal cross modulation, usually there is distortion along with it, although it is possible to have either one without the other; however, inasmuch as the cure for one is frequently the cure for the other, it will be assumed that the troubles are interchangeable.

The cause of this trouble is always the overload of some tube to such an extent that signal present from the interfering station is large enough to cancel out the bias on this tube, thus causing the tube to act as a detector.

The causes of this overload may be:

1. *Lack of preselection* (two gang condensers). There are probably some sets having three gang tuning condensers in which this is still the real cause of the trouble, especially when shielding and design are bad.

2. *Lack of a good ground.* For years engineers have stressed the value of a good ground connection, but the lack of one is still a major cause of poor operation of modern radios. Why does a good ground help? Simply because radios are usually built with the idea of having the aerial wire pick up the desired signals rather than the power line; and, unless a ground is connected, the power line may be putting more signal energy into the radio than the aerial, and, the line may be introducing the signal directly to the first detector while signals from the aerial must travel through the tuned circuits of the detector and r.f. stages, if any.

3. Several cases of cross modulation recently occurred in which the trouble was due to a *very short aerial* (10 ft.). Even though a ground was being used, apparently more energy was still being introduced by the power line than by the aerial, because increasing the aerial length immediately cured it.

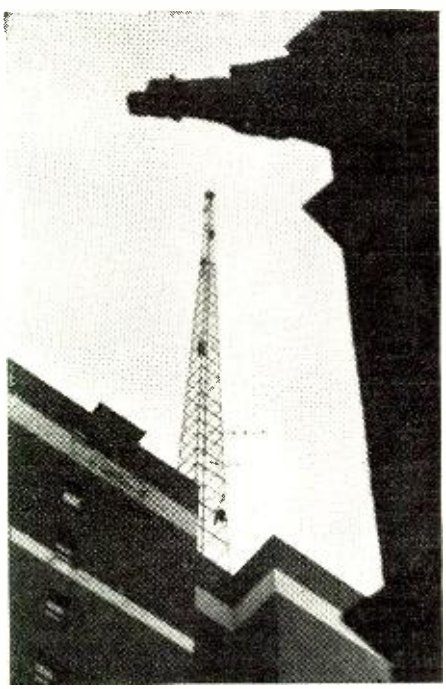
4. *Lack of line filter.* Next in importance as a cause of overload and distortion is the case of the *power line acting as an aerial.* The presence of a good aerial and ground does not help much unless the power line is further prevented from acting as an aerial. Seemingly miraculous is the cure of some old and some new sets when .01 mfd. condensers are connected from the line to ground. This also helps to control volume on local stations.

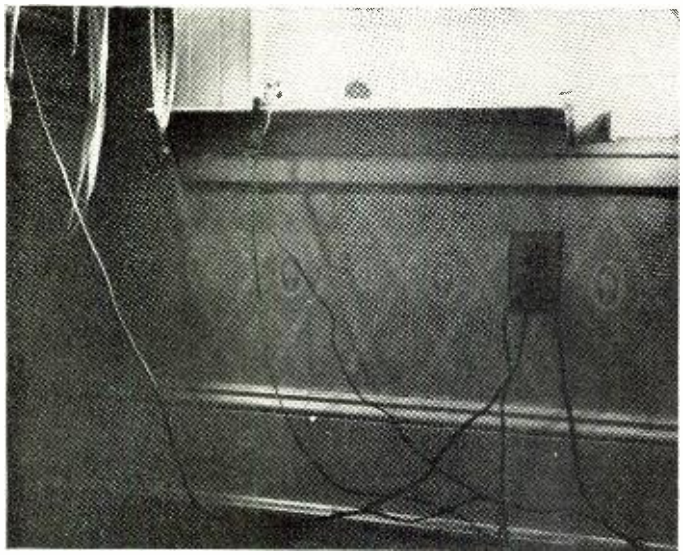
5. Many early all-wave aerials of the so-called noise reducing type are causes of overload on the broadcast band because the *transmission line acts as an aerial.* If the aerial has no transformer at the aerial end of the transmission line, this undoubtedly is the case. Make sure the can does contain a transformer. Many cans formed only a junction box for the leads. To test this, make a simple continuity test of the transmission line. If open, there is no transformer at the top. There is at least one exception to this in the case of a popular all-wave aerial shipped with each set from the factory. Small mica condensers were placed in series with the line just inside the transformer housing.

If the set is overloading due to excessive aerial, whether it be due to too much top or the combination of top and lead-in being too much, matters not. If you cannot sell the customer a modern noise reducing aerial, there is an easier and better way to cure the trouble than by going up on the roof and cutting off the aerial. In the first place, you cannot be sure just how much aerial to cut off, and *no aerial is ever too long.* The reason for this is that long aerials always give better reception on distant stations both in signal strength and noise ratio.

A. But to get back to curing the overload. The easiest way to reduce signal strength is simply to connect a *small mica condenser* in series with the lead-in at the aerial terminals. If an L aerial, only one is needed; if a twisted pair lead in, two of equal size are required. The size will depend on the amount of signal reduction needed to cure the cross talk. Usually the

A new tower going up. Notice men working?





An example of sloppy type installation which tends to create cross-talk. The lead in strip is one of the chief causes of this annoyance.

size will vary between 50 and 100 mmfd.; but less than 50 mmfd. will almost always cause excessive hiss on distant stations. Check this with a weak station at the low frequency end of the dial. The exact size can be quickly determined without making several trips to the roof; and there is no loss of the noise reducing effect of the long aerial.

A word about local-distance switches. What serviceman has not made fool trips to someone's home to find the antenna switch open? Secondly, any radio is subject to any one of a dozen troubles if operated without an aerial even if it be only on local stations. To enumerate only a few of them, they are: fading or sudden change in volume when light switches are thrown, noise, hum on carrier, and cross talk.

B. Next comes the old faithful *wave trap*. If one station is the cause of all the trouble, the very best solution is a wave trap, as this affects only the interfering station. However, with modern types of aerials involving transmission lines, the problem becomes very complicated. In some cases, two traps may be necessary, one in each side of the line. There are a great many types of wave traps appearing on the market, but usually only one will do the job. The problem is to know which type to use. Two basic types are available; one in series, the other parallel tuned. This difference is very important.

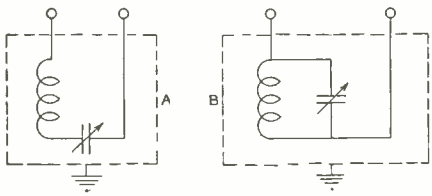


Fig. 1—Two Basic Types of Wave Traps.

Type A is a new article commercially and works by allowing only the undesired signal to pass through it, rejecting all others. It must, therefore, be connected in parallel with either the antenna coil, if an L aerial, or across the transmission line. As such it is very effective provided the transmission line is acting as a *true* line. If not a true line, the effect will be nil and the only solution is a type B trap in each wire of the so-called line. Type B is an old friend that you have used for years; its action is one of absorption. The undesired signal is absorbed within the tuned circuit and the trap must, therefore, be connected in series with the circuit for best results. This is ideal for L type aerials and may be used with some success, if connected as shown in Fig. 2, on transmission line couples.

C. There is another gadget available which does a good job of removing cross talk, at the expense of the weaker stations, however. It frequently reduces their level down into noticeable hiss. It is a cross talk eliminator, whose action is that of a *selective shunt*, for it is merely a small r.f. choke of low resistance which is connected across the transmission line. Its impedance is sufficient to prevent short wave signals from being by-passed.

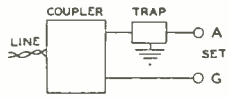


Fig. 2—Wave Trap.

D. It is obvious that there is very little hope of removing cross talk unless all coils, tubes and long grid leads are shielded.

E. Much cross talk and distortion would not occur if there were sufficient automatic volume control action to properly bias the tubes. This whole problem is a very complicated one of the vicious circle type; for as soon as the r.f. voltage is available and the gain decreases, the available voltage also decreases with which to cut down the gain. The real problem arises from the fact that it is a characteristic of most automatic volume control systems to work inefficiently on strong signals. The problem is to increase and conserve all the available voltage. Increasing the voltage is best done by making sure the alignment of all trimmers is absolutely perfect. Frequently the distortion and cross talk disappear at the same time. In rare cases the trouble is too much AVC voltage, although this usually is only indirectly the cause of the trouble.

Sometimes placing new tubes in a set or balancing up the set will cause distortion to appear that previously was not present. This would seem to indicate too good a job had been done, and the temptation is to throw the set slightly out of balance again or perhaps put back one of the old, weak tubes. The real trouble is the outdated design of the set or else some trouble we have missed. Suggestion: Check all the bypass condensers in the AVC feed line. Replace all those that show any leakage whatsoever. Leakages of 10 or 20 megohms will cause trouble. Make sure none of the tubes have any cathode leakage. This applies especially to the tubes used in early AVC circuits. Occasionally, the tubes being controlled by AVC voltages develop defects which cause them to draw grid current. Most tube testers are incapable of detecting this defect. When in doubt, try new tubes—an excellent rule always.

It may be helpful in some modern sets to separate the detection and AVC actions. This is easily possible if a duplex-diode triode is used. The reason for the improvement is that for detection purposes one cannot make the detector load resistor more than .5 megohms; .35 megohms, or even .1 megohm, would give better audio quality, but if the same resistor is used to develop AVC voltage, obviously more could be developed across a larger resistor. The change is illustrated in the circuit below:

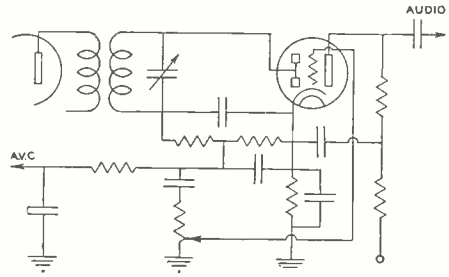


Fig. 3—Original Circuit.

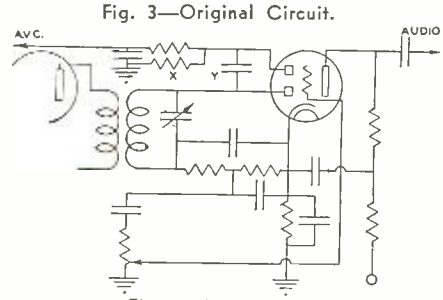


Fig. 4—New Circuit.

X—1 megohm. Y—100 mfd. All other parts are the same.

F. So much for the newer sets. There are many older sets that can be much improved by some modernization. If the changes are made at the same time as repairs, the cost will be very little more than the repairs alone, and the result will be a job that you will get paid for. The customer seldom questions a bill if the set performs better than ever; whereas, if merely routine repairs are made, the general pepping up of the set often results in distortion or lack of control of volume on locals which the customer says he did not have before. So, rightly or not, he questions your bill and probably refuses to pay at all. The solution is simple.

Sometimes, this means a change in the volume control circuit. Most likely the set needs a new volume control anyway, so change it over to an antenna-bias circuit and you will have a much better performing set. Again the trouble may be only the volume control circuit. Much improvement will frequently be had if the control circuit is merely changed a bit. The '24 tubes and old control, if not noisy, may be left right in. Such a circuit change is shown on the next page (Figs. 5 and 6). Only a few connections have to be changed.

The value must be determined by experiment. Size is correct when you can cut down the locals to zero volume and just a

little to spare. Resistance will vary between a few thousand ohms and ¼ megohm.

C is the antenna section, if the control happens to be a dual. The only change desirable would be to shield the antenna lead from the volume control to the primary coil.

External Cross Modulations

For some years, servicemen have noted that certain peculiar cases of distortion or cross modulation on local stations cleared up when lead in strips were wiggled. The answer is what some servicemen have long suspected. In the presence of strong signals from locals, poor contact between portions of the aerial and ground or of other metal objects such as pipe, BX or house wiring acts as a rectifier or detector of the strong radio signals flowing in them. Unfortunately, detector action is such that if signals from two or more strong stations are present, their combined carriers and modulation are reradiated into the air on frequencies other than their original. This is similar to the action of the first detector of any super-heterodyne. Thus, we will be able to tune in these composite locals in numerous places on the dial. If we assign frequencies to imaginary Stations A and B, we should be able to hear them as shown below in addition to their regular frequencies:

A= 600 kc.	2A+B=1900 kc.
B= 700 kc.	2A−B= 500 kc.
A+B=1300 kc.	2B+A=2000 kc.
A−B= 100 kc.	2B−A= 800 kc.
2A=1200 kc.	3A=1800 kc.
2B=1400 kc.	3B=2100 kc.

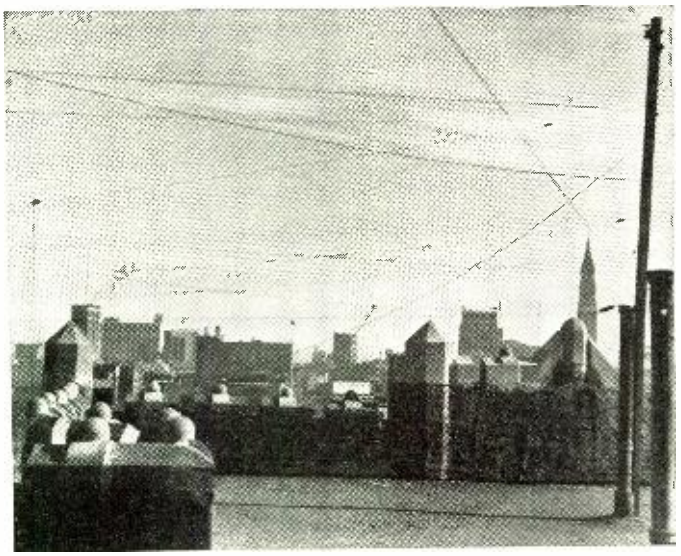
If this is the result of a "cross" between only two locals, think of the confusion if three or four strong carriers are present.

Such a cross may occur in any conductor. It is only necessary to have two alternating currents present such as 60 cycle a.c. on open wire. The result is 60 cycle hum modulation on the carrier of your locals—one or more. This type of hum-on carrier does not respond to the usual cures because it enters the set through the aerial as a regular carrier. Distant stations are, of course. O. K. Do not confuse this with a similar hum due to lack of line bypass condenser.

As to cures—that old nemesis of the radio man, the *lead-in strip,* is the most frequent cause of trouble. As we all know, copper oxides make fine rectifiers; and wherever we have copper exposed to the weather, this oxide develops and sooner or later starts its dirty work. The best way is to remove the strip altogether and bring a new lead wire direct from the arrestor to the set.

Poor ground clamps, loose connections, or *bad lead in strips* in the *ground lead* may be the cause of hum-on-carrier and cross talk. *Leakage between* the *terminals* of the *lightning arrestor* has been a frequent cause of cross modulation and hum-on-carrier too, if the set and arrestor grounds are of the same wire.

One of the most annoying cases of cross talk observed is that caused by a *break in one or both wires* of the *transmission line.* This usually occurs under the insulation and cannot be seen. Worst of all, one popular type of all-wave aerial, as previously mentioned, has a line which normally shows open circuit. Although a screw eye is usually not furnished with all-wave aerial kits, it is absolutely essential that one be used for the first place of attachment or trouble will always result. Impossible as it is to understand, one may throw the lead-in from the offending aerial out the window and then, using another aerial, the noise will be just as bad as with the defective one.



The maze of poorly installed antennae on the average apartment house causes the serviceman much work tracing trouble.

If the trouble is not due to the aerial in use, it has definitely been proven that adjacent aerials will produce the same result; in fact, it behooves any serviceman who goes to a roof to inspect his customer's aerial to also inspect all other aerials on that roof, eliminating all shorts between them or possibly cases of loose connection. Quite an undertaking, but absolutely necessary if you wish to be successful.

Intermittent connections between metal objects of *any sort, especially pipes* and *electrical* conduit in cellars or walls of the building or even adjacent buildings, are frequently the cause of noise or cross molulation. The cure may be effected by either separating the offending conductors by an insulator or by connecting them together.

If, as occasionally happens, the cause cannot be located or is inaccessible, the installation of one of the best types of shielded lead-in aerial systems will materially reduce this trouble. Transmission line types of aerial may be used if the line acts as a *true line* and better if the set coupler has an electrostatic shield.

C—Monkey Chatter

With the advent of super power stations operating on adjacent channels (the classic example is WOR, Newark, and WLW, Cincinnati), another form of cross modulation has become apparent. Many have heard the unintelligible jibber-jabber in the background when tuned to one of these stations. This trouble can occur on any two stations operating on adjacent channels provided they are fairly strong and their carriers are not greatly different in strength. For lack of a better name, the effect has been called "monkey chatter." The trouble is commonly thought to be due to lack of selectivity in the set, but actually this is only partly true because, theoretically at least, the effect would be impossible if stations stopped all audio modulation above 5000 cycles, and the audio system of all receivers cut off abruptly at the same place.

This is not being done, nor is it likely to be done in the future; the tendency is to let the higher frequencies modulate the transmitter and build receivers that reproduce these high frequencies. There are a few sets that have a trap in the speaker that limits reproduction to those frequencies below 5000 cycles, but this does not eliminate money chatter. The reason for this is: The *overall* selectivity of most sets is sufficient to adequately separate the carriers of the adjacent stations. Most of this selectivity is in the I. F. amplifier, but the selectivity of the preselection circuits is inadequate to prevent both signals from arriving at the first detector.

(*Continued on page* 73)

Fig. 5—Old Circuit.

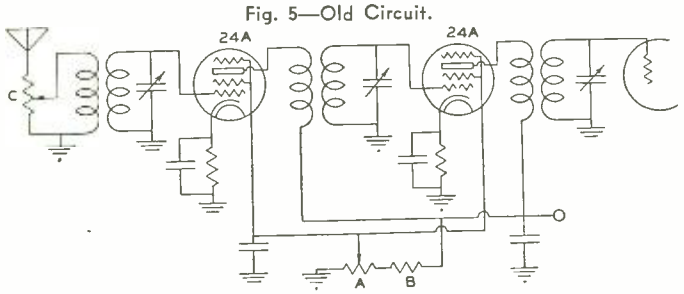
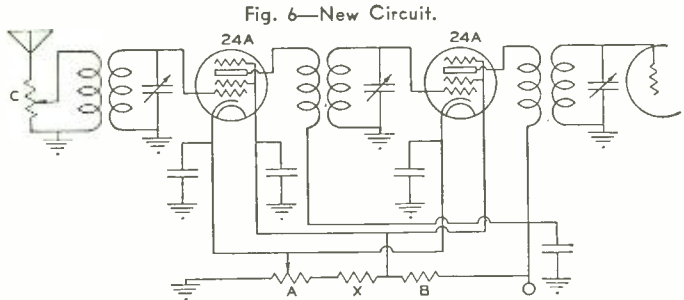


Fig. 6—New Circuit.

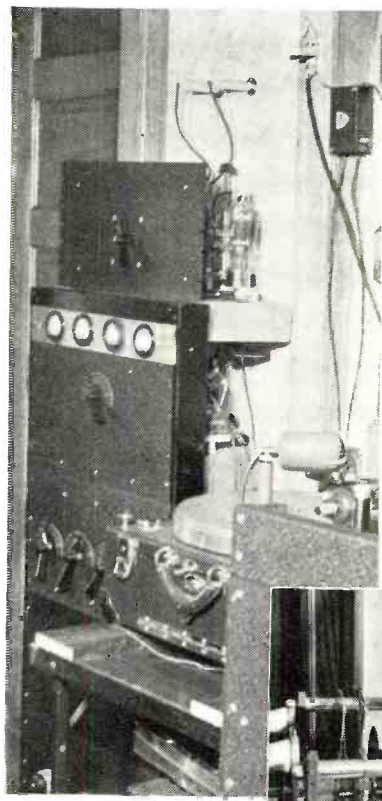


A is old volume control. B is old screen resistor. X is a new resistor to be inserted (2—5 watt size).

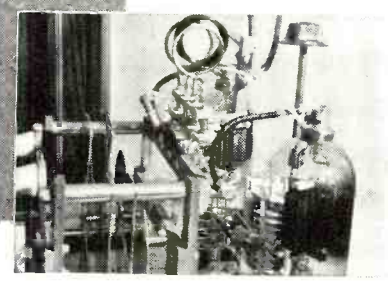
CRYSTAL CONTROL

↑ When you hear the sound of the chimes it will be W9TLQ of Park Ridge, Illinois. The owner of this fine 300 watt rig is Al Knodell. With a lineup as follows, 6L6 crystal oscillator using a twenty meter rock, an 807 first doubler, a TZ40 second buffer doubler, and a pair of T55's in the final, Al has worked almost everything that he has heard on his Hallicrafter SX 17. The speech unit is one of those high fidelity bloopers, commercially made. This drives the Class B Taylor 203Z's. The antenna is a half wave vertical. When not on 5, W9TLQ is on 160 meters. The frequency is 58.68 mc. A complete remote control unit has been built into the wall of the shack. Al is a widower, has 3 YL junior ops, and is vice-pres. of Angel Dainty Die Co.

Earl Sorenson is keenly interested in building receivers. He uses a "Sorenson Special" 6 tube superhet for 56 mc. reception. His xmtr can be heard nightly with the call W9-ZEO. While capable of operating on 2½ meters, the rig is now on 56 with 6J5 xtal stage and a 10M quartz, 6L6 doubler, pair of T20's final at 50 watts. Ultimately 200 watts will be used. Frequency, 57.988 mc. Antenna is a "J" vertical.



← W9UAQ of the automatic 56 mc. transmitter, owns this job. 6L6 xtal osc.-40M rock, Taylor 756, T55, pair T55's, pair T125's final at 1 KW. Modulator is pair Taylor 822's Cl. B. Speech is commercial with 6L6's in output. Receiver, Hallicrafter's Ultra Skyrider Special. Antenna, 2 vert. half waves with push-button phasing for directivity. Al Cox, Jr. is the owner. He is married, has a junior op with the call W9YJE (honestly!), and is proprietor of Illinois Letter Service. Station is located at Oak Park, Ill. Al's frequency, 56.08 mc. Final amp. shown below.



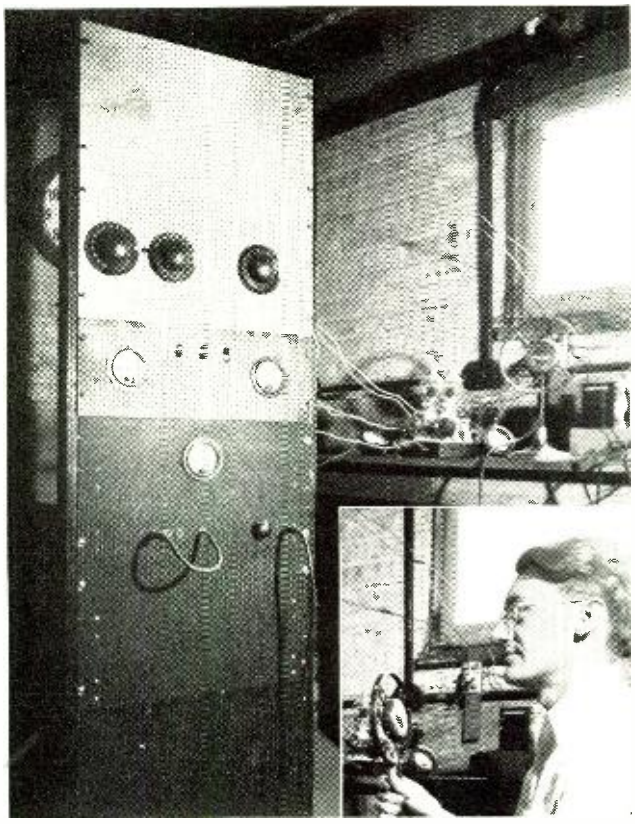
Consistently on the 5M band, and among the first to work real DX, is W9FP. Earl Arthur can be heard pumping out his 140 watts of xtal controlled signal on 56.3 mc. whenever he is not busy nights working for Wieboldt's. Tube lineup: 6A6 osc.-40 meter plate, 6A6 doubler, 6L6 doubler, pair 6L6 PP buffers, pair of T40's final. Speech is 6C5, pair 6C5's, pair of 6L6's Class AB. Condenser mike with 2 stages. Receiver: Super infra-generator with 4000 kc.IF's. Ant. "J" type array.

ON 56 MC.

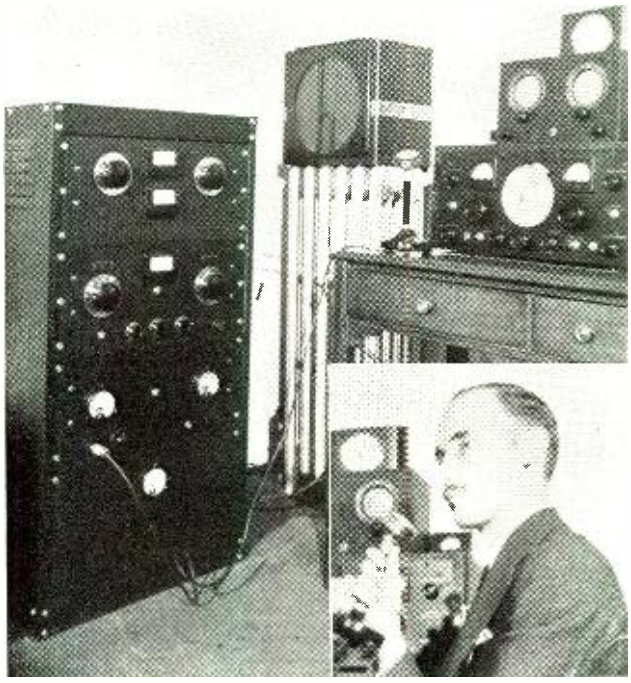
by AL COX, Jr., W9UAQ

All photos by the author.

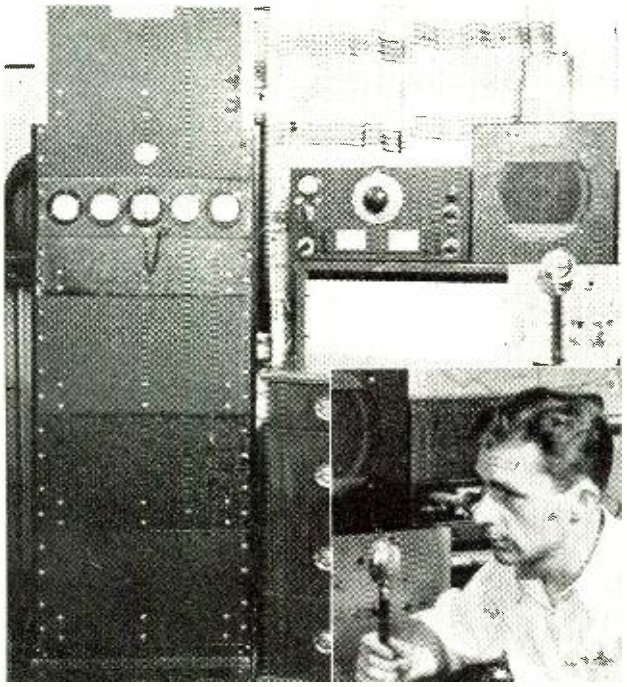
THE advance of the radio art has made the use of crystal controlled transmitters on 56,000 kc almost a necessity. Why the amateur fraternity is loth to do this, as a body, is hard to understand. Some have gone over to the crystal with surprisingly fb results. Here are a few of the rigs that the author photographed in and around Chicago, Illinois, where the five meter activity is at fever heat. All of these stations are home-built and most of them have worked remarkable dx for their respective locations. A wide variety of receivers are in use, but all are superheterodynes upon which the MOPA and modulated oscillator have little chance of being heard. In spite of the average restrictions as to range, the use of high power on the five meter band presents some problems which must and can be solved, as well as a good evening's fun. Experimental work in this band indicates that it may become one of the most valuable to hams; more should try it.



W9VHG, as "Dud" Little is known to the ham fraternity, dumps his signal on 58.5 mc. When he's not engineering at WBBM he putters at home in Glenview, Illinois, at the rig. Tube lineup is 6L6 osc with 40M xtal, 6L6 doubler, TZ20 second doubler, pair of T20's final. Speech is 6C6, 76, pair of 76's, pair 6A3's, and a pair TZ20's Class B. Antenna is "J" type. Receiver—8 tube autodyne superheterodyne with 30kc IF's. Dud is married.



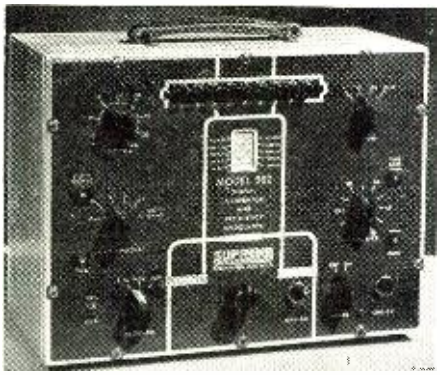
Rogers Park, Illinois, has its W9QDA, with Vic Ruebhausen, ex-W2HXD, the op. Vic, married, has a YL junior op. 14 months old. The rig starts with a 6L6 xtal osc., RK39 doubler, a pair of T20's buffers, followed by 2-100TH's final at 600 watts. Plugin coils for 5, 10 & 20 meters. Modulation by T40's Class B. Receiver, Hallicrafter SX 17 also Special 5 tube super. Antennae, 8JK 4 element vert. array, and 2 half wave, vert. in phase.



Aviation enthusiast Ken Burroughs is known as W9YFQ. When not a ham, Ken is Instructor of Meterology at Wright Aviation School. The qra is Oak Park, Ill. The xmtr uses 7 mc stone 6L6 osc., 807 buffer, 809 second buffer, PP T55's final at 300 watts on 57.6mc. Modulators, Class B 809's. Speech is commercial amplifier. Antenna is vertical Johnson "Q," while receiver is a resistance coupled 6 tube superheterodyne.

What's NEW in Radio

A unique push-button signal generator has been developed by Supreme Instruments Corp. of Greenwood, Miss. The RF and IF frequencies are controlled by push-buttons and previously laboratory checked and calibrated. Frequencies from 85KC to 15MC are provided on fundamentals,



Supreme Signal Generator

and up to 60MC on harmonics. Newly developed iron core IF stages and air tuned high Q circuits result in freedom from drift and greatly improved accuracy. Hair line dial eliminates parallax.

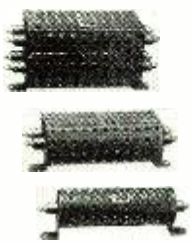
Meissner Mfg. Co., Mt. Carmel, Ill., has brought out a new P. A. Tuner Kit with full broadcast band coverage 530 to 1600kc. A 4" calibrated airplane dial, 4 tuned circuits using iron core shielded R. F. transformers and a 4 gang precision condenser are some of the features.

The American Television & Radio Co. of St. Paul, Minn., has moved to larger quarters at No. 300 East Fourth Street in the same city. They are manufacturers of television apparatus.

Wholesale Radio Service Co. announce a new superior portable public-address system Model 825-T Studio Portable. It is rated conservatively at 30 watts with a peak of 40 watts. Two 12" high fidelity speakers, 4 input channels, beam-power tubes, etc. are features.

Newark Electric Co., 323 W. Madison St., Chicago, has just released a free circular to amateurs and experimenters containing advance information on receiver and transmitter components. New tubes and a new receiver are featured.

A new improved flashlight battery has been released by the Burgess Battery Co. of Freeport, Ill. Features are a seamless zinc can, hermetic wax seal, and "Chrome" process of protecting cell against shelf deterioration.



Standardized cage type resistors have been brought out by Ohmite Mfg. Co. of Chicago, Ill. They are well suited where accidental contact with the resistor is to be prevented. Three sizes are furnished for one, two or four resistors in one enclosure.

General Transformer Corp., of Chicago, Ill., announces the new "Pee Wee" transmitter kit. When completed it will work three bands with one crystal, or all five bands to 10 meters with two crystals. It forms a flexible exciter for a 100 watt amplifier stage. Input of 25 watts.

Nipper, probably the best trade mark in the world, has been resurrected and will grace the carton of the new RCA Victor radio tube. All new RCA receivers will be equipped with the new RCA Victor tubes.

Standard Transformer Corp., of Chicago, Ill., has released an ingenious line of 14 transformers which will service the majority of receivers. Furnished in conventional half-shell or Underwriter's type mounting.

Presto Recording Corp., 139 West 19th St., New York, N. Y., announces a new recorder to be known as the Presto Junior Sound Recorder. It makes home recordings and plays records. Price $149.

RCA VICTOR has brought out a combination phonograph-radio to retail at $39.50. The record part plays 10" and 12" disks, while the radio is a sensitive 5 tube superhet. Tuning range is 540 to 1720 KC, covering domestic broadcast and one police band.

Raytheon Manufacturing Co., Waltham, Mass., announce a new rectifier for arcs. This instrument converts 115 v. AC to 60 v., 5A DC, and is completely portable. The new Raytheon RX-207 is used.

The Western Electric Co. patent rights in amplifiers was upheld on May 2, 1938 by the United States Supreme Court, in a suit against the General Talking Picture Corp. when the court found the latter guilty of patent infringement.

Clarostat Mfg. Co., of Brooklyn, N. Y., announce that their volume controls are now triple-tested to insure a perfect product reaching the consumer. Metal clad bakelite-insulated fixed resistors are now offered by the same firm. They are available in values from 10 to 10000 ohm.

A new ceramic cased mica condenser has been released by Cornell-Dubilier Electric Corp. of South Plainfield, N. J. The loss of power is 1/20 that of ordinary flint glass dielectric capacitators.

The David Bogen Co., of New York City, N. Y., announce a new low priced Centralized Sound System of extreme flexibility for use in schools, etc. It is known as the Model S-32 and includes an all-wave tuner, monitor speaker, master and emergency switch, visual volume level indicator, special Class A amplifier, and tone compensator.

The same company announces a new Model CX70 Amplifier for biaural use. Auditory perspective reproduction is featured. Actually two amplifiers in one, it delivers 35 watts output to two separate stages with less than 4% distortion. Electronic Tone Correction, exclusive Bogen feature is incorporated. 17 tubes are used ending with 4 6L6 output tubes.

Dr. F. Lowenberg, of New York City, N. Y., has been granted exclusive distributorship of the Vertex non-tilting mercury relay for United States and Canada. In this instrument all mechanical moving parts are scaled in a glass tube.

A flasher display board is being offered free to jobbers by the Dial Light Co. of New York, N. Y. The jewel flasher is quite attractive and arresting. Certain jobber requirements concerning the sale of the company's merchandise must be met before the flasher is given away.

A special long life transcription needle for laterally cut recordings is announced by RCA Victor. It is known as No. 1 Transcription Needle. To guard against imperfections, each needle is shadowgraphed twice during manufacture.

Operadio Mfg. Co., of St. Charles, Ill., has released a new remote volume controlled portable 14 watt P. A. unit, Model 414. Features in addition to the remote volume control are, high gain, beam power tubes, 3 channel input, and attractive two tone gray carrying cases.

Prosperity Note: Acturus Radio Tube Company, of Newark, N. J., reports an excess of tubes produced and sold by them in the first quarter of 1929 in the first quarter of 1938. Particularly favorable has been the expert markets, it is claimed.

The Kerrel Mfg. Co., has moved to 350 Greenwich St., New York, N. Y., where they will occupy the entire building exclusive of the store. They are engaged in the manufacture of metal products for the radio trade.

A new auto radio antenna has been developed by the American Injector Co. of Detroit, and is called the Hi-Fi Hood Antenna. It is placed down the center of the car motor hood, and completely eliminates wheel static, and over head trolley static is also reduced to a minimum.

Solar Mfg. Co. of New York, N. Y., announce a new type wet electrolitic called the "Minicap."

(Continued on page 66)

ON THE COVER WE HAVE . . .

CHICAGO'S NBC Annette King is the attractive lady who is talking into the *Beer Mug*. Born in 1915, Miss King passed through the usual childhood without showing the slightest inclination towards radio. Later she became a choir singer in Aurora, Ill. Coming to Chicago, she was finally successful in an audition at NBC, and was signed by them. She still lives in Aurora, from which she commutes every day for her various programs. She is heard on *Breakfast Club, Club Matinee,* and *Alice Chalmers' Family.*

In January of this year she was married to the Assistant State's Attorney in Aurora. Personally, she hates bow ties on men as much as she dislikes derby hats; likes to wear green, and always puts on her right shoe and stocking first. Her hobbies include swimming and horseback riding. She tops the scales at 126 lbs., is 5½ feet tall and says her favorite radio stars are Gail Page and Bing Crosby. Her favorite song is *Stardust.*

The cover was made from a Kodachrome transparency taken with a Retina II camera. Mr. Henry F. Kroeger, Jr., of Chicago, was the photographer, and over 4000 watts of light was used. The lens was an *f*2, stopped down to *f*8.6 and the shutter speed 1/50 second.

Data on the "Beer Mug"

Wherever the NBC *Beer Mug* goes—to a fashion show, among the crowds in Fifth Avenue's Easter parade, at the

The "Beer Mug" Transmitter

swank annual Horse Show in Madison Square Garden, or out on the crowded floor of some convention hall—it excites curiosity and skepticism. Few will believe that this small aluminum case, just over a foot high without its 18-inch antenna, is a complete radio station from its sensitive microphone to its crystal controlled radio-frequency unit.

(Continued on page 74)

A commercial "cue" receiver is the basis for an extremely compact ham job which can be used for QRR work. It makes a good standby, too.

by HOWARD BURGESS, W9TGU

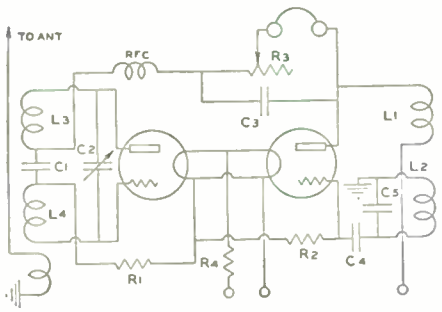
DURING design and construction of the short wave pack transmitter, little thought was given to other details. Shortly after putting the transmitter into operation one fact became plain. All good programs must be cued and a relay broadcast is no exception. The business of cueing a remote pick-up may become a much more delicate job than a studio program. Waving of handkerchiefs, hats and the like were soon ruled out as being hangovers from the dark ages. Even when the point of pick-up is in visual distance from the transmitter such means are not satisfactory.

In construction of the transmitter a space about two inches wide by four and one-half inches square was left at the end of the audio section. This was the only space left where a receiver might be put, so it was decided to make one to fit the space.

To keep the types of tubes used to a minimum, it was decided to use a tube or tubes similar to those used in the transmitter. The receiver could then be run directly on the batteries used for the transmitter.

The entire design depends on the type of tube used, so a 19 was selected and the set built around it both physically and electrically. The chief point in favor of the 19 is its compactness in being really two tubes in one envelope.

For sensitivity and ease of tuning at this high frequency, superregeneration must be used. Of all the possible combinations, it was decided to use one section as a detector and the other section as an interrupter oscillator. A self-quenched detector and one stage of audio could be used, but for real results they cannot compare with a separately quenched detector.



Hookup of the receiver.

PARTS LIST

C_1—150 mmfd. mica
C_2—35 mmfd. variable
C_3—.001 mfd. mica
C_4—.0005 mfd. mica
C_5—.002 mfd. mica
R_1—1 megohm 1 watt
R_2—50,000 ohm 1 watt
R_3—100,000 ohm pot.
R_4—See text
RFC—See text
L_1L_2—Midget interrupter coils

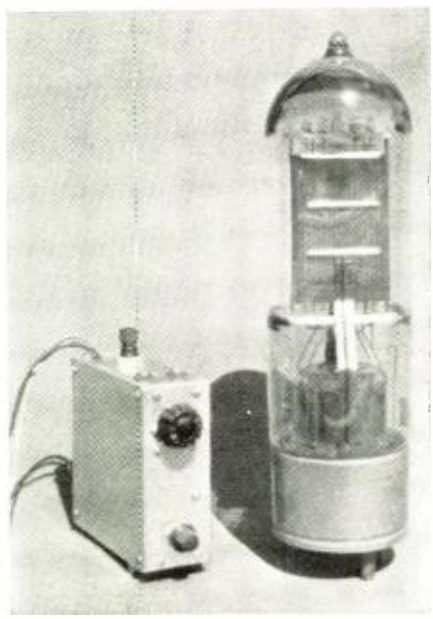
The mounting base for the receiver was bent from 1/16 inch aluminum 1⅝ inches wide and 13⅛ inches long and bent in the shape of a U with the bottom 4⅛ inches wide and the sides 4½ inches high. A cover for the receiver is made from the same material bent in the form of another U to fit over the base, each U forming three sides of the box. The cover piece is lined with paper to prevent it from shorting to any of the parts.

The tube is centered in the middle of the base with the socket mounted diagonally to take up less width. To one side of the tube is mounted the tuning condenser on short supporting lengths of brass tubing which hold it ⅞ inches from the base. Mounted self-supporting on the condenser are the tuning coils. Above the coils are mounted the detector blocking condenser and the grid leak. Also the phone tip jacks and the post for the antenna.

To the other side of the tube is the regeneration control. This must be juggled somewhat in mounting to make the switch clear the tube socket. On the side of the chassis, above the regeneration control, are the interrupter coils, interrupter grid leak and condenser and the phone bypass condenser.

The circuit is a familiar standby of five meter use and is equivalent to a two tube set. This circuit works very smooth and oscillates readily with as low as 22½ volts on the plates. The only unconventional part of the set is the plate choke. To save space and make for easier mounting a choke was made by winding a three inch length of ⅛ inch spaghetti tubing with a single layer of number thirty wire and then slipping a piece of the next size larger spaghetti over it as a cover. The ends of the wire are anchored in pinholes punched in the tubing. The choke can then be bent in place quite simply. Care should be taken to prevent the choke from coming too close to other parts of the set or its effectiveness will be reduced.

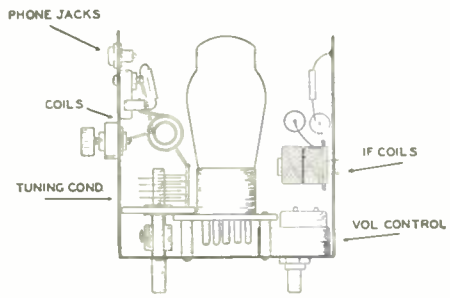
The filament dropping resistor is similar to the choke except that it is space wound of number twenty-six or twenty-eight resistance wire and is pruned down until the filament voltage is correct. No specifications as to length can be given due to the variation in resistance of various types of wire that may be used.



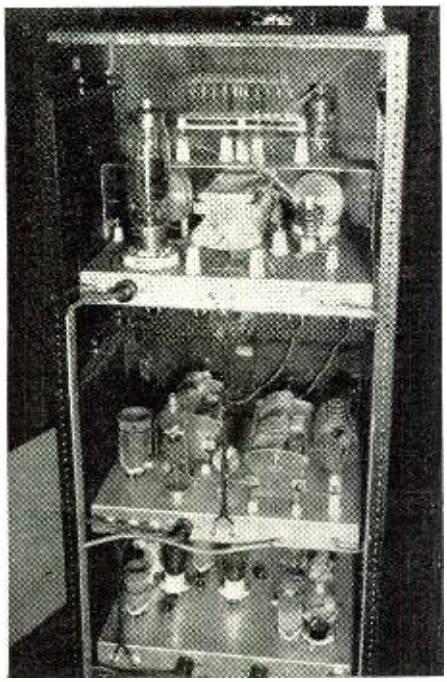
The rig compared to an xmting bottle.

The tuning coils must be made cut and try method, as the parts are mounted so close together that a slight variation in mounting will change the number of turns. Also it is unlikely that a receiver will be made for this exact frequency range. The antenna is coupled to the receiver with a one turn coil with one end grounded and the other end brought out to a post through a National H.F. Bushing. To prevent hand capacity effects an insulated coupling should

(Continued on page 70)



Placement of parts of receiver.



The business end of the 1 KW rig.

A Deluxe Kilowatt Transmitter

by STEVE TUNDER, W8QCF

The building of a kilowatt presents many problems not found in low powered sets. The author's solution is at once commercial and practical. For the high-power ham, this is the last word in transmitter construction.

YES—I had my fill of incomplete QSO's—too many reports of being covered by QRM with the accompanying discouragement. I had developed our previous rigs—though all of low power—to the point where I knew they were very efficient—but my schedule keeping average was way, way down. So, I decided to do something about it.

I arrived at some very definite conclusions, namely, I must use the maximum power allowed us and use it well. This called for the highest type of planning and engineering possible. My rig had to be extremely flexible, not only in the various units but also to the very ultimate degree when I got to antenna arrangement.

Everyone who has had the delightful experience of planning and building a rig of this magnitude will realize that I ended my initial paper session with quite a list of ideas to use.

One of the most important desires, to me, was oodles of excitation, to the extent that all stages could loaf at all times. I also knew that to control this excess power I had to incorporate easily accessible and simple means of varying coupling between stages. I knew "batteryless," though very stable, bias must be used, and quick changes must be arranged for in raising or reducing power, in QSYing, in standing by or going on the air. These features were finally planned, and built in, to work through a Master Control Box located on the operating table from which position all changes are made by the mere turning of a knob. Some consideration was given to quick band change ideas but I felt that due to the power only the lower powered stages could be so handled and decided to use plug-in coils throughout.

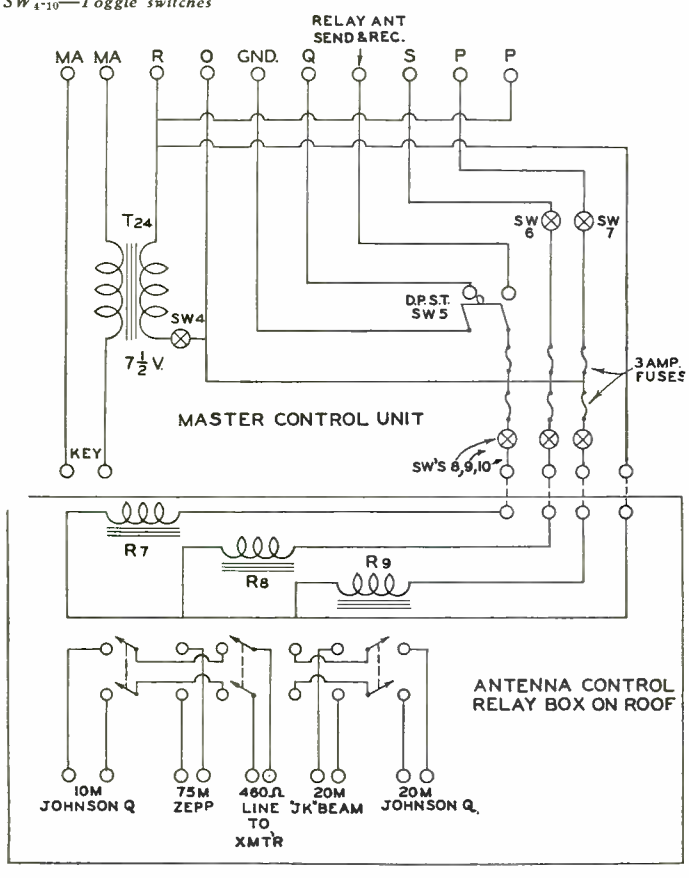
The rig is contained in three fully enclosed racks, the six-foot sectional type. The right hand rack contains the two bias supplies, the exciter stages and their supplies and the final amplifier. The center rack contains the oscillograph, the antenna pi-network, autoformers for power change and final power supply. The left hand rack contains all the speech and modulator equipment and their power supplies.

The units, with the exception of the high voltage plate supplies, are all mounted on 10x13 chassis with all connections either plug-in or screw type for easy assembling.

(*Please turn to page* 48)

Parts for Antenna Relay System.

T_{24}—115 v. A.C. to 7½ v. A.C. transformer
R_7 R_8 R_9—D.P.D.T. Relays
$SW_{4\text{-}10}$—Toggle switches



Parts List for the Transmitter. →

C_1 C_{12}—75 mmfd. each section
C_2 C_3—Neut Cond Bud No. 893
C_4 C_5 C_{10} C_{11}—.005 mfd.
C_6—75 mmfd. each section
C_7—75 mmfd. each section
C_8—Neut Cond Bud No. 892
C_9 C_{25}—.002 mfd.
C_{13}—.00004 mfd. mica
C_{14}—.01 mfd. mica
C_{15} C_{21} C_{22} C_{23}—.002 mfd.
C_{16}—100 mmfd.
C_{17} C_{19}—100 mmfd.
C_{18} C_{28}—15 mmfd.
C_{20}—75 mmfd.
C_{24}—75 mmfd.
C_{27} C_{28}—2 mfd. 2000 v.
C_{29}—2 mfd. 400 v. electro.
C_{30} C_{31}—16 mfd. 400 v. electro.
C_{32}—50 mfd. 100 v. electro.
C_{33} C_{34} C_{39} C_{40}—8 mfd. 600 v.
C_{35} C_{36}—340 mfd.
C_{37} C_{38} C_{47} C_{48}—2 mfd. 2500 v.
C_{41}—10 mfd. 100 v. electro.
C_{42} C_{45}—25 mfd. 25 v. electro.
C_{43}—8 mfd. 450 v. electro.
C_{44} C_{46}—.1 mfd. 400 v. paper

R_1—1000 ohm, 100 w.
R_2 R_4—100 ohm, 10 w.
R_3—2000 ohm, 50 w.
R_5—500 ohm, 10 w.
R_6—20,000 ohm, 10 w.
R_7 R_8—6000 ohm, 10 w.
R_9—5000 ohm, 100 w.
R_{10}—25,000 ohm, 100 w.
R_{11}—2500 ohm, 25 w.
R_{12} R_{13}—2500 ohm, 200 w.
R_{14}—25,000 ohm, 25 w.
R_{15} R_{31}—100,000 ohm, 200 w.
R_{16}—25,000 ohm, 50 w.
R_{17}—400 ohm, 25 w.
R_{18}—3 megohm, 1 w.
R_{19} R_{24}—25,000 ohm, 1 w.
R_{20}—100,000 ohm, 1 w.
R_{21}—25,000 ohm, 1 w.
R_{22}—250,000 ohm, 1 w.
R_{23}—500,000 vari.
R_{25}—75,000 ohm, 1 w.
R_{26}—750 ohm, 1 w.
R_{27} R_{28} R_{29} R_{30}—100 ohm, 1 w.

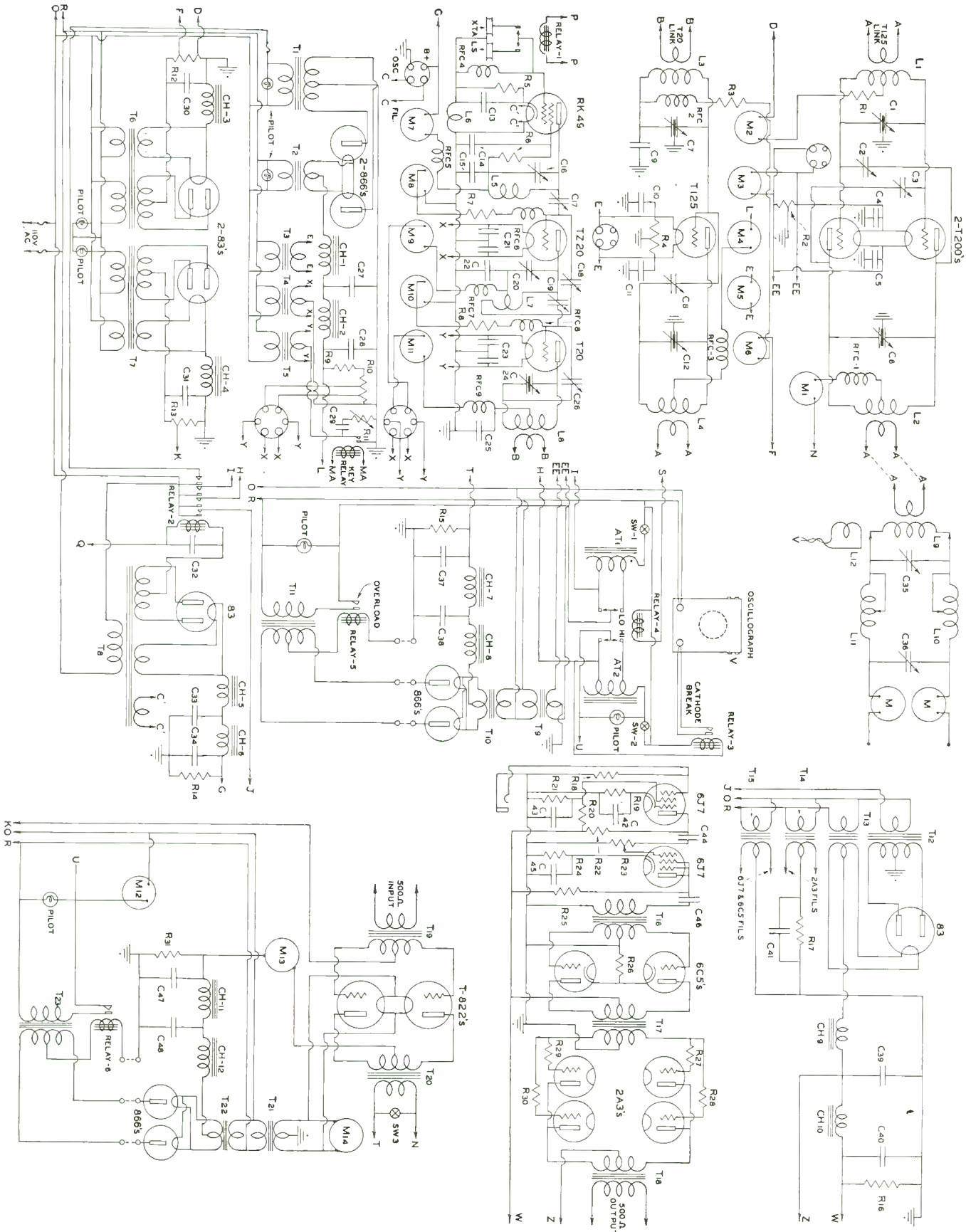
RFC_1—2.8 mh choke Bud No. 568
RFC_3—2.5 mh choke Bud. No. 876
$RFC_{2,4,5,6,7,8,9}$—2.5 mh choke Bud. No. 920

M—0-2½ RF amp
M_1—0-750 ma
M_2—0-150 ma
M_3 M_5—0-15 v. A.C.
M_4—0-300 ma
M_6 M_8 M_{10}—50 ma
M_7 M_9 M_{11}—100 ma
M_{12}—150 v. A.C.
M_{13}—500 ma
M_{14}—15 v. A.C.

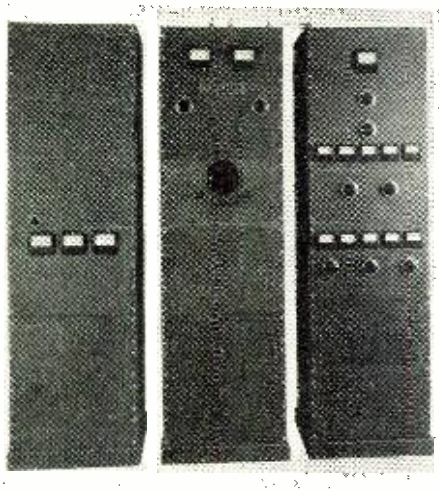
T_1—1750 volts 325 ma. All U.T.C.
T_2—2½ volts 12 amp
T_3—10 volts 6½ amp
T_4 T_5—7½ volts 6½ amp
T_6 T_7—475 volts 500 ma
T_8—400 volts 125 ma
T_9 T_{21}—10 volts 8 amp
T_{10} T_{22}—2½ volts 10 amp
T_{11} T_{23}—2000 volts 500 ma
T_{12}—475 volts 250 ma
T_{13}—5 volts 3 amp
T_{14}—2½ volts 12 amp
T_{15}—6.3 volts 3 amp
T_{16}—Plate to PP Grids
T_{17}—PP Plates to PP Grids
T_{18}—PP par 2A3 to 500 ohms
T_{19}—500 ohms to PP C_1 B Grids
T_{20}—Varimatch Mod. Trans
AT_1 AT_2—2000 watt Auto Trans

CH_1—Swg. choke 350 ma
CH_2—Fil. choke 350 ma
CH_3—Fil. choke 500 ma
CH_4—Fil. choke 500 ma
CH_5—Swg. choke 125 ma
CH_6—Fil. choke 125 ma
CH_7—Fil. choke 500 ma
CH_8—Swg. choke 500 ma
CH_9—Swg. choke 250 ma
CH_{10}—Fil. choke 250 ma
CH_{11}—Fil. choke 500 ma
CH_{12}—Swg. choke 500 ma

L_1, L_2, L_3, L_4, L_9, L_{10}, L_{11}—Coto Coils Variable Link
L_5, L_6, L_7, L_8—Wound on Bud No. 125
SW_1 SW_2 SW_3—toggle switches



Circuit Diagram of the DeLuxe Kilowatt Transmitter



These three cabinets house the kilowatt transmitter. A super-FB ham installation.

The oscillator circuit was "borrowed" from the December, 1936, issue of RADIO, page 36, due to past satisfactory performance and doubling ability. Provisions were made to use either of two crystals at will without retuning by switching with a relay actuated from the control box. The frequencies are eight KC apart and have in many cases made it possible to continue and finish a QSO.

The buffers consist of a TZ 20 in the first buffer stage (used as doubler on ten meters) with a T 20 following as a straight amplifier at all times, driving the T 125 stage. These stages are conventional.

The T 125 stage, or third amplifier, is loafing in every sense of the word as the input at no time exceeds 150 watts.

The coupling between the exciter stages preceding the T125 is by variable capacity and the final by variable link to the T125.

The final amplifier consists of a pair of T200's in push-pull and is laid out in such a way to insure the best balance with the accompanying high efficiency. The arrangement used was arrived at after three tries at moving things around.

Bias for the T125 and the T200's is supplied by one of the bias supplies located in the right hand rack, in conjunction with series grid resistors.

The antenna tuning unit is the pinet-work type familiar to all and therefore requires no further explanation.

The speech line-up is a 6J7 pentode connected, resistance coupled to another 6J7 triode connected transformer coupled to 6C5's in push-pull which in turn are coupled to push-pull parallel drivers, 2A3's. The modulators are T822's running class B. The speech input is designed for low level microphone. Bias for the T822's is supplied by a second bias supply located in the right hand rack.

The entire transmitter is remotely controlled, once the main line switch is closed. Interlocking relays are a positive protection to equipment and make the controls fool-proof. All filaments and bias supplies must be on before plate voltage can reach the oscillator. A relay adjusted to operate at 55ma. is connected in series with the oscillator supply which closes the plate circuit to all other RF stages. The oscillator is adjusted to draw 60ma. normally. In the event that the crystal does not kick-in the plate current does not exceed 40ma. and the relay for the following stages does not close.

Keying is accomplished by a relay in the center tap of the second buffer with the relay mounted under the power chassis and wired to a jack in the side of the control box at the operating table. A switch is used to short the secondary of the modulation transformer when "on CW" to prevent damage from induced voltage.

Power change from 250 watts to 1000 watts is accomplished by actuating relay number four from the control box. This relay, a DPDT type changes from the high or low tap on the autoformers in the primaries of the final and modulator plate transformers.

The control box located on the operating table contains all the switches to actuate all the relays making absolute control of the built-in flexibility available to the operator by the flip of the proper switch. The controls, upper left, frequency selector (two frequencies, 8KC apart)—bottom left to right, power change, 250 to 1000 watts—antenna selectors, 20-20 or 75-10.—20 beam or 20 Q—antenna change over and oscillator plate supply—upper right 75 Zepp or 10 Q.

The antenna change over relay, from send to receive, is not included in the drawing but is mounted on the wall behind the transmitter.

Located in the center of the middle rack is the three-inch type oscillograph. It has a six-inch lens mounted before it to enlarge the image. This large reminder is constantly before the eyes of the operator and makes evident at all times just to what extent the carrier is being modulated. The block or wave form style of pattern is used merely because it is a personal preference. The 'scope is so connected that a relay closes the cathode circuit of the 906 Cathode Ray Tube when the T822 modulators are operating.

The transmitter and operating room is located on the ground floor of a six-story downtown industrial building. A two-inch open line of about 150 feet runs to the roof where the antenna change over relays are contained in a weatherproof box. The four antennas are connected as desired by these relays to the feeders, by operation of the proper switch on the control box at the operating position.

In operating the kilowatt transmitter the ham should remember that his signal passes over a large amount of territory. Having the highest power allowed him by our government, the operator should attempt to set a good example for all other hams. Many short wave fans have occasion to eavesdrop on the hams and he who uses as powerful a signal as this rig will produce should think of the impression that he gives the outside world of American Amateurs, and make it above reproach. Not that I am preaching, but the thought just came to me on finishing the rig above described.

The rear view of the three cabinets appearing above. Note large transformers.

—30—

The ABC of ANTENNA DESIGN

by I. QUEEN

Completing the series of articles on antenna design, the author discusses the intricacies of directive arrays and how they work. To those hams who have wondered why and how they "got out better" with that signal squisher, this final article will clarify things.

CONSIDER now the system of two wires shown in figure 8. We assume we are looking down on two vertical wires. These are two similar vertical antennas, for instance, half-wave doublets. Radiation from A will take place as usual since this wire is supplied with r.f. excitation. B, however, is not fed. The radio field due to A will induce a voltage in B which will oscillate and therefore radiate also. With B approximately a quarter-wave length from A, the radiation from the two wires will be favorable for energy propagation in the direction of the arrow. The radiation from B at any instant is 90° out of phase with that from A. Suppose the point X of a wave is transmitted from A (figure 9). It will reach B at the instant that the point Y is being radiated and the two will cancel for this direction. On the other hand, if a point such as Y emanates from B at a certain instant it will arrive at A a quarter of a cycle later and will reinforce the point Z which is being radiated from the aerial A.

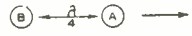


FIG.8

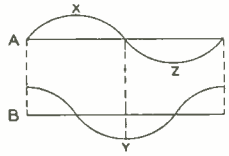


FIG.9

Antenna B is known as a reflector and because it is not fed with energy it is called a parasitic antenna. If a parasitic antenna is tuned to a higher frequency than the primary radiator and placed with the field of the latter as before, it is found that this unfed wire becomes a director and will aid propagation in its direction while cancelling waves in the backward direction. This is because of the resulting phase changes.

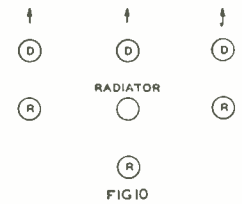


FIG 10

Since a conductor of electricity reflects radio waves it is also possible to use a reflector consisting of solid metal arranged in the form of a parabola with the radiator at the focus. This is, of course, practical only at ultra-short wave-lengths. An excellent reflecting system could be the use of several reflecting parasitic antennas and directors as in figure 10, the result being a sharp beam radiation.

The distance between director and antenna should be three-eighths wave-length for maximum focusing of the beam. The distance between reflector and antenna should be one-fourth wave-length.

On the ultra-high frequencies the earth becomes an excellent conductor and therefore may act as a reflector unless the height of the radiator is great compared with a wave-length. By increasing the height more than a quarter-wave length, more of the energy is radiated at a low angle to earth, which is desirable. In fact, in accordance with what has been said in the earlier parts of this article, it can be seen that the lower the wave length, the more desirable it is to transmit at a low angle to earth for maximum distance coverage.

Antenna Arrays

In order to conserve energy and obtain more reliable communication under adverse conditions, it is usual to arrange an antenna system so as to transmit most of the energy in one desired direction. For communication between fixed points, such systems take the form of a great number of antennas erected with the above in mind. In figure 11, there is drawn a system of two radiators fed in phase, and placed one-half wave-length apart. It is plain that a receiving station located broadside to the system (on the perpendicular bisector of the wires) will receive energy in phase from both wires, that is, a strong signal. A receiver on the line joining the two wires, on the other hand, receives no signal.

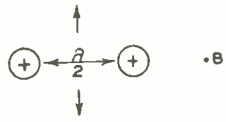


FIG.11

If each wire is fed out of phase with respect to that next to itself, a receiver in a broadside direction receives energy out of phase from each radiator and no signal results. On the line joining the antennas, however, the opposite is true. Each energy radiation is in phase as far as the receiver is concerned and a maximum signal is heard. A number of such radiators may be used, each one-half wave-length from the next in a straight line, and each fed out of phase with the next. This is called an *end-fire array*.

The above principles can be taken advantage of in a number of ways. We may use the broadside array of figure 11 and back it up with a similar array one-quarter wave-length away to form a reflecting array. We may also modify the "V" antenna previously described by adding another "V" alongside it, forming a "W" which will transmit a sharp beam in the broadside direction. Another "W" erected a quarter wave-length behind the first would form a powerful reflector. It can be seen that it is possible to secure as sharp and powerful a beam in a given direction as is desired with the cost a limiting factor. An array of wires may be used simply as a unit of a great antenna array. This is practical on the shorter wave-lengths. On the ultra high-frequencies, it also becomes practical to erect the system so that it can be rotated to different directions.

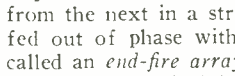


FIG.12

Wave Antenna

In figure 13 is shown a wave antenna, used especially for receiving. When a radio wave travels in the direction of the arrow towards the receiver a current is being continually induced in the wire, so that by the time it reaches the end, it is of large amplitude. The wire cannot be more than several wave-lengths long, since the current travels slower than the radio wave and in time would be out of phase with it.

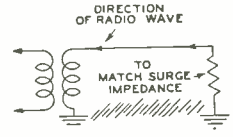


FIG.13

Other Systems

Among other directional systems used is that illustrated in figure 14. Here four—half-wave radiators are fed in phase. The transmission is, of course, broadside to the system, that is towards and away from the reader. A similar system may be erected at a distance of a quarter wave-length as reflector. The in-phase condition is maintained by crossing the feeders between the two horizontal wires.

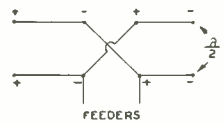


FIG 14

Another useful system for the reception of distant signals is the so-called diversity system. Different receiving antennas (directional or non-directional) are erected at great distances from each other. The energy gathered by each is amplified and detected and then combined to form a single audio signal. Although one antenna may be receiving energy out of phase with another at radio frequency, the a.f. resultants will be in phase. The combined audio frequency energy may then be amplified as usual. This system greatly eliminates fading.

Loops

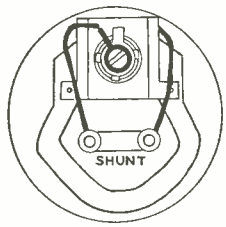
The loop type of antenna has been used

(*Continued on page 72*)

"RADIO Gadgets"

Revamping Old Meters

IF you have an old automobile ammeter in your junk box you may be able to turn it to good use. Although you may not know it excellent milliammeters can be made from ammeters manufactured in 1914. These meters may be readily recognized as they are usually about 3½ inches in diameter and have a moving coil type of movement. The later models are about 2 inches in diameter and as they have a magnetic vane movement they are not suitable for this purpose. To convert the moving coil type ammeter to a milliammeter remove the shunt, a brass strip or a small resistance in parallel with the moving coil and meter terminals. The converted meter must be recalibrated by placing it in series with a standard 0-100 milliampere meter and a 10 ma. load and the reading, read on each meter and the scale marked accordingly on the converted instrument. The load should be increased until the maximum scale reading is secured. A *Westinghouse* 0-15 ammeter, with the shunt removed, will read to twenty ma. each side of the center point. A *Roller-Smith* 0-20 ammeter, with the shunt removed, will read to 100 ma. each side of the center point.



REAR VIEW SHOWING POSITION OF SHUNT

Checking Receiver Calibration

NOW that the great majority of modern receivers tune down to the short waves, and even the ultra-short waves, receiver calibration becomes increasingly important. It is of course highly desirable that the calibration be accurate, but if it is not, at least it is a great convenience to know in what part of the range the calibration is off, and to what extent.

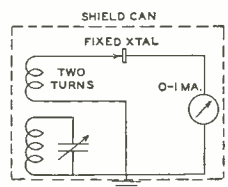
It is a simple matter to check your receiver throughout the entire range of frequencies. All you need is an r.f. oscillator of any kind, it need not be calibrated, particularly stable or special in any way. The one requirement is that it be capable of tuning to some spot in the broadcast band, around 100 kc. If the oscillator is modulated, so much the better but if the receiver to be checked has a beat-frequency oscillator, or any other form of signal indicator, modulation is not essential.

The checking procedure is extremely simple. Tune the oscillator to zero beat with some broadcast station to which the receiver is tuned. If you can hear a station on 1000 kc. that will be fine because you are going to use the harmonics for checking and if they fall on even thousands it eases the mental strain. Having tuned the oscillator to this frequency, leave it alone and tune the receiver through its range. At twice the above frequency the oscillator will be picked up, again at three times this frequency, etc. The limit to which this can be carried depends largely on the power output of the oscillator, and its richness in harmonics. It is entirely practical to use this method up to the sixtieth or seventieth harmonics, and this is plenty high enough to meet the requirements of any receiver today. If the higher harmonics are too weak for practical use the oscillator can be returned to 2000 kc. which will permit checking frequencies twice as high as with the 1000 kc. fundamental.

Low-Cost Field Strength Meter

A FIELD strength meter for the amateur need not be a complicated affair particularly for noting field patterns near the antenna system or plotting strength of field from directional systems. A fixed crystal, milliammeter and tunable tank are the essentials and can be put together quickly by any radio builder.

The outfit can be made breadboard style but more stable readings can be obtained by enclosing the hook-up in a can or metal box. Mount the 0 to 1 milliammeter and the condenser on the panel. Then fit a four prong socket on the top of the box for the tuning coils. The crystal is mounted within the box. The tuning condenser and tank coil should be of a size to suit the frequency being tested. A .00025 mfd. condenser will suit most anything down to 20 meters. Wind both the tank coil and absorption coil on the same form.



In testing the field strength and pattern of an antenna system it is only necessary to insert the coil to suit the transmitted frequency and note the various readings of the milliammeter in different locations with reference to the antenna after carefully tuning the meter for maximum readings. The readings can then be plotted on a suitable chart.

A Silent Microphone Ring

A SIX inch embroidery hoop and eight small rubber bands can be made into a very serviceable microphone ring.

First, form four hooks by straightening office paper clips out and cutting into 1½ inch lengths and blending as shown in the drawing with round nose pliers.

The hooks are inserted into the holes intended for them in the mike and then two small rubber bands looped into each hook.

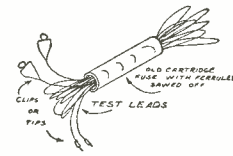
Set the mike on the table, hold the smallest hoop in the hand, and run the rubber bands from one hook over the rim, around under and back into the hook again. Do the same with the other three. Move the mike into the exact center and then place the other hoop over the smaller one. This will keep the bands from slipping from the weight of the mike.

The mike may be mounted anyway desired; the suspension method is excellent.

In an apartment on the main street of town with street cars going by every few minutes, the rubber bands absorb more shock than the usual springs.

Holder for Test Leads

AN efficient means of avoiding tangled messes of test leads is by the use of a piece of fibre tubing for holding the leads in the manner of the old-fashioned napkin holder.



An old cartridge fuse of a larger size, 60-amp. or 100-amp., which are often discarded by factories and power companies, is good enough for this purpose, although new fibre tubing may, of course, be used. The inner corners should be rounded away to permit easy insertion of the folded leads.

Tubing Antenna

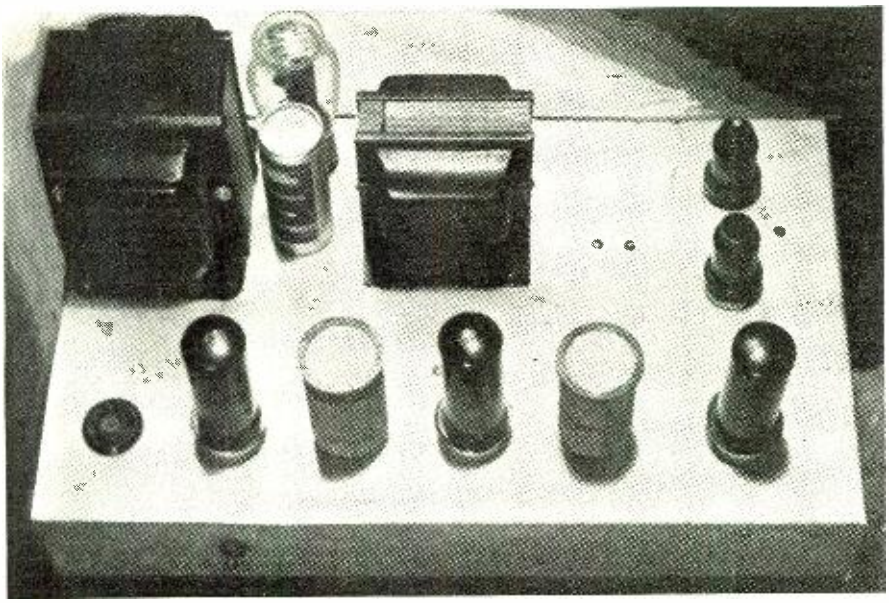
THE use of metal tubing rather than wire offers a number of advantages for antennas designed for use in the ultra-high frequency ranges. First there is the larger surface area and the resulting reduction in r.f. resistance. Second, the tubing is sufficiently rigid in itself to reduce the amount of support required and this in turn reduces the leakage paths, results in a lighter weight antenna structure, and permits far better appearance. Moreover, in the case of vertical antennas, such as those used for 5-meter work, the radiator or radiators may be allowed to project three or four feet above the top of the mast, thus gaining this much in overall height above ground—a decidedly important factor where waves follow the line-of-sight principle of light.

The tubing commonly employed is either copper or aluminum. The resistance of copper is of course lower, but the large surface area of ½-inch aluminum tubing results in the resistance of aluminum being entirely satisfactory for the purpose. Aluminum is, of course, lighter than copper but except in the case of certain complicated, multi-element beam antennas this is not a particularly important item. The difference in cost is not enough to represent an important consideration either. The most important differences are that connections can be soldered to the copper and not successfully to aluminum; that hard-drawn copper is more rigid than aluminum for a given diameter and wall thickness; and that the copper is stronger.

In soldering the copper tubing and its connections, a soldering iron is of little use, unless it be one of the very large, heavy type, because the copper conducts the heat

(*Continued on page 67*)

Low Power Transmitter



Simplicity and lots of "finger-room" features this transmitter layout.

by W. C. BELLHEIMER, W9SDX

The proper way to break into the amateur ranks is to get your license, and then build the simple transmitter described.

THIS article describes a fone transmitter which was constructed primarily to be used as a portable rig on the 160 meter fone band. I am sure many hams will find use for it as a permanent, portable or emergency rig.

Usually, an experimenter will first build up the apparatus, make all adjustments, and, in the case of a transmitter, put it on the air to collect a few reports. In many cases, laboratory instruments are used for the final adjustments. This, of course, is for speed and accuracy. But the ham who tries to duplicate the apparatus often fails because of the lack of these same laboratory instruments. After hours of patient checking and adjustments, after the ham has finally completed the outfit he will either find the fault, or give up and start all over again on some other described rig.

I am of the opinion, and the idea is shared by many hams who have heard of it, that if one ham builds a rig for his own personal use, works it over, and gets it to operate satisfactorily, without the aid of laboratory instruments, and only with his few simple meters, and intelligently collected data, he can tell another ham how to do the same thing.

When that ham tells what he used in his own rig, how he used it, and what the meters read, others should be able to duplicate both the equipment and the results.

So, instead of building up the equipment and then telling the ham fraternity how it was done, I will deal only with Amateur equipment which is in actual and active use.

All important data is given, including the names of the parts manufacturers, meter readings and results obtained. No changes should be made from the original circuit diagram and meter readings, although I may offer suggestions at different stages of construction. The photographs show the layout of parts, and it is advisable to follow them as closely as possible.

The transmitter to be described at this time was designed and constructed by Mr. Harry J. Moss, a member of the Nite Owls Radio Club of Chicago. Although unlicensed, and therefore not allowed to operate the transmitter himself, he designed and constructed this rig in his spare time for the use of the Club members. With the able assistance of W9MJE, it was air tested, and if you happen to work the Club call, W9UAX, on 160 meter fone, you might be talking to the builder himself, as he is very active at the Club mike.

Several features are incorporated in this rig, probably the most notable being the absolute absence of meters and tuning dials. No jack is used for the current test, as the connection is broken at voltage side of the r.f. choke, but it may be advisable for any constructor to incorporate one in this position. The FCC demands this data in the amateur station log.

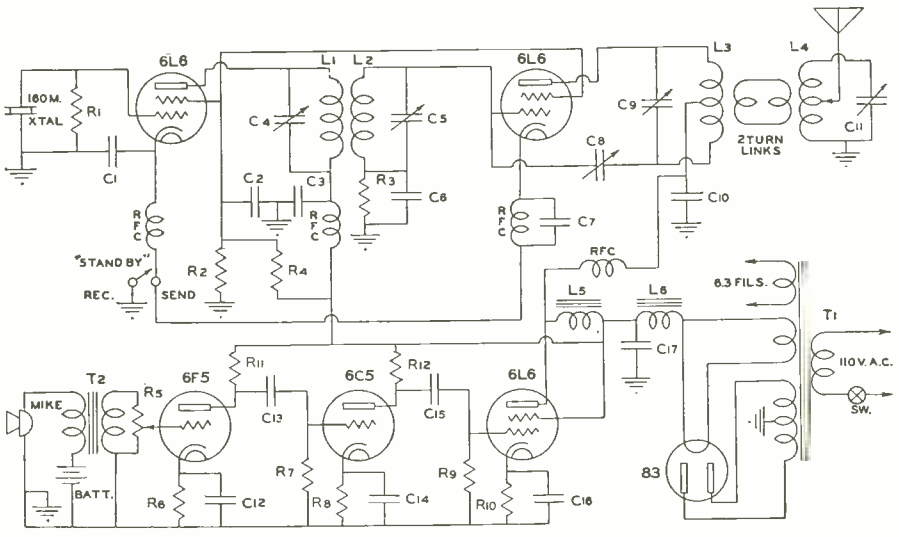
All tuning is accomplished by the use of a neon bulb, so the ham who may build this rig will be sure that he will get it in operation with a minimum of trouble.

The coils are home made, and wound for the 160 meter fone band. Two windings are used on the oscillator coil. The oscillator plate winding consists of 60 turns of No. 24 DSC wire on a standard 1½ inch coil form. The "final" grid winding is identical and is wound directly over the oscillator plate winding.

The final plate coil is wound similar to the oscillator plate coil, and center tapped for neutralizing. A two turn link coil is wound over the center of this coil for antenna feed.

Several crystals are on hand at the Club, and the rig has been in use on several different frequencies in the 160 m. band. It

(*Continued on page* 78)



The hookup of the beginner's rig.

R_1—100,000 ohms 1 w
R_2—25,000 ohms 10 w
R_3—10,000 ohms 1 w
R_4—25,000 ohms 10 w
R_5—500,000 ohms vari.
R_6—5,000 ohms 1 w
R_7—500,000 ohms 1 w
R_8—2,000 ohms 1 w
R_9—500,000 ohms 1 w
R_{10}—250 ohms 1 w
R_{11}—250,000 ohms 1 w
R_{12}—50,000 ohms 1 w
C_1—.00025 mfd mica
C_2—.002 mfd 600 v
C_3—.002 mfd 600 v
C_4—50 mmfd vari.
C_5—50 mmfd vari.
C_6—.002 mfd 600 v
C_7—.002 mfd 600 v
C_8—3-15 mmfd vari.
C_9—50 mmfd vari.
C_{10}—.002 mfd 600 v
C_{11}—100 mmfd 5000 v
C_{12}—.01 mfd 400 v
C_{13}—.01 mfd 600 v
C_{14}—25 mfd 25 v
C_{15}—.01 mfd 600 v
C_{16}—1 mfd 200 v
C_{17}—8 mfd elect. 450 v
L_1—160 m. osc. pl. coil
L_2—160 m. amp. gr. coil
L_3—160 m. amp. pl. coil
L_4—Ant. Coil 160T
L_5—Mod. ch. T-6807
L_6—Filter ch. 300 ma 20 H
T_1—Power Transformer T89R28
T_2—Single button microphone transformer

WORLD SHORT WAVE TIME-TABLE

Compiled by the Editors of RADIO NEWS

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

HOURS OF TRANSMISSION

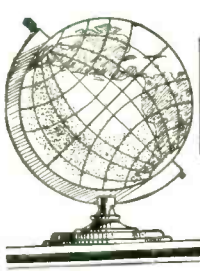
8 9 10 11 M 1 2 3 4 5 6 7

EASTERN STANDARD TIME

Wave-length Meters	Call Letters	Frequency Kc.	City Country
13.93	W8XK	21540	Pittsburgh, Pa.
13.93	GSJ	21530	Daventry, England
13.94	W2XE	21520	New York. N. Y.
13.97	GSH	21470	Daventry, England
13.99	DJS	21450	Zeesen, Germany
15.77	HS8PJ	19020	Bangkok, Siam
16.86	GSG	17790	Daventry, England
16.87	W3XAL	17780	Bound Brook, N. J.
16.88	PHI	17770	Huizen, Holland
16.89	DJE	17760	Zeesen, Germany
19.56	DJR	15340	Zeesen, Germany
19.57	W2XAD	15330	Schenectady, N. Y.
19.60	GSP	15310	Daventry, England
19.62	LRU	15290	Buenos Aires, Arg.
19.63	DJQ	15280	Zeesen, Germany
19.65	W2XE	15270	New York, N. Y.
19.66	GSI	15260	Daventry, England
19.68	TPA2	15243	Pontoise, France
19.71	PCJ	15220	Huizen, Holland
19.72	W8XK	15210	Pittsburgh, Pa.
19.74	DJB	15200	Zeesen, Germany
19.75	ZBW4	15190	Hong Kong, China
19.76	GSO	15180	Daventry, England
19.79	JZK	15160	Nazaki, Japan
19.82	GSF	15140	Daventry, England
19.84	HVJ	15121	Vatican City
19.85	DJL	15110	Zeesen, Germany
19.88	RKI	15090	Moscow, U.S.S.R.
20.04	LZA	14970	Sofia, Bulgaria
22.00	SPW	13635	Warsaw, Poland
24.52	TFJ	12235	Reykjavik, Iceland
25.00	RV59(RNE)	12000	Moscow, U.S.S.R.
25.24	TPA3	11885	Pontoise, France
25.27	W8XK	11870	Pittsburgh, Pa.
25.34	OLR4A	11840	Podebrady, Czech.
25.36	W9XAA	11830	Chicago, Ill.
25.36	W2XE	11830	New York, N. Y.
25.42	JZJ	11800	Nazaki, Japan
25.42	DJO	11800	Zeesen, Germany
25.45	W1XAL	11790	Boston, Mass.
25.49	DJD	11770	Zeesen, Germany
25.51	OLR4B	11760	Podebrady, Czech.
25.53	GSD	11750	Daventry, England
25.58	CJRX	11730	Winnipeg, Canada
25.60	TPA4	11720	Pontoise, France
25.62	HJ4ABA	11710	Medellin, Colombia
25.63	SBP	11705	Motala, Sweden
25.64	HP5A	11700	Panama, Pana.
26.01	SPD	11535	Warsaw, Poland
26.24	COCX	11435	Havana, Cuba
26.60	HIN	11280	Trujillo, D. R.
27.17	CSW	11040	Lisbon, Portugal
29.04	ORK	10330	Ruysselede, Belgium
29.35	PSH	10220	Rio de Janeiro, Brazil
30.18	CSW	9940	Lisbon, Portugal
30.43	EAQ	9860	Madrid, Spain
30.31	IRF	9830	Rome, Italy
31.06	LRX	9660	Buenos Aires, Argentina
31.09	YNLF	9650	Managua, Nicaragua
31.09	CS2AA	9650	Lisbon, Portugal
31.10	HH3W	9645	Port-au-Prince, Haiti
31.14	12RO3	9635	Rome, Italy
31.25	RAN	9600	Moscow, U.S.S.R.
31.25	HJ1ABP	9600	Cartagena, Colombia
31.27	HBL	9595	Geneva, Switzerland
31.28	VK6ME	9590	Perth, Australia
31.28	W3XAU	9590	Philadelphia, Pa.
31.28	VK2ME	9590	Sydney, Australia
31.28	PCJ	9590	Huizen, Holland
31.28	HP5J	9590	Panama City, Pana.
31.32	GSC	9580	Daventry, England
31.32	VKVLR	9580	Lyndhurst, Australia
31.33	HJ2ABC	9575	Cucuta, Colombia
31.35	W1XK	9570	Millis, Mass.
31.38	DJA	9560	Zeesen, Germany
31.40	TIPG	9559	San Jose, C. R.
31.42	OLR3A	9550	Podebrady, Czech.
31.42	XEFT	9550	Veracruz, Mexico
31.45	DJN	9540	Zeesen, Germany
31.48	W2XAF	9530	Schenectady, N. Y.
31.48	LKJ1	9530	Jeloy, Norway
31.49	ZBW3	9525	Hong Kong, China
31.55	GSB	9510	Daventry, England
31.55	HJU	9510	Buenaventura, Colom.
31.55	VK3ME	9510	Melbourne, Australia
31.58	PRF5	9500	Rio de Janeiro, Brazil
31.82	COCH	9428	Havana, Cuba
32.09	HS8PJ	9350	Bangkok, Siam
33.32	COBZ	9030	Havana, Cuba
34.62	COJK	8665	Camaguey, Cuba
38.48	HBP	7797	Geneva, Switzerland
43.48	HI3C	6900	La Romana, D. R.
43.99	XGOX	6820	Nanking, China
44.14	HIH	6796	San Pedro, D. R.

HOURS OF TRANSMISSION

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



WORLD SHORT WAVE TIME-TABLE

Compiled by the Editors of RADIO NEWS

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

HOURS OF TRANSMISSION

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

EASTERN STANDARD TIME

Wave-length Meters	Call Letters	Frequency Kc.	City Country
44.71	TIEP	6710	San Jose, Costa Rica
45.22	HC2RL	6635	Guayaquil, Ecuador
45.25	HIT	6630	Trujillo, D. R.
45.34	PRADO	6618	Riobamba, Ecuador
45.80	H14D	6550	Trujillo, D. R.
46.01	YV4RB	6520	Valencia, Venezuela
46.08	HIL	6510	Trujillo, D. R.
46.66	H11S	6430	Puerto Plata, D. R.
46.85	YV5RH	6400	Caracas, Venezuela
46.91	HI8Q	6395	Trujillo, D. R.
47.10	YV5RF	6375	Caracas, Venezuela
47.12	YV1RH	6360	Maracaibo, Venezuela
47.24	HRPI	6350	San Pedro Sula, Hond.
47.77	H1G	6280	Trujillo, D. R.
47.77	COHB	6280	Cancti Spiritus, Cuba
48.05	H1N	6243	Trujillo, D. R.
48.15	OAX4G	6230	Lima, Peru
48.19	HJ1ABH	6225	Cienaga, Colombia
48.50	HI1A	6185	Santiago, D. R.
48.62	OAX1A	6170	Chiclayo, Peru
48.70	XEXA	6160	Mexico, D. F. Mexico
48.70	VPB	6160	Colombo, Ceylon
48.70	CJRO	6160	Winnipeg, Canada
48.72	YV5RD	6158	Caracas, Venezuela
48.78	VE9CL	6150	Winnipeg, Canada
48.78	HJ2ABA	6150	Tunja, Colombia
48.78	HJ5ABC	6150	Cali, Colombia
48.86	W8XK	6140	Pittsburgh, Pa.
48.88	CR7AA	6137	Lourenzo Marques, A.
48.94	LKJ1	6130	Jeloy, Norway
48.94	VE9HX	6130	Halifax, N. S.
48.94	COCD	6130	Havana, Cuba
48.96	HJ3ABX	6122	Bogota, Colombia
49.00	HJ1ABB	6120	Barranquilla, Colom.
49.00	W2XE	6120	New York, N. Y.
49.18	YTC	6100	Belgrade, Yugoslavia
49.18	W3XAL	6100	Bound Brook, N. J.
49.18	W9XF	6100	Chicago, Ill.
49.20	ZRJ	6098	Johannesburg, Africa
49.20	HJ4ABE	6097	Medellin, Colombia
49.26	CRCX	6090	Toronto, Canada
49.30	HJ5ABD	6085	Cali, Colombia
49.31	HJ3ABF	6084	Bogota, Colombia
49.32	VQ7LO	6083	Nairobi, Kenya, Afr.
49.34	HP5F	6080	Colon, Panama
49.34	W9XAA	6080	Chicago, Ill.
49.34	ZHJ	6080	Penang, S. S.
49.42	YV1RE	6070	Maracaibo, Venez.
49.46	SBO	6065	Motala, Sweden
49.50	W8XAL	6060	Cincinnati, Ohio
49.50	W3XAU	6060	Philadelphia, Pa.
49.59	HJ3ABD	6050	Bogota, Colombia
49.59	H19B	6050	Trujillo, D. R.
49.65	HJ1ABG	6042	Barranquilla, Colom.
49.67	W1XAL	6040	Boston, Mass.
49.67	YDA	6040	Tanjong Priok, Java
49.75	OLR2B	6030	Podebrady, Czech.
49.75	HP5B	6030	Panama City, Panama
49.79	HJ1ABJ	6025	Santa Maria, Colombia
49.83	DJC	6020	Zeesen, Germany
49.83	XEUW	6020	Veracruz. Mexico
49.88	XEWI	6015	Mexico, D. F., Mexico
49.90	HJ3ABH	6012	Bogota, Colombia
49.92	COCO	6010	Havana, Cuba
49.96	CFCX	6005	Montreal, Canada
49.96	HP5K	6005	Colon, Panama
50.00	XEBT	6000	Mexico, D. F., Mexico
50.17	HIX	5980	Trujillo, D. R.
50.25	HJN	5970	Bogota, Colombia
50.26	HVJ	5969	Vatican City
50.50	TG2X	5940	Guatemala City, Gua.
50.72	HH2S	5915	Port-au-Prince, Haiti
50.76	HRN	5910	Tegucigalpa, Honduras
50.85	YV3RA	5900	Barquisimeto, Venez.
51.15	HI1J	5865	San Pedro, D. R.
51.46	TIGPH	5830	Alma Tica, Costa Rica
51.72	YV5RC	5800	Caracas, Venezuela
51.90	OAX4D	5780	Lima, Peru

HOURS OF TRANSMISSION

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

LIST OF SYMBOLS

S—Sunday

M—Monday

T—Tuesday

W—Wednesday

Th—Thursday

F—Friday

SA—Saturday

SS—Saturday, Sunday

—Daily

—Irregular

—Daily Except Sunday

—Daily Except Saturday, Sunday

SHORT WAVE FLASHES

BY CHARLES A. MORRISON and JOHN D. CLARK

EACH month this department will feature flashes from the world of short wave, setting forth the very latest news concerning new stations, changes in frequency, schedule, and outstanding DX broadcasts. This is information that has been received after the issue has gone to press.

All frequencies in the column are given in *megacycles* and all time is *Eastern Standard Time*.

Special

With this issue RADIO NEWS inaugurates a new short wave section—the first national radio magazine to bring Pacific Coast listeners news and tips on low wave reception west of the Rockies.

In the future, this section of *Short Wave Flashes* will be edited by John D. Clark, one of the West's leading authorities on short wave, and the information contained will be based on reports from listeners in all parts of the Western United States. General reception on the lower wavebands is quite different on the Pacific Coast than it is in the eastern states, and the need for data designed to assist the western listener has long been realized.

All frequencies in the West Coast section of *Short Wave Flashes* are also in *megacycles*, but all times are given in *Pacific Standard Time* for the convenience of West Coast listeners.

Short Waves for DX'ers East of the Rockies
by CHARLES A. MORRISON

Feature Broadcasts

Linton Wells, famous roving reporter, now on a good-will tour of Latin America, will report interesting and little known facts, direct from the countries that he visits, via short-wave for the RCA *Magic Key* program, Sundays from 1:00 to 2:00 p.m., as follows: June 12th, from Santiago, Chile; June 19th, from Montevideo, Uruguay; June 26th from Buenos Aires, Argentina; July 3rd, from Caracas, Venezuela; July 10th, from Trujillo City, Dominican Republic; July 17th, from Port-au-Prince, Haiti; July 24th, from Havana, Cuba and on July 31st from Hamilton, Bermuda.

On Saturday, June 18th, at 7:00 p.m., Polskie Radio stations SPW (13.635) and SPD (11.535), will transmit a special program for short-wave listeners in North America.

New Short-Wave Stations (On the Air)

COLOMBIA—HJ3ABY (6.122), "La Voz de Colombia," Bogota, supposed to be on the air according to official Colombian list.

COSTA RICA—T12X. San Jose, on 11.93, was first heard on April 23rd, at 8:00 p.m.

ETHIOPIA—"Radio Addis Ababa" (9.6), went on the air on May 9th, according to an announcement over 2RO3 of Rome.

FINLAND—A new transmitter, location as yet unknown, is testing afternoons on 9.5.

ITALY—2RO8 (17.82), Rome, testing afternoons in parallel with 2RO4 (11.81), is being heard with strong signals.

NORWAY—A 5000 watt National Short Wave Station at Oslo, replacing the former low-power transmitter at Jeloy and licensed to operate on 6.13. 9.53, 11.735, 15.17, or 17.755, was scheduled to come on the air during the latter part of May.

PHILIPPINE ISLANDS—Broadcast station KZIB, Manila, whose schedule is Sundays 6:00 to 10:00 a.m., Sundays through Fridays 7:00 p.m. to midnight, and Saturdays 9:00 to 11:00 p.m., is now being relayed by a short-wave transmitter on 6.122.

U. S. A.—Two additional transmitters, each of 25,000 watts power, are now being utilized by NBC station W3XAL at Boundbrook, N. J.

U. S. S. R.—Reported to be broadcasting irregularly: RBO (8.31), RWG (8.183), RPK (7.42), RKA (6.96) and RYS (6.75).

VENEZUELA—A station in Valencia, call as yet unidentified, is being heard irregularly on 5.59 to 5.595.

(Under Construction)

MALAYA—A 400 watt station will be opened at Kuala Trengganu during the course of the year. . . *CZECHOSLOVAKIA*—A second transmitter to be known as Praha II, is under construction at Prague.

SWITZERLAND—The 25,000 watt National Transmitter now under construction will be completed in 1939. . . *SYRIA*—The French company, Radio-Orient, will open a station at Beirut in the near future.

TURKEY—The 20,000 watt station, nearing completion at Ankara, licensed to operate on 9.465 and 15.195, will be officially inaugurated on July 22nd. . . *YUGOSLAVIA*—A 10,000 watt station near Belgrade will be inaugurated by the middle of the summer.

Notes of Interest

AUSTRALIA—VLR, Melbourne, is now verifying with a form letter, which is of little value to the short-wave dx'er. . . *BRAZIL*—PSH (10.22), Rio de Janeiro, is not operating on a regular schedule at present.

CAYMAN ISLANDS—Having just realized $40,000 from sale of its *Coronation* issue of stamps, the local government is spending part of this sum in installing several high-power short-wave sets and centralized loud speakers so the natives may listen to the Daventry programs. . . *CHANNEL ISLANDS*—The unlicensed short-wave transmitter that operated on the islands for a time, has been forced off the air, its equipment having been confiscated by the British Postal authorities.

CHILE—CD1190, Valdivia, heard daily 7:00 to 10:00 p.m., comes on the air with the selection *Marching Through Georgia*. . . *CHINA*—XGW (10.42), Shanghai, heard daily 9:00 to 10:00 a.m. News in English is given from 9:00 to 9:15 a.m., followed by five chimes and the news in Chinese. . . *COLOMBIA*—The interval signal for HJ7ABB (4.82), Bucaramanga, is three cuckoo calls; HJ7ABD (9.63), Bucaramanga, verifies with an attractive two-tone brown QSL card. Reports to HJ1ABP (9.618), Cartagena, will be rewarded with a new QSL card issued in honor of the station's second anniversary on the air.

COSTA RICA—To help in identifying his station TI4NRH (9.7), at Heredia, Senor Amando Cespedes Marin utilizes a cuckoo call, a clock which chimes the hour, and occasionally a few words tapped out in C.W. . . *CUBA*—Commercial station CMA5 (10.89), Havana, relays Cuban programs irregularly. . . *DOMINICAN REPUBLIC*—HI1S (6.43), "La Voz de Hispaniola," Santiago, on the air again, broadcasts from 5:40 to 7:10 p.m. and signs-off with *Indian Love Call*.

EL SALVADOR—Reports to YSD (7.894), San Salvador, are being verified with neat yellow, blue, and white QSL cards. . . *FRANCE*—TPB13 (9.52) is being tested out on the 1:00 to 3:00 a.m. transmission from "Paris Mondial," Paris. . . *JAPAN*—JZK (15.16), Nagasaki, has been testing from midnight to 12:15 a.m. and will probably be transmitting the overseas periods regularly early in June.

MARTINIQUE—The long awaited QSL cards from "Radio Martinique" (9.7) of Fort-de-France are now being issued. Multi-colored and printed in a modernistic style, they are really unique. . . *MEXICO*—Listeners who fill in the questionnaires sent out by station XEXA (6.172), Radiodifusora "DAPP" of Mexico D.F., will receive from time-to-time interesting folders and literature from the Mexican Department of Press and Publicity. . . *NEW ZEALAND*—No broadcasts are being made over ZMBJ (8.84) of the S. S. Awatea, at present.

PANAMA—Despite erroneous reports to the contrary, all correct reports enclosing an international reply coupon, and sent *direct* to HP5A (11.7), Panama City, will be verified. The power of HP5J (9.604), Panama City, is being increased. . . *PARAGUAY*—ZP14, formerly ZP15 (6.15), of Villarica, broadcasts from 4:00 to 6:00 p.m.; the programs opening with a march.

PITCAIRN—VR6AY (14.346), now being operated by Andrew Young, subsequent to the departure of the American engineers on May 5th, may often be heard in QSO with amateur W2IXY of New York City, at 1:00 a.m. Natives from the island often take part in these interesting contacts. Max Fisher of San Francisco, one of the first listeners to receive a verification from Pitcairn, states the card has VR6A in large red letters, with the Y added by hand in red ink. . . *PORTUGAL*—CSW, Lisbon, has been testing irregularly on 11.82.

St. KITTS—A letter from VP2LO (6.384) states there has been a delay in verifying reports due to a shortage on QSL cards, but that as soon as the new cards arrive all letters will be promptly answered and verifications sent. VP2LO broadcasts daily from 4:00 to 4:30 p.m. and sometimes until 5:00 p.m., opening the program with *Rule Brittania*, and signing off with *God Save the King*. The station has been conducting aerial tests late Saturday nights. . . *SOUTH AFRICA*—The setting-up exercises from South Africa, formerly heard nightly from 11:45 p.m. to 12:45 a.m. over ZRH (9.523), are now being heard over ZRH (6.007). . . *SWEDEN*—SBP (11.705), Motala, is now sending out form *thank you* letters in place of the much more desirable conventional verifications.

TAIWAN (Formosa)—Jiro Hayashi, mgr. of Taihoku broadcasting stations, states that the short-wave station on 9.636 is not JFAK, but JFO. . . *U. S. A.*—W4XB (6.04), Miami, Florida, after a long absence, is once more on the air, and broadcasting nightly from 9:00 to 11:55 p.m. . . *VENEZUELA*—It is reported that YV1RB (5.845), Maracaibo, is issuing new QSL cards.

The following Latin stations give English announcements: HH3W (9.645); HRD (6.235); YV1RI (6.205); COCD (6.13); XEUZ (6.117) and TG2X (5.94).

Transmissions of Interest

Daily—12:45 to 1:45 p.m., noon-day marimba concert from TGWA (15.17), *GUATEMALA CITY, GUATEMALA;* 4:30 and 7:15 p.m., Spanish insurgent news in English, from EA9AH (13.992), *TETUAN, SPANISH MOROCCO;* 6:00 to 9:00 p.m., North American program from *WARSAW, POLAND*, stations SPW (13.635) and SPD (11.535).

Tues. and Sat., 10:00 to 11:00 p.m., broadcast of the Guatemalan National Network, over TGQA (6.4), TGWA (9.685), TG2 (6.21) and TG2X (5.94).

Saturdays—8:00 to 9:00 p.m., *Hour of Costa Rica*, in English, over TIPG (6.41), *SAN JOSE, C. R.*

Sat., 3:45 to 4:45 p.m., *and Sun.*, 7:15 to 9:15 p.m. irreg., concert of the British Guiana Militia Band, over VP3MR (6.075), *GEORGETOWN, BRITISH GUIANA*.

Revised Schedules

AUSTRALIA—VK2ME (9.59), Sydney, *Sundays* 12:00 m. to 2:00 a.m., 5:00 to 9:00 a.m., and 11:30 a.m. to 1:30 p.m. . . *BRITISH HONDURAS*—ZIK2 (10.6), *Tues., Thurs. and Sat.*, 8:45 to 9:00 p.m.

CZECHOSLOVAKIA—Broadcasts from Prague: for North America, in English, *Mon., Tues., Thrus. and Fri.*, 6:55 to 9:55 p.m., and *Sun., Wed. and Sat.*, 5:00 to 5:10 p.m., over OLR5A (15.23) or OLR5B (15.32); for South America, *Sundays* 5:55 to 8:55 p.m., over OLR5A or OLR5B; for Europe, *daily* 1:55 to 4:30 p.m., over OLR4A (11.84) or OLR4B (11.76); *Mon. and Tues.*, 4:40 to 5:10 p.m.

(*Continued on page* 70)

Serviceman's Experiences

by LEE SHELDON

"Customer analysis" is not restricted to the large stores and sales organizations alone, any serviceman can use it to his advantage.

THE owner of the Colonial 32 looked at me steadily, and I felt the repair job slipping.

"I'll think it over," he finally said, "and call you later."

Very disappointedly, I picked up my three hundred dollars' worth of test equipment, and returned to the store. You know how it feels, losing work out of the bag.

To excuse myself, I muttered the customary comment for such cases, designating the customer for a descending journey; but I knew the fault was mine. Too many jobs had been fumbled; and although the reason was not obvious, it was evident I lacked something important.

There I was, carrying the latest equipment; brimming over with sixteen years' experience; entering a home where work and payment had been awaiting me; then, muffing the thing. I had turned the set on, listened to its choky quality, took one confirming socket reading, and quoted $7.50 for replacement of a bias resistor. The time, less than fifteen minutes, and I had promised delivery the following day. It was a perfect call, except for not getting the job. The operation was a success, but the patient died. Nothing so discouraging happened when I started in business.

In those days, the prime prerequisites to set servicing were a screwdriver, three technical phrases, and the ability to sprint on short notice. Thus qualified, I visited the home of a real estate operator on one of my first calls. He was encumbered with a pair of Murdock 'phones, six A, B, and C batteries, and a table set three feet long. The cabinet, laying on two tables, sported fifteen knobs and dials from one to four inches in diameter. Its heavy Florentine carving made excelsior as simple as a straight line drawing.

"Doesn't it play?" I asked.

"Too well," he said, handing the cans to me. "Listen."

Three locals came in, bringing with them: a time tick, a piano duo playing *Kaloa*, and a man named Jerry, singing "Double-you cue jay, Chicago, U. S. A."

I assumed my professional worried countenance and let fly with a technical phrase: "It sounds like radio frequency."

"It sounds like hell," he corrected. "Fix it!"

No dial adjustment affected the three programs. I reached for my screwdriver, intending to remove the back cover. When I saw the screws were covered with a manufacturer's wax stamp, I turned to him.

"Mister, you had better send it back to the factory. If these seals are broken, the guarantee is no good."

"The guarantee is no good, anyway." He was smiling. "Open it."

The inside was astonishing. There was one tube, and each dial shaft was connected only to a spring, washer, and cotter pin. The dials were useless except for roulette.

"How interesting!" he remarked. "Are all sets hollow, like this one?" I could not understand why he chuckled.

"No. The better models have rheostats, potentiometers, tuning condensers, and variocouplers. These parts put station selection into the hands of the purchaser, instead of to chance. Your particular set gets three simultaneous programs because there's nothing in it to stop two of them. How much was it?"

"Hey, you guys! Cut it out. I can't hear the fight!"

"Four hundred dollars." He laughed loudly.

"This," I reminded him, "is no laughing matter. You have been well taken. Some dealer has come west from Gyp Row."

"Cortlandt Street must be Melody Lane if this beautiful set came from there. How much will you charge to build a radio into the box?" He was still laughing, and had me giggling by induction.

"Build you a three-tuber for one hundred dollars. What's so funny?"

"Man I bought it from took $500 in Florida real estate from me. Gave me this set and $100 in cash." He held his appendix, and brushed the tears from his eyes. "How soon can you make delivery?"

"Four days. Isn't the real estate worth anything?"

"It is to the alligators," he answered. "Here, grab the other end of this casket—I'll help you carry it out."

Since then, after years of study and experience, I couldn't handle a resistor replacement! What good were training and equipment if they didn't help in getting work? I locked up early that night.

Russ stopped in the next morning. Although he serviced my neighborhood from his car, he wasn't exactly a competitor because he turned all his work over to me. I looked down on him, professionally, as being inexperienced. He managed nicely, though; his only expenses were those for his auto and for a frequent meter replacement in his home-made tester. (He had wired the instrument himself, but did not understand it. The border of binding posts was too complicated for him, and the single meter was always getting in series with something which burned more current than the meter coil was wont to handle.) In spite of his incompetence, he picked up as many chassis as I, but I didn't care—he brought them to me.

"Hold the door open," he said. "I got a big set coming in."

I recognized the tube stickers. The set was the 32 I lost the day before. He laid it on the bench, and said:

"Give it the works. I'll pick it up for delivery in about a week."

"Wait a minute," I called. "Do you know what's wrong with it?"

"No. What difference does it make? You find it."

"I already have found it," I told him, as acidly as possible, "and it will cost you exactly $7.50, plus tubes, of which there are eight, in case you haven't seen the 24A's under the shields."

"So what? Make it perk!"

"So you had better get more than that from your customer," I answered angrily. "How much *are* you getting?"

"Twenty-two fifty. Very busy. See you later."

I wondered what formalities were required for going on relief. Then, with rising spirit bred in me by a conviction I was better than average, but misunderstood, I went through my files, picking out each record of call failure during the previous year. The pile was annoyingly high.

There was a factor common to them all: like the Colonial 32, they were simple jobs on familiar models; those requiring the least time in the customers' homes. Then the light appeared. I was neglecting the customer.

That explained why Russ, poking meaningless test prods into sets he did not understand, was more successful than I. He impressed the customer with his display of effort, reconciling him to shop work on a major repair. He analyzed the customer, not the set! If I answered the same call, the customer mistook my quicker, more efficient socket tests for gyppery.

I was reminded of Fredericks, who had the fault of efficiency in a greater degree. He was trained in theory to the point of being a technical knockout, and was equally adept with slide rule and soldering iron. His customers paid resentfully, admitting his proficiency, but he left a trail of ill-will among set owners which poisoned them

(*Continued on page* 68)

Easy to operate is this PA rig.

A Complete PA Amplifier

by OLIVER T. READ, W9ETI

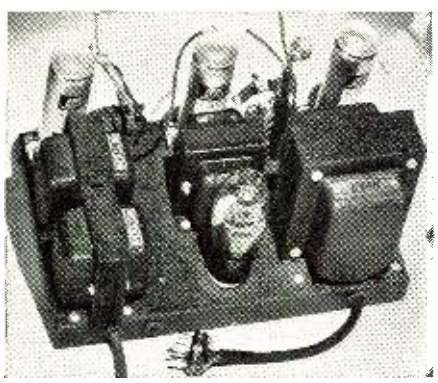
Engineer, Utah Radio Products Co.

Many a customer has been amazed by the great amount of equipment that the PA man brings on location while at the same time requiring a multi-input job. The author's solution is this compact 4 channel portable PA System.

THE use of high-impedance microphones such as crystal, velocity, etc., as standard equipment for most public address applications is now almost universally adapted. Likewise, the modern Permanent Magnet type of speaker having a Universal line transformer makes for a rapid installation. The amplifier shown and described in this article was designed to have four individual high gain input channels to accommodate four microphones at one time. These may be any of the high impedance types designed to work directly to grid, or may be low impedance types with a line transformer to grid. A master gain is used, permitting general volume control or for pre-setting of the audio gain. And a means of adjusting the audio watts output from eight watts to approximately thirty watts by means of a special tapped plate supply transformer which supplies various potenials to the rectifier is incorporated. The use of p.m. speakers with Universal line inputs of 500-1000-1500 and 2000 ohms makes it convenient to use a 500 ohm output at the amplifier. The use of 500 ohms permits standard characteristics in the speaker line and a db. meter may be used to indicate various output levels.

It is always desirable to have extra input channels available to be able to meet any normal pickup requirements such as a local minstrel or stage show, where the action is not always confined to a fixed position where the use of one or two mikes would suffice.

The ampifier is built in two sections as shown in the photographs. The audio chassis with all component parts is located in the bottom half of the cabinet, where the various controls are within easy reach of the operator. The power supply mounts on the upper chassis as shown, together with two illuminated meters and the voltage selector switch and on-off switch. It was discovered that by mounting the power supply in this position, that the hum level was barely audible to the ear with the master gain wide open. In addition, the heat from the rectifier tube was kept away from the various bypass condensers.



The power supply chassis connects by cable.

The four high gain input channels make use of type 6C6 glass tubes with metal shields. Various metal tubes tried had a decided microphonic and hum tendency. It is important that all of the input circuit leads be shielded and grounded. This also applies to the input connectors which are shielded with large enough shielding to leave room on the inside for the 5 megohm ¼ watt resistors. These resistors are connected from the No. 1 terminal, which is "ground" to the No. 2 terminal, which is "grid." The assembly of these connectors are done before screwing on the metal caps and a length of shielded wire is brought out from the No. 2 lug for connection to the various grids. The complete elimination of hum-pickup is therefore accomplished by an easy and convenient method of assembly.

The sockets should be laid out as shown and all bypass condensers must first be mounted in position in order to obtain a compact unit which requires so many parts. The output transformers may be mounted and wired next, together with any other parts which mount under wiring, etc.

Mixing of the various inputs is accomplished by using two type 6N7 metal tubes with the four grids, serving the individual input channels and with the four plates all in parallel.

The audio signals applied to the grids is controlled by the four potentiometer "mixers" and any balance or proportion from four separate inputs is had. If it is desired to have a low gain input position for a phono. pickup, it is only necessary to include a switch on the "hot" end of one of the controls so that a signal may be applied across the control.

Complete filtering of the plate circuits is essential to stability in an audio stage of high gain and care must be exercised or motorboating and other difficuties will be encountered. The values of the various resistors are rather critical for maximum gain and frequency response and substitutions should be made only where absolutely necessary.

The use of phase inversion is becoming very popular in amplifier design, as its use in conjunction with resistors eleminates another source of hum-pickup, namely, the input transformer. Certain precautions are needed if proper drive ratio to the amplifier stage grids is to be obtained. The phase inverter tube type 6C8G contains two high *mu* triodes with separate cathodes.

The control grid of the first section receives the input voltage from the mixer tubes and by means of the coupling condenser in the first plate circuit, feeds the No. 2 control grid with voltage of identical amplitude, but opposite in phase to the No. 1 grid. The setting of the correct proportion between the two No. 1 plate resistors determines the amplitude voltage and may be adjusted by means of a vacuum tube voltmeter if one is available. The 6L6 amplifier tubes are resistance coupled to the inverter and the quality of the audio is extremely free from distortion at the grids of the 6L6's. No grid driving power is required in the amplifier stage due to the use of "Class A" amplification. This adds to the economy of the unit, as self bias may be used with only 2% total harmonic distortion.

In order to reproduce the excellent fidelity of the amplifier, the selection of the output transformer and speakers must be considered. The use of a Universal type of output to line transformer permits a proper impedance match to be made to meet various loads at changes in plate voltage. The selection of the taps shown are correct for the average watts output as is had when using the 2nd position on the voltage switch. By using a 500 ohm secondary the change of plate load offers far less mismatch to 500 ohms line than it would if a low voice coil impedance were used, with a net result that the audio watts output may be changed by choosing various positions on the switch and the change in voltage applied to the 6L6 plates will not materially effect the response of the amplifier. One to four speakers may be used. When

using all four speakers at one time, the 2000 ohm taps are used all in parallel, or a total impedance of 500 ohms.

If coverage is required out-of-doors and two speakers with projection baffles will suffice. The 1000 ohm taps are used in parallel and each speaker may be run at 16 watts. The connecting cables to the speakers may be ordinary lamp cord up to about a thousand feet without unbalancing the 500 ohm line.

The frequency response of the amplifier may further be enhanced by adding a simple network in order to provide stabilized feed-back. The values of R16 and R17, together with C8 and R19, control the amount of signal output voltage that may be fed back to the control grids. Many different methods of obtaining a stabilized feed-back have recently been publicized, but the one shown is the simplest one that may be built into an existing amplifier or as part of the initial construction of a modern unit. It is important that the resistors and the two condensers be of equal values, otherwise the proportions of balance will be upset and the amplitude of the applied signal back to grids will not be alike. The value of C8 may be increased to .25 mfd. if greater feed-back is wanted, but will have a tendency to "block" when using the amplifier on the full output setting.

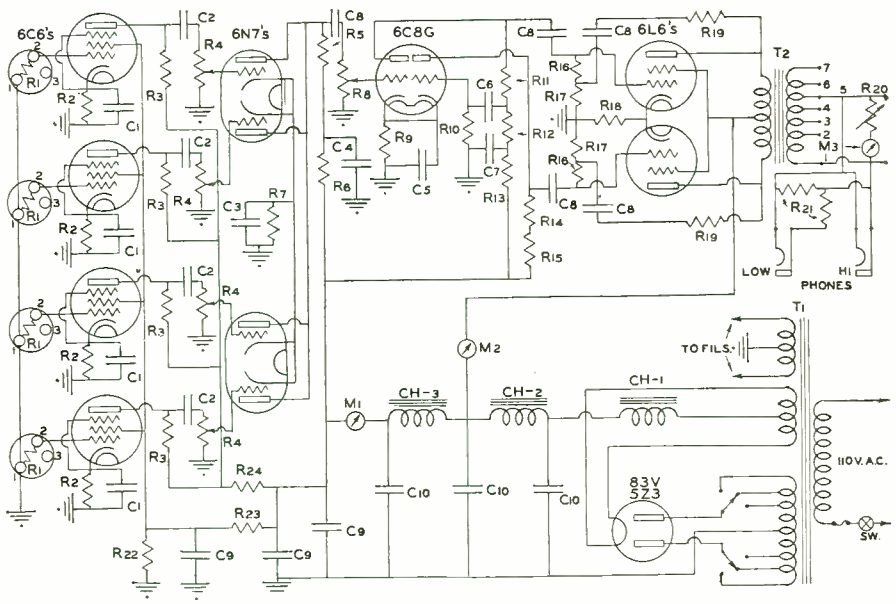
A Sub-Panel mounts on the front of the audio chassis so as to be able to mount and wire the controls at a convenient position for comfortable reach when "riding gain."

A five-prong socket is mounted on the rear of the audio chassis and is used as a receptacle for all of the filament and plate voltages from the power supply cable and plug.

The complete plate and filament supply mounts on a chassis 11" x 7" x 1" with the parts laid out so that room is allowed for the two meter cases when the chassis is inserted into the metal cabinet. First the transformers and chokes should be mounted. The "On-Off" switch and the "plate volts" change switch mount on small brackets so they may be wired conveniently. If illuminated meters are to be used, the pilot light filament leads must be wired, as part of the assembly and the pilot lights may be plugged into the meters after the unit is placed in the cabinet.

The choice of fuse location was the result of remembering a rather embarrassing situation when riding gain at a local theatrical performance. Its placement where it is convenient offers much mental comfort when used in one of the rural communities where the line volts may decide to inflate without reason. Another ailment common to the serviceman's itinerary is the burning out of pilot jewel bulbs, which are usually gotten at with difficulty, so one of the removable type of Pilot jewels is used. To replace the bulb from the *outside* of the cabinet, unscrew the jewel. A three section filter is shown, although a two section might suffice. A type 83V or 5Z3 rectifier is used, together with a "Swinging" choke and two filter or "smoothing" chokes and a total of 24 mfds. of filter capacity.

The plates and screens of the 6L6 amplifier tubes operate at the same potential. Two meters are shown in the photograph,



The hook-up of the 4 channel input portable P.A. system.

R_1—*5 megohms ¼ w.*
R_2—*4000 ohms ½ w.*
R_3—*250,000 ohms 1 w.*
R_4—*500,000 ohms Utah RC 500 M*
R_5—*20,000 ohms 1 w.*
R_6—*10,000 ohms 1 w*
R_7—*400 ohms 1 w.*
R_8—*200,000 ohms Utah RC 200 M*
R_9—*1500 ohms 1 w.*
R_{10}—*50,000 ohms ½ w.*
R_{11}—*100,000 ohms ½ w.*
R_{12}—*10,000 ohms ½ w.*
R_{13}—*10,000 ohms ½ w.*
R_{14}—*100,000 ohms ½ w.*
R_{15}—*10,000 ohms ½ w.*
R_{16}—*100,000 ohms ½ w.*
R_{17}—*5,000 ohms ½ w.*
R_{18}—*200 ohms 10 w., Utah CC 200*
R_{19}—*50,000 ohms ½ w.*
R_{20}—*200,000 ohms Utah RC 200 M*
R_{21}—*5,000 or 10,000 ohms ¼ w.*
R_{22}—*25,000 ohms ½ w.*
R_{23}—*100,000 ohms 1 w.*
R_{24}—*35,000 ohms 1 w.*
C_1—*10 mfd. 25v. electro.*
C_2—*.05 mfd. 400v. paper*
C_3—*25 mfd. 25v. electro.*
C_4—*4 mfd. 25v. electro.*
C_5—*10 mfd. 25v. electro.*
C_6—*.1 mfd. 400v. paper*
C_7—*8 mfd. 450v. electro.*
C_8—*.1 mfd. 400v. paper*
C_9—*8 mfd. 450v. electro.*
C_{10}—*8 mfd. 450v. electro.*
T_1—*pl. & fil. trans. Utah No 2422*
T_2—*universal Cl. A Output Utah No. 8446*
CH_1—*Swgg. ch. 200 M.A. Utah 4501*
CH_2—*Filt. ch. 200 M.A. Utah 4501*
CH_3—*Filt. ch. 100 M.A. Utah 4508*
M_1—*0-25 D.C. milliameter*
M_2—*0-200 D.C. milliameter*
M_3— *—10+6 DB Meter*

one of which indicates the plate and screen currents of the 6L6's and the other the current drawn by the remaining tubes.

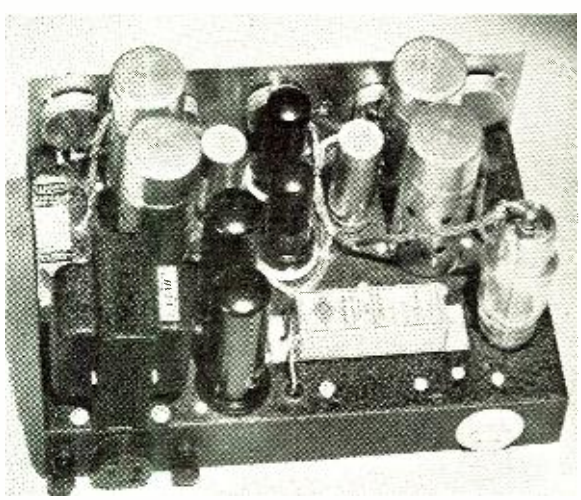
A standard D.B. meter may be used in place of the O-25 ma. This meter has its scale marked from —10 to + 6 D.B. and is calibrated for 500 ohm lines. In order to provide a means of setting the meter to a certain audio level, a 200,000 ohm potentiometer may be used as a series resistor and connected as shown on the schematic. This will not provide any accurate reading to be had, but is used simply to limit the maximum deflection of the needle to read zero on the scale at the peak volume required for a given application.

The complete amplifier is contained in a metal cabinet measuring 12 inches wide, 12 inches high and only 7½" deep. A durable leather carrying handle is bolted securely to the top of the cabinet.

Many P.A. installations that are set up in connection with stage presentations use two or more microphones, not only to permit greater range of pick-up, but also to allow the gain to be reduced to the individual mikes in order to reduce the possibility of feedback from the speakers. The use of a pair of head phones to monitor the amplifier is highly recommended as it permits the operator to concentrate on the pickup from the various microphones where unbalanced condition might easily be corrected. Provision is made for the operator's head-set and a choice of jack position may be had for either high or low level.

In setting up the amplifier, the master gain should be adjusted so that the top level of volume on *all* the inputs can not be exceeded.

—30—



The layout on the chassis is carefully thought out.

How To Make A Pitchfork Antenna

by S. GORDON TAYLOR, W2JCR
Author & Engineer

A new approach to the 56MC beam antennae. This unique antenna showed a consistent increase in the received signal. The beam is not too sharp, affording good coverage.

WE are on the threshold of another radio advance which will offer a number of problems to the engineers but an increased variety of service and entertainment to the radio enthusiast. This is to come as the result of the extension of broadcast ranges into the ultra high-frequency regions, the forthcoming introduction of television and facsimile, and the introduction of various types of radio services not heretofore existing except perhaps in the experimental laboratories.

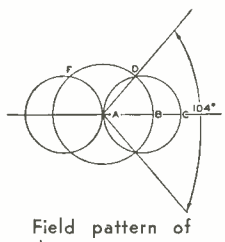
In anticipation of this a number of the all-wave receivers now on the market have extended their range down to five meters. Antennas for use at these very low wavelengths are due to come in for a good deal of attention. One reason is that receiver efficiency is likely to be much lower than on the longer waves. Another is that the small physical size of antennas suitable for this type of reception make practical the erection of beams and arrays in small space.

When a new antenna was to be erected for the five-meter operations at the amateur station W2JCR careful advance thought was given to various types. Located in an apartment house, it became quickly apparent that any sort of rotating mechanism was out of the question, as was also any sort of complicated structure which would encroach too much on the roof areas reserved for residents of the house to accumulate sun tan.

The design arrived at eventually, and which has proven highly successful since it was installed, is illustrated in the accompanying drawings. It consists of two half-wave radiators, spaced about one-eighth wave apart and fed 180 degrees out of phase by means of a quarter-wave matching section. The basic design, while not well known is not new. Such novelty as this particular model may offer is in the attention given to efficiency and security, and to ease of erection. Basically it is one of the "double J" type.

As for accomplishments, every station that I have worked at a distance of 10 miles or more has reported my signals stronger than ever before. These reported improvements varied from one to three R's. Of perhaps more importance is that the signals now succeed in hopping over the Palisades into New Jersey much more effectively. Losses in the "off-the-beam" directions are unnoticed, perhaps because the beam is turned so that the "dead" areas fall largely in territory where there is little five-meter activity.

The figure shows the pattern for beams of this type, as it appeared in an article by G. H. Brown on *Directional Antennas* in the January, 1937, issue of the *Proceedings of the Institute of Radio Engineers*. The large circle represents the field of a single dipole antenna with a given power input. The two smaller circles represent this same amount of power put into a beam of the type described here, and the resulting fields over which the signal intensity equals that of the larger circle. Suppose, for instance, that the large circle represents the area over which a transmitter at "A" can lay down an "R-9" signal when using an ordinary dipole antenna. The two smaller circles will then represent the areas over which this same transmitter will lay down an R9 signal when a beam of this type is substituted for the dipole.



Field pattern of the antenna.

Along the "nose" of the beam we see that the R9 range has been extended from (B) to (C), an increase of about 1.7. To obtain a similar increase with the dipole antenna it would be necessary to increase the power output from the antenna 1.7 x 1.7, or 2.89 times. So by the use of this beam a gain of almost three-to-one in power is obtained in the desired directions. The width of the beam, as indicated by the angle (D-A-E), with an equivalent in the opposite direction, is such as to provide wide coverage without the need for rotation. Moreover, radiation in the area (F-A-D) is not zero. In actual practice there is ample here for local work, due perhaps to radiation by the matching section, reflection and other phenomena.

The construction details are for the most part shown. Two 12 foot lengths of half-inch outside diameter, hard-drawn copper tubing are used for the two halves. This is the greatest length carried in stock by the supply houses so in order to provide a total length of about 12 feet, 10 inches required to tune the antenna down to 56 megacycles, the top ends of the tubes are slotted and smaller tubes slipped into them to form telescoping extensions which are adjusted during the tuning-up process and then soldered or clamped in position.

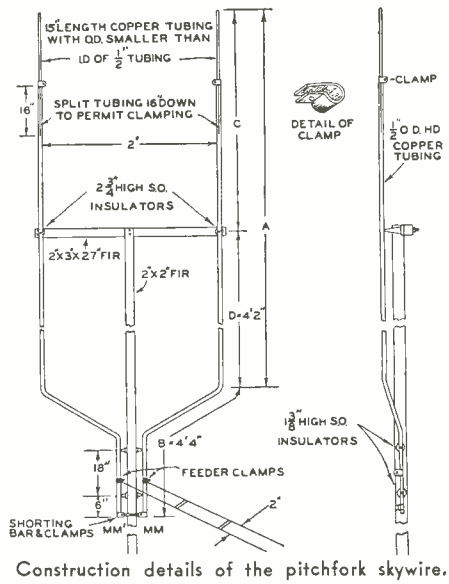
Each 12 foot rood makes up into a radiator with a quarter-wave extension at the bottom to serve as one side of the matching section. The former is indicated as (A) the latter as (B). The length (B) is 4 feet, 4 inches but the length (A) should be adjusted according to the operating frequency as shown in the table. Electrically the length of (B) is adjusted later by moving the shorting bar up and down.

The first job is to bend the tubes as shown. This hard-drawn copper is tough stuff but is readily bent by first heating the metal a few inches where each bend is to come. About three minutes over a gas stove flame for each bend will do the trick. When it cools it will bend nicely. You can bend it over your knee, but it is better to place a tube flat on the floor and make the bends around some round object such as a bucket, with a diameter of not less than 6 inches. This will keep the bends uniform and gradual.

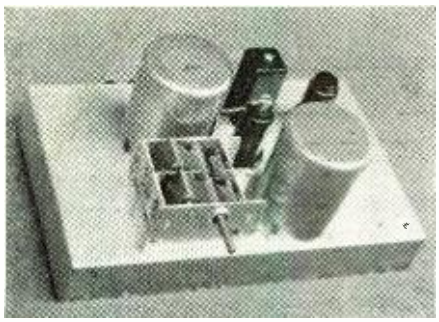
With this finished, prepare the wood frame. Notch the crosspiece in the center to take the upright and bolt them securely together. Then monnt the six insulators with machine screws. A single pair of screws will serve for two insulators at the lower end. The upright should be long enough to extend down about four feet below the copper tubing to overlap the mast or other support on which it is to be mounted.

For the sake of its ultimate appearance it is advisable to bend the tubing slightly. After doing this, drill the tubing to slip over the terminal screws of the insulators, tighten on the nuts and the job is complete. The clamps may then be slipped into position on the tubes, one pair below the bottom insulators and the other between the two pairs of insulators. These clamps

(*Continued on page 72*)



Construction details of the pitchfork skywire.



The topside chassis view of the 2 tube super.

Two Tube Superhet Tuner

by DON C. DUNCAN
Illinois Bell Telephone Co.

Whenever the experimenter is willing to stick to strong local stations, he can, by using a tuner such as this, get the finest in audio reception.

RECEIVERS designed for country-wide reception must of necessity have high sensitivity and selectivity. Such receivers, with their inherently higher noise level and restricted audio range (high selectivity) cannot compete with a simple tuner for the best reception from local stations.

Design Details

The entire tuner with tubes can be built for less than seven dollars. It is imperative, of course, that the audio amplifier with which it is used must be capable of high fidelity performance if full benefit is to be realized from the tuner.

Before deciding on the ultimate layout, a one tube tuner using a 6C6 biased detector was built first. Although the quality of this tuner was excellent, a long antenna was required for reasonable output, and the single tuned circuit was unable to completely separate local stations which differed in frequency by fifty kilocycles or less.

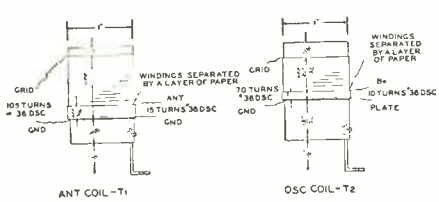
Due to the fact that it was obvious at least two tubes would be required for the desired results, it was decided to use the super-het circuit in its most simple form. The schematic circuit diagram shows the complete circuit of the tuner, as constructed by the author.

The new 6K8 converter tube forms the heart of the tuner in its role of oscillator and mixer. This tube departs from the design of older converter tubes such as the 2A7, 6A8, etc., in that its oscillator and mixer plates are on opposite sides of a common cathode.

The oscillator section of the tube consists of a triode, and the mixer section consists of a hexode. These two sections of the tube are isolated except for a common grid by means of which the oscillator voltage is injected into the mixer section. Unwanted reaction between mixer and oscillator sections has been reduced to a minimum, resulting in better frequency stability of the oscillator. The tube is further characterized by lower interelectrode capacitances.

The usual intermediate frequency amplifier was eliminated on the basis of cost, unnecessary gain, and a source of some noise and distortion.

A 6C5 biased detector was chosen in preference to diode detection to obtain higher selectivity from the intermediate frequency transformer. Manual volume control has been left to the audio frequency amplifier.



Constructional details of the coil windings.

Construction Details

Both the antenna and oscillator coils are wound on one inch diameter bakelite tubing about one and one-half inches long, supported by a metal angle as illustrated in the sketches. The coils should be wound as close to specifications as possible to avoid difficulty in lining up the tuner later. The two windings of each coil are wound in the same direction, with the bottom end of the windings starting at the same level. The completed coils should be moisture proofed by an application of coil dope, or by immersion in hot paraffin. The shield cans used were 2⅝" in diameter and 3⅜" high. Use of smaller shield cans may necessitate adding one or more turns to the tuned windings of each coil. Shield cans less than 2" in diameter should be avoided.

Due to the apparatus layout that was chosen, the two-gang variable condenser C_1-C_2 should be selected with parallel trimmers on the left side for convenience of adjustment.

Padding condenser, C_3, is shown in the list of parts as a variable trimmer of approximately 375 mmfd. Actually this may be a fixed mica condenser in parallel with a small mica trimmer. It may take some "cut and try" procedure to get the correct value of fixed condenser to use inasmuch as many of the mica condensers on the market measure as much as 35 per cent below their rated capacity.

The radio frequency choke shown in the output circuit of the 6C5 is not critical as to value. A value of 10 or 15 m.h. is suggested.

The value of the detector cathode biasing resistor, R_3, was chosen to provide a no signal detector plate current of .2 m.a. If a meter is available, it would be desirable to adjust R_3 to the exact value required to give a plate current of .2 m.a. with the particular 6C5 tube to be used.

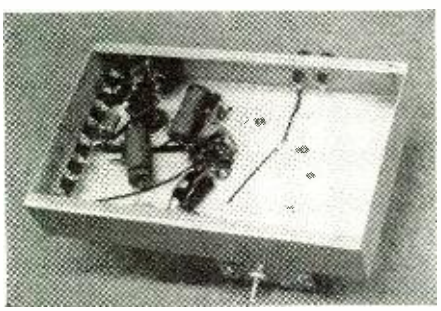
The i.f. transformer, T_3, should be of the powdered-iron core type and preferably the exact transformer specified in the list of parts. It will be necessary to temporarily remove the transformer from its case to bring the grid lead out of the bottom of the case instead of out of the top, as it is supplied by the manufacturer.

The chassis is 7" x 11" x 2" and allows ample room for everything.

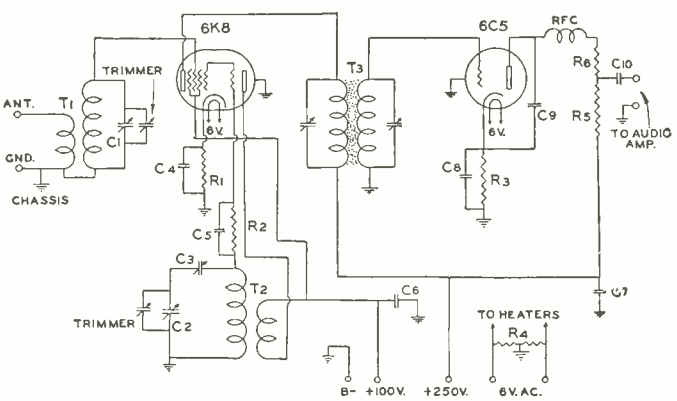
Lining-up Procedure

Before starting the lining-up procedure, a measurement of the total B supply current (in B-lead) should be made; (this

(*Continued on page* 68)



Underside the chassis shows simple wiring used.



Wiring diagram of the 2 tube superheterodyne.

C_1, C_2—2 gang .000365 mfd. with parallel trimmers
C_3—mica padding, approximately 375 mmfd.
C_4, C_6, C_7, C_8, C_{10}—.1 mfd. paper
C_5—.0002 mfd. mica
C_9—.0005 mfd. mica
R_1—300 ohm, ½ w
R_2—50,000 ohm, 1/10 w
R_3—50,000 ohm, 1/10 w
R_4—50 ohm, center tapped
R_5—500,000 ohm, 1/10 w
R_6—50,000 ohm, 1/10 w
T_1—Antenna coil
T_2—Oscillator coil
T_3—Aladdin, type C-101-M Polyiron core, 465 kc. i.f. transformer

Something New in Radio

by McMURDO SILVER
Chief Engineer, McMurdo Silver Corp.

For those who are satisfied with local programs but want the finest in musical reproduction, this new type of circuit will please the most exacting.

LOOKING back but over a few of the substantially fifty years that number the existence of radio communication, it is interesting to note that the general popularity of all-wave receivers which are today 90% of the radio receivers offered to the public dates from 1932-33. True it is that all-wave receivers in the sense of receivers covering the standard broadcast and one or more short-wave bands were offered as early as 1926-27, but we may still date their general sale from 1932-33. Since that date the purchaser of anything but the very cheapest midget has literally had to buy an all-wave receiver, for since then every set even boasting of good to fine tone has been of the long and short wave variety.

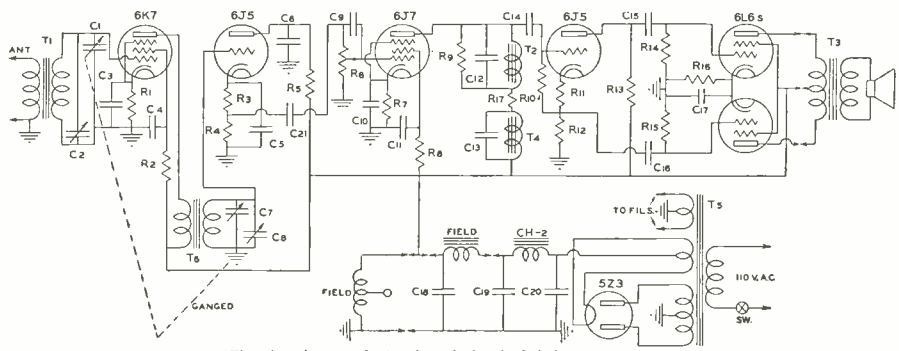
There is not a radio engineer living who has not toyed with the idea of, and in some few cases actually has built for his own personal use, a strictly local high-fidelity receiver.

The receiver here illustrated is a carefully considered attempt to do full justice both to the demand for and the possibilities of high-fidelity reproduction of local and nearby stations. In it sensitivity has been sacrificed to noise and interference-free reception of strong nearby stations capable of producing reproduction satisfying to the critical musician. Selectivity has been sacrificed to the same consideration, as it may be in reception of strong nearby stations only. At every point the emphasis and accent has been upon tone quality—so much so that initial demonstrations to musicians of wide experience has resulted in considerable praise of the results attained.

Circuit-wise, the story is briefly told by the illustrations herewith. The remote control radio tuner, thru a 25 ft. flat cable connects to the tuner which is in turn connected to the power amplifier and 15" loudspeaker placed in the console.

The speaker is housed in a large cabinet for better reproduction of the musical programs.

The various parts of the new type receiver.



The hook-up of the local, high fidelity receiver.

C_1—375 mmfd. var.
C_2—12 mmfd. trimmer
C_3—.1 mfd. 50v. paper
C_4—.25 mfd. paper
C_5—100 mmfd. paper
C_6—.5 mfd. paper
C_7—12 mmfd. trimmer
C_8—375 mmfd. var.
C_9—100 mmfd. mica
C_{10}—5 mfd. electro.
C_{11}—.25 mfd. paper
C_{12}—.025 mfd. paper
C_{13}—.025 mfd. paper
C_{14}—.1 mfd. paper
C_{15}—.1 mfd. paper
C_{16}—.1 mfd. paper
C_{17}—5 mfd. electro.
C_{18}—25 mfd. electro.
C_{19}—25 mfd. electro.
C_{20}—25 mfd. electro.
C_{21}—.025 mfd. mica
R_1—500 ohms, 1 w.
R_2—100,000 ohms, 1 w.
R_3—40,000 ohms, 1 w.
R_4—100.000 ohms, 1 w.
R_5—15,000 ohms, 1 w.
R_6—1 megohm, pot.
R_7—700 ohms, 10 w.
R_8—30,000 ohms, 5 w.
R_9—40,000 ohms, 5 w.
R_{10}—30,000 ohms, 5 w.
R_{11}—6,000 ohms, 5 w.
R_{12}—30,000 ohms, 5 w.
R_{13}—30,000 ohms, 5 w.
R_{14}—100,000 ohms, 2 w.
R_{15}—100,000 ohms, 2 w.
R_{16}—125 ohms, 20 w.
T_1—McMurdo Silver Ant. coupler
T_2—McMurdo Silver Ch. No. 3852
T_3—Output transformer
T_4—McMurdo Silver Ch. No. 1858B
T_5—McMurdo Silver Pwr. Trans. No. 4810
T_6—McMurdo Silver IF Trans.
SW—Switches
CH_2—McMurdo Silver Ch. No. 3193F

The turner has four knobs—one controlling the tuning dial, which through a relatively new optical projection system presents to the user's eye upon a ground glass screen calibration in broadcast band frequencies from 1600 to 540 kc., in figures large enough for easy reading even by those of impaired eyesight. The three remaining knobs control volume, bass tone and separately treble tone, with a toggle switch to shift from radio to phonograph reproduction. This is quite a step forward from current remote control receivers, in which station selection and on-off functions only are usually remotely controlled. Thus in operation the user need never leave his easy chair, for complete tuning, volume and tone control is at his finger-tips.

Chassis-wise, the receiver is divided into three units for convenience and efficiency. At the left is the tuner, carrying one stage of tuned r.f. amplification using a 6K7G tube and the infinite impedance 6J5G detector. The small shields at the right house the two high-gain iron core coupling transformers, which are tuned over the range of 1650 to 550 kc. by the two gang condensers at the center. Sensitivity is intentionally set for local to 100 mile receptional only in order to completely exclude noise and interference-high sensitivity is undesirable in such reception. The dial is upon the rear of the gang condenser and is not viewed directly. Instead, it is backed by a "mask" carrying a condensing lens and an automobile headlight bulb which projects a desired portion of the dial scale, printed in green kilocycle figures upon a solid black background, forward to two focusing lens seen in the "barrel" just in front of the dial. Through this system, in which the dial calibrations appear as large easy-to-read figures upon a ground glass screen on the control panel.

(*Continued on page* 70)

Advance Report of ARRL Board Meeting

THE combined pressure of RADIO NEWS, the Midwest group of hams, and the far West group of hams, together with the astuteness of R. H. G. Mathews, ARRL director of the Chicago district, served to compel the ARRL to adopt many measures which have been vigorously fought for the past few years. Only the old timers, whose memory in amateur radio runs backs many years, can appreciate what must have happened at headquarters to have the "powers that be" there divest themselves of so much power and vest it directly with the members. As soon as The Editors see the complete detailed report, RADIO NEWS will comment further on this matter.

A full report of what the Board accomplished properly belongs in the ARRL magazine, and so only a few of the outstanding changes and adoptions will be set down here for those readers who have been following the campaign of RADIO NEWS to have the ARRL returned to the hands of the amateur that compiles its membership.

(1) The Board passed a resolution providing for the publication of the minutes of the meetings of the Executive Committee. Heretofore these meetings have been held in secret and not until the year was over did the membership know what occurred or what action had been taken. It had to wait until the end of the year at which time the Directors generally approved the action of the Executive Committee. This was in effect, merely putting the stamp of approval on something which had already been done, and the membership had no chance to discuss or think about the advisability of approving the Executive Committee's actions. In the first step to return the League to the members, the same are now informed of what the Executive Committee has done so that they may approve or disapprove, as the occasion may warrant.

(2) The famous Direct Referendum for which RADIO NEWS has fought consistently, has been passed. It will be recalled that last year this Referendum was tabled by almost a unanimous vote. With the publicity given to this situation and the insistance of Director Mathews, the Board resolved that whenever the Board shall see fit, a direct poll of the membership shall be taken and the results of the ballots published, and the Board shall take notice of the results of the poll in making its decisions.

For the first time in the history of the ARRL, the members have a direct "say" in their government. It is now possible to force many things which have been kept in the dark, out into the open and thus to clean the situation up. More will appear in RADIO NEWS later concerning the "opinion of the Board needed to have a Referendum;" however, while this is not the complete victory some of the more liberal hams are seeking, it can safely be termed to be a "90%" one.

In keeping with this resolution, a General Referendum will be taken on what shall be done with the phone bands in the frequencies above 60 megacycles.

(3) The Board resolved that there will be published in the ARRL magazine an agendum which will set forth the matters to come before the next meeting of the Board. This agendum will be published in sufficient time to permit all members to think the matter over and properly to instruct their directors as to the members' feelings in the matter. Heretofore the membership has not known what will come before the Board and, therefore, was unable to express its opinion to the Directors. This is a great step forward on the part of the hams towards getting the control of the ARRL back to the membership.

(4) Breaking all precedence for the League, it was voted to hold the next annual meeting in San Francisco. For those of us who can recall the 20 years' struggle to have the League hold its annual meetings in the various places throughout the United States so as to feel the pulse of the amateur more properly, this resolution comes as a pleasant surprise. Heretofore, the League has always insisted that the meetings must be held in its headquarters at Hartford.

We feel certain that when the League goes to San Francisco next May, and thereafter holds its meetings throughout the nation, that it will be better able to know the desires, wishes and opinions of its ham membership.—THE EDITORS.

—30—

SPECIAL BROADCAST PROGRAMS FOR THE DX FAN

HERE are the latest special DX broadcast programs dedicated to RADIO NEWS. Tune in on these broadcasts and send in your reports direct to the station. Give them complete information, reporting the station's signal strength, quality, fading, etc. State in your report if verification is desired, practically all of the stations listed will be pleased to verify reports. The schedule is shown in *Eastern Standard Time* and all hours are *A.M.* unless otherwise indicated.

RADIO NEWS invites all DX clubs and all those having to do with special programs, DX tips and frequency checks to send in the information and help make these schedules as complete as possible. Anyone submitting such data, please bear in mind that RADIO NEWS goes to press thirty days before it makes its appearance on the newsstands, which means that notice of programs for a given month should be in our hands by the first of the preceding month.

JUNE

Day	Hour	Call	State	Kc.	Kw.
9	4:30-4:45	WFOR	Miss.	1370	.1
10	4:20-4:35	WRAK	Pa.	1370	.1
10	5:30-5:45	KWYO	Wyo.	1370	.1
11	4:05-4:20	WJBO	La.	1120	.5
14	5:35-5:50	KGMB	T.H.	1320	1.

JULY

8	4:20-4:35	WRAK	Pa.	1370	.1
8	5:30-5:45	KWYO	Wyo.	1370	.1
9	4:05-4:20	WJBO	La.	1120	.5
12	5:35-5:50	KGMB	T.H.	1320	1.
14	4:30-4:45	WFOR	Miss.	1370	.1

PERIODIC PROGRAMS

Frequency Checks and Dedications to DX Clubs and RADIO NEWS

Mondays—

9:15-9:30 p.m., 690 kc., CJCJ, Calgary, Alta., Canada, .1 kw. (tips).

Wednesdays—

12:30 a.m., 1390 kc., KOY, Phoenix, Ariz., 1 kw. (tips).

1:45-2:00 p.m., 780 kc., WTAR, Norfolk, Va., 1 kw. (URDXC) (tips).

Saturdays—

10:30 a.m., 830 kc., WEEU, Reading, Pa., 1 kw. (tips).

2:45-4:00 a.m., 780 kc., CHWK, Chilliwack, B. C., .1 kw. (URDXC).

Sundays—

12:45-1:00 a.m., 1280 kc., KLS, Oakland, Calif., .25 kw. (URDXC) (tips).

2:45-3:00 a.m., 1010 kc., CKWX, Vancouver, B. C., Canada, .1 kw.

3:00-3:30 a.m., 1410 kc., CKMO, Vancouver, B. C., Canada, .1 kw.

3:30-3:45 a.m., 570 kc., KMTR, Los Angeles, Calif., 1 kw. (tips).

Monthly—

1st day of each month, 3:00-4:00 a.m., 1260 kc., WTOC, Savannah, Ga., 1 kw.

1st Sunday of each month, 4:00-4:30 a.m., 1340 kc., KGDY, Huron, S. Dak., 25 kw.

2nd Monday of each month, 5:20-5:40 a.m., 1250 kc., WAIR, Winston-Salem, N. C., .1 kw.

2nd Tuesday of each month, 5:00-5:30 a.m., 1370 kc., KRMC, Jamestown, N. Dak., 1 kw. 5:00-5:20 a.m., 1210 kc., WSAY, Rochester, N. Y., .1 kw. (NNRC).

2nd Wednesday of each month, 3:40-4:00 a.m., 1310 kc., KAND, Corsicana, Texas, .1 kw. (NNRC).

2nd Thursday of each month, 4:00-4:20 a.m., 1330 kc., KRIS, Corpus Christi, Texas, .5 kw. (NNRC).

2nd Friday of each month, 4:00-4:20 a.m., 1370 kc., WBTM, Danville, Va., .1 kw.

2nd Saturday of each month, 4:35-4:50 a.m., 1310 kc., KTSM, El Paso, Texas, .1 kw. (FC).

Notes from Readers and DX Clubs

Eric W. Watson of Christchurch, New Zealand, submitted the following interesting report on DX reception in his country: "Reception poor, high noise level, all channels blocked by the Australians. No doubt we are at the peak of the sun-spot 11 year cycle. Even KFI is inaudible. Congratulations to W. T. Golson of station WJBO, Baton Rouge, La., 1120 kc., for his fine special programs."

Shokichi Yoshimura of Moji, Japan, writes: "By 1940 station JOLK, 910 kc., Fukuoka will increase its present power of 500 watts to 100 kw. and stations JOBK 1 and 2 to 75 kw. each."

We acknowledge the following from the New Zealand DX Radio Association—New Australia and New Zealand stations: "7EX Launceston, 1000 kc., 500 w.; 4QR Brisbane, 940 kc., 500 w.; 2LF Young, 1340 kc.; and 7DY Derby, 1400 kc. Frequency changes 3OL 1000 to 900 kc.; 7QT to 680 kc.; 4VL 1430 to 570 kc.; and 1ZB 1070 to 1090 kc."

New Monitor Schedule

In addition to the regular F.C.C. monthly frequency checks, the Commercial Radio Equipment Company, of Kansas City, Mo., also conduct precision frequency measurements on a number of stations each month, and the following list is their latest special after-midnight monitoring schedule. All hours are a.m., E.S.T. RADIO NEWS Broadcast DX Fans will appreciate the courtesy of the above named concern in supplying this new schedule.

Call	Kc.	Location	Monthly Schedule (A.M.—E.S.T.)
WPAY	1370	Portsmouth, Ohio.	1st of every mo., 4:00 to 4:30
KTSA	550	San Antonio, Tex.	1st Monday, 1:00 to 1:15
WRR	1280	Dallas, Tex.	1st & 3rd Tues., 1:00 to 1:30
KLAH	1210	Carlsbad, N. Mex.	1st Tuesday, 4:00 to 4:30
KAND	1310	Corsicana, Tex.	1st Tuesday, 4:00 to 5:00
KWOS	1310	Jefferson City, Mo	1st Wednesday, 2:00 to 2:30
KWBG	1420	Hutchinson, Kans.	3rd Wednesdays, 6:30 to 7:00
KNOW	1500	Austin, Tex.	1st Thursday, 1:45 to 2:15
WACO	1420	Waco, Tex.	1st Friday, 1:45 to 2:15
KIUN	1420	Pecos, Tex.	1st Friday, 2:30 to 3:00
KAWM	1500	Gallup, N. Mex.	Every Thurs. except the 2nd of mo. from 4:00 to 5:00
KEUB	1420	Price, Utah.	1st Sat. from 2:00 to 2:30
KGFI	1500	Brownsville, Tex.	1st Saturday, 2:00 to 2:30
KSAL	1500	Salina, Kans.	1st Saturday, 2:30 to 3:00
KTEM	1370	Temple, Tex.	On the 5th of every mo. from 3:00 to 3:30
WGRC	1370	New Albany, Ind.	On the 6th of every mo. from 3:30 to 4:00
KVGB	1370	Great Bend, Kans.	On the 7th of every mo. from 3:00 to 3:30
WPAD	1420	Paducah, Ky.	On the 7th of every mo. from 3:00 to 3:30
WHEF	1500	Kosciusko, Miss.	2nd Tuesday, 2:30 to 3:00
WJAG	1060	Norfolk, Neb.	2nd Friday, 1:30 to 2:00
KPOF	880	Denver, Colo.	2nd Friday, 2:15 to 2:45
WCAZ	1070	Carthage, Ill.	2nd Saturday, 3:30 to 4:00
KGFW	1310	Kearney, Neb.	On the 15th & 29th of month from 2:00 to 2:30
WLAP	1420	Lexington, Ky.	Last Fri. of the mo. from 2:00 to 2:30
KADA	1200	Ada, Okla.	On the 25th of every mo. from 2:45 to 3:15
KBIX	1500	Muskogee, Okla.	4th Saturday, 5:00 to 5:15
WBBZ	1200	Ponca City, Okla.	On the 29th of the month from 6:00 to 6:30
WSUI	880	Iowa City, Ia.	On the Wednesday morning preceeding the 1st Sat. of every month from 1:30 to 2:30

All Schedules are subject to change without notice.

DX Listening Posts

If owners of DX Listening Posts will forward good, sharp photographs of their receivers and the surrounding "veris" to the Editor of RADIO NEWS, they will be published in an early issue.

With the photograph, also forward information pertaining to the type of receiver you use and the greatest DX you have been able to pick up and substantiate with a "veri."

While RADIO NEWS will be unable to reproduce all of the photographs received, as many as possible will be published. If possible, the owner of the LP should also appear in the picture.

-30-

HAMS, SERVICEMEN AND BROADCASTERS, ATTENTION!

Always ready to advance the general radio art, RADIO NEWS conceived the idea of finding a sentence which would at once contain all the vowels and diphthongs of the English language. For this purpose it retained the services of D. Doob, B.A.,M.A., teacher at Hunter College, N. Y. C. The sentence to be used to test amplifiers, transmitters or any acoustical device is:

"THE FEATURES OF RADIO NEWS CAN HELP ALL ALERT ANNOUNCERS ENLARGE THE SPHERE OF THEIR KNOWLEDGE ABOUT CHOICE CURRENT IMPROVEMENTS, VITAL TO GOOD BROADCASTING."

To use, speak this sentence slowly and carefully into the microphone. If the output response is clear and legible, the device "passes" all the sounds of the English language without frequency loss.

QUESTIONS and ANSWERS

R. C. D., Detroit, Mich.: What job does the vibrator unit perform in a motor-car receiver.

Answer: The vibrator is employed in the power-supply circuit and its function is to convert the 6 volt direct-current of the car storage battery to a higher d.c. potential of approximately 200 volts or more, required for the plate circuits of the receiving tubes.

V. R., Bangor, Maine: My auto set is five years old and lately it was necessary to replace the vibrator unit. The set is in operation about six hours every day, would you say that I had received satisfactory service from this device.

Answer: The vibrator is subjected to a difficult mechanical task and on the average you have had very good service from your unit.

R. R. E., St. Joseph, Mo.: Please advise a simple method to determine if a low-power class A audio amplifier is performing correctly. I don't want to use any elaborate set-up and I am under the impression that my connecting a current meter in the circuit it will indicate the presence of objectionable oscillation in the circuit to cause distortion. A little help on this will be appreciated.

Answer: A milliammeter inserted into plate circuit of the output stage of the amplifier is the easiest method to observe the operation of the amplifier. The meter could be connected in the plate circuits of the preceding tubes and the action of each stage noted under operation. If the amplifier is performing correctly, as originally designed and constructed, the pointer of the meter should hold steady, the pointer will fluctuate and act erratic if undue distortion is present.

J. T. Q., Santa Barbara, Calif.: Is there any way I can add an "R" meter to my all-wave superheterodyne receiver? I have an 0-10 milliampere meter. Would this be suitable?

Answer: If your receiver includes automatic volume control it is a simple matter to add a signal-strength meter. The a. v. c. system causes the grid-bias and therefore the plate current of the controlled tubes to vary in accordance with the strength of the signal. A strong local signal will result in a very high grid-bias and low plate-current whereas a weak signal will permit almost normal plate current to flow. By placing a milliammeter in the B-plus lead to the i. f. amplifier these variations in plate current provide a relative measure of signal strength. The widest range of meter variation is obtained with a meter which will just show full scale deflection with normal plate current, which is the plate current when no signal is tuned in.

The best way to accomplish this is to insert the meter in the B-plus supply to two tubes if it is an 0-10 ma. meter because the two tubes will draw more than 10 ma. The meter is then shunted with a 100-ohm rheostat and the rheostat adjusted until the meter reads full scale on no signal. Weak signals will then retard the meter slightly while local signals may drive it back almost to zero, depending on the type of tubes used and other factors.

You can calibrate the meter in terms of the "R" scale by comparison with a receiver having a commercial "R" meter, or you can do it approximately by noting the meter readings on what you would consider an "R-9" signal, an "R-8" signal, etc. and then adopting these as standard. This is not exact, of course, but then neither is the "R" scale exact, its interpretation varying widely with individuals.

A. E. L., Chatham, N. Y.: I notice that the amateurs who are most consistent and successful in DX contacts all seem to be using special types of antennas, mostly beams of one kind or another. Cannot these same types of antennas be used by short-wave listeners to advantage, providing they are properly proportioned for the desired band?

Answer: Yes, any of the beams or arrays used by the amateurs for transmission and reception can be used with equal success for any type of short-wave reception, provided the same amount of care is put into their proportions and erection. It must be remembered however that these antennas, with few exceptions, are highly directional and are more or less useless for reception or transmission in directions other than that in which they are "aimed." Also, most of them are of use on only one hand—the one to which they are tuned by their physical proportions.

F. O., Cleveland, Ohio: What is the difference between a pre-selector and a converter; both units to be used ahead of a receiver?

Answer: A converter consists of an oscillator and mixer similar to those in super-heterodyne receivers. Its purpose is usually to extend the range of a standard receiver. In using the converter ahead of a receiver, the receiver is tuned to some frequency within its range and left that. It serves in effect as the intermediate amplifier for the combination, the converter providing the tuning. A pre-selector is a straight tuned radio-frequency amplifier, the purpose of which is to provide greater sensitivity and better image selectivity. Both it and the receiver must be tuned.

T. E. S., Bangor, Maine: Please advise the response range required of a so called high-fidelity receiver.

Answer: A high-fidelity set should be capable of reproducing audio frequencies from about 40 to 7,000 cycles. The Radio Manufacturers Association defines a high-fidelity set as one that has a frequency range from 50 to 7500 cycles with not more than 5% harmonic distortion.

I received my June copy of RADIO NEWS and am taking back the brick I threw at you in my last letter.

The June copy is a "wow," it's wonderful. Keep up the good work and make it the best magazine in radio.

—Byron A. Neal,
Neal Radio Lab.,
Mansfield, Penna.

I am a reader of R.N. now about 1 year, and I just had to write you about your May and April issues of R.N. I wish to say that they are really swell. . . . On April 16, I heard T14NRH call your name out. He says that he will send you as much as possible about himself and his station.

Howard Schrieffer,
New Orleans, La.

(For forwarding the message and the kind words about R.N., many thanks.—Ed.)

Count me in strong favor of returning the practical lessons on Television by Sprayberry.

L. Price,
Reading, Pa.

(They will be returned in the fall. Television will be "white hot" then, too.—Ed.)

Just got my second copy of the NEW RADIO NEWS, and let me say just one thing at the beginning—YOU'VE GOT SOMETHING THERE! . . . I've read many a copy of RADIO NEWS, but if it keeps on being so interesting as the new copies have been, April and May, 1938, well,—I'll be a lifetime friend and subscriber of your fine magazine. . . . For the first time in my life I've read RADIO NEWS from COVER TO COVER ads and all. Now that's something for me. . . . Best of luck to the new RADIO NEWS, and keep going just AS IS!

Claude R. Crever,
North Star Radio Service,
St. Joseph, Minn.

Personally, I like the new form of the magazine, not only from the standpoint of information contained in the various departments, but also from the standpoint of improved appearance.

Ray H. Manson,
Vice-Pres. & Chief Engineer,
Stromberg-Carlson Tel. Mfg. Co.,
Rochester, N. Y.

The writer has just completed the small radio set described in RADIO NEWS. I thought that your readers might be interested to know that this little set can be made to work.

Stanley Manning,
Detroit, Mich.

(Thank you, Mr. Manning, for the report.—Ed.)

As a subscriber to your magazine I wish to take this opportunity to tell you how pleased I am with the changes in RADIO NEWS. I think that it has been greatly improved. . . .

W. B. Byers. W4EXI,
Talladega, Ala.

. . . First, I want to compliment you on your editorial. Radio has needed an open forum of this type long ago. It is only through pro & con discussion & comment like this that we get to the bottom of any subject; through the route of free thinking, free speech, press & radio. Even though we may occasionally disagree with you, we but reserve our right to answer, and uphold your right to express yourself on anything. . . . Congratulations on breaking the ARRL open for public discussion. Although we are not a licensed amateur, we are interested in this division of the vast field of radio. We would like to know what the insiders will have to say for themselves—if they will!

L. M. Jensen (former L.P.O.),
Cowley, Wyo.

(Thank you, Mr. Byers and Mr. Jensen. We will try to keep in a fair "groove" on all subjects, giving the "opposition" ample space and chance to express itself. Actually, we are not opposed to the ARRL, but there are some things therein which could use an airing out. This we aim to do. Radio News will carry all the inside dope it can get!—Ed.)

Please accept our . . . congratulations on its (RADIO NEWS') attractive appearance.

Horton Heath, RCA,
New York City.

I just finished the May issue and like it fine in the new form. My wife even reads it now.

H. V. Markell.
San Antonio, Tex.

I am of the opinion that radio men do not buy radio magazines for human interest stories.

G. J. Irvin,
Philco Prod., Ltd.,
Toronto, Can.

(Mr. Irvin seems to disagree with Mr. Heath of RCA, Mr. Manson of S-C, and Mr. Crever.—Ed.)

You can count on me for a renewal on my subscription when the time comes. . . . To those whose interest in Radio field means their income and hobby, this magazine sure is a "Bible."

Edward F. Witkowski,
W1HRM, WMEE, USNR,
E. Portchester, Conn.

(Here is a radio man, a ham, and a naval reservist who likes R.N. Glad that you wrote in, W1HRM. We will have lots of "ham" articles in R.N., too.—Ed.)

TECHNICAL BOOK & BULLETIN REVIEW

ELECTRON OPTICS IN TELEVISION, by I. G. Maloff and D. W. Epstein. 299 pages. Price, $3.50. Size, 6½ by 9½ inches. Published by McGraw Hill Book Company, 330 West 42nd Street, New York City.

It is apparent that the authors have written this book with the special purpose in mind of developing the theory of electron optics and its most useful application, the television cathode-ray tube. It is in effect an account of their first-hand experience on this subject at one of the largest research laboratories in the country.

The introduction presents a brief description of a complete cathode-ray television system. Starting with a chapter on Nipkow's scanning scheme, this section concludes with descriptions of the image tube and the electron microscope. The body of the book is divided in two parts: Part 1 develops the theory of electron emission and electron optics. Part 2 deals with the problems encountered in designing tubes, practical and economical construction, and tubes capable of producing satisfactory television pictures when used with practical associated apparatus.

PRACTICAL RADIO MATHEMATICS, by M. N. Beitman, 22 pages. Size, 9 by 11 inches. Price $.50. Published by Supreme Publications, Chicago, Illinois.

This is a new booklet on mathematics, encountered in everyday radio problems, and is intended for the man engaged in radio servicing and experimental work. It has been prepared for home study and written especially for those with a working knowledge of arithmetic and elementary algebra. The purpose of the book is to clarify some points of elementary mathematics and connect the subject with radio and allied applications. A brief on the chapters show discussions on Ohm's law with radio examples; vacuum tubes, voltage, power amplification, and a chapter on the decibel.

TELEVISION, A STRUGGLE FOR POWER, by Frank Waldrop and Joseph Borkin, 299 pages. 5½x8. William Morrow and Co., 386 Fourth Avenue, New York City. ($2.75.)

Dealing not only with the difficult technical problems in a popular manner, but also with a complicated struggle for financial and manufacturing control by corporations holding patents, this book tells an amazing story, at times a sordid one, with brilliance. With television offering a substantial threat to the whole present communications structure, the book is timely to the *n*th degree and should be read by the average American citizen as well as those more intimately interested in or associated with the subject.

RCA REVIEW. Volume II, Number 4, April, 1938. 105 pages. Size, 6 by 9 inches. Published by RCA Institute's Technical Press, 75 Varick Street, New York City.

In this quarterly issue Charles J. Young discusses the equipment and methods developed for broadcast facsimile service. His treatment of the subject is very complete and interesting. C. E. Burnett writes on the new Monoscope tube, explaining its structure, operation and uses. Additional articles cover the latest advances in other branches of radio.

FREQUENCY CONTROL WITH QUARTZ CRYSTALS, Bulletin E-6. 28 pages. Price, 10 cents. Size, 6 by 9¾ inches. Published by Bliley Electric Company, Erie, Pennsylvania.

This new engineering bulletin on quartz crystals includes theoretical considerations on the subject, effects of temperatures, crystal controlled oscillators, frequency standards, and general operating notes.

RCA TRANSMITTING TUBE MANUAL, Number TT3. 192 pages. Price, 25 cents. Size, 5½ by 9 inches. Published by RCA Manufacturing Company, Radiotron Division, Harrison, N. J.

A complete technical manual on air-cooled transmitting tubes. It is an extremely helpful guide for both the amateur and broadcast station engineer. The book covers transmitting-tube installation, and design considerations. This last section gives a choice of tube types and presents grid-bias problems, interstage-coupling, neutralization, and a great deal of other useful formula. There are, of course, charts and also a chapter on rectifiers and filters.

INTERNATIONAL RESISTANCE CO., CATALOG 42, 401 North Broad St., Philadelphia, Pa.

A new large size listing of the complete line of IRC resistors and volume controls. The catalog includes the new cement-coated power-wire wound resistors and there is a compilation for the required replacement volume control on all the popular radio receivers. Free to all readers.

HAMMARLUND MANUFACTURING CO., 424 West 33rd St., New York City.

This finely prepared catalog for quick and easy reference includes a description on the latest Super-Pro receivers. It includes specifications on the "MC" midget condensers and the "ICT" iron core transformers. Free copies available.

REVIEW OF CONTEMPORARY LITERATURE

A LOW IMPEDANCE DRIVER BY DEGENERATIVE FEEDBACK. Hy-grade Sylvania Engineering News Letter Number 47, issue April 21, 1938. Hy-grade Sylvania Corp. Emporium, Pennsylvania. The treatise on this subject will be appreciated by many engineers and experimenters because of the increasing use of degenerative circuits in the design of audio amplifiers. Previous bulletins issued by this company have described various phases and applica-

tions of degeneration. This paper covers a degenerative system of economical design. The combination includes a type 6T7G, a 6W7G and two 6Z7G tubes.

Program and Bulletin of the joint meeting of the International Scientific Radio Union and the Institute of Radio Engineers held April 28 to 30 in Washington, D. C. The following important papers were presented at this meeting. *Ultra-Short Wave Transmissions and Atmospheric Irregularities,* by C. R. Englund, A. B. Crawford, and W. W. Mumford, Bell Telephone Laboratories, and *Photoelectric Measurements of Ultraviolet Solar Intensities in the Stratosphere* Stair and W. W. Coblentz, National Bu- *Transmitted from Unmanned Balloons,* R. reau of Standards.

Amateur's SOS Saves Sick Wife

AMATEUR radio enthusiast Ralph W. Emerson is thanking his lucky stars that he operates amateur station W8GMQ.

Unable to leave his home at 7001 Linwood Avenue, Cleveland, Ohio, because he had to stay at the bedside of his suddenly sick wife, and having no telephone Emerson sent out an SOS call. His wife was becoming sicker and sicker and he wished to summon a doctor.

After Emerson had tried to reach his friends for several minutes, John Bossman, 480 East 117th Street, Cleveland, another amateur, picked up the message. Emerson explained the situation and Bossman called Cleveland police, who hurried a doctor to the Emerson home.

What's New in Radio

(*Continued from page* 44)

Ultra-compactness, weight reduction, nonfreezing qualities, self-healing characteristics, resealing vent and long life, are the claims made for the condenser by the manufacturer.

A new 5" oscillograph presenting modification and elaboration of unit Type 168 is announced by Allen B. DuMont Laboratories, Inc., of Passaic, N. J. It has 3 additional controls; beam switch, grid amplifier, and single sweep. Symmetrical horizontal deflection is also provided for.

Two band coverage, electric motor tuning with push-buttons, slide-rule dial scale and several new circuit refinements are among the features of the new Knight 6 tube superhet offered by Allied Radio Corp., of Chicago. Reception is on 16-54 and 175-560 meter range.

Meissner Mfg. Co., of Mt. Carmel, Ill., announce the release of a new remote push button tuner which can be attached to any superhet receiver without tools. A 6A7 and 1-V tubes are used. They are manufactured to operate from 110 or 220 volts AC or DC.

Wright-DeCoster Inc., of St. Paul, Minn., announces a new bulletin A-18 on sound installations for suburban schools. The connections of various components of a public address system with the manufacturer's products is fully described.

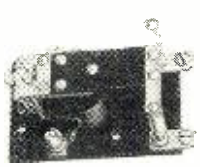
A new economy record player to retail at $14.95 has been released by RCA Victor.

Supreme Instruments Corp., of Greenwood, Miss., offer a new oscillograph for the amateur, serviceman and experiment who use the 2" tube. Sold complete with tubes at $21.95. The unit weighs but 8 lbs., and is complete in every respect.

A new metal-can electrolytic condenser with an insulating jacket and of extremely compact dimensions is announced by Aerovox Corp., of New York City, N. Y. Capacities from 4 to 40 mfd, at working voltages from 100 to 450 volts are offered. It has been given the trade name of "Dandee."

Mr. Harry F. Boe has been appointed Manager of Service Department of Westinghouse Elec. & Mfg. Co., of Pittsburgh, Pa., to replace Mr. W. K. Dunlap, assistant to the vice-president, who is retiring.

Western Electric Co., of New York, announces a new line of hearing aids for the hard of hearing. These newly perfected devices are so small that for the most part they can be secreted in the clothing and worn without being visible.



Ward Leonard Electric Co., of Mt. Vernon, N. Y., have released a new high voltage keying relay for use with the new grid controlled rectifier tubes. Silver to silver contacts insulated for 5000 volts to ground and an operating coil for 6-8 volts DC are features.

Capitol Radio Engineering Institute, Washington, D. C., has moved to the former Breckinridge Long Mansion, which has been remodeled to fit its requirements. Complete scholastic facilities, including a laboratory and dormitory will be housed there. Residence school classes begin September 19th.

Bell Sound Systems, Inc., Columbus, O., offer a new 60 watt amplifier featuring beam power tubes.

RCA Victor announces a new deluxe record player Model R94-B priced at $32.50. It can be attached to any electric radio set and will give high fidelity reproductions of the 10" and 12" disks it accommodates.

DuMont Laboratories, of Passaic, N. J., have moved into their own factory building at 2 Main Street, where they occupy a new two story building.

Lectrohm, Inc., Chicago, Ill., announces a new line of vitreous enameled resistors and electric heating elements. Ranges are from 5 to 200 watts and tolerances are plus or minus 5%. 5 and 10 watt sizes have pigtail leads, while the rest have copper soldering lugs.

Mr. R. E. Potts has been appointed Sales Manager for Bell Sound Systems, Columbus, Ohio, is the announcement made by the president of that firm. It is a newly created position, since the latter formerly directed sales.

A new "hash" suppressor for automobiles or generators in the form of a condenser has been released by Aerovox Corp., Brooklyn, N. Y. Standard capacity is ½ mfd at a voltage rating of 100 volts.

RCA Mfg. Co., Camden, N. J., has just released data sheets on the new OA4-G tube, which is a cold-cathode starter-anode type, glow-discharge tube.

Wright-DeCoster, of St. Paul, Minn., have developed and released a new powerful 12" "No-koil" speaker. It is furnished in three types; 50-3500cps, 60-5000cps, and 60-7000cps. The units handle an output of 20 watts continuously.

Emerson Radio & Phonograph Corp., New York City, N. Y., have released Service Notes on models AY-194, 195, and BD-197. Also on chassis AL used in combination radio-phonograph models AL-164 and 202.

Operadio Mfg. Co., of St. Charles, Ill., announces a new mobile P. A. System for AC-DC use, incorporated in one case and offered under the number, Model 172. Provisions for remote

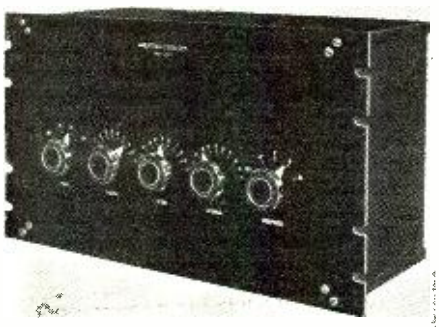
PRIZE OFFER

THE Convention Committee of the National A.R.R.L. Convention, to be held in Chicago, September 3rd, 4th and 5th, 1938 (Labor Day Weekend) under the auspices of the Chicago Area Radio Club Council, will give a prize of $10.00 to the amateur submitting the best letter telling: "WHY I AM COMING TO THE NATIONAL A.R.R.L. CONVENTION."

Letters should be of 100 words or less. They must be postmarked before midnight, July 15th, 1938, and will become the property of the Committee, whose decision on the winner will be final. The prize winner will be notified on or before July 30th, and the prize will be presented at the Convention banquet. Address the National A.R.R.L. Convention, Room 504, Hotel Sherman, Chicago, Illinois, U.S.A.

volume control, headfone and meter monitoring are included.

Victor J. Andrew, of Chicago, Ill., announces the release of a new type remote-reading antenna meter designed for maximum safety from failure due to lightning. Rugged construction and a shielded current transformer with a tube rectifier insure reliability.



A new line equalizer panel featuring exceptional ease and flexibility of adjustment has been developed and offered by American Transformer Co., Newark, N. J., under their trade name of Amer-Tran. It is known as the type F-188. equalization can be controlled at 25, 50, or 100cps throughout a range of 0-25db in 11 steps, and also on the high side in frequencies of 5, 7, 8 or 10kc. Designed for levels up to plus 20db, the impedance being 500 ohms.

F. W. Stewart Mfg. Corp., of Chicago, Ill., announces a new 1938 line of auto radio remote controls.

Radio Gadgets

(*Continued from page* 50)

away from the iron so fast that a sufficiently high temperature for soldering cannot be maintained. The best way to make the soldered connections is by applying a blowtorch flame to the tubing about an inch or so from the point where the soldered connection is to be made. In a short time the desired spot will be brought up to proper temperature and solder applied at the joint will flow freely. If the flame is applied to the joint directly the copper will oxidize and the solder will not stick.

The Advantage of a Good Ground System

IN suburban and rural sections a good ground system is oftentimes second only to the antenna itself in importance, so far as good reception of distant radio signals is concerned. In spite of its importance, however, there has been little definite information available to the radio fan to give him definite guidance in planning his own ground system.

The information given herewith has been gleaned from various sources including the U. S. Bureau of Standards.

Basically, of course, a ground system varies in effectiveness depending on the formation of the soil, the local terrain, local rainfall and other factors which affect the conductivity of the soil. Through infiltration of rock salt "planted" for the purpose one can improve the ground considerably in many cases, but much has been written on this angle. Less is known about such other factors, as the best diameter for the ground rod, the best depth to drive it, and the advantages of driving more than one rod.

In the figure 1 line A shows the resistance effect of pipe diameter, for various pipes from ½-inch to 2 inches in diameter. It will be noted that 1-inch pipe is 15 per cent better than ½-inch, but that 2-inch pipe is only about 5 per cent better than 1-inch. The 1-inch pipe therefore seems to represent the best selection. It is stronger and will withstand driving better than the ½-inch size. On the other hand, it is a good deal easier to drive than the 2-inch size and electrically almost as good.

In the figure 1 line B shows the importance of suitable depth, for one typi-

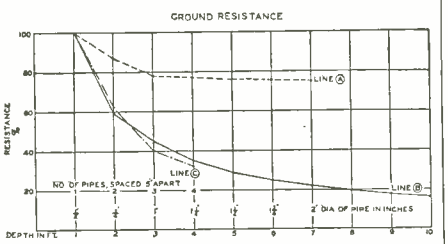


Fig. 1—Ground resistance chart.

cal location. It indicates that a depth of three feet represents about the minimum practical value, but that normally little is to be gained by driving down more than about seven feet. A pipe driven three feet results in about half the resistance of one driven only one foot. At seven feet this resistance has decreased to about 22 per cent but beyond that the improvement is so little as to become relatively unimportant.

In the figure 1 line C is shown the benefit of driving more than one pipe and connecting them together to serve as one ground. This is for pipes spaced five feet apart and assumes that each pipe is a duplicate of the others in size and depth. Analyzing this curve shows that adding a second pipe reduces the resistance of the system about 40 per cent, and a third pipe brings about a 60 per cent reduction. Above this number the improvement is too small to justify the effort involved and the space required.

How would a 1-inch pipe, driven 1 foot into the ground be improved?

Little would be gained by increasing the diameter, but by using a longer pipe and driving it 7 feet into the ground the resistance in typical ground would be reduced from 150 to 35 ohms. Drive two more similar pipes to the same depth, and spaced 5 and 10 feet from the first and the resistance goes down to about 14 ohms. Thus the effectiveness of the ground system has been increased about 90 per cent.

Assuming a good antenna, with good low-resistance connections throughout the antenna and ground systems, this reduction of ground resistance will make a tremendous difference in the reception of formerly weak signals.

—30—

Two Tube Superhet Tuner

(*Continued from page* 59)

should give a rough check on errors in circuit wiring). If the total B supply current reads approximately 12 m.a., proceed to the alignment; otherwise check the circuit thoroughly for errors in wiring, or defective parts.

If a spare single section variable condenser is available, the easiest way to line up the tuner is to temporarily disconnect the oscillator section of the regular condenser, C_2, and substitute the spare condenser in its place. Now, with the antenna and supply voltages connected, it should be possible to pick up signals by adjustment of the spare condenser and condenser C_1. Headphones may be used during this alignment procedure, but the tone quality will be poor due to impedance mismatch. By identification of broadcast stations near the 550 and 1500 kilocycle ends of the broadcast band, the band can be centered on the antenna tuning condenser, C_1, by adjusting its parallel trimmer, or in extreme cases by adding to, or removing from, the turns of the 105 turn winding of coil T_1.

It was assumed in the preceding paragraph that the i.f. transformer windings were tuned to approximately the same frequency, although not necessarily to 465 kilocycles. This will be true if the i.f. transformer trimmers have not been changed from their factory settings.

The next job is to tune the i.f. transformer to approximately 465 kilocycles, with both windings tuned to exactly the same frequency. If a calibrated oscillator and output meter is available, this job can be accurately and quickly done. Assuming that these instruments are not available, the next best way is to exactly tune in a local station near the low frequency end of the band, such as 670 kc., for example. If the i.f. transformer was tuned to 465 kc., the oscillator would be operating at a frequency of 670 plus 465, or 1135 kc. Now, if a second receiver is tuned to a station operating on 1130 kc., a 5000 cycle beat note will be set up in the second receiver provided some of the 1135 kc. oscillator voltage finds its way into the antenna along with the 1130 kc. broadcast signal.

This can be conveniently arranged by bringing the antenna wire of the second receiver into close proximity to the oscillator variable condenser leads. If no beat note is heard, a slight movement of the oscillator condenser should produce one (leaving C_1 untouched). A beat note will be obtained with an oscillator frequency either higher or lower than 1130 kc., but, of course, in this example the oscillator condenser setting should be on the high frequency side of zero beat. The setting giving a 5000 cycle note will, of course, have to be estimated (this will be close enough for all practical purposes).

Next, leaving the antenna and oscillator condensers untouched, adjust the i.f. trimmers until the 670 kc. station is perfectly tuned in. This completes the tuning of i.f. transformer. In the foregoing example, a broadcast station operating on 1140 kc. could have been used to beat the 1135 kc. oscillator voltage against, but the desired oscillator condenser setting for 1135 kc. would had to have been 5000 cycles lower than zero beat frequency.

Tracking the oscillator condenser C_2 with the antenna tuning condenser C_1 will complete the alignment job. With the spare condenser still replacing C_2, tune in a station near 1500 kc. Be sure to tune C_1 as perfectly as possible. Now, remove the spare oscillator condenser and reconnect C_2, taking precaution not to disturb the setting of the gang condenser. Now, by adjusting the parallel trimmer associated with C_2, the desired station should be exactly tuned in. Next, substitute the spare condenser for C_2 again and tune in a station on the 550 kc. end of the band. Again remove the spare condenser and reconnect C_2, taking care not to disturb the gang condenser setting. By adjustment of C_3, the desired station should be exactly tuned in. Repeat the procedure at the 1500 kc. end of the band, as a large change in C_3 will have some effect on the alignment at that end. It will ordinarily be found that the alignment in the center of the band will be good if the gang condensers are in alignment at both ends of the band. Slight deviations may be cared for by bending the outer rotor plates of condenser C_1 or C_2, as appropriate.

—30—

Serviceman's Experiences

(*Continued from page* 55)

against repeat calls.

One day he telephoned to the store a day after he left on a fifteen dollar Bosch filter block replacement.

"Don't tell me you need more than a day on that job," I said. "Did you have lunch from a bottle? Is the Bosch okay?"

"The set is working," he answered, "but I'm not. I'm speaking from a hospital."

I'm no fool. From now on, I might appear slow, but not presumptuous, to my customers. I work on the set owner in the house, and save the set work for the shop. I find he is usually interested; if not in his set, in my efforts to recondition his most important, except one, household fixture.

—30—

Dial Light Substitution

Some of the small a.c.-d.c. receivers use dial lamps of odd voltages, and if one cannot be procured for replacement use the following stunt. Shunt the dial light socket with a variable resistor of fairly high wattage and across the terminals connect a voltmeter. Then insert an ordinary 2.5 to 6.3 volt bulb with the full resistance in. Change the resistance until the voltage reads normal for the bulb used. Measure the resistance used and substitute a piece of fixed resistance up to 1000 ohms taken from an old rheostat for the variable. This gives a fixed resistance across the bulb socket and that type bulb can be used thereafter.

Within Earshot of the Editor

(*Continued from page 4*)

says, "Ever since Francis Scott Key set the inspiring words to the air of *Anacreon in Heaven*, back in 1814, *The Star Spangled Banner* has been accepted by millions of Americans as our national anthem, although Congress did not officially designate it as such until 1931. For two years now WCAU has opened and closed its broadcasting day with the playing of *The Star Spangled Banner* as it was written and will continue to do so." To WCAU our sincere compliments on their stand.

* * *

IT HAS come to our attention that a great number of short-wave listeners are still using cards with the call-letters "W-9 (or whatever district they may be located in) SWL." This is contrary to the rules and regulations of the Federal Communications Commission. All such short-wave listeners are warned not to continue this practice, because of the serious fine and possible jail sentence, which might result. Actually speaking, there is little advantage to the use of the letters SWL and the District. If a short-wave listener will make up an attractive card, setting forth the necessary information, we are quite sure that anyone will be happy to receive this sort of a token of the receipt of his signal.

* * *

QUESTION mark dept. What Vice-President of a local network insists that before anything can be done to his station or the network, that there will have to be "an Act of Congress"?

He uses this way to get out of answering every embarrassing question put to him by the local scribes. The funny thing about the whole matter is the ignorance of the writers who believe it. Congress need not ask act on a frequency, time nor power change. Changes are made by the Commission. The FCC has complete power to do this, granted to it by Congress in the Act of 1924.

* * *

THE FCC has taken a decided step toward helping the elimination of interference with broadcast receivers, arising from apparatus other than amateur radio or telegraph signals. It has said of apparatus which might cause qrm:

"The Commission will be glad to take samples of such equipment and send it to its offices in Washington, D. C., to determine whether such equipment when properly installed and operated would be capable of causing objectionable interference. It will be appreciated if manufacturers of this class of equipment will co-operate by installing adequate filtering in their apparatus.. The Commission will be glad to furnish an opinion as to the type of filter which may be used for the practical elimination of interference potentialities."

This closely follows the Canadian Commission's system of eliminating interference from broadcasts. The Canadian Commission, however, maintains a group of troubleshooters, who go out and locate the interference and remedy it. Interference with radio programs in Canada is a serious occurrence, and it is to their credit that the programs in Canada are freer from this annoyance than those of the United States.

* * *

TELEVISION came one step closer to becoming a national actuality when the first television program to be broadcast on a regular schedule began from the Empire State Building of the National Broadcasting Company Studios. Programs are to be transmitted weekly for four weeks in a practical test of the new equipment installed since the station was set down about a month ago. The television period will be divided between afternoons and evenings. The afternoon programs will begin at 3:00 p.m. on Tuesdays, Wednesdays, and Thursdays. The evening features will be on Tuesdays and Thursdays from 8:00 to 9:00 p.m. During this period only test shots and still pictures will be televised. If the programs work out well in New York City, they will be extended gradually across the country. Our compliments to NBC for starting the television ball rolling.

* * *

THE Federal Communication Commission will shortly launch an investigation as to the activities of stations carrying foreign language programs. It is hinted that some of these programs are propaganda disseminators, while others use "blue" or objectionable language. It is about time that the FCC became cognizant of the fact that a great deal of propaganda is being disseminated in the United States by foreign speaking broadcasters. Not all of the propaganda comes to us via short waves by any means.

* * *

A NEW advertising angle. J. Walter Thompson Agency called the powers that be at Columbia Broadcasting System and asked that Charlie McCarthy not be given any mention on any CBS programs. The McCarthy show is, of course, an NBC feature. The reason behind all this is as obscure as is the request not to give any publicity to Charlie McCarthy on a rival network.

* * *

GREENBACK department. To those who wonder how much the comedians get for broadcasting their nonsense over the air, which entertains us so much these evenings, Burns & Allen will receive 12,000 simoleons *per broadcast* for the new Chesterfield series starting in the Fall. This is certainly a lot of money for a half hour's actual air work.

* * *

NEXT month we will publish complete photos, diagrams, and constructional details of a marine superheterodyne receiver, suitable for receiving commercial broadcast, amateurs, and also radio beacons. It will feature the well-known marine loop which is universally employed by great ocean liners. The article was prepared especially for RADIO NEWS by Raymond P. Adams of Los Angeles, who is an expert on receivers.

* * *

WE have just returned from the 15th Annual Milwaukee Radio Club QSO Party. This affair has grown into a midwestern institution. Over 325 hams attended and were addressed by W9TSN, Dos Doseland who acted in place of RHG Mathews the midwestern ARRL director. What impressed us most was the seriousness with which the group conducted itself when the matter of the ARRL Board Meeting was reported to them. Certainly here was proof that the average ham IS interested in his radio to the extent of doing something about keeping the bands into which the commercials seek ingress. It is to the credit of ham radio and the Milwaukee bunch that the former acted with complete decorum and the latter put on the finest show and entertainment seen in these parts for many a year. If the rest of the hams will take a lesson from this group, the ARRL Headquarters will have to amend its ways, and hamdom in general will be bettered by many percent. Our congratulations to the Milwaukee Radio Club!

* * *

ARRANGEMENTS for our professional program are moving apace. We are dickering with a local Chicago station for a fifteen-minute program the first thing in the morning, sometime around 6:00 or 6:30 a.m. Central Daylight Saving Time. On this program we intend to read such recent DX tips and flashes.

* * *

THE kilowatt transmitter described in this issue is, without a doubt, the most complete amateur transmitter it has been our pleasure to see in the twenty-six years we have been associated in this field. Complete in every respect, with overload relays, remote switching antenna controls for every band, it represents as fine a piece of equipment as any manufacturer could hope to put out for the job required. If any of our readers are contemplating the construction of a job of this size and power, we heartily recommend this "rock-crusher."

* * *

THE low-level modulation transmitter described in this issue was developed by one of the most outstanding amateur engineers in the business. We had the opportunity to test this rig and can say that it is a fairly practical and feasible solution for medium highpower, without the expense of highpower Class B transformers.

To those who have built lowpower stations, and wish to increase to 150 or 200 watts, with a minimum of expense, we urge that they study the hookup and read the article carefully. It may be the solution for which they are looking.

* * *

WE WILL be interested in receiving pictures of outstanding amateur rigs from all over the country. These we will try and group in a double-page spread to be run every month. When these pictures are sent in, we require also a short description of the transmitter and the receiver, together with a short biographic of the amateur owner.

* * *

AS WE look out of our window across Lake Michigan, we find it hard to concentrate on radio with the weather as beautiful as it is, and so, without further ado, we wish you the best 73 until next month.—W9QEA.

—30—

Something New in Radio

(*Continued from page 60*)

At the left of the tuner is the 6J5G infinite impedance detector, the only type known today which is really distortionless upon high modulation percentages, and which unlike a diode, does not ruin the circuit feeding it through low internal resistance. Just to the front are the two audio chokes in the 6J7G first audio amplifier plate circuit—the means of providing complete tone control adequate to overcome any peculiarities of personal listener taste, home acoustics, or program variability. The two tone controls regulating bass and treble tone separately and as desired are seen hanging upon their connecting leads, for they mount directly on the control panel not shown. This type of tone compensation or control is that used in broadcast stations, and expensive circuits where complete variability is essential.

The bass knob will give control from a boost of 10 db. to flat, and down to a drop of 30 db. while the treble control will give from a rise of 6 db. and a drop of 30 db. Thus the user may make the audio response flat from 30 to 9,000 cycles, make it humped up or sway-backed, or slant it in either direction. He has absolutely complete control of tone.

Just behind the coil of 25 feet of flat cable used to connect tuner and amplifier, and which carries antenna and ground leads also, is the 15", 18 pound, Jensen-Silver speaker.

At the right is the power amplifier and power supply. It uses one 6J5G tube as second audio amplifier and inverse-feedback phase-inverter. Thus is eliminated the ordinarily unavoidable frequency discrimination of audio coupling transformers, their customary hum pick-up in an amplifier capable of real bass reproduction, and is substituted a better method. This system has none of the disadvantages of two-tube phase-inverters, for unbalance due to dissimilarity of multiple tube aging cannot occur in this single tube, and practically 50% inverse-feedback is obtained to iron out any possible distortion. This 6J5G drives two 6L6G beam power tubes in push-pull, resistance coupled for complete elimination of hysteretic distortion due to varying transformer core magnetization completely to eliminate hum trouble. Inverse feed-back might have been used in this push-pull stage, but much psychological investigation and testing proved conclusively that there can be such a thing as a "too clean" audio system. So advantage was taken of the slight "tailing" effect possible in 6L6 stages through proper adjustment of plate load impedance and other factors to materially increase "life" or "depth" of sound reproduction. The result of careful coordination of all of the factors entering into the receiver is a startlingly new concept of what purity and brilliance of radio and phonograph reproduction can be—in brief, more is present than is apparent from a simple scrutiny of the circuit constants given.

The remote control box of McMurdo Silver receiver. It is connected by means of cable.

Such then, is the form the author's solution of the problem of giving music lovers and the public not interested in dx-ing, but most demanding of fine tone in the fullest sense of the words upon local stations and records.

—30—

OOPS! SO SORRY!

On page 49 of June issue the leads from the genemotor to the connector socket have been reversed. These connections should be put to the socket so that the "B plus" lead goes to the upper right hand contact, and the "B minus" to the upper left hand contact. To Mr. Read, our sincere apologies!

Ham Shack

(*Continued from page 45*)

be used to couple the condenser to the tuning knob.

If the receiver is mounted in the case of the transmitter, provisions must be made for extending the tuning and regeneration control through the front panel. Due to its small size it was decided it would not be necessary to mount it in the case, so leads were left long enough to reach the battery supply in the bottom of the transmitter and the receiver can be carried in the coat pocket or on the belt of the operator.

After putting into service the little receiver gave most gratifying results. Aside from lack of selectivity due to no r.f. stage, this midget receiver gave a better account of itself than some well known commercial one to ten meter receivers that happened to be on hand.

With a twelve inch piece of wire as an antenna there was enough signal pickup for all cue work. When a longer antenna was used, amateur ten meter stations on both coasts came in with good headset volume.

—30—

Short Wave Flashes

(*Continued from page 54*)

over OLR3A (9.55); *Wed.*, 5:10 to 5:40 p.m. and *Thurs.*, 4:40 to 5:10 p.m., over OLR2A (6.01) or OLR2B (6.03); *Fri.*, 4:40 to 5:10 p.m. and *Sat.*, 5:10 to 5:40 p.m., over OK1MPT (5.145).

HOLLAND—PHI2 (17.77), *weekdays* 7:25 to 9:30 a.m., *Sundays* 6:25 to 9:30 a.m.; over PCJ2 (15.22), *Tuesdays* 2:00 to 3:30 a.m.. and *Wednesdays* 9:30 to 11:00 a.m.; over PCJ (9.59), *Sundays* 2:00 to 3:00 p.m., and 7:15 to 9:25 p.m.; *Mondays* 8:15 to 9:45 p.m.; *Tuesdays* 2:10 to 3:40, and 7:00 to 10:15 p.m., and *Wednesdays* 7:15 to 8:15 p.m.

U. S. A.—W2XE, New York City, N. Y.. on 21.52, for Europe, *Mon. through Fri.*, 6:30 to 9:00 a.m., and *Sat. and Sun.*, 7 a.m. to noon; on 15.27, for Europe, *Mon. through Fri.*. noon to 5:00 p.m., and *Sat. and Sun.*, 1:30 to 5:00 p.m.; on 11.83, for South America, *daily* 5:30 to 10:00 p.m., and on 6.12, for South America, *daily* 10:30 to 11:30 p.m.

VENEZUELA—YV5RC (5.8), Caracas, *Sundays* 8:30 to 11:30 a.m. and 3:30 to 9:30 p.m.; *weekdays*, 7:00 to 8:00 a.m., and 10:30 a.m. to 1:30 p.m.; *Mon., Wed. and Fri.*, 3:45 to 9:30 p.m., and *Tues., Thurs. and Sat.*, 3:45 to 10:30 p.m.

Frequency Changes

BULGARIA—LZA, Sofia, supposed to have moved to 8.735, but still being reported on 14.96. . . *COLOMBIA*—HJ3ABX, Bogota, to 5.99. . . *CUBA* — COCX, Havana, now variable near 11.74.

CURACAO—PJC2, "Radio Curom," to 9.095. . . *DOMINICAN REPUBLIC*—HI7P, Trujillo City, to 6.765; HI2D, Trujillo City, to 6.198; HI5G, La Vega, to 6.654. . . *GUATEMALA*—TGQA. Quezaltenango, to 6.40, where it is buried under YV5RH, until that station signs-off. . . *HAITI*—HH2S, Port-au-Prince, back to 5.925. . . *PERU*—OAX5C, Ica, now variable near 9.49.

SIAM—HS8PJ, Bangkok, to 9.51. . . *U. S. S. R.*—RNE, Moscow. back to old frequency of 12 mc's; RAN, Moscow, operating on new frequency of 9.565 irregularly. . . *VENEZUELA*—YV3RA, Barquisimeto, to 5.875, where it is right on top of HRN, Tegucigalpa, Honduras.

Data

CEYLON—VPB, Colombo, which is government owned, was opened in 1925. It operates on 700 kilocycles until 6:30 a.m., when it shifts to 6.16 mc's. Power is 5.000 watts. . . *COLOM-*

BIA—Correct schedule for HJ4ABE (6.145): *daily* 9:30 a.m. to 1:00 p.m., and 5:00 to 11:30 p.m. Correct schedule for HJ6ABH (9.52), *ARMENIA: daily* 8:00 to 11:00 a.m. and 6:00 to 10:00 p.m.

DOMINICAN REPUBLIC—HI4V (6.45), San Francisco de Macoris, power 250 watts, broadcasts daily from 2:40 to 4:40 p.m., and from 7:10 to 9:10 p.m.; opens and closes broadcasts with the Dominican National Anthem.

FRANCE—According to the NNRC, commercial telephone stations operated by Cie. Radio France, 79 Boulevarde Haussman, Paris, are as follows: FTM (19.355), FTK (15.88), FTA (14.612) and FTH (10.94).

GERMANY (Austria)—R. B. Oxrieder of State College, Penna., writes that a station in Vienna, presumably old OER3, is operating on 11.79, evenings to 9:00 p.m., or later irregularly. Says "Germany Calling, National Broadcasting Station," and then usually either "Frankfort and Vienna" or "Leipzig and Vienna." Apparently one is the Vienna short-wave station, the other the broadcast station being relayed.

MOZAMBIQUE—Latest revised schedule for CR7BH (11.718) and CR7AA (6.137), Laurenco Marques: *Daily* midnight to 1:00 a.m., 4:00 to 6:30 a.m., 9:30 to 11:00 a.m., and 12:10 to 4:00 p.m.; *Sundays* 5:00 to 7:00 a.m., and 10:00 a.m. to 2:00 p.m. Stations verify with attractive green, black, and white cards.

PANAMA—HP5B (6.033), P. O. Box 910, Panama City, operates *daily* from 11:00 a.m. to 1:00 p.m., and from 6:00 to 10:00 p.m. . . . *PERU*—"Radio Rancho Grande" (now on 12), is operating from approximately 6:00 to 7:45 p.m.

SPAIN—According to a letter from General Franco's headquarters, received by Gail Beyer of Chicago, Ill., the principal insurgent short-wave stations in operation at present are as follows: FET1 (7.006), Valladolid; "Radio Espana" (7.203), San Sebastian; "Radio National" (7.5); FET5 (7.35), Burgos; "Radio Espana" (7.246), Bilbao; "Radio National AZ" (6.75); "Radio Espana" (7.06), and EAJ43 (10.37), Teneriife, Canary Islands.

STRAITS SETTLEMENT—First authentic information concerning the new 400 watt short-wave station recently inaugurated on Thompson Road, near Singapore, comes from Alan Breen of Dunedin, New Zealand, who states that the station operates as follows: Over ZHO (6.012), *Mondays through Fridays*, 5:40 to 9:40 a.m., *Saturdays* 5:40 to 9:15 a.m., and on *Sundays* 5:40 to 7:40 a.m.; over ZHP (9.53), *Wednesdays* 12:40 to 1:40 a.m., *Saturdays* 12:25 to 1:40 a.m., and on *Saturdays* 10:40 p.m. to 1:10 a.m.

U. S. A.—W1XAL, Boston, Mass., is operating as follows at present: On 15.25, *weekdays* 1:00 to 2:00 p.m., and on *Sundays* 10:00 to 11:00 a.m.; on 11.79, *weekdays* 3:30 to 5:30 p.m., and on *Sundays* 2:00 to 5:30 p.m.; on 11.73, *weekdays* 8:00 to 10:00 p.m., and on 6.04, *weekdays* 6:00 to 7:45 p.m.

Amateur Notes

ALBANIA—Add a new country to your log by tuning—for ZA1CC (14.3), near 7:00 a.m. or 2:00 p.m.

BRITISH GUIANA—VP3AA (14.07) is now the call being used by former VP3BG, who has also used VP3ABC, VP3XYZ, and VP3NV as calls upon certain occasions. . . *BRITISH HONDURAS*—VP1BA (14.08), now radiating 120 watts, is anxious for SWL reports from the West Coast, particularly from Los Angeles and vicinity.

GREAT BRITAIN—Unidentified amateurs are pirating the British calls G2ZA, and G2ZB, as a letter from the rightful owner of these calls states that his transmitter has not been on the air for years.

HAWAII—K6FAB is coming to the States in September. . . *HOWLAND ISLAND*—K6BAZ is operating portable on this island, and will be there for about six months in connection with establishing the trans-Pacific air-base. He is on the air daily near 5:00 a.m. . . *MADAGASCAR*—FB8AH (14.37) is being heard regularly on the West coast Saturdays from approximately 9:00 to 9:45 a.m.

Last Minute Notes

New: 2R06 (15.3), *ROME*, first heard on April 29th, by James Christie of Winnipeg, Canada, is now relaying 2RO3 (9.635) regularly. . . *New:* Station broadcasting Oriental and European music on April 25th, at 10:45 a.m., on a frequency of 11.875, is believed to have been *VUD3* at *DELHI, INDIA*, according to word from the Newark News Radio Club. . . *New:* Earl Roberts of Indianapolis, Indiana, reports YN3DG (7.128), Estacion Radiodifusora "Gilfillan," owned by Dennis E. Gallo, of *LEON, NICARAGUA*, is now on the air with a power of 200 watts, and broadcasting on *weekdays* from 2:00 to 2:30 p.m., and from 8:30 to 9:30 p.m. . . EAR, *MADRID, SPAIN*, has shifted in frequency to approximately 9.47.

The latest official schedule of TGWA, "The Voice of Guatemala," *GUATEMALA CITY, GUATEMALA*, follows: Over TGWA (15.17), *weekdays* from 7:50 to 8:30 a.m., from 12:45 to 3:15 p.m., and on *Sundays* from 10:30 a.m. to 4:15 p.m.; over TGWA (9.685), *weekdays* from 7:30 p.m. to midnight, and on *Sundays* from 7:00 p.m. to 12:15 a.m. Concerts especially dedicated to the United States are broadcast on 9.685, *Mondays, Fridays*, and *Sundays* from 10:00 to 11:30 p.m.

Short Waves for West Coast DX'ers
by JOHN D. CLARK

(All Times Are *PACIFIC STANDARD*)

JAPAN—JVH (14.6 meg.) seldom breaks into print in this country, but is an old standby out west. Commencing at about 2:10 p.m. this station relays programs of the Japanese National Network at irregular intervals throughout the afternoon and early evening. A time signal, consisting of three deep gongs, followed by two deep gongs, one deep gong, and one chime is released nightly at 7 o'clock.

Other short wave relays from the JBC are effected from 10:50 to 11:20 p.m., and from 1 to 4:40 a.m. daily. Except for news bulletins at 1:50, the English language is not used through JVN.

The world-famous *Overseas Program* for the Pacific Coast, announced in both English and Japanese, and at present released through JZJ (11.8 meg.) from 9:30 to 10:30 p.m., is received with excellent volume as we go to press. JZJ may soon be replaced by JZK (15.16 meg.) for transmission during the summer months.

The Broadcasting Corporation of Japan's other *Overseas Programs* are still sent through JZJ from 5 to 6:30 a.m. (announced in French, Chinese, and English); from 3 to 3:30 p.m. (announced in English); from 1:30 to 2:30 p.m. (announced in Spanish and Portuguese); and from 11:30 a.m. to 1 p.m. (announced in English, French, and German). Only the early morning transmission is received with good volume on the Pacific Coast. Station JZI, which carries the last two broadcasts simultaneously with JZJ, will undoubtedly be replaced by JZK (15.16 meg.) in the near future. This change was effected June 5 last year.

INDIA—Station VUD2 (9.59 meg.) is heard with fair strength as early as 5:30 p.m. (schedules show transmission should begin at 6:30), but has virtually faded to a whisper after 6:30 p.m.

JAVA—Broadcasts from the Dutch East Indies, particularly from the Island of Java, reach the western United States with surprising volume. Stations YDB (9.55 meg.), PMN (10.26 meg.) and PLP (11.00 meg.) transmit native eastern music and recorded western music from 2:30 to 7 a.m. daily except Friday, Saturday, and Sunday, from 2 to 6:30 a.m. Sunday, from 2:30 to 8:30 a.m. Saturday, and from 2 to 8 a.m. Friday. (Although these times do not correspond with published schedules they have been charted, checked and rechecked by listening posts many times.)

During the past month PMN has been signing off as noted above, only to return to the air about 10 kc. higher in frequency (10.27 meg.) a few minutes later. Many fans have mistaken this for a new station.

Other Java tips . . . PMY is audible on 5.14 meg. from 2:30 to 5:30 a.m. . . . PLE (18.83 meg.) coming through with tremendous signal on phone at 4:00 p.m. . . . PLV (9.43 meg.) also with tremendous phone signal at 6:50 a.m., and irregular broadcast near 7 a.m. . . . PMK (6.72 meg.) often relaying programs of YDB from 2:30 to 5:30 a.m., and carrying a surprisingly strong signal.

AUSTRALIA—Station VLR (formerly VK3LR), Melbourne, (9.58 meg.), is received with excellent volume from 12:30 to 5:30 a.m. daily. The station is now on the air Sunday as well as on weekdays, and Sabbath transmissions commence 30 minutes earlier. Commentaries on sporting events are released from 10:30 to about 11:20 p.m.

Although the schedule of VK6ME, Perth, (9.59 meg.) calls for operation between 3 and 5 a.m., the station has often been heard both before and after this time.

Miscellaneous TRANS-PACIFIC news—The powerful Japanese station on 9.62 meg. is JFO of *TAIHOKU, FORMOSA*, and is at present operated simultaneously with JIB (10.53 meg.), broadcasting news in English from 6:50 to 7:15 a.m. Sunday, and from 7:05 to 7:30 a.m. several times a week . . . KZRM, *MANILA*, is on 9:57 meg. with good signal from 3 to 6 a.m. daily . . . FO8AA, *PAPEETE, TAHITI*, (7.1 meg.) has shifted schedule slightly again, and is now heard Tuesday and Friday from 8:30 to 9:45 p.m. . . . note that HS8PJ *BANKOK, SIAM*, is now on 9.51 meg. and not 9.35—every Thursday from 5 to 7 a.m.

General European Reception

Pacific Coast listeners who are not so familiar with the peculiarities of reception on the abbreviated wavelengths will undoubtedly find the following information extremely valuable when tuning for European stations.

LONDON . . . best volume on transmission 6 (6:20 to 8:20 p.m.) via stations GSD (11.75 meg.) and GSC (9.58 meg.). GSB (9.51 meg.) and GSI (15.26 meg.) fair at same time . . . good signal strength also on GSD from 9 to 10 p.m., but fading badly after that hour. GSB fair and GSO (15.18 meg.) weak at same time . . . transmission three (6 to 9 a.m.) good through GSG (17.79 meg.) and GSF (15.14 meg.). GSD good only from 7 to 8 a.m. . . . transmission 4 only audible through GSG (17.79 meg.) from 9:20 to noon . . . latter part of transmission five (3:20 to 5:30 p.m.) fair through GSD and GSC, and weak through GSB and GSP.

PARIS . . . new French station on 11.89 meg. good from 5:30 to 8 p.m., and fair on 9.57 meg. from 10 to 11 p.m. . . . "Paris-Mondial" good on 11.88 meg. after 7:15 a.m., but fades out after 8:30 a.m.

BERLIN . . . DJD (11.77 meg.) good from 5 to 8 p.m. DJB (15.2 meg.), DJQ (15.28 meg.), DJR (15.34 meg.), DJA (9.56 meg.) and DJN

(*Please turn to next page*)

(9.54 meg.) fair at same time . . . DJA (9.56 meg.) and DJF (11.78 meg.) good from 9:05 to 10:30 p.m., fading out after 10:30 . . . DJL (15.11 meg.) and DJD good from 7:45 a.m., fading out after 8:30 p.m.

ROME . . . 2RO (9.64 meg.) and IRF (9.83 meg.) weak from 4:30 to 5 p.m., and fair from 5 to 6 p.m. . . . 2RO4 (11.81 meg.) fair near 7 a.m.

CZECHOSLOVAKIA . . . fair on 11.84 meg. during 30 to 60 minute period before 7:35 p.m.

MISCELLANEOUS—COCX of *HAVANA, CUBA*, is not holding frequency any too closely since shifting from 11.43 to 11.74 meg., sometimes causes slight heterodyne with GSD during early evening hours . . . new "El Mundo" station at *BUENOS AIRES* sometimes blocks Rome's IRF on 9.83 meg. between 5 and 6 p.m. . . . "Radio Tananarive," *MADAGASCAR*, heard with fair volume after 7 a.m., signing with *MARSELLAISE* at 8:30 — 10.95 meg. . . . ZRK (9.61 meg.), *JOHANNESBURG, SO. AFRICA*, reaches Pacific Coast with good volume from 8:45 to 9:45 p.m. except Sat.

Last Minute Pacific Coast Flashes

SOUTH AFRICA—ZRK, South Africa's powerful short wave relay on 9.61 meg. is again reaching the West Coast with fine volume between 6:30 and 8 a.m. A time signal, followed by the announcement "Johannesburg calling on 500 and 31.23 meters" is released at 7 a.m. daily. ZRK's evening broadcast (8:45 to 9:45) seems to have weakened considerably.

MISCELLANEOUS—KZRM, *MANILA*, 9.57 meg. remaining on the air until 7 a.m. Saturday, but signing off at 6 a.m. other days . . . JDY, *DARIEN, KWANTUNG* (9.92 meg.) again being heard near 4:00 a.m. after being silent for short period . . . JFO, *TAIHOKU, FORMOSA*, 9.62 meg. now comes on the air at 2:00 a.m. daily, but signs off at irregular times between 5:30 and 7:30 a.m. . . . New Japanese station on 9.76 meg. relaying JVN from 1:55 to 4:40 a.m. daily . . . GSH (21.47 meg.) now strongest British station on transmission three (6:00 to 9:00 a.m.) . . . JFO and JIB (10.53 meg.) have cancelled 7 a.m. English news broadcast as a daily feature.

—30—

Pitchfork Antenna

(*Continued from page* 58)

are made by "Johnson" and are of the type used in assembling "Q" antennas but are also sold separately. The insulators are also Johnson, of the type having a metal cap reinforcing the base to prevent cracking and chipping.

Adjustment and Tuning

Adjust the telescoping tips so that the dimension A is correct for your operating frequency if it is to be used for transmitting, or for the middle of the band if it is to be used for receiving. Next, with another antenna connected to your transmitter indirectly to excite the new one, and without the feeders connected to the "Pitchfork," turn on the transmitter, being sure that it is tuned to the frequency for which you are adjusting.

Connect a No. 12 wire across the bottom clamps to serve as a shorting bar and across this shunt a thermo galvanometer, lamp or other current measuring device. Then move the shorting bar up and down until maximum current flows through it. This will be the correct position for the bar and you can replace the wire with a strip of copper or with two or three thicknesses of No. 12 wire, being sure that its length from clamp to clamp is the same as the wire used before.

Now attach the feeders to the upper clamps and to the transmitter and, sliding the feeder clamps along the tubing, find the spot where the maximum "soup" gets into the antenna. This can be determined by use of a field-strength meter or by having someone check your carrier on his receiver as you make the adjustment. If you are using 2-inch spaced feeders this spot will occur somewhere between five and ten inches above the shorting bar. If the feeder spacing is greater, the distance above the shorting bar will likewise be greater.

All of the foregoing adjustments can be made with the antenna down low enough to permit you to reach the matching section, raising it to its final position after the tuning is completed.

In case twisted-pair feeders are to be employed, the shorting bar will not be needed and instead the twisted pair will be connected to the bottom clamps as it will serve as both shorting bar and feeders. The adjustment is accomplished by means of a field-strength meter or receiver as before.

If the antenna is to be used only for receiving you can make the adjustments in the same way as above by listening in on some signal around the middle of the band and adjusting the antenna for maximum response. Or you can use an oscillator tuned to about 58 megacycles and placed some distance from the "Pitchfork." A short length of wire will serve as an antenna on the oscillator. [A license is needed to operate the oscillator in this fashion.—Ed.]

If the antenna is to be used on some band other than 5 meters, the procedure will be the same as outlined above. The dimensions, however, will of course be different. The length (A) can be determined by dividing the operating frequency (in megacycles) into 480. The answer will be in feet. The length (B) will be one-half of this.

In the design of the "Pitchfork" careful attention has been given to the avoidance of losses. It is for that reason that the radiators are supported only at the center, where the voltage is practically zero and the matching section as close to the lower end as possible because here too the voltage is low. Leakage is thus held to a minimum even in wet weather. The large diameter copper tubing also makes for lower r.f. resistance—an especially important factor in beams which employ close spaced elements as does this one.

Table Lengths

Megacycles	Radiator Length (A)
56	8 feet 7 inches
57	8 feet 5 inches
58	8 feet 3 inches
59	8 feet 1½ inches
60	8 feet even

If you have facilities for erecting a rotating beam, by all means do so; and go as far as you can in the direction of multiple elements, directors, reflectors, etc. But if you are limited to a fixed antenna of small proportions I know of nothing that will equal the "Pitchfork," and it will be found definitely superior to a single dipole.

—30—

ABC of Antenna Design

(*Continued from page* 49)

for years in conjunction with the more sensitive receivers. This is simply a rotatable directional aerial and is used extensively for direction finding on ships and aeroplanes. Because it is practically a closed circuit it does not form a very powerful transmitting antenna.

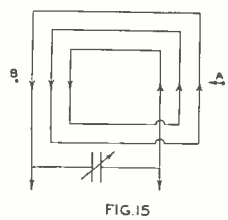


FIG. 15

From the illustration of the loop in figure 15 we see that when a wave approaches from direction A, there is a maximum phase difference between the two vertical sides of the loop. (If these two sides were half a wave-length apart we would obtain maximum phase difference and maximum induced voltage.) The above is true also for a wave approaching from B. A wave coming from a direction broadside to the loop causes currents to cancel since they will be in the same direction in both sides of the loop. Rotation of the loop thus shows two possible directions of the transmitter. Because the minimum indication is much sharper than the maximum indication, the former is used as a rule.

For direction finding it is essential to know the direction of the transmitter. The loop may be made unilateral as follows.

In conjunction with a loop, a vertical antenna is erected. The combined energy is fed into the receiving circuits. Now the current in one side of the loop is always out of phase with that in the other side. Suppose that a station is tuned in at maximum volume using both the loop and the vertical wire. If the loop is now turned 180° the total loop current which before was aiding the vertical wire will now nullify it, and if the energy pickup of each aerial is equal the resultant will be zero. The entire system thus becomes uni-directional. It is only necessary to know which side of the loop always points to the transmitter.

—30—

Modern Service Problems

(*Continued from page 41*)

The result is that the sidebands of the interfering station heterodyne with the carrier of the desired station and said detector does a fine job of extracting the beats. This beat varies with the modulation of the interfering station, but is not understandable because it is an inversion of the original. For example, suppose a station on 700 kc. is modulated with a constant pitch of 6000 cycles. This will produce sidebands or virtual carrier frequencies of 706,000 cycles and 694,000 cycles. If there is another station of approximately equal power on 710 kc. that we wish to receive, we will hear an interfering tone on the desired station of 4000 cycles. Whereas, if the modulation of the interfering station had been 4000 cycles, the tone on the desired station will be 6000 cycles. Obviously, in the first case, limiting the peak modulation frequencies to 5000 cycles would produce a 5000 cycle or higher beat on the desired station, and if the receiver audio system cut off abruptly at 5000 cycles, no interfering signal would be heard. But if the peak modulation of the transmitter is not limited to 5000 cycles, beats of less than 5000 cycles will be produced on the desired station and will be heard in the receiver. There is no solution to this problem but to limit transmitter modulation to 5000 cycles so long as channels are only 10,000 cycles apart. See table below:

Carrier			
Desired Station		Interfering Station	
710,000 cycles (710 kc.)		700,000 cycles (700 kc.)	
Modulation Carriers			
Monkey Chatter		Monkey Chatter	
714,000	706,000	706,000	694,000
4000 cycle Modulation		6000 cycle Modulation	

It is apparent that 4000 cycles modulation on 710 kc. produces a sideband which is identical with a 6000 cycle sideband on 700 kc.

There is no cure for monkey chatter except as outlined. A high frequency tone control or trap in detector or speaker circuit will reduce it somewhat, as will additional tuned circuits ahead of the first detector, but no permanent cure can be effected as long as the broadcasting stations modulate above 5000 cycles with only 10 kc. separating their carriers. May there somehow be 20 or at least 15 kc. channels soon.

—30—

Radio Physics Course

by Alfred A. Ghirardi

Sound and electromagnetic radiations: Recently we studied some of the characteristics of sound waves produced by the mechanical vibration of air, and having frequencies between about 16 and 20,000 complete vibrations per second. It was mentioned that the broadcasting of sound programs could be accomplished practically by making use of electromagnetic and electrostatic waves or radiation of high frequency (commonly called radio waves), radiated in all directions over long distances from the transmitting aerial. Distant reception of radio programs almost daily proves that it is possible to hurl into space and scatter literally to the four corners of the earth at a speed of 186,000 miles per second, electric energy in the form of waves or radiations exactly representing the spoken words of the human voice or the music of great orchestras; and anywhere thousands of miles away on land or sea, or even in the air above, to pick out of the atmosphere a tiny bit of this energy and from it reconstruct the sounds almost as originally produced.

We will now study some of the important characteristics of these radiations and will find that they belong to the same family as do those which produce the common sensations of heat and light. There are many fundamental things regarding the production and propagation of electromagnetic waves through space, which have never been explained to the complete satisfaction of scientists, and it is upon these questions that many of the most brilliant scientific minds in the world today are concentrating their efforts. Important data is being collected almost daily toward a solution of some of these entrancing mysteries of nature. The fact that we do not know as much about these things as we would like to, need not prevent us from making practical use of them, because there are many things with which we are on familiar terms in our daily lives, but which we really know little about. The origin of life itself is still a mystery.

Structure of the atom: We found from our study of the structure of the atoms of substances, that all matter is composed of atoms, each one of which consists of a central nucleus of positive electrical charges (protons) and negative electrical charges (electrons), surrounded by one or more negative planetary electrons revolving about it in more or less circular orbits or shells.

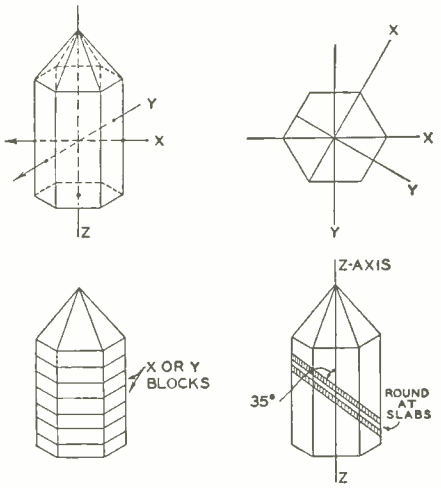
Notice that it is possible to tabulate the 92 elements in such a way that each one has one more planetary electron per atom than the element above it. This fact led to the discovery of many elements which were missing in this table several years ago, for it was known that the element with the electron structure enabling it to fit into the missing place existed somewhere.

(*Continued next month*)

Frequency Control

(*Continued from page 26*)

slightly concave (about 1 to 2%). Grinding thick cuts concave is a bit difficult because the crystal will not bend sufficiently



How "X," "Y," or "A"-cut crystals are cut.

to allow grinding the middle. In the above case middle is ground down somewhat by grinding over the corner of the plate glass.

While some crystals will oscillate when "out of parallel" by as much as 10% they are usually ground within 2% of parallel.

—30—

Cover—"Beer Mug"

(*Continued from page* 44)

This tiny radio station, the smallest practicable unit in the world, was developed in the NBC Laboratories at Radio City by Jarrett L. Hathaway after several years of research and experiment. The first model was used at the Democratic National Convention at Philadelphia in 1936. It weighed 13 pounds. Since that time Hathaway has improved and simplified his *Beer Mug* until it now weighs only seven pounds. It is standard field equipment at all NBC offices.

Hathaway built the *Beer Mug* to overcome the difficulty announcers and engineers had in stretching microphone lines through crowds and then keeping them clear. The new transmitter has proved itself to be almost as easy to handle as a microphone without lines and its programs come through with perfect fidelity.

This pet of the NBC engineering department operates on frequencies from 30,000 to 41,000 kilocycles. Entirely self-contained, it includes a crystal oscillator, frequency doubler, power amplifier, crystal microphone, audio amplifier, modulator, and a power supply sufficient for ten hours of continuous operation. More than that, it has an automatic modulation control which compensates for variations in sound level registered by the microphone. If the speaker's voice is low, the automatic control raises the "gain." If he shouts the modulator lowers the volume. This feature is frequently called a "built-in studio engineer." A handle on either side makes the *Beer Mug* easy to carry and to hold out for speakers' comments.

Its power output is 0.2 watt, sufficient under favorable circumstances for transmission over distances up to one mile. Power is derived from unusually light and efficient batteries developed in cooperation with NBC engineers. Finally, the *Beer Mug* satisfies every strict requirement laid down by the Federation Communications Commission for radio transmitters.

—30—

Black Night

(*Continued from page* 19)

duster before the mike.

When a chain rattle was desired almost everyone thought that the solution would be reached by clanking a chain before the mike, but His Honor, Mr. Mike thought otherwise. The chain sounded like anything but a chain and it was necessary for the sound effects department to stack several metal gadgets in a cigar box and rotate the box enticingly. (Yes, a shoe box would do).

When the *House of Usher* collapsed in the presentation of that story the dwelling's demise was indicated by rattling choice English walnuts and bird shot in a special container. Eerie music, directed by Gene Baugh, well known Southwestern maestro, lends much spice to the general effect, and, in many instances, original scores are written for individual dramas. But remember, if you go for grandma's smelling salts the next time you dial *Black Night,* don't say we didn't warn you!

—30—

Landing Blind

(*Continued from page* 18)

taken at the laboratory and airport which are located at College Park, Maryland, just outside of Washington, D. C., near the University of Maryland. Courageous and skillful pilots risked their lives in testing various phases of the instruments. Literally thousands of landings were made, many "under the hood" when the pilot could see nothing but his instrument panel. Some of the birdmen received severe jolts and bruises due to inaccuracies which in time

The monitor in the airport's control tower.

were corrected, but no one was seriously hurt and no one was killed.

Colonel Charles Lindbergh later flew the *bent beam,* as it was called then, at Newark and expressed great interest in the development to date. The highlight of the early demonstrations was the flight by James L. Kinney, Department of Air Commerce pilot, from College Park to the Newark airport. This epochal aerial journey was undertaken when every plane in the East was grounded due to one of the heaviest fogs in years. Pilot Kinney took off in this fog, flew to Newark, and landed without ever having seen the ground. It was the first actual zero-zero, cross-country flight ever made.

According to W. E. Jackson, Chief of the Radio Development Section of the Bureau of Air Commerce, an amendment to the Air Commerce Act of 1926 will be presented at this session of Congress to make possible the expenditure of addition Federal funds on airports as well as airways. This will make possible the installation of blind landing equipment at every important airport in the United States.

Credit for the evolution of the *curved beam* system goes to Harry Diamond, radio expert of the National Bureau of Standards; Gomer L. Davis and Dr. Frank G. Kear, formerly of the Bureau and now with the Washington Institute of Technology; W. E. Jackson, of the Bureau of Air Commerce and Pennsylvania Central Air Lines.

As their motto, the men of science who have developed their newest aid to safety in the air, have adopted these words, "A safe flight must end in a safe landing."

—30—

Border Patrol

(*Continued from page* 15)

condition could be concealed by skillful dressing and the fish foisted upon unsuspecting New York housewives for consumption.

Bick and Dubrofsky were found to be entering the United States illegally and were subsequently prosecuted.

The relaying of information received at headquarters to the mobile units which could not otherwise have been contacted made possible apprehension of the contraband fish. Without the radio the patrolmen would not have known of the movements of the truck, crossing as it did, at an isolated point on the border.

Some of the most spectacular apprehensions directed by radio have been made by the Customs Service in cases of opium and jewel smuggling. The famous *Chin Pak-Chin Wah* case in which a large shipment of opium was discovered by an agent posing as a crooked officer was directed by radio in the final maneuvers.

When the steamer docked, agents concealed in boats under the dock on either side opened communication with agents stationed on the docks and on the boat, advising them as to what was happening at the port holes below the dock level. Two minutes after the opium was unloaded the smugglers and 200 tins of opium were seized. The opium, at that time, was worth approximately $15,000.

The smuggling of watch movements is one of the most profitable "big time" rackets due to the extremely high duty imposed. In a recent case in which a man in New York was believed to be engaged in the business of smuggling watch movements, Customs agents were able to keep informed of his activities from the time he left New York until he returned.

He was known to be sailing for Europe and a radio message was sent to the agents there to cover him. Every move he made was watched and reported. Word came that he was returning by way of Montreal. Acting on the information received in the course of his trip, the Montreal agents radioed that the man in question had arrived and that he had immediately telephoned New York. At the Grand Central Station he was met by other Customs agents and his traveling case searched. In the false bottom they found 1,998 Swiss watch movements with a domestic value of $11,762.04.

Whether the contraband is diamonds or onions, the same methods of apprehension by radio communication are used. While Perl Weinberg was being seized for concealing eighteen packages of diamonds, valued at $286,346, in the false bottom of a fitted bag, Customs agents at another port were engaged in hauling in a fleet of small rowboats carrying 20,000 pounds of onions on which there is a duty of 2½c per pound.

The lives of a great many government agents operating along the Mexican border have been saved through the use of the most simple radio equipment. Frequently the men are outnumbered, or gun play is anticipated when they are too far from the patrol car to communicate with the headquarters station or other cars in the vicinity. When such an emergency occurs a small radio hand set, with fish pole antenna, often saves many lives.

In addition to the cooperation now existing between law enforcement units of the federal government through the close working contact by radio communication, plans are also underway to tie the service in with the Inter-city Police Radio Telegraph System, a police service being extended over the United States for the expeditious broadcasting of police information. This cooperation with the police organizations will serve to tighten the loopholes that remain in the sweeping radio dragnet of law enforcement. It will be another step toward making radio the outstanding law enforcement service of the United States.

—30—

The Life Stream of Broadcast Networks

(*Continued from page* 8)

And so it goes on through the day and night, a continuous operation of distributing communications which eventually find their way to the ears of the nation's radio listeners via the air waves. After midnight the day's work ends and work starts immediately in preparation for the next day.

Because of the exacting requirements inherent in the radio program service much new equipment has been designed and especially constructed, or existing telephone facilities suitably modified, exclusively for service to broadcasting companies.

For instance, on our first journey we noted the amplification of a weakend current every fifty miles. This is made possible, in a very large part, by mechanisms known as *repeaters*. They are costly and differ from repeaters used in ordinary long distance telephony in several important respects. For example they will transmit a wider range of tone, and they introduce less distortion through the use of special transformers.

Other special apparatus needed in furnishing this service includes equipment to interconnect sections of the network. The switching operations we looked over in our journey at Cleveland were a case in point. More than 60 other telephone offices throughout the country are similarly equipped. Some 260 more telephone offices contain special equipment for testing, adjusting, checking up, and rearranging the broadcasting networks to insure utmost efficiency.

As early as 1915, Bell System engineers achieved radio telephone transmission from the United States to Paris and Honolulu. In these experiments, and in the subsequent expansion of radio telephony, which today encompasses virtually all the world, the technicians applied much that they had learned during more than half-a-century in the development of nation-wide telephone service by wire.

The storehouse of experience included intensive study of sound, particularly speech sounds; tireless research in transforming these sounds into electrical impulses, and transmitting them clearly over ever greater distances; development of apparatus for amplifying telephone currents which had lost strength over these long stretches of wire.

In commenting on the tomorrow of radio the Bell System in one of its public statements points out, "Our ultimate goal, of course is the reproduction of music and speech in the listener's home, wherever located, so nearly equivalent to the actual program that there will be no audible difference. While keeping this objective in view the Bell System will endeavor to anticipate other requirements of radio broadcasting in the future."

—30—

Television by Resonance

(*Continued from page 31*)

quencies in their structure that were harmonics of the applied driving frequencies, and vibrated in an odd jumble of ways to react upon the purity of the path of the mirror motion, producing elliptical motion, of varying shapes and frequencies. The life of the parts was measured in seconds, and it was a turbulent short life. There was no simplicity of cause and effect, for there were many interacting causes, and the effect was always destruction in many variations, and in a short interval. Two weeks of model building, for an active life of two or three seconds.

The job was now one of isolating all extraneous effects so that the resonant member could be studied in motion, free from all other influences. This resulted in a discovery of far-reaching importance, a property of materials that was so far unsuspected. The resonant build up of a system employing a metal rod in torsion as the elastic element, without pivots and bearings, was of the order of five thousand, or one hundred times as great as suspected. Now at last the reason for the destruction of known materials under apparently safe known applied forces was clear. The forces, instead of having to be multiplied by fifty, must be multiplied by five thousand to determine the peak stresses. For example, if a steel rod had an elastic limit of five thousand pounds, this rod could be destroyed with a resonating driving force of one pound. The energy of the applied force would be stored in the vibrating rod and summed up on each cycle, until at equilibrium the stored-up vibrating energy in the rod became five thousand times as great as the energy expended by each cycle of the driving force.

Here at last was a principle that inherently possessed an activity that multiplied brute force by five thousand. A principle that provided harmonic motion in the purest form we have ever experienced, for the purity of the motion marches step by step with the gain of the motion with respect to the applied force. The track of the motion gave an ideal constancy for scanning.

The rate of decay or decrement could be controlled by merely varying the absolute values of the elasticity and the moment of inertia, while keeping the ratio constant for a given frequency. Vacuum enclosure would still further lower the decrement. Decrements could be exactly measured by the driving frequency-rod motion curves.

Many forms of resonant devices were constructed and tested. The ideal form is one where the elastic element is a rod, firmly embedded in an anchorage of substantial inertia at each end, and with the dynamic moment of inertia element affixed to the center of the rod.

The natural period of the system could be made independent of temperature, by proper choice of materials for the elastic element and the moment of inertia element, whose separate coefficients of expansion formed a compensating couple in such a way that the elasticity and moment of inertia each raised an equal percentage for a given raise in temperature. This cannot be done with either the piezo electric crystal or the magnetostriction rod, for their substance is both factors jointly, and not subject to the separation that is possible with structures such as the ones we devised.

Now our elementary scanner mechanism had been developed, but as yet the optical element had not been applied. This looked to be an easy task involving nothing more than cementing a mirror to the rod; so just that was done. The result was an average mirror life of a few seconds. The cement, under the action of an intense high frequency mechanical motion, turned to a fluffy dust. Bezeling a mirror somewhat in the manner of a jeweler's setting was tried. This likewise did not work, for the mirror developed an infinitesimal play in its mounting which prevented the vibrating motion from building up after the slightest play had developed. Other methods were tried without success. Ultimately a portion of the surface of metal welded to the rod was polished and plated and the surface plated with iridium or rhodium; and the problem was solved. There can be no joints, no possible relative sliding movement of parts, or the gains inherent in the system are lost. The final solution was operated steadily for a run of fifty billion swings without observable deterioration.

It was a simple matter to mount the high frequency vibrating mirror in a cross frame that vibrated slowly at right angles to the original motion, and thus produce a scanner capable of dissecting two or three million picture elements a second at the studio, and reassembling the same number of picture elements a second in the home. There, at last, was a scanner with no wearing parts, and costing about as much as an inexpensive radio speaker to build.

As actually constructed, the rod has an angular twist of 4 degrees on either side of neutral, or a total swing of 8 degrees, providing a scanning angle of 16 degrees. The mirror device optically doubles the mechanical angle, since the angles of incidence and reflection for a mirror are equal. Only one-half a watt of low voltage power is required to drive the mechanism. If a higher definition is desired it can be designed, and we have built scanners that exceed the allowable channel limitations determined by the rules of the Federal Communications Commission and our ability to construct such ultra high frequency amplifiers. The power to drive the low frequency motion is infinitesimal.

Here is a scanner that should bring television in the home with a set to retail at $200 initially, and provide a projected picture approximating the size, *quality and brilliancy of a home motion picture.* A blank in our knowledge of resonance has been sketched in. Other uses and devices will follow. This principle has already been applied to a clock mechanism that runs with microscopic power, and to relays sharply responsive to frequency for the operation of remote control devices. These relays have a valuable unique property of inherently preventing contacts from sticking, for the total summed up force required to cause the movable contact to finally reach the fixed contact is, in its full summation, the force available for breaking the contact.

Briefly, this excursion into the unknowns of resonance has sprouted mechanisms of importance. The ten kilowatt impossibility and monstrosity becomes a docile steady performer needing but a half watt to satisfy its requirements. Much more will be done by others in this new resonance field. There are always many who follow if even so little as a gleam of ultimate success shows.

—30—

Let's Listen for MARS

(*Continued from page* 14)

cations, but the receiver buzz was plenty annoying; diathermy produced pyrexia, not only in patients, but in many short wave listeners.

Means of suppression have been found. Some thought was given to the allocation of a frequency band for medical use, but, because the wave varies according to the doctor's adjustment and the size of the patient, other means of elimination were used. Occasionally, one gets on the air even now. It can be identified by its similarity to ordinary 60-cycle hum; unlike it, it is sharply tuned. "Tuneable hum" occurs in one definite spot; diathermy hum wanders about the scale. If you come across it some night, you can either tune it out or sit back and listen to what is probably a broadcast of a bad case of rheumatism.

The essential question concerning our raising Mars boils down to "How far advanced is Martian intelligence?" not "Is there life on Mars?" When one considers the myriad of life forms on earth which exist under adverse conditions of temperature and pressure, it is logical to suppose life can be instilled into groups of matter other than those of the human combination. There is no reason to suppose other cellular compositions are not viable only because they are remote.

There's a common noise from the set—a *Brrrp, brrrp,* with alternate noises alike. It isn't Mars, though; it's the flashing sign in the tailor shop across the street. Look out the window while you listen to the speaker; the sound comes each time the light goes on and off. One way to get rid of it is to speak pleasantly to the shop owner, asking him to remove the gadget. If he won't tune it out with a brick.

Wishful thinking and late hours over a receiver have made many listeners jump up from their chairs when they heard such noises. The jumping motion is well known. You have heard of cosmic "raise," haven't you?

Here's a peculiar sound. It isn't a planet, either, but I'll bet many set owners who stumbled on it wondered about it. A picture is being sent by radio. It might be from Berlin, Buenos Aires, New York, or London; they all have photoradio transmitters. The variations are caused by the scanning equipment, as it follows variations in picture density. The photograph revolves, and, as adjoining lines of the subject are sent out, it sounds like a man tearing one starched collar after another. You hear them most frequently following a disaster or *putsch,* when news agencies cannot wait for the material to arrive by ship.

I'm beginning to doubt if we'll ever hear Mars. If they are less civilized than we, they can't; if more civilized, they probably don't want to.

Hear that station, on voice? The speaker seems to be talking through a pillow. No chance of understanding it—the distortion is intentional. If it was Mars, they would call more distinctly. It happens to be trans-oceanic telephony, jumbled for secrecy.

A person who goes hunting for Mars must know how to exclude a great number of such sounds. First, there is the huge group of all radio transmitters, damped and undamped. Their number is terrific, and includes all equipment designed for one- or two-way communication—all forms of voice, code, and the numerous intermediate forms; television, for instance.

Then there is another huge group of noise sources that are not intended by design to give out waves which affect your receiver. For example, the purpose of a doorbell isn't to disrupt reception, but it does so while performing its intended function. The static coming from a doorbell, like a street-cleaner's interest in horses, is secondary. Both, however, exist.

These forms of interference must be checked by the listener before he calls his local newspaper and announces that Mars finally has burst through our Heaviside layer. They fall into three general classifications:

Man-Made Static
- Trolleys
- Shocking Machines
- Motors, malted milk drive
- Oil Burners

Woman-Made Static
- Curling Irons
- Vacuum Cleaners
- Juice Extractors
- Violet Ray Machines

Asexual Static
- Snow
- Hail
- Microphonic Tubes
- Lightning

There are thousands of other unearthly sounds with no earthly purpose, but we are too close to the 30 to list them.

Let's give up for the night. If Mars has been waiting for centuries another week or so will make little difference. Of course, if we really wanted to establish interplanetary communication, we could use light. We are positive light rays get across both ways, but we're not so sure about radio. Radio is lots of fun, though.

[Jorgen Hals, mentioned in the second paragraph, observed the 4 minute, 20 second delay in a radio signal during tests in Oslo, Norway, on 31 meters. He reported his observations of the phenomenon on February 2, 1929. Mention of it was made in Proc., I. R. E., October, 1929, page 1750.

In the third paragraph mention is made of a French Academy award for interplanetary communication with any heavenly body except Mars. This was derived from an article in the May, 1938, issue of *Coronet,* titled "The Strangest Prize." It concerned the peculiar conditions of Mme. Guzman's will, which offered the money to the Academy for use as the specified prize; and the embarrassing position the members of the Academy since then while they tried to decide whether or not to accept the money and post the award.

The U. S. Naval Research Lab report mentioned in paragraph 4 was published in the Proc., I. R. E., in October, 1929, in a paper "Ionization of the Atmosphere of Mars" by E. O. Hulburt.

Part of the information concerning "The Shadow" was taken from RCA publicity on March, 1936, and December, 1935. The MS. was passed by that company's Department of Information on April 28, 1938.—ED.]

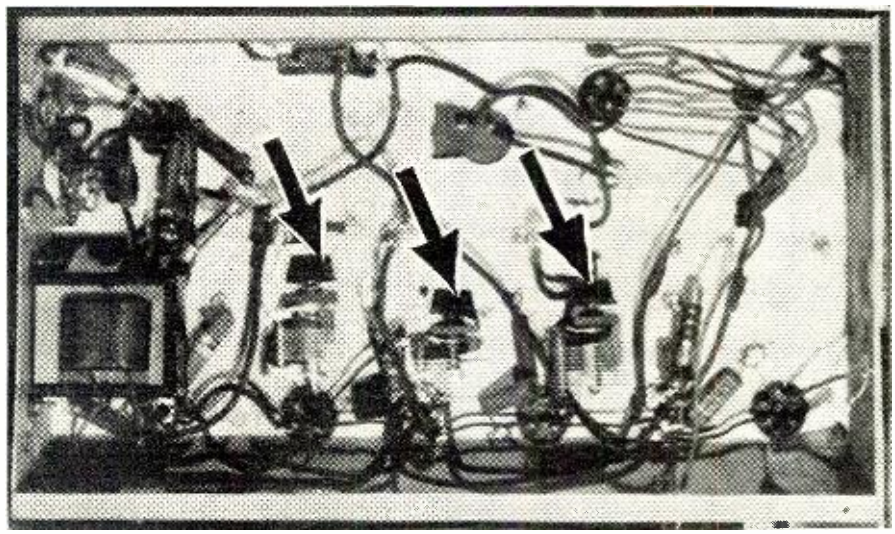
—30—

Low Power Transmitter

(*Continued from page* 51)

is inadvisable to use this type of transmitter on any other band for fone purposes, although, with proper crystal and coils, it may be used for c. w. on any band. A jack connected in any conventional keying position will allow the rig to be used for both fone and c. w.

It is entirely feasible to double in the oscillator stage with this circuit, so that merely by changing coils the rig may be operated on two bands. Information found in any handbook, and a little "cut and try," will enable the ham to adapt the rig to any or all bands.



An underside view of the transmitter chassis. Arrows point to tuning condensers.

The antenna used is a Marconi type, 100 feet long, and tuned by the coil and condenser unit as shown in the circuit diagram. This tuning unit is located at the window. The coil of this unit is factory made, and any such unit designed for the band desired will operate efficiently.

The modulator used in the rig consists of a 6L6 Class A choke coupled to the plate circuit of the final stage. No dropping resistor is used in the final as is usually the custom in this type of circuit, since none was found necessary.

The speech amplifier is a 6F5 resistance coupled to 6C5, which in turn is resistance coupled to the 6L6 modulator. The mike used was a single button carbon type of some prehistoric vintage, and the mike transformer is built into the stand. Again, it is advisable to use what is on hand. Any good single button mike will probably work just as well.

The entire unit is built on a standard chassis 17" x 13" x 3". If desired, a case could be built for portable operation, although it may be placed in a car "as is" for transporting. The complete unit weighs approximately 15 pounds.

The photo shows one empty tube socket, which is for the crystal.

Tuning

For the initial tuning, the final stage 6L6 should be left out of its socket because of the dangerously high plate current it would draw if its circuit were not tuned to resonance.

The crystal is inserted in the first socket, and a neon bulb or a loop and lamp used for the indicator. Maximum brilliance in either indicates resonance. Knobs may be put on the shafts of the tuning condensers, as in the photograph, or slots may be cut in the end of the shafts, and a neutralizing screw driver used for tuning adjustments.

The amplifier grid circuit is then tuned to resonance, as indicated by maximum brilliance of the indicator. The plate lead to the final stage is broken at the voltage side of r.f. choke and the indicator touched to the plates of the plate tuning condenser. Grid and plate tuning condensers are then varied for maximum indication. Now vary the neutralizing condenser for minimum indication. This process is carried out until no indication of r.f. is present at the plate of the tube when the circuit is tuned to resonance. The rig is then completely neutralized.

A milliampmeter may now be connected in the final plate circuit temporarily to check resonance and logging current. The antenna is now connected and the stage loaded to the proper plate current, as indicated in the voltage tables.

After the rig is tuned up it need not be touched again. This is one feature which makes it desirable for portable use.

Voltage Tables

Tube and Purpose	Plate Volts	Screen
6L6 Oscillator	400	200
6L6 Final Amp	400	200
6F5 Audio	250	
6C5 Audio	300	
6L6 Modulator	400	400

Final stage plate current with antenna load connected and set in operation—70 ma. Input—28 watts.

DX Record

DX record—600 miles with report RST 458.

—30—

Rural Wits From the Ozarks

(*Continued from page 9*)

were good enough to get a lot more money than that.

They turned him down. And that was the luckiest move of their lives.

Goff's father was a wholesale grocer and Norris was one of his buyers. The result was that he knew the Quaker Oats salesman who covered that Arkansas territory. The salesman had often suggested that if Norris ever got to Chicago he should look up the company and visit their plant. So before coming the boys had armed themselves with a letter of introduction from Norris' father.

There luck entered the picture once again. That company was sponsoring Gene and Glenn as a radio series. Gene and Glenn were going on a vacation and the sponsor wanted something to fill in with during their absence. So one of the officials mentioned the fact and immediately the boys offered to do a *Lum and Abner* audition for them.

Although Lum and Abner are strictly hayseed characters, old timers from the rural mountains, the boys themselves are really young and modern. They realized they couldn't accomplish a thing if the officers could see them.

So they herded all the officials in the board of directors' room and seated them facing the wall. In such a position they couldn't see the boys work but could hear them just as any radio fan would. Then the boys went to the opposite wall. They spied a broom stick and brought it into service for a microphone.

The Quaker Oats officials liked the act immediately. In fact, they signed them to fill in for Gene and Glenn's vacation although another act had already been promised the job.

But let's pause a moment to look back into the lives of the boys and to get acquainted with them. Chester Lauck is Lum. In addition he plays the parts of Grandpappy Spears, old citizen, Butch Dolan, Oscar Fields, Dan Davis, Frank Foster, Clarence O. Willoughby, and Snake Hogan, Pine Ridge's Public Enemy No. 1. He was born February 9, 1902, at Allene, Arkansas, but soon the family moved to Mena, Arkansas, where he was raised. He attended the University of Arkansas and the Chicago Academy of Fine Arts. He edited a magazine in the Texas Rio Grande Valley. Later he returned to Mena to enter the bank and then became manager of an auto finance company there. He is married and has two children, Shirley May and Nancy.

Abner is really Norris Goff, born May 30, 1906, at Cove, Arkansas. He also moved to Mena early in life. He attended the Universities of Arkansas and Oklahoma. Later he worked for his father in the wholesale grocery firm in Mena and finally became the company's secretary and treasurer. He also is married. He has one son, Gary. In addition to being Abner, Norris (Toughy) Goff is Dick Huddleston, proprietor of the store and post office, Mose Moots, Lord Chalmondelay and Squire Skimp, villain of the series.

Both men were companions from childhood and used to indulge in much local entertainment. Their first venture into radio came on April 26, 1931, when they were asked to assist the Mena Lions Club in a town-boosting program over KTHS, Hot Springs, Arkansas. Lum and Abner had planned to put on a blackface act for this show but discovered shortly before the program was to go on the air that another blackface team was scheduled for the same performance. With a half hour to work in, they decided to "sit and talk" much in the manner of the old Ozarks residents whom they had known all their lives. With five minutes to spare before the program opened they decided to call themselves Lum and Abner. The presentation was such a success that Lum and Abner were invited back to KTHS to repeat for eight more broadcasts. The deluge of fan mail was the greatest up to that time in the station's history.

That led them up to the Chicago audition and their first sponsor. They stayed with the Quaker Oats Company long after Gene and Glenn returned to resume their broadcasting. When that happened the company sent Lum and Abner to broadcast on stations in Fort Worth and Dallas, Texas.

Subsequently the team was sponsored by the Ford Motor Company, for whom Lum and Abner developed a program known as the *Pine Ridge Sociable* in addition to their nightly fifteen-minute show.

The Horlick Malted Milk Company of Racine, Wisconsin, took over sponsorship of the act during the early part of 1934. No network spot being available at that time, Lum and Abner were shipped up to Minneapolis to do a one-station stand via WCCO.

At the instigation of the Horlick Company, the Mutual Broadcasting System was formed in the fall of 1934 in order to bring Lum and Abner to a wider radio audience. The network consisted of WGN, WLW, WXYZ and WOR.

About their personal habits: both of them go in for golf, handball and tennis. For real entertainment they visit places like Coney Island. They have the native horsesense of their home territory when it comes to business dealings, and considering the fact that they are among the best paid stars in the radio world they live lives that some people might consider moderately frugal. The answer to this frugality is that they have laid the groundwork for eventual retirement by investing in annuities, insurance policies for their wives and children, and property holdings of one type or another which will net them an income in the future. Not given to lavish entertainment, both men prefer an evening of bridge and conversation with a few friends.

And there you have Lum and Abner, the men themselves, the characters of their radio series and something about the history of how they reached fame via the Ozark mountains—a fame which was proved when they offered to give away copies of their newspaper, the *Pine Ridge News*, and 350,000 requests came in!

—30—

Studio Briefs

(*Continued from page 34*)

York's *Casa Manana* during a program from that spot, he brought the mike to the table and urged her to talk. She consented readily and even wound up her brief remarks with the expected tag-line of "Come up and see me sometime."

Radio gossipers hold that Miss West will come back to the air in a radio series. It is believed that most big sponsors and the chains feel that she would be delicate to handle after the way the Federal Communications Commission leaped into disciplinary action after the Westian-Chase & Sanborn broadcast. But, in the same light, there are some sponsors who think it would be a sensational thing to bring her to the air with carefully written and edited material.

* * *

DRAMATIC performers on several network programs are entering *sotto voce* complaints over what they call unfair treatment.

It deals with those network shows that are recorded "off the line" while the original program goes on the air. The disks are then routed to small town stations for broadcasts at subsequent dates, but many actors claim that they don't get any extra pay for the use of the transcriptions and that their regular pay is small enough. But there is so much competition in getting radio drama assignments these days that the complaints remain whispers rather than howls.

The actors hold that musicians are protected against such double use of talent at single pay and that similar consideration should be given them.

* * *

MARY MARGARET McBRIDE, also known on the air as Martha Deane, doesn't want to admit it, but she's really superstitious. 'Tis said that Miss McBride is one of the highest paid women in America. And if being superstitious helped to that classification, no one will blame her for carrying a rabbit's foot and an amber lucky piece about the size of a silver dollar to each broadcast on CBS. Her close friends say that amber has always been associated with her climb to success as a radio columnist.

Next to sailors and actors, radio stars are perhaps the most superstitious single group in the land. Jack Pearl, the dialect comedian, always wears his suspenders inside out and insists on having his father at every broadcast.

* * *

CBS—Chicago Briefs

EDITH DAVIS, CBS character actress heard on numerous programs and her husband, Dr. Loyal Davis, were house guests of Mrs. Frank Navin during the Derby week-end and saw the race from the Navin's box. . . . Ken Griffin, who plays Charles Williams in *Kitty Keene, Inc.*, turned up with the cast's first case of sunburn. Ken attributed his tomato-like complexion to "too much outdoors after too much indoors."

Following the lead of Spencer Bentley, Alice Hill, Betty in *Betty and Bob*, launched her sloop, *Foo*, a week sooner than planned. Both players are ardent sail enthusiasts. . . . Ilka Diehl, absent from the script for a few days, turned up in the wrong studio to play a role in *The Romance of Helen Trent*, dramatic show with its locale in Southern California. As the minutes passed and no other member of the cast put in an appearance Ilka whistled softly to herself and murmured, awed, "There must have been another earthquake!"

With leading roles five days a week in *Kitty Keene, Inc.*, and *Joan and Kermit* on Sunday, Frances Carlon keeps a "time budget" during the week so that not a minute of her Saturdays will be wasted. . . . Hugh Studebaker is forever resolving to bring his movie camera to the studio with him to shoot other members of the *Bachelor's Children* cast—but he's always too sleepy in the mornings to remember to take the gadget with him.

* * *

NBC—Chicago Briefs

NBC Announcer Charles Lyon, back in Chicago from a South American cruise, reports the neighboring Americas are unusually interested in the type of radio fare which the U. S. proposes to offer for South American consumption. According to Lyon, consensus seems to be that current programs aimed at South America from Europe bear down too heavily on the politics and propaganda, and that South America is about fed up. Stations in Germany and Italy, with the aid of beam transmitters, bang in below the equator with the strength of locals. Opposed to this type of fare, South American listeners expressed to Lyon a decided preference for out-and-out entertainment, McCarthy and Bergen rating tops. He was tickled to find a group of fans partial to NBC's *Escorts and Betty* in the consulate at Caracas, Vz.

All artists aren't temperamental. Jim Ameche had his shoes shined on the way to the NBC Chicago studios. As he stepped into the elevator, hurrying for the broadcast of *Attorney-at-Law*, in which he plays the leading role, someone stepped on his heel, ruining that portion of his shine. As he apologized, the offender awkwardly stepped on his toes. Jim continued to smile.

Betty seems to be a lucky name in radio as far as the artists at the NBC Chicago studios are concerned. Of the feminine star-liners at NBC Chicago, five are named Betty—Betty Winkler of *Dan Harding's Wife* and the *Fibber McGee and Molly* funcast; Betty Lou Gerson of the *Attorney-at-Law* serial; Betty Olson, girl friend of the *Escorts and Betty* quartet; Betty Caine of the *Story of Mary Marlin* and Betty Bennett of the song-guitar team of *Bennett and Wolverton*.

* * *

WGN-Mutual Briefs

BOB HAWK, master of ceremonies on the WGN *Music Box* program, heard each week-day morning from 7:30 to 8 a.m. (CDST), has returned from a New York vacation. Bob spent most of his time seeing the new stage shows in Gotham.

Arlene Francis, who with Budd Hulik, m.c.'s the WGN-Mutual popular series of *What's My Name programs*, heard each Friday at 7 p.m. (CDST), is a former understudy of Claudette Colbert in the movies.

Little Josephine Starr, child prodigy of George Jessel, heard on WGN-Mutual's *Thirty Minutes in Hollywood* each Sunday evening at 5 p.m. (CDST), is getting the thrill of her life touring the country with the Jessel company. She dislikes only her early morning routine which means a session with a private tutor.

Jack Pearce, WGN's engineering department supervisor, is completely refitting and refurnishing his cabin cruiser. Jack and Mrs. Pearce lived on the boat in Chicago's Jackson Park harbor last summer.

Quin Ryan is dispensing good luck in the form of a rabbit's foot to each of his guests on his *Sports Celebrity* parade heard nightly at 8:52 p.m. (CDST).

"Britt Reid," the crusading young publisher who dons the mask of *The Green Hornet* in the WGN-Mutual series of dramas offered each Tuesday and Thursday night at 7:30 p.m. (CDST), is played by Al Hodge.

—30—

Not for Rebroadcast

(*Continued from page* 38)

ever purpose he has in mind which might be prohibited by that same constitution? . . . bases its membership on religious grounds although not a member of any church denomination? . . . appears at every non-radio commercial convention or show in the locale, in which the Head Man needs an attraction for his booth? . . . *is* a member of the American Radio Relay League which is supposed to stand for the "American Way of Doing Things"? . . . and how long will it be before that August Body and the hams in general get wise and expell Mr. Head Man and his whole kaboodle from their ranks as un-american?

* * *

THE deadlock between Chicago network stations and local hotel and ballroom owners continued into the summer months. The fixed rate of $100 a week for all local dance pickups continues in effect by the four network key stations. It is strongly rumored, however, that by fall the hotel owners' association will consent to payment. In all but a few hotels lack of nightly radio pickups has definitely hurt their café, night-club and restaurant business. Two Chicago hotels have already expressed their desire (privately) to pay the networks for time, as, they claim, they are unable to book big-name orchestras into their hotels without radio.

* * *

DURING the summer months the casual observer will notice quite a few persons seated and waiting in the NBC outside reception rooms and corridors; they have no apparent business, and sit for hours at a time comfortably satisfied with life. The reason: NBC studios are rigidly air-conditioned, and furnish excellent places for stray visitors to "cool off."

* * *

KOVERING THE KILOCYCLES: Contrary to rumor, Texaco will not team up Stokowski and Deanna Durbin (*not* Garbo) on the air next fall; they still seek a comedian! How about Chicago's Bob Hawk? . . . Admission to broadcasts by ticket is to cost 10c, if Alan Correlli has his way. This is similar to the 10c charge made for tickets to go aboard an ocean liner to see someone off to Europe. The money realized from the tickets would go to theatrical charities. I think it would be a swell idea. How's to writing to your local station or to me and letting me know how you feel about this? . . . Bing Crosby was offered a ten-year contract by Kraft Music Hall. Joker in it is that it is cancellable on 13 weeks' notice . . . or in other words it is only good for 13 weeks, and prevents Bing from working for anyone else unless Kraft releases him. Nice Thing! . . . Kay Kyser is sometimes mistaken for Pinky Tomlin . . . but *not* by Pinky's wife, we hope! . . . A prominent agency after telling the world that people DO listen in the hot summer months, killed four of its shows! Ho, hum! Who can figure them out anyway? . . .

—30—

De Mille's Technique

(*Continued from page* 14)

may live within a few blocks of these same stars they seldom catch even a glimpse of them except at these broadcasts. Most of the stars get away as quickly as they can after the program to avoid the crowds. But Joe E. Brown kept a transcontinental airplane waiting twenty minutes so he could sign autographs for some of the kids who had gathered to see him emerge from the theatre. And when he found he didn't have time to sign for all of them he promised autographs to everyone who would write him asking for his signature.

When De Mille broadcasts he sees himself as a guest in your home. "When I step to the microphone," he explains, "I have a feeling I'm sitting by a fireside talking to an ordinary American family—father, mother and children, with perhaps a grandmother or grandfaather also in the circle. I assume I am an invited guest. Therefore, when I speak into the microphone I must try to be as interesting and sincere as I can because I want to be invited back again."

The power of radio and its enormous ability to penetrate beyond any other realm of entertainment was well brought home to De Mille recently when he worked for several weeks in the swamps and bayous of the Louisiana gulf making the film *The Buccaneer*, which is the story of Pirate Jean Lafitte. Down there he found many natives, most of them descendants of Lafitte and his pirates, who had never travelled even as far as nearby New Orleans. Yet they all knew De Mille's name and his radio program and were frank to express their opinions on the worth and demerits of his various broadcasts. Such is the power of radio.

"Isolated from the rest of the world in those bayous and swamps, these people have never seen a city," says De Mille. "Yet they have radio sets with which to keep in touch with the world."

De Mille doesn't think the advent of television will bring legitimate drama to the air in the same manner as it is done on the stage. When talking films first came in he tried to film actual stage productions but the movie audience didn't like that. Silent films had trained them to a faster tempo and a different technique. So the job of making a talking film was different from both the stage and the silent film. The job of presenting a dramatic radio broadcast was something different again. And a new and different technique will be needed when television finally does arrive with its sweeping consequences to the entertainment world.

What he does expect television to do, rather than bring the legitimate stage to the air, is to bring about a vogue for the televising of films into the moving picture theatres of the country. But when he gets through making this prediction and answering all the questions you can ask he adds one final statement: "These are my ideas, my theories, my technique, and my predictions. But you mustn't forget that I'm the man who years ago said we would never have a practical horseless carriage!"

—30—

The Coast Guard Stands By

(*Continued from page* 11)

1937, carrying disease and starvation with the flow of its muddy waters, the Coast Guard took to life-saving boats, which were brought in by freight from Coast Guard stations on the coast, and entered the fight against death and privation. The life-saving boats were equipped, in some cases, with both transmitters and receivers, and in some case only receivers. Again and again the Coast Guard was called into action, performing every conceivable service from the rescuing of marooned people and animals to the rushing of medical supplies and reinforcements to the relief centers.

Mobile radio stations, on Coast Guard trucks, are maintained at all division headquarters. These are fully equipped to move into a disaster area in time of tornado, hurricane, earthquake, or flood. These mobile stations or radio trucks were run into the flood area in 1937 and established communication with division headquarters in Chicago and with national headquarters at Washington with very little loss of time. Radio furnished communication between the commander of the Coast Guard in the Ohio Valley and the small boats under his supervision. In addition, the Coast Guard furnished communication to the Red Cross and to other relief agencies operating in the area of the disaster, where the normal channels of communication failed.

Communication trucks are used along the coast of Florida and the other southern States to go into the threatened territory prior to the actual striking of the full force of the hurricane or tropical storms. These warn the natives to get out of the endangered country. Radio is used to keep in contact with the division headquarters and, through them, with the Weather Bureau. By this means, the Coast Guard trucks have accurate information as to the path and probable strength of the storm. All units are in constant communication with Coast Guard Radio at Washington, as well.

Planes are used to patrol the boundaries between the United States and Mexico, frequently flying over vast desert wastelands. The mobile stations are also used in those districts, so that the planes, too, can be kept in constant communication with their bases and with national headquarters.

Portable radio equipment has been established in surf boats in many cases, chiefly in Alaska, where landing is frequently difficult and dangerous. By using these portable sets, type T22-CGR22, on frequencies of 2,670 or 4,050 kilocycles, the surf boats can notify the cutters of safe landing, as well as of the time of their departure from shore, so that the cutters can gage the approximate time of their arrival and send aid when the length of time indicates accident or trouble.

Radio also enables the surf boats to warn the cutters of dangers outside of their vision and, on occasion, of incidents arising which compel the small boats to remain ashore until conditions for returning are more favorable. Many lives have been lost in the past because landing parties have taken risks, in order that the lives of others should not be endangered in a search for them, such a search being the natural result of the landing party's not returning to the cutter within a certain interval. Now, with radio communication between the cutters and surf boats, the commander of the landing party can notify the mother ship of any adverse circumstance which may arise to prevent either the landing or the launching of the small boats.

Rescue work at sea, a major part of the duty of the Coast Guard, has been greatly facilitated by the use of radio on patrol vessels. Outstanding cases in the last few years, in which radio was a deciding factor, include the case of the grounding of the *S. S. Dixie*, in September, 1935, during a tropical storm. The radio direction-finder enabled the Coast Guard cutter *Carrabasset*, in conjunction with other Coast Guard vessels, to locate the distressed ship and remove all of the passengers safely.

In the case of the Greek steamer *Stefanos Costemenis*, in February, 1936, the leaking and disabled steamer was located by the direction finder of the *City of Newport News*. After the receiving of weak and incoherent distress signals from the Greek ship, all hands were removed without mishap. Another case was that of the Norwegian steamer *Bjerkli*, which was disabled by heavy seas and was unable to give correct bearings. In this case, the Coast Guard cutter *Chelan* effected a rescue through the use of the radio direction-finder.

The Coast Guard cutter *Itasca* was constantly in communication with Amelia Earhart after she left the Hawaiian Island, but only by voice. The urged her constantly to give them her bearings, but were handicapped by the fact that her ability to operate a radio was slight. The last word heard from Miss Earhart was, however, received by the *Itasca*, and the cutter searched for three or four days before the arrival of the Navy ships on the scene.

In a single month (October) the Coast Guard answered more than forty radio calls requesting medical aid at sea. In some of these cases the Coast Guard planes were used in the transfer of the sick and injured to hospitals. Numerous calls from ships aground or in mechanical trouble were answered; at least nine warnings concerning submerged, partly submerged, and floating menaces to navigation were sent out; and many other services were performed, with the aid of radio, in the same month.

In conjunction with rescue work, the use of planes, of the amphibian type, equipped with radio direction-finders and with radios operating at 4,200 kilocycles, plays a large part. These planes remain in constant communication with their bases, except when in the interior of the country, at which times they switch to commercial stations.

One thing is certain, without radio the Coast Guard would be seriously handicapped. While we take our radio as a pleasure find, this arm of our government needs it as its life's blood.

—30—

Introducing

2 NEW Hallicrafters Receivers . .

the SKY BUDDY

Only an organization with the facilities, experience and resources of the Hallicrafters could build a practical communications receiver to sell at this low price.

The 1938 SKY BUDDY covers everything on the air from 18.5 MC to 545 KC, including the 20, 40, 80 and 160 meter amateur bands, regular broadcast, police, aviation, foreign short wave, and government services. It's an amateur's and short wave listener's receiver in every respect—an AC set of conventional power transformer construction, and built of highest quality material and parts throughout. Sensitivity and selectivity are comparable only to receivers selling at many times its modest price. Any Amateur or critical short wave listener will be delighted at its fine performance—it has all the painstaking, careful engineering of the better Hallicrafters receivers. See the New 1938 SKY BUDDY at your Hallicrafters dealer today.

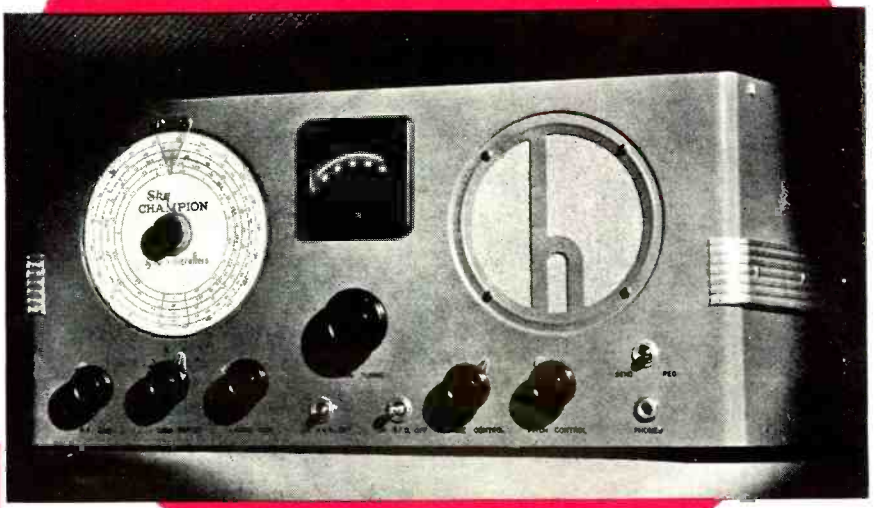
- 5 Tubes
- 3 Bands
- Complete Coverage 18.5 MC to 545 KC
- Built-in Speaker
- Separate Band Spread Dial
- Easily Adapted for Battery Operation
- All Necessary Controls

Amateurs' Net Price (Including Speaker and Tubes) **$29.50**

and the SKY CHAMPION

At no time previously, has the Amateur or Short Wave Listener with a limited purse been offered so much in a communications receiver for so little in price. The SKY CHAMPION is an 8-Tube, AC superheterodyne with Pre-Selection, complete coverage from 44MC (6.8 meters) to the top of the broadcast band, Built-in Speaker, every essential control for amateur reception and a Band Spread better than A.R.R.L. Handbook recommendations. In Sensitivity, Selectivity and all around performance, the SKY CHAMPION equals and betters receivers selling at double its price. It's a true Hallicrafters receiver — incorporating only the finest of parts, and the most careful and painstaking engineering and workmanship. See the New Sky Champion at your Hallicrafters dealer today or write for complete information.

Amateur's Net Price (Including Speaker and Tubes) **$49.50**



- 8 Tubes
- Complete Coverage 44 MC to 545 KC
- For AC and Battery Operation
- 4 Bands
- Separate Band Spread Dial
- Built-In Speaker
- Individual Coils for Each Band
- Every Essential Control for efficient Amateur Reception

A champion endorses the SKY CHAMPION. Mr. T. R. McElroy, Famous World's Champion Code Operator, says:
"Congratulations on the SKY CHAMPION! It's got performance you can't get for twice the money elsewhere!"

All Hallicrafters Receivers Available on Liberal Time Payments

the hallicrafters inc.

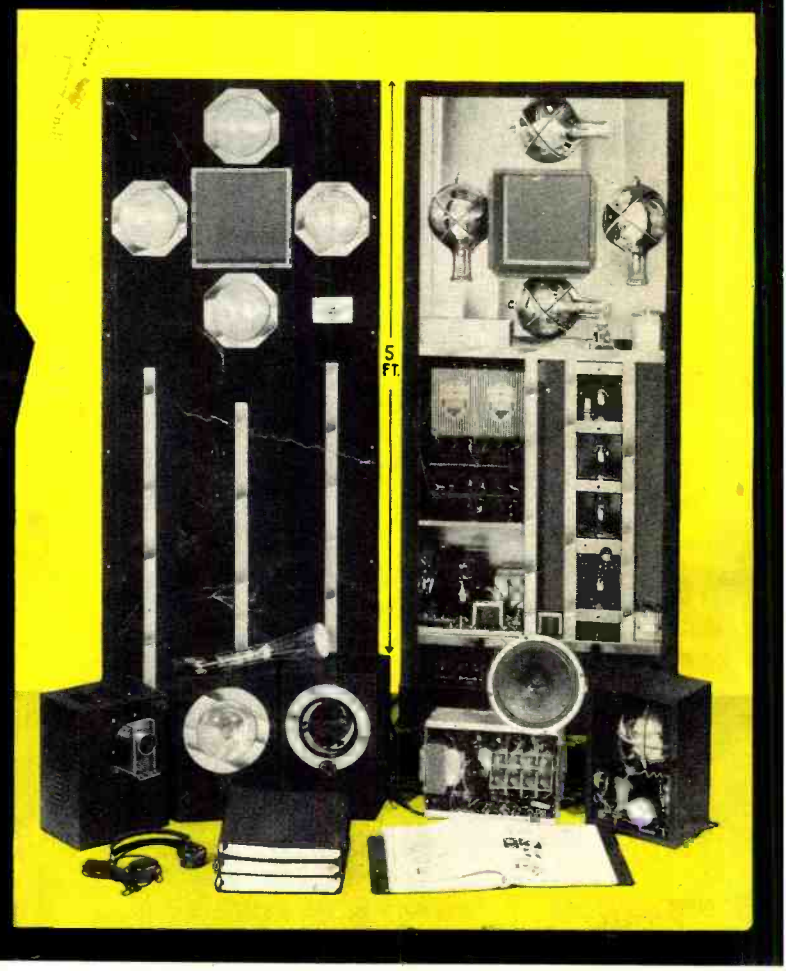
2603 Indiana Avenue,
Chicago, U. S. A.
Cable Address:
"Hallicraft" Chicago

WORLD'S LARGEST BUILDERS OF AMATEUR COMMUNICATIONS RECEIVERS

TELEVISION

Cannot Be Properly Mastered With Just Texts Alone...You Need ACTUAL Experience WORKING With Real Equipment!

THAT'S WHY WE GIVE YOU THIS *Professional Television* EQUIPMENT INCLUDED WITH YOUR TRAINING AT NO EXTRA COST



Television Men Will Be Needed Soon!

Television is already commercial in England. When it is launched here, thousands of jobs will be opened. Executives know that thousands of TRAINED men will be needed. Be ready to step into a GOOD PAY TELEVISION JOB. Now is the time to prepare . . don't wait until the field is crowded. Get in on the ground floor first! The A.T.I. method of training is new, startlingly different. No dull, hard-to-understand, monotonous texts. We train you as you never thought you could be trained . . you get ACTUAL EXPERIENCE with YOUR OWN TELEVISION APPARATUS just like on the real job . . RIGHT IN YOUR OWN HOME!

Prepare Now for the Big Pay Television Jobs

A.T.I. Training prepares you for good paying jobs in these fields: Television Engineer, Radio Station Operator, Laboratory Technician, Radio-Electronic Engineer, Sound Camera Technician, Public Address Engineer, Electrician and many other fascinating profitable positions. A.T.I. Training qualifies you during the first few months to take your RADIO TELEPHONE FIRST CLASS GOVERNMENT LICENSE EXAMINATION and get into a good paying job in the radio field while completing your television instruction. A complete Radio Servicing Course is also included.

Edward Gibbons, W9TAK, says, "I have worked with A.T.I. equipment. It lends itself perfectly to experimental work and hundreds of tests which give you a first hand practical knowledge of television."

E. F. Wiechmann, W9RLA, says, "I am tremendous y impressed by the size and quality of your equipment. The cathode ray tube and four photo electric cells alone are worth the entire price you ask for the complete machine and training."

Here's What You Get . . .

Television cannot be properly mastered by texts alone. That's why we give you all this genuine Television equipment along with your A.T.I. training AT NO EXTRA COST. It is sent to you at home and is yours to keep. Includes a complete professional Television Transmitter and Receiver 5 ft. high; 50 Watt Radio Transmitter; Superheterodyne Receiver; 7" x 21" Cathode Ray Tube with 7" screen; 4 Giant Photo-Electric Cells; Hi-Gain Transmission Amplifier; Projector, Mazdas, Lenses; Phones; R.C.A. Tubes; and all other necessary apparatus. We give you a full engineering course in Television, Electronics, Radio Servicing and Electricity, with final training in Chicago in our laboratories, (transportation to Chicago paid).

Here's What You Can Do . . .

With your A.T.I. Equipment you can make over 350 amazing, interesting experiments right in your own home. You can produce your own Television program for a local audience . . . transmitting and receiving the faces of your friends. You can build complete Television Transmission and Reception Systems, Television Amplifiers, Radio Transmitters, Television Pick-ups, Photo-Electric Relays, Light Beam Telephone, Magic Lantern, Grid-Glow Alarms, Sound Amplifiers, Photo-Electric Photometers. You can make hundreds of comparison tests that show you Television and Radio in a quick, simple way . . much easier to understand than just mere words in a book. The entire A.T.I. course with all above equipment is remarkably low in price and on terms arranged to suit you. It costs you nothing to thoroughly investigate. SEND Coupon Now!

A.T.I. TRAINING WITH COMPLETE EQUIPMENT IS AVAILABLE ON AMAZINGLY LOW EASY MONTHLY PAYMENTS

AMERICAN TELEVISION INSTITUTE
433 E. Erie St., Dept. RN-738, Chicago, Ill.

Gentlemen: Please send me your free book on Television and literature describing A.T.I. Training. It is understood that this is FREE. No obligation.

Name..... Age.....

...ress .....

..... State.....

GET THE REAL *Inside* FACTS ON TELEVISION