RADIO'S *Complete* MAGAZINE

RADIO & TELEVISION

AMATEUR RADIO Department

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RADIO — THE ARMY — AND YOU

How Radio Advances You — By Lieut. Myron F. Eddy, Ret.

RADIO HOOK-UPS Department

MARCH OF RADIO Department

RADIO PATENTS Department

TELEVISION NEWS Department

RADIO CONSTRUCTION Department

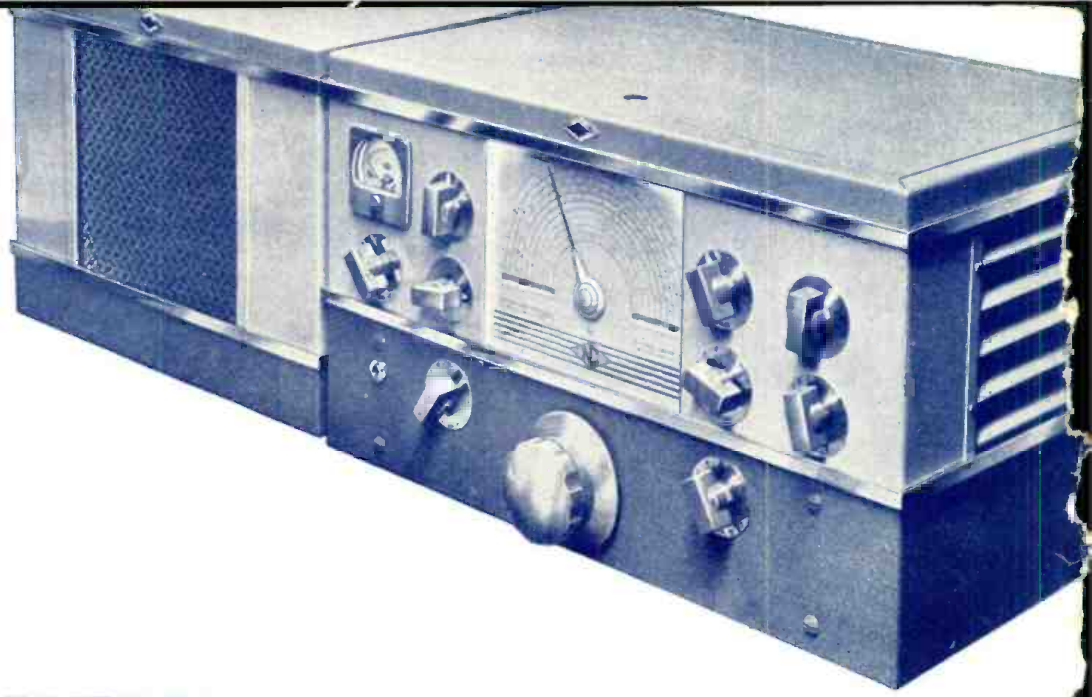
25¢
CANADA 30¢

HUGO GERNSBACK
EDITOR

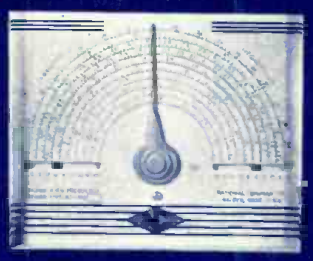
AMATEUR & EXPERIMENTAL RADIO JAN.

CONSTRUCTIVE RADIO ARTICLES 1941

THE NEW NC-200

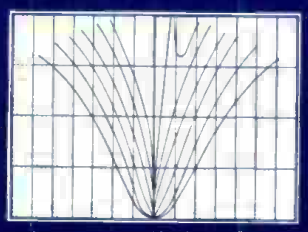


TEN CALIBRATED COIL RANGES



The NC-200 has ten calibrated coil ranges. Six of these ranges provide continuous coverage from 490 KC to 30 MC. The remaining four ranges cover the 10, 20, 40 and 80 meter bands, each band being spread out over the major portion of the dial scale. Each bandspread range is independent of the other ranges. Its calibration is fixed, it is tuned by the main tuning control and its frequency is read from the big sweep pointer on the dial.

WIDE RANGE CRYSTAL FILTER



An improved wide range crystal filter is used in the NC-200. Selectivity is adjustable in six steps, corresponding to total band widths of approximately 200, 1000, 2200, 4000, 5800, and 7600 cycles respectively for 10 to 1 attenuation. The phasing circuit has been given particular attention with the result that rejection ratios as high as 10,000 to 1 are available when the interfering signal is only a few hundred cycles from the desired signal.

MOVABLE COIL TUNING SYSTEM

The NC-200 employs the movable coil tuning system which has thoroughly proved its soundness on the NC-100. RF and Oscillator coils, together with their associated padding condensers, are mounted in separate pockets in a heavy cast aluminum shield. This shield moves bodily on a track, bringing the desired coils into operating position directly below the tubes and condenser, and taking unused coils out of the way. The shield is shown at the left without its heavy cast cover. Ranges are selected by the same knob on the front of the receiver that is used for tuning.

PORTABLE OR AC OPERATION

Typical of the refinement of detail in the NC-200 is the provision for operating standard AC models on batteries for emergency or portable use. All that is necessary is to plug in a battery cable in place of the dummy plug supplied with the receiver. This makes all necessary connections, and leaves the speaker and standby switch in operation. The B-supply filter is left in circuit to assist in filtering vibrator and dynamotor B-power units.

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NATIONAL RADIO INSTITUTE
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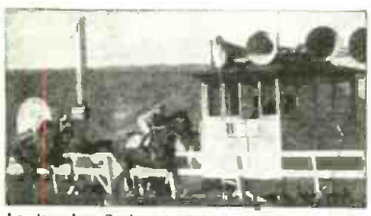
Get my sample lesson Free. Examine it, read it—see how clear it is, how easy to understand. Find out how I train you at home in spare time to be a Radio Technician. Do it now. Mail the coupon.

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

Set Servicing pays many Radio Technicians $30, $40, $50 a week, others hold their regular jobs and make $5 to $10 extra a week in spare time.



Loudspeaker System building, installing, servicing and operating is another growing field for well trained Radio Technicians.

Jobs Like These Go to Men Who Know Radio

Radio Broadcasting stations employ Radio Technicians as operators, maintenance men and pay well for trained men. Radio manufacturers employ testers, inspectors, servicemen in good pay jobs with opportunities for advancement. Radio jobbers and dealers employ installation and servicemen. Many Radio Technicians open their own Radio sales and repair businesses and make $30, $40, $50 a week. Others hold their regular jobs and make $5 to $10 a week fixing Radios in spare time. Automobile, police, aviation, commercial Radio, loudspeaker systems, electronic devices, are newer opportunity fields for which N. R. I. gives the required knowledge of Radio. And my Course includes Television, which promises to open good jobs soon.

Why Many Radio Technicians Make $30, $40, $50 a Week

Radio is already one of the country's large industries even though it is still young and growing. The arrival of Television, the use of Radio principles in industry, are but a few of many recent Radio developments. More than 28,000,000 homes have one or more Radios. There are more Radios than telephones. Every year millions of Radios go out of date and are replaced. Millions more need new tubes, repairs, etc. Over 5,000,000 auto Radios are in use and thousands more are being sold every day. In every branch, Radio offers opportunities for which I give you the required knowledge of Radio at home in your spare time. Yes, the few hundred $30, $40, $50 a week jobs of 20 years ago have grown to thousands.

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

The day you enroll, in addition to my regular Course, I start sending you Extra Money Job Sheets—start showing you how to do actual Radio repair jobs. Throughout your course I send plans and directions which have helped many make $5 to $10 a week in spare time while learning. I send special Radio equipment; show you how to conduct experiments, build circuits. My Course includes Television, too.

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This instrument makes practically any test you will be called upon to make in Radio service work on both spare time and full time jobs. It can be used on the test bench, or carried along when out on calls. It measures A.C. and D.C. voltages and currents; tests resistances; has a multi-band oscillator for aligning

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Act today. Mail coupon now for Sample Lesson and 64-page Book. They're FREE. They point out Radio's spare time and full time opportunities and those coming in Television; tell about my course in Radio and Television; show more than 100 letters from men I trained, telling what they are doing and earning. Read my money back agreement. Find out what Radio offers you. Mail coupon in an envelope or paste on penny postcard—NOW.

J. E. SMITH, President
Dept. 1AB3
National Radio Institute
Washington, D. C.

I Trained These Men

Chief Operator Broadcasting Station

Before I completed all the lessons, I obtained my Radio Broadcast Operator's license and immediately joined Station WMPC where I am now Chief Operator. HOLLIS F. HAYES, 327 Madison St., Lapeer, Mich.

$10 to $20 a Week in Spare Time

I repaired some Radio sets when I was on my tenth lesson. I really don't see how you can give so much for such a small amount of money. I made $600 in a year and a half, and I have made an average of $10 to $20 a week—just spare time. JOHN JERRY, 1629 Arapahoe St., Rm. 17, Denver, Colorado.

Former Truck Driver Has Own Radio Shop

Before taking your Course I earned about 17½ cents an hour as a truck driver. When I had completed 20 lessons I started service work. During the last two years I have made about $3,000 in Radio. I now own my own shop. KARL KELLY, 409 W. Calhoun St., Magnolia, Ark.

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I want to send you a sample lesson, "Broadcast, All-Wave and Television Superheterodyne Receiver Principles". It covers the basic interferences in superhets and how they are rectified. It brings out the importance of the preselector, mixed first-detector, local oscillator, intermediate frequency I.F. amplifier, tracking, peak and band pass adjustments, band switching and modification for adapting to Television reception. All subjects covered with special emphasis on servicing. You can get this lesson FREE. Just mail the coupon.

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RADIO & TELEVISION

The Popular Radio Magazine

HUGO GERNSBACK, Editor
H. WINFIELD SECOR, Manag. Editor
ROBERT EICHBERG, Television and Digest Editor

Januory — 1941
Vol. XI No. 9

In February Issue

F-M Transmitter and Receiver for the Amateur — new simplified design — Ricardo Muniz, E.E., and S. Morton Decker

A Compact High-Fidelity 20-Watt Amplifier—Harry D. Hooton, W8KPX

New Design of All-Wave Tuner—Herman Yellin, W2AJL

14-Tube Communications Receiver—Charles R. Leutz

A Bamboo Beam Antenna—R. M. Blanchard, W4FIC

UHF Receivers for F-M and A-M—S. Gordon Taylor

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TELEVISION NEWS

MISCELLANEOUS

Cover Composition by Hugo Gernsback and Thomas D. Pentz

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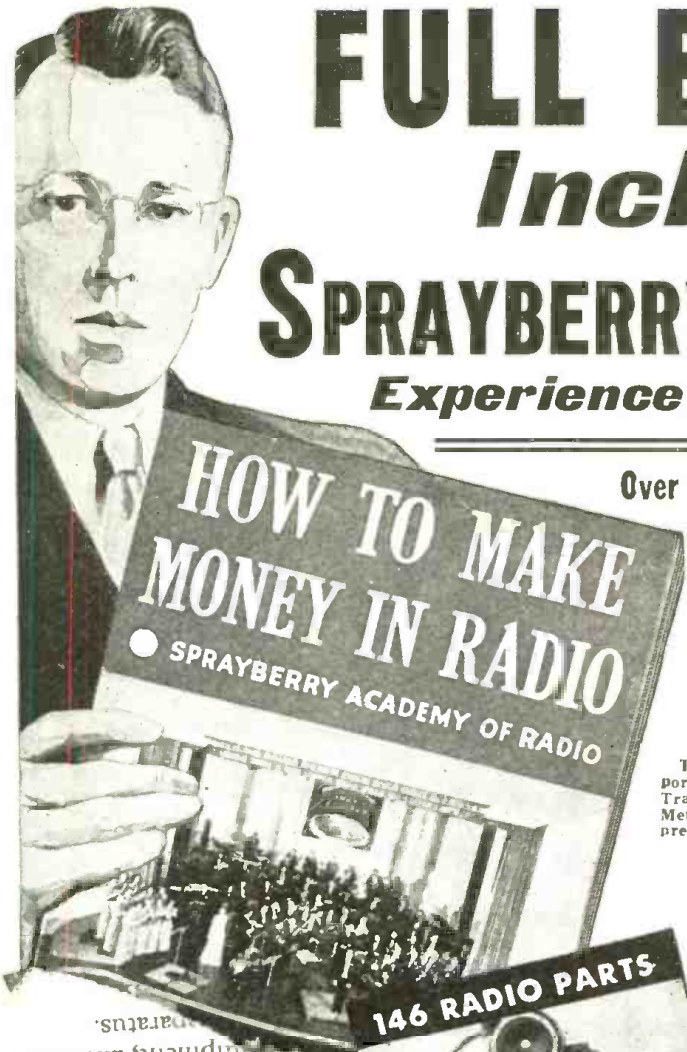

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RADIO WOULD HAVE MADE IT THE "MILD" WEST!

BACK IN THE DAYS when the stagecoach careened through the "wild west," highway bandits were the terror of travellers. Inadequate communications slowed reports of robberies, made capture of criminals difficult.

Had radio been available at the time, this lawlessness would not have flourished. Today, radio aids highway patrols and police everywhere in the important task of stamping out crime.

Radio today gives vital news to the world almost as soon as it happens. In making and keeping modern Americans the best informed people on earth, an RCA Service, the National Broadcasting Company, operates two nation-wide networks 35 hours a day.

Vitally important also is the role of R. C. A. Communications with its direct transmission to and from 43 countries, and between leading U. S. cities.

So that all America may keep tuned to the pulse of the world by radio . . . so that quality will be ever higher... prices ever lower...the RCA Laboratories continuously engi-

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RADIO CITY • NEW YORK

Editorial

RADIO KNOWLEDGE PAYS

By HUGO GERNSBACK, Editor

THE radio industry has become such a huge art that it is quite hopeless for the average individual to know everything that is going on in the many branches of radio.

As this is also an age of specialization, it is of paramount importance to those who wish to become identified with the radio industry, that they should make themselves letter-perfect in the particular branch in which they are most interested. Should you wish to become identified later on in any one division,—such as radio transmitters, radio tubes, radio broadcasting, radio receiver design, television, aviation radio, or several dozen others, it is of the utmost importance that you know all about this particular endeavor and make it your business to learn everything that there is to know about it in one way or another.

While it is necessary to have a general knowledge of radio in all its branches, this can at best be only superficial, and very few men can embrace the entire radio art today. It is much too big for that and far too complex—yet what this country needs today mostly is specialists. This can best be demonstrated in that branch of radio known as "radio amateurism."

For over two decades American radio amateurs went along unmindful of foreign strife and war. Suddenly the present emergency comes along when hundreds of thousands of young men will be drafted for national defense. It is quickly found that instead of the fifty odd thousand licensed radio amateurs, the Army, Navy and Aviation branches will require over 100,000 signaling men who not only know transmission and code, but who know signaling right from the ground up. It is one thing to know the code but quite another to know how to handle a rig—both transmitter and receiver—in theory and practice, how to put them together and, when either gets out of order, know how to hunt for trouble and eliminate it successfully. This is the kind of knowledge needed by men in the service, and these men cannot know too much. Particularly during war times does this hold doubly true, because then not only knowledge, but speed becomes the order of the day.

When I talk of "specialization" in any given branch, I mean just that, and I repeat that it is necessary to know *all* about it. Thus, for instance, the amateur who may know how to transmit and receive at a fast clip may not be a good radio technician. He might know the theory of radio but he may not be a practical radio man. If, let us say, he gets into the Army and has a chance for early promotion, he might be handicapped on account of deficient knowledge in technical radio matters pertaining to signaling, and this alone might disqualify him. That is the reason why I lay such great emphasis on the term "specialization." It means that you cannot be haphazard in your chosen work—*you must be letter-perfect* in it. I repeat it because it is so very important and so obvious, yet it is constantly being overlooked by so many otherwise ambitious young men who later on wonder why they have not advanced more rapidly.

If you wish to specialize—if you wish to get somewhere in your particular endeavor—you must leave no stone unturned to get the last ounce of knowledge out of your subject—theoretical as well as practical—all of which will, in due time, be of tremendous importance to you. Theoretical knowledge is, of course, important and you can get that from books, from radio courses, magazines and the printed word in general. Just as important is the practical end—whether in the field or at home makes little difference. You must constantly train yourself with both mind and hands and you must keep everlastingly at it. Even a single week of neglect will make itself felt, because during that time you may have overlooked a certain magazine or newspaper article which is often the information that you need most when you want it later on. You will say that all of this is difficult and a hard task. Very true, but there is nothing that you or anyone else can do about it. This is in the nature of things and something that cannot be avoided. Those who get to the top are the ones who strive incessantly and make great sacrifices to get there. Everything has its price and success is no exception to the rule.

In radio particularly, due to the huge expansion of the art and due to its great ramifications, the radio expert today is in demand everywhere—whether in the industry or in the Army. It is not easy to become an expert and it is not an easy road to travel to become one, but in the end it pays huge dividends.

What should be of particular interest to those who take radio seriously, is that there is one outstanding point to be considered. Of all endeavors, the radio art is perhaps one of the least costly in which to acquire knowledge—theoretical as well as practical.

Neither the theoretical learning nor the practical is expensive and you do not necessarily have to go to college to become a radio expert. Very frequently you can do it in your leisure hours at a cost that is low. Thus, the theoretical knowledge can be readily obtained through books, correspondence school courses, magazines, etc. The practical knowledge can also be so obtained, and if it cannot be done at home, it is possible to get a position in a factory or laboratory, if you offer to work as an apprentice without cost. This often appeals to the employer, who might take you on even at a minimum rate if you are persistent and show him that you want to get into the game badly enough. Remember, the expert is not worth his salt if he cannot sell himself and if he is not persistent enough to make others see that he has a sufficient knowledge in his chosen endeavor.

"WIRELESS POWER TRANSMISSION"?

(Cover Feature)

The possibility that homes may be lighted with power picked up from the air, as we now receive radio programs, is seen by Westinghouse engineers as a potential future development of the "Klystron," a newly developed tube which transmits power through space. The accompanying photograph shows I. E. Mouromtseff, a company research engineer, making some final adjustments on one of the tubes. The energy from such a tube may be focused like a light beam with the aid of a copper-lined horn.

A recent demonstration held in the company laboratories for a group of university deans and professors demonstrated the tube's ability to light electric light bulbs at a considerable distance. At the demonstration, visitors were given flashlights to which short antennas were connected and these were lit by means of the Klystron waves.

Other possible uses suggested by Mr. Mouromtseff were to supply ultra-short-wave heat for medical treatment, to increase the number of television channels, and to serve as airplane beacons. This tube was described at some length in a previous issue of RADIO & TELEVISION.

MORE FCC MAIL

The Federal Communications Commission keeps busy not only with regulatory work, but also in answering just oodles of letters from listeners who have complaints to make or "axes to grind." It explains that it lacks authority to help such persons as (1) those who do or do not want Father Coughlin on the air; (2) a Louisville man who complains about the "commercial" on a tobacco show; (3) the Cincinnati listener who worries that a certain show "might influence children against law and order"; (4) residents of Lowell, Mass., and Duluth, Minn., who want liquor advertising banned; (5) several persons in Baton Rouge, La., who want all but religious programs banned on Sunday; and finally (6) a Connecticut man who is angry because his receiver is not working properly.

The Commission also cannot supply the following items which have been requested: (1) A list of radio stations which issue membership cards to listening clubs; (2) a list of approved schools; (3) a certain radio script; or (4) program schedules.

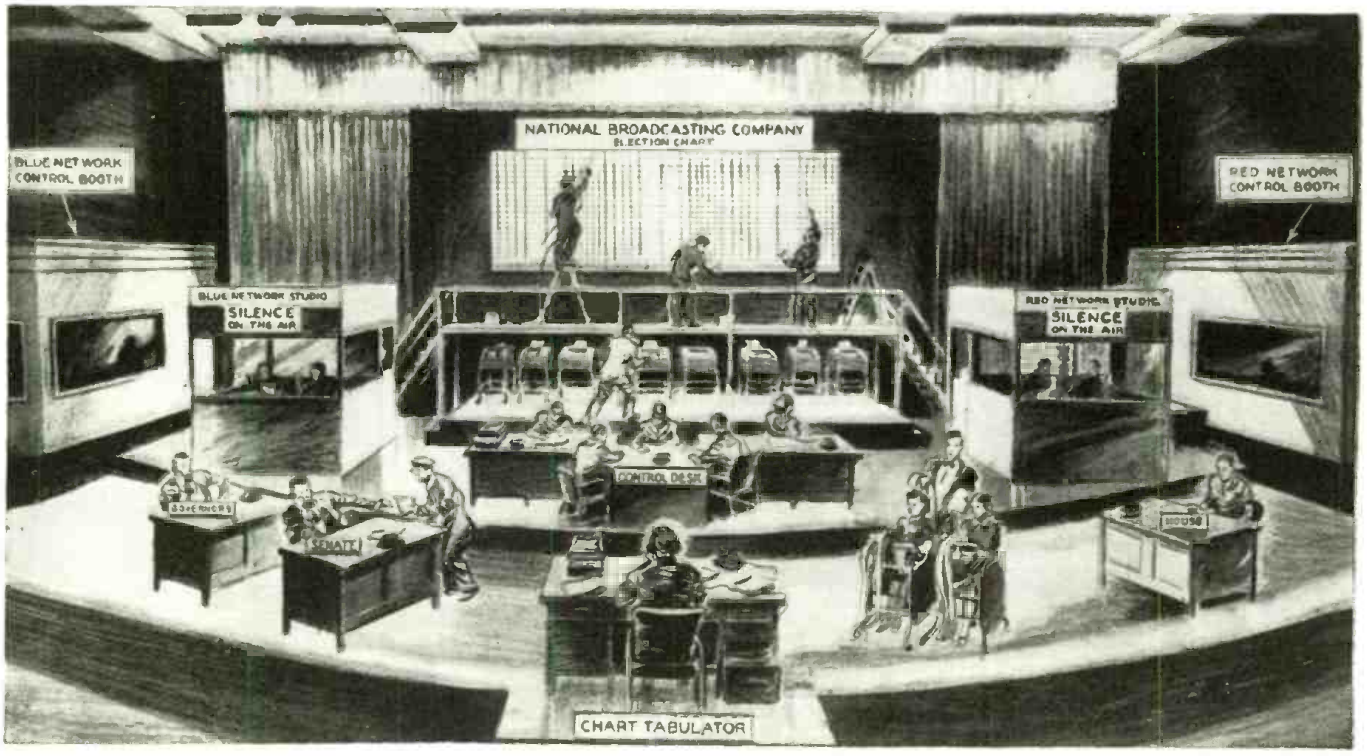
Incidentally, remember that *Jimmy* Stewart was given the set of call letters which were KH*JIM*? Now it might interest you to know that Charles Rogers, motion picture actor, has been given the license for his airplane radio. His call letters are KH*BUD*—his nickname is *Buddy*.

TELEVISION'S GALA COMEBACK

Television came back with a bang in the New York area for the last gasp of the presidential race. NBC went on the air with a remote control from Madison Square Garden to cover the address of President Roosevelt at the bang-up Democratic rally and followed a few nights later from the same point with the Republican rally starring one Wendell L. Willkie. (Remember him?)

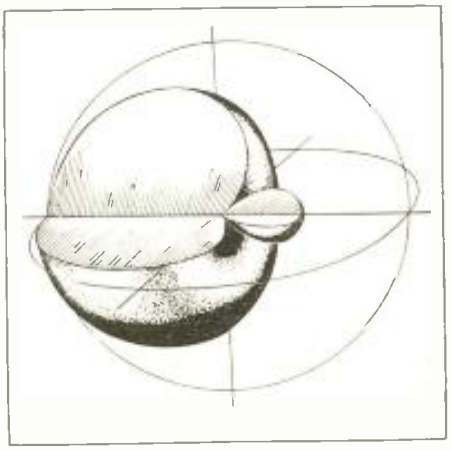
Although the television trucks had been torn apart for reconstruction, they were hastily re-assembled in a week less than the time which had been allotted for the job, in order to make these broadcasts.

On election night, television really went to town with the most comprehensive coverage of election returns ever put on the air. W2XBS commenced its program at 6:45 P.M. with Lowell Thomas and continued with election returns straight through until 1 A.M. Among the personalities featured in the show were Leo Rosenberg, who broadcast the world's first election returns on radio (and who is now Vice-President of Lord & Thomas); Graham McNamee, pioneer radio announcer; John B. Kennedy; Raymond Clapper; William Godwin; H. V. Kaltenborn; "Baukhage"; "Red" Barber, and, of course, that pioneer television announcer, Ray Forrest. But the star of the show by a long shot was an Associated Press teletype machine which ticked away merrily for the larger portion of the time, showing the televiewers latest returns as fast as they came over the AP tickers. Also interesting were various little gadgets and the map which the Television Department had prepared to make the coverage even clearer. The sketch below shows how NBC's largest studio was set up not only to put the election returns on the air with the least possible delay, but also to serve as a reception room for some 2500 members of the radio industry and other guests at the broadcast.



SIX-WAY DIRECTIONAL MIKE USES TWO SETS OF ELEMENTS IN SERIES

A *new directional* microphone known as 639B has been developed by an engineer of the Western Electric Co. Its internal structure combines in series the outputs of a moving coil and a ribbon microphone element. When a sound strikes this combination from the front, the output voltages of the two elements are in phase and therefore additive, but when the sound arrives from the rear, the phase of the ribbon element is reversed while that of the moving coil element remains unchanged, and the outputs tend to cancel each other. The photograph shows the external appearance of the microphone, while the drawing is a three-dimensional diagram showing the directivity pattern of this new unit. A quarter section is cut out to reveal the form of the surface. At any angle, the sensitivity is proportional to the length of the radius drawn to the center of the solid, as indicated by the crossed lines. The microphone has many applications for pickup. It may be used with great efficiency for speakers in a hall where a large audience is assembled when the sensitive side is directed at the speaker and the insensitive side toward the audience. It thus permits the voice of the speaker to dominate any applause or other manifestation from the audience.



CONTROVERSY OVER COLOR IMAGES ROCKS TELEVISION INDUSTRY

Charles Chaplin, comedian, saw a reel of color film televised on black and white and color receivers standing side by side in a CBS demonstration room. Mr. Chaplin, according to CBS, said, "The color television I have just seen is an American product and is a striking argument for democracy." The last phrase refers to a statement by Dr. Peter C. Goldmark that Nazi scientists had failed to produce color television and finally abandoned it as impossible. *(In Britain, however, John Logie Baird had demonstrated color images almost two years ago; here in the United States, Bell Telephone Laboratories had presented full color television more than ten years ago.*—Editor)

Mr. Chaplin is, however, quoted as saying that "color television is terrific" and concluding with, "I think that now that you have got color you can start television off on its right foot." However, other television engineers claim that, while color television may be suited to film transmissions, it will require such light intensity (and resulting heat) that in its present stage it will be impractical for indoor "live" pickups. They also criticized the use of the Goldmark color wheel and compared it to the obsolete scanning disk abandoned by all laboratories many years ago.

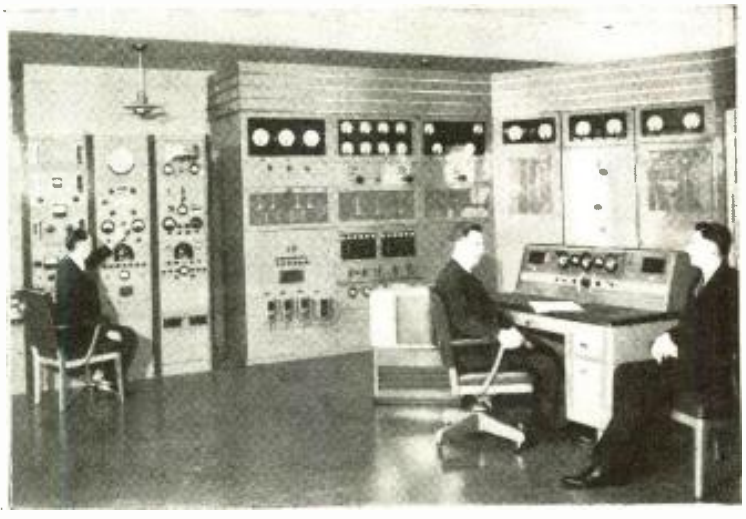
Color will probably be one of the subjects under discussion when the Federal Communications Commission goes into a huddle with the National Television Systems Committee early in January. Rumors are that the major change possibly to be made in television is that waves will be *vertically* polarized rather than horizontally polarized, as at present.

Interviewed in his office, T. S. Hutchinson, NBC television program director, pointed out that horizontal dipoles (aerials) are highly directional and are desirable when but one station is on the air, but that multi-directional vertical dipoles are far more practical when several television transmitters surround a point of reception. It is expected that the 441 line, 30 frame standard will be maintained although it is possible that the 525 line, 30 frame, or the 15 frame method with transmitted synchronizing pulse, may win out.

PIONEER STATION GETS NEW PLANT TO BOOST SIGNAL

WEAF, one of the oldest stations in the Eastern United States, has just built itself a handsome new home at Port Washington, L. I. One accompanying illustration shows the outside of the building, together with the basin used for the water supply employed to cool the tubes; the other shows the interior of the transmission room.

It is believed that the station location, on the north shore of Long Island and with direct over-water paths to Westchester County and Connecticut, will lay down a far stronger signal in densely populated Manhattan. Two quarter-wavelength antennas (seen in the background) will give the station's signal a slightly directional effect in the direction of this borough, which has frequently reported some difficulty in receiving the old WEAF signal strongly enough to over-ride local interference.



RADIO ENLISTS FOR NATIONAL DEFENSE AS FACTORIES ORGANIZE

Radio from research to assembly line is geared and moving as never before in its history to provide Uncle Sam with the most efficient and extensive communication system ever operated on land, sea and in the air.

The recent $7,605,773 order placed by the United States Army with the Radio Corporation of America was the largest order of its kind in the records of radio manufacturing. The industry is gearing the machinery of manufacturing to accelerate production of all types of radio apparatus. Vacuum tubes now are being turned out by the industry as a whole at the rate of 400,000 daily.

So vast has the radio industry become since the first World War that it is estimated military orders for radio equipment in 1940 will be *fifty to one* compared with 1917. It is pointed out that vacuum tubes in 1917 were limited in number and highly expensive, yet today more than 500 different types are manufactured at prices that represent only a fraction of those prevailing twenty years ago. Also during the first World War an aviator "just looked at the ground" to find his way or get back to his base. Today, radio provides him with a voice that travels far, with "blind" flying instruments, and with *direction finders.*

Further, development of auto radios, short waves, microwaves and broadcasting, unknown or little used during the old World War, are now powerful "weapons" in communication on land, sea and in the air. The massive alternators of 1917 have been replaced by the more efficient vacuum tubes that hurl spoken words around the globe. It was a real achievement in 1917-18 to toss dots and dashes across the Atlantic on long wavelengths. To a large extent, radio men confess, their activities must be couched in secrecy at this time, especially in regard to the development of secret communication. But they are quick to add, "national defense is our *No. 1* theme song."

In addition, through broadcasting and continued improvement of the American system, the public is being informed quickly of all new developments at home and abroad. Since broadcasting as a public service was a "by-product" of the first World War, such simultaneous contact with the populace was not possible when the A.E.F. was overseas. Also, today, radio is an important Pan-American link of friendship that helps the Americas to act *"all for one; one for all."*

The key to putting the United States far in the lead in radio is generally recognized as *research*, out of which it is expected to bring forth new instruments, if, as and when world peace lifts the curtain of mystery behind which the radio research experts are now at work.

Evidence of RCA's policy of "full steam ahead" is found in the recent announcement that the corporation has arranged with a group of banks to borrow $15,000,000 at 1½ per cent for five years, for expansion of research and production facilities to speed national defense orders of the Government.

Recognizing the vital role of communication in national defense, the radio companies last summer placed large orders for tool machinery and took steps to remove any possible "bottlenecks" long before actual orders were received. In the case of RCA, throughout the entire organization national defense is the "must" program bulletined as *No. 1* all the way from television research to manufacturing, from domestic broadcasting to international communication. It is no secret that the National Research Council at a time such as this calls in the experts of all fields, and that the RCA Laboratories have been enlisted to help the United States Government.

"As a leader in radio, we are conscious of our obligation to the Government in the speedy advancement of the defense program," said Meade Brunet, manager of engineering products, who is also in charge of the company's Washington office. "For more than six months we have been training additional personnel, while expanding research and production facilities in a program that has added considerably to employment.

"The program was carefully mapped last June," said Mr. Brunet, "and we are following it to the letter. Thoroughly coordinated all along the line, it has entailed an expenditure of several million dollars in tools and in expanding manufacturing space. We recognize defense as self-preservation, and that is why plans were so elaborately made early in 1940."

"FM" CONTINUES SPREAD IN MIDWEST

Public acceptance of frequency modulation in the Duluth, Minnesota, area has exceeded expectations, according to W. C. Bridges, manager of Station W9XYH. The picture herewith shows C. B. Persons, chief engineer, at the controls of the W9XYH and WEBC transmitter room, which utilizes 250 watt General Electric apparatus for FM that has been in operation since early March, 1940. Reports are that perfect reception day and night is heard 40 miles south of the station, where two AM stations are inaudible. W9XYH is also heard in the Mesabi Iron Range about 60 miles north.

According to the latest reports from the FCC, 15 radio stations have been authorized to engage in frequency modulation broadcasting on a *commercial* basis as soon as they are equipped to do so. The stations are located in New York City, Binghamton and Schenectady, New York; Detroit, Michigan; Los Angeles, California; Baton Rouge, Louisiana; Salt Lake City, Utah; Chicago, Illinois; Mt. Washington, New Hampshire; Milwaukee, Wisconsin; Evansville, Indiana; and Columbus, Ohio. Thirty-five other applications are being considered.—*Photo courtesy G. E. Co.*

DON'T FORGET NEW FREQUENCY ALLOCATIONS

On March 29th—just a few short months off—862 radio stations now operating in the standard broadcast band (550 to 1600 kc.) in the United States will be affected by allocation rulings by the FCC.

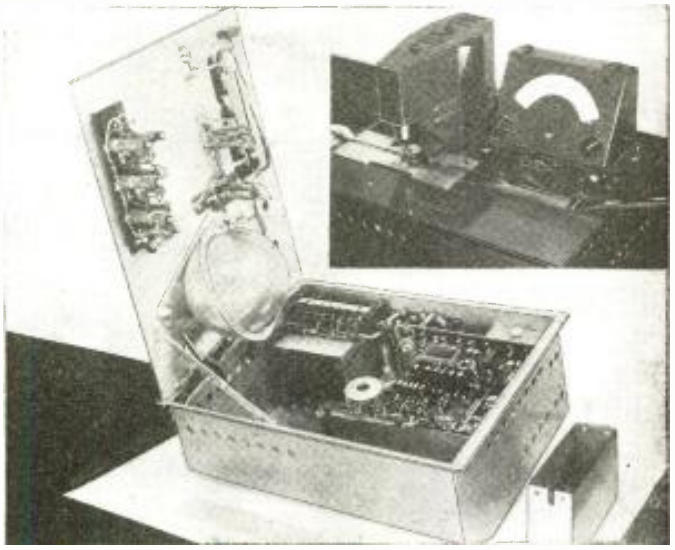
Here is a summary of the shifts that will be made: Stations operating between 740 and 780 kc. will move up 10 kc. Stations from 790 to 870 kc. will move up 20 kc. Stations from 880 to 1450 kc. will move up 30 kc. Clear channel stations will shift from 1460-1490 kc. to 1500-1530 kc. Local stations now on 1500 kc. will move to 1490 kc. Stations between 550 and 720 kc. will remain unchanged.

All this means to the average radio listener is that, if his set is manually tuned, he may have to tune to a slightly different position on the dial. If it is tuned with push buttons, some of the buttons may have to be reset. It is believed that the new changes in frequency will do much to eliminate interference between stations in the United States and in Canada and Mexico.

Approximately 777 of the United States 862 stations will be affected, those moving up 10 kc. will number 20; those moving up 20 kc. will be 26; those moving up 30 kc. will be 614; those moving up 40 kc. will be 25 and those moving down 10 kc. will be 64, while 28 will have irregular shifts. Then everything will be hunky-dory until the next shake-up.

MACHINE MEASURES FILM BEHAVIOR

A *gadget* known by the cute appellation of "integrating-sphere densitometer" has been developed by the radio wizards of the Electrical Research Products, Inc., to tell motion picture technicians just how film will behave during the development process. In principle it is similar to the exposure meters used by amateur photographers but is far more sensitive and accurate. Not only does it relieve eye strain on the part of the photographic technicians, but also enables them to get more accurate results. The pictures herewith show the device in use and give a glimpse of its innards.



The "works" of the integrating - sphere densitometer. Inset:— the instrument ready for operation.

FCC TAKES UP DIATHERMY

As *this issue* goes to press, the Federal Communications Commission is conducting a hearing on medical short-wave radio apparatus used to generate artificial fevers and to produce local heat. It is hoped that certain frequency bands will be specifically allotted for the use of such apparatus, which often causes interference with the radio receivers if it is permitted to operate on an adjacent channel.

CLUB MEETING CONDUCTED VIA TELEVISION

"*Accidentally*" delayed in mid-town Manhattan when he was to have opened a meeting of the Radio Club of America in session at Pupin Hall, Columbia University campus, John L. Callahan, vice-president of the club, took advantage of facilities under construction at the Allen B. Du Mont Television Station, W2XWV, in New York City, and conducted the first portion of the meeting *via television!*

A routine demonstration of television images had been scheduled for transmission to the Radio Club meeting in advance, but the conduct of the session by means of television came as a startling surprise to the assemblage of radio men gathered at Pupin Hall.

Since the sound unit of W2XWV is not as yet completely equipped, a telephone line was connected to Pupin Hall and an amplifier permitted Mr. Callahan to address the several hundred men in attendance. Mr. Callahan ventured the prediction that long-range conduct of meetings in the future *via television* may yet come to pass.

He then introduced Dr. Thomas T. Goldsmith, Jr., director of research for the Du Mont Laboratories, who was present at the meeting. Dr. Goldsmith delivered a technical paper.

Dr. Goldsmith outlined the flexibility of the Du Mont synchronizing signal characteristics and how they can be applied to images transmitted at 441 lines at 30 frames, 525 lines at 30 frames, 343 lines at 60 frames for color television, and at 625 lines at 15 frames with the Du Mont persistent or "memory" tube.

He emphasized the multiple advantages inherent in this flexible television system, claiming that with it obsolescence of receivers is completely removed, standards can be altered at any time without necessitating changes in receivers and, highly important, the system permits incorporation of color television, a factor which looms as a possible future adjunct to the electronic visual art.

TELEVISION BOOMS IN HOLLYWOOD WITH 525 LINES

(Cover Feature)

According *to* Konstantin Kalser, noted Hollywood photographer, newsreel cameramen are the most sought after for television operation because of their almost uncanny accuracy in following action with a camera. As a television show cannot be cut, once it is on the air (like a movie is

cut) and as retakes are impossible, the cameramen must have thorough experience in getting "takes" right the first time. On the cover, Nelson McEdwards, veteran newsreel man, is seen focussing a telephoto television camera with a special non-flare lens.

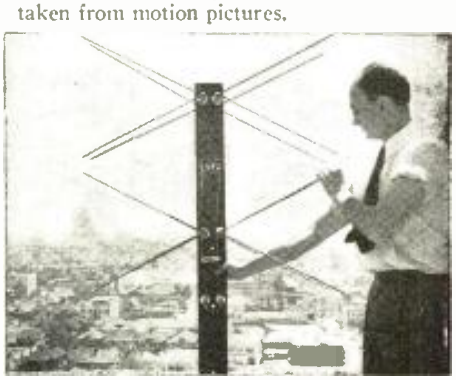
The picture above shows a view of the Don Lee monitoring room in Hollywood. Here the engineer controls the visual portion of the program. In front of him is the control panel which consists of three television receivers as the main constituent. Two of these are directly connected by wire with each of the two television cameras. The other one receives the program over the air exactly the way some 500 home receivers within the telecasting limits of the Don Lee Television System do. The engineer also focuses the cameras by remote control, and switches from one camera to the other at certain intervals, to change the picture from a *long shot* to a *close-up*. Often two or more sets are built on the same stage and, by simply turning the camera from one to the other, the locale of the action is changed.

The Don Lee station has pioneered in many television techniques since that December 23, 1931, when it first went on the air over W6XAO with an 80-line image. It has televised the "Soapbox Derby," the "Tournament of Roses" and other notable events. It transmits fights from the Legion Stadium and this is one of the most popular of its regular broadcasts.

In addition to its well equipped studios the station, under the direction of Thomas S. Lee and Harry R. Lubcke, maintains trucks for the transmission of images from outside events and remote points. From these trucks the images are picked up by the hayrake antenna (illustrated below) located on top of the Don Lee building and relayed from there into the stationary amplifier (in the transmitter room) by means of co-axial cable.

From the transmitter, the amplified signals are retransmitted from another antenna on the same roof while the associated sound is sent over a third antenna. The station transmits its images on the 45.25 megacycle band and the accompanying sound on 49.75 megacycles. Transmission detail has recently been shoved up to 525 lines but the standard, 30-60 frames, is used.

Most of this station's programs are specialty numbers, and recently the first musical show in true Hollywood style was telecast. But, in addition to its live talent shows, the station is equipped to send out images taken from motion pictures.



Left—Here we are at the "reception center." Here's where you sign up and get lined up for proper placement. Then the Sergeant is going to give you an intelligence test, after which you'll have a chance to show just how good a radioman you are and whether you need more code practice or some special schooling in theory and testing. Center—"You're in the Army now"—and your uniform is important, it must look well on you! So the tailor fits it carefully. You'll look better and feel better. Right—You're a recruit now, you've got your outfit of clothing and you're on your way!

Radio—The Army—and YOU!

Lieut. Myron F. Eddy, U.S.N. Ret.

● SO you're in the Army now—or think you may be soon—and you are definitely "radio" and you want to know what you can get out of a year's service. The answer is, "Plenty!" The Army needs radiomen. So does the Navy. If that is your background and you enlist or are selected for military service, tell the Sergeant. He'll tell the Lieutenant and the Lieutenant will tell the Captain, for the Major wants to know *who's who* and *what's what*, and if you can *handle radio in any way* that's fine for this new highly selective Army we're getting. It's fine for you, too! If you're thinking about "joining up" before your number comes up, and have something on the ball when it comes to radio, remember this: *a year from now there will be a lot of new men coming in; the time to get a "rate" is THIS year.*

For the benefit of our readers, RADIO & TELEVISION has commissioned me to find out just what happens to you *when* and *if* you are inducted into the service.

I found out this at once: whether you enlist or are selected, you will be given an opportunity to demonstrate your radio talent and then you will be detailed to duties that will give you an opportunity to develop this talent.

Here's another favorable report: After you have completed recruit training, which is the same for all hands and helps a man to familiarize himself with service conditions, every recruit will receive equal consideration for admittance into service radio schools.

Suppose you are one of a group of 1000 new men, just selected for service. ALL of these men have been SELECTED—hand picked from a long list of available men, men of every degree of education and training in every walk of life. Remember, it is known ahead of time how many clerks, buglers, cooks, radiotelegraph operators, etc., are required within this specialist group. The selection board carefully puts on record all data concerning the selected man's capabilities along these occupational lines.

We'll say you are a licensed radio amateur and the man in line ahead of you is a commercial operator; you will see him tagged as a potential corporal or sergeant in the signal corps. Or, if he expresses a preference for the Navy he will be interviewed by some Navy officers and probably sent to sea after a brief period in "boot camp" and a short stay in some class in Naval Communications.

Whether you're just a radio fan or a fully licensed Ham—of what advantage is this to you in the Selective Draft, or in the event that you should enlist? So many readers asked this question that the Editors commissioned Lt. Eddy, author of numerous books on the subject of military radio, to prepare an up-to-date comprehensive article on the subject. Whether you intend to go into military service or not, this article on what radio can do for you, will prove of unusual interest.

If You Can Do 15 Words Per Minute

Now, it's your turn! If you can do fifteen words a minute you may be sent to an Army Signal Corps school for a short time until you can do twenty, then made a Corporal or given a *specialist's* rating with an advance in pay. You are going to have to show some ability as a leader of men and some theoretical knowledge of radio to make this rate, *but the rate is there*, waiting for you from the time you put on a uniform.

The next man up says he is an amateur but has never secured a license. After he gets into recruit camp he is called up with others and takes an operating test, then a quiz on theory. If he shows up well he'll also go to school and will be given three months to acquire the speed necessary for a rating. It may be that in this same general class there will be found servicemen, experimenters, radio set-builders and the like. They represent a type that will be given an opportunity to qualify for any number of jobs requiring mechanical skill.

These men will first be given a mechanical aptitude test. It may look silly at first, this test; you put a lot of odd shaped blocks of wood into holes that they fit. Then you fill out blanks on a paper as rapidly as you can. The answers are easy IF you know tools and mechanical equipment. If you've never worked in a shop you'll not think this test so silly; you'll find it hard. The main point is that you'll be assigned a place among the other men in exact accordance with how well you have done on these things in comparison with their efforts.

Radio Men May Classify as "Specialists"

We must remember this in considering this new type of Army: the "line" officers which includes the executives, the drill masters, the discipline "non-coms," will be of the regular service, but the "specialists" like yourself, who repair and operate a radio set will all come from among a group of ex-civilians like yourself, some pretty well advanced in radio, some just getting started. The Army doesn't know yet just what it is going to get in the way of specialists. Once inducted, everyone will be on a competitive basis for the good jobs. If a man beats you out for a corporal's job, you will have discovered—if you've been with him—that he's a faster, more experienced operator than you are; he's some one you can turn to for help and guidance

Left—You're working with another radioman, a Signal Corps radioman, and he is going to give you a chance to decide for yourself whether or not you can handle his work.
Center—Here you get "code!" You copy in plain English and cipher. You send to yourself, to other soldiers and to your instructors. Later on you learn to use a "mill." Finally you get to be a good operator—as good as they come.
Right—You're a "walkie-talkie man" now—a full-fledged radio operator in the field. That pack contains both transmitter and receiver.

professionally, if he makes Technical Sergeant. This means that your year's service is going to build you up in a professional way; you'll go in as an amateur and come out with a commercial ticket if you want that.

You May Fall into One of 3 Groups

Readers of RADIO & TELEVISION probably fall within three groups: 1. Operators, both commercial and amateur; 2. Servicemen; 3. Experimenters (potential operators and radio repairmen). All of these men will be termed "specialists" in the Army. Here's the way one West Point instructor* explains "specialist":

"The term *specialist* in its military meaning does not indicate, as it does in civilian terminology, that the individual is particularly outstanding in his profession or trade. It simply means that he has a trade or skill useful to the Army, above and beyond the basic military requirements demanded of the buck private. For his extra qualification he receives extra pay. The bugler, for instance, usually has a rating which gives him from $3.00 to $10.00 extra per month. The cooks, mechanics, clerks, and so forth, come under this group, which we shall call the *usual* specialists.

"Rated higher than the usual specialist because of their technical education and scarcity are the *unusual* specialists, such as topographic draftsmen, radio operators, instrument repairmen, and photographers.

"The *unusual* specialist will be the one sent to the replacement centers from the first group inducted under the Selective Service Act. There will be too great a demand for good radiomen to hold them in an enlisted replacement center. Most of them will receive their basic and disciplinary training as soldiers in *unit training centers*.

"First, at the replacement center, the unusual specialists will be given whatever basic military training is considered necessary for their understanding of the branch to which they will be assigned. Then follows a *one* to *three months*' course in their *occupational specialty*. After this, the radioman will be assigned to duty with troops."

Modern armies are made up of specialized teams, or branches, which have different functions, use different weapons, and apply different tactics. The combat branches—the arms that collectively make up the "line" of our Army—are the Infantry, Cavalry, Field Artillery, Coast Artillery Corps, Air Corps, Corps of Engineers, and Signal Corps.

As a radioman you'll probably elect duty in the Signal Corps where 69% of the personnel are specialists. You'll be classified at the reception center where you first report for duty as "skilled," if you have a commercial license, or the equivalent serviceman's standing, and "semi-skilled" if an amateur or serviceman's helper. What you'll want to do next is to qualify for a specialist's rating. Their pay is shown in Table 1. Please note that this pay is in addition to that of your rank. It is evidence of your professional skill. You can be disrated by your commanding officer for either military or professional delinquencies.

Chances for Promotion

Now as to promotion. One earns promotion in a military outfit as the result of service. The first year's service is devoted mostly to learning HOW to serve. Selected men will get a lot of training, not much service in the field. This is true of the man who enlists for one year. Naturally the program and plans for handling these men must be different than for the three year regular, because the whole idea back of this selective service plan is to build up a potential war-time army as fast as possible. The pay of the various grades for first enlistment are shown in Table (See below).

About *enlisting* instead of waiting to be *drafted*. If a man expects to serve his year sooner or later, and wishes to do so at once, he may enlist for *one year* in any branch of the services in which vacancies exist. As a matter of fact the Navy, Marine Corps, and Army Air Corps expect to keep full up from among this group of volunteers who feel they possess special qualifications or a desire for these specialized branches. Unless the draftee is a pilot he probably will not find a vacancy in the Air Corps. Even a radio operator who is drafted may find it hard to get into the Air Corps.

Army intelligence, trade and aptitude tests are very important. No matter how you enter the service, the various tests given you at the start influence your career right from the beginning. All men are rated according to their intelligence examinations in the following categories:

Grade 1. Very superior intelligence. About 7 men of each 100 earn this rating.

Grade 2. Superior intelligence. About 24 men earn this rating.

Grade 3. Average intelligence. About 38 percent of the soldiers are so classified.

Grade 4. Inferior intelligence. About 24 percent of the men fall in this group.

Grade 5. Very inferior intelligence. This remaining group (7%) will have to be discharged or placed on labor assignments.

TABLE 1
ARMY SPECIALISTS' EXTRA PAY

Rating	1st Class	2nd Class	3rd Class	4th Class	5th Class	6th Class
Monthly rate	$30.00	$25.00	$20.00	$15.00	$6.00	$3.00

TABLE 2
MONTHLY PAY OF ENLISTED MEN

Navy—	Chief Petty Officer	Petty Officer 1st Class	Petty Officer 2nd Class	Petty Officer 3rd Class	
Army	Master Sergeant $126.00	Technical Sergeant* $84.00	Staff Sergeant $72.00	Sergeant $60.00	
Navy— Army—	Corporal $54.00	Seaman 1st Class Private 1st Class $36.00		Seaman 2nd Class Private* $30.00	

The monthly base pay of enlisted men with less than four months' service during their first enlistment period, and of enlisted men of the seventh grade, whose inefficiency or other unfitness has been determined under regulations prescribed by the Secretary of War, shall be $21.00. Apprentice seamen (recruits in training at "boat camp") also receive $21.00 per month.

*Wm. H. Baumer, Jr.

A man's rating furnishes a fairly reliable index of his capacity to learn, to think quickly and accurately, and to analyze a situation. It indicates to a certain extent the state of mental alertness and shows his probable ability to understand orders and instructions. Schooling has little influence on such tests.

By this test of general intelligence, the men are given an immediate and dependable classification which will aid in discovering those eligible for advancement, special training, and special duties. Conversely, it will show up those inferior persons who are suited for selected assignments or who must be eliminated as a burden or menace to the service. Normally, in making assignments to permanent organizations in the Army, it is important that each unit have its proportion of superior, average, and usable inferior men, as rated in the intelligence tests.

Four types of aptitude tests have been developed. These are the *oral*, *picture*, performance, and written.

(a) The oral test is a list of questions pertaining to a particular job.

(b) The picture test contains pictures of the tools or apparatus used in the occupation, and the applicant is asked to name them, and describe their use. An electrician, for instance, is shown the parts of an electric motor and asked to name them.

(c) The performance test involves use of the tools and materials of the occupation and the applicant is asked to make a specified product. The applicant is given a *grade* on his work in this test. Typing applicants are given the standard exercises.

(d) The written tests may consist, for example, of a list of questions with three or four answers shown, and the applicants are asked to check the correct answer.

These tests and all the information on the soldier's qualification card are considered in classifying him: schooling, age, civilian experience, military training, firm worked for, leadership, intelligence, licenses held, and so on. If you're thinking of joining the service you should talk these things over with some officer NOW.

$8,000,000 TO SPEED UP TELEVISION

● DEVELOPMENT of television to a workable unified system is being speeded by an aggregate of $8,000,000 which has been budgeted for that purpose by some two score individuals and firms which, to date, have been authorized by the Federal Communications Commission to engage in such practical research and experimentation on a nation-wide basis.

Expenditure of more than $3,000,000 is proposed by 10 television projects which received Commission approval on November 15th. Two of these grants are to the Hughes Production Division of the Hughes Tool Company, which has $2,000,000 available for stations in Los Angeles and San Francisco. The establishment of Howard R. Hughes proposes to experiment in program production development in cooperation with Hughes Productions of Hollywood; study studio lighting effects; seek improvement of television transmitters, cameras, and synchronizing generators; test transmission of various numbers of lines between 421 and 525; compare different types of synchronizing signals, and try FM (frequency modulation) for the sound accompanying the pictures. In both cities the Hughes concern will operate on Television Channel No. 2 (60,000-66,000 kilocycles) with 10 kilowatts aural and visual power.

At the same time the Commission authorized like experimental operation for five other Los Angeles applicants:

Columbia Broadcasting System, Inc., to operate on Channel No. 8 (162,000-168,000 kilocycles), 1,000 watts aural and visual power; for the purpose of transmitting programs to ascertain public reaction and otherwise conducting a program of research in Los Angeles in conjunction with that of its New York television station.

Earle C. Anthony, Inc., to operate on Channel No. 6 (96,000-102,000 kilocycles), 1000 watts aural and visual power; to study the relative merits of horizontal and vertical polarization in the Los Angeles area, with particular study of the effect of ignition and diathermy interference, and transmission over salt water, to Catalina Island.

Leroy's Jewelers, to operate on Channel No. 10 (186,000-192,000), 1000 watts aural and visual power; "to further improve the quality of pictures transmitted by television from the standpoint of reception quality and to determine the system of television transmission which will produce the best results for widespread use from a visual and optical standpoint."

May Department Stores Co., to operate on Channel No. 12 (210,000-216,000 kilocycles), with 1 kilowatt aural and visual power, for general research and experimentation in the Los Angeles area.

Television Productions, Inc., a subsidiary of Paramount Pictures, to operate a television relay station on Channels Nos. 13 and 14 (234,000-240,000; 240,000-246,000 kilocycles), 250 watts visual power, to supplement television broadcast station W6XYZ, also in Los Angeles, for which the applicant has a construction permit. The latter, using Channel No. 4 (78,000-84,000 kilocycles), proposes experimentation with the "DuMont standards".

In addition, the Commission granted stations to New York, Chicago, and Manhattan, Kans., as follows:

Metropolitan Television, Inc., New York, to operate on Channel No. 8 (162,000-168,000 kilocycles), 1 kilowatt aural and visual power; to develop program techniques for determining public tastes, including the use of two television theaters where daily programs will be projected for free public viewing. This applicant is associated with two department stores, Bloomingdale Bros. and Abraham & Straus.

Columbia Broadcasting System, Inc., Chicago, to operate on Channel No. 4 (78,000-84,000 kilocycles), 1 kilowatt aural and visual power; to participate in CBS television research by developing data on Chicago conditions that may assist in the ultimate determination of polarization and synchronization for a national service.

Kansas State College of Agriculture and Applied Science, Manhattan, Kans., to use Channel No. 1 (50,000-56,000 kilocycles), 100 watts aural and visual power; to determine propagation characteristics, study horizontal and vertical polarization, and experiment with various synchronizing systems using various numbers of lines and frames.

The Commission recently designated Monday, January 27, as the time to receive a formal over-all progress report from the full committee. Members of the Commission plan to visit the New York area on January 24 to see late television developments firsthand prior to this conference with the National Television Systems Committee.

An investment of $5,000,000 is represented in previous television authorizations by the Commission. This list, which shows wide distribution of facilities, includes Balaban & Katz Corp., Chicago; Bamberger Broadcasting Service, Inc., New York; Columbia Broadcasting System, New York; Crosley Corporation, Cincinnati; Allen B. DuMont Laboratories, New York, Washington and Passaic, N. J.; Don Lee Broadcasting System, Los Angeles, Hollywood and San Francisco; First National Television, Inc., Kansas City, Mo.; General Electric Co., Schenectady; General Television Corporation, Boston; National Broadcasting Co., New York, Philadelphia and Washington; RCA Manufacturing Co., Camden, N. J.; Philco Radio & Television Corporation, Philadelphia; Purdue University, West Lafayette, Ind.; Radio Pictures, Long Island City, N. Y.; State University of Iowa, Iowa City; WCAU Broadcasting Co., Philadelphia; Zenith Radio Corporation, Chicago, and The Journal Co., Milwaukee, Wis.

"DIRECT PICK-UP" IN COLOR TELEVISION ACHIEVED

● DR. PETER C. GOLDMARK, CBS Chief Television Engineer, revealed to the joint Fall meeting of the Institute of Radio Engineers and the Radio Manufacturers Association at Rochester, N. Y., that *direct pick-up* in color television has been achieved experimentally in the Columbia Broadcasting System's laboratories.

While developmental work on direct pick-up for full-color television has been under way at CBS for some time, this announcement was the first public indication that the radio network's theories on direct pick-up had been verified. This announcement removed one of the principal obstacles from the path of color television.

"Direct pick-up of full color television," Dr. Goldmark said, "has definitely graduated from the drawing board and formula stage, and appears to require only straightforward engineering effort."

With the particular equipment used in his experiments, no more intense light level was required for color pick-up than has been needed for black and white equipment in the CBS studios, Dr. Goldmark added. Although it is probable that with the same kind of equipment, color pick-up will require more light than if black and white were picked up alone, the amount of light needed does not appear to present a problem.

Dr. Goldmark said his staff of engineers already is constructing equipment with which it is hoped laboratory demonstrations can be given for the Federal Communications Commission, the National Television Systems Committee and the press.

"The results of our experiments," Dr. Goldmark declared, "are most encouraging and augur well for the complete practicability of full color television. But understand—we are still in the laboratory."

4 Star Performers!

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MODEL "435"

An outstanding performer on all bands. 6 tubes, electrical band spread, ceramic coil forms, BFO, AVC, built-in 6½ inch speaker and iron core IF's. Tunes 540 KC to 43 MC in four bands. The finest low priced receiver available. **$29.95**

MODEL "436"

7 tubes. Contains all features of Model 435 but adds noise limiter, flywheel inertia tuning controls and micrometer band spread dial. **$39.95**

MODEL "437"

9 tubes. Provides RF preselection, 2 IF stages, crystal filter, noise limiter, electrical band spread, built-in speaker and other important features. A top performer. **$54.50**

(With Crystal $62.00)

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Quality at a price that isn't "loaded" will always command a buyer's attention. That's why HOWARD Communication Receivers sell in steadily growing volume. Every HOWARD Receiver is truly a triumph of design, performance, beauty and engineering craftsmanship—each developed to meet the exacting demands of today and tomorrow.

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HOWARD RADIO COMPANY

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America's Oldest Radio Manufacturer

Building Multi-Range Meters, a Simple Task for Radio Man

● AS *The Australasian Radio World* points out, a multi-range meter is nothing but a sensitive milliammeter with various resistances connected in series or parallel. With the resistance in series, the instrument is a voltmeter; if in parallel it is used as a milliammeter or ammeter. The article suggests that the experimenter secure a good meter which has a full scale deflection of one milliampere and has low internal resistance.

Most 0-1 milliammeters have an internal resistance of about 30 ohms, which is indicated by R in Fig. 1. If S in this figure is 30 ohms, the meter will read ½ ma., when 1 ma. flows as half the current will go through R and half through S. Thus the range of the meter has been doubled, for full-scale deflection will indicate 2 ma.

A formula for calculating shunts follows: Let the resistance of the shunt be S ohms, the main current I ma., and the branch currents I_1 and I_2. With S across it, the meter will measure a current N+ full-scale deflection. As $I = I_1 + I_2$, and $N + I_1 = 1$ we may substitute for I in the first equation: $I_1 (N-1) = I_2$. Substituting for I_2 from this equation we get

$$S = \frac{R}{N-1}.$$

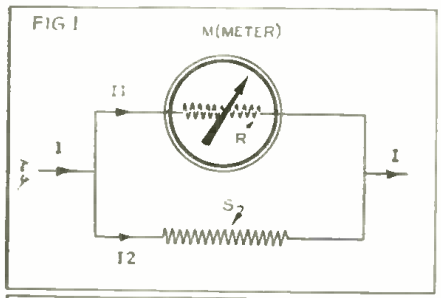
In measuring voltages the circuit shown in Fig. 2 is used, where R equals the resistance of the meter and R1, the resistance of the series resistor. If E is the maximum voltage to be measured, the current $I = \frac{E}{R + R_1}$ and as I = 1 ma. in this meter (or 1/1000 ampere) the final formula is

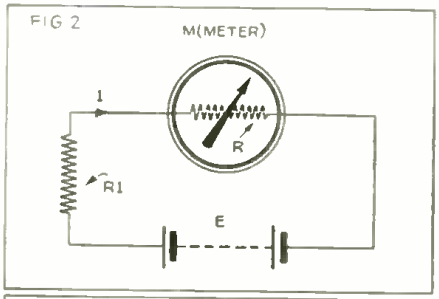
$$R + R_1 = 1000\ E.$$

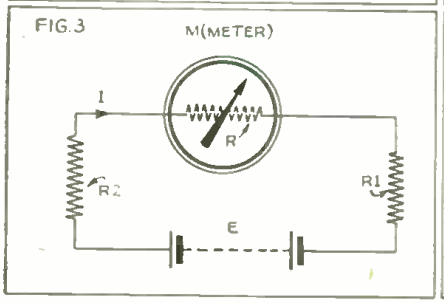
Fig. 3 shows how the apparatus is set up as an ohmmeter. The formula used is $I = \frac{E}{R_1 + R_2}$ in which R_2 is the unknown resistor being measured and R_1 is the limiting resistor.

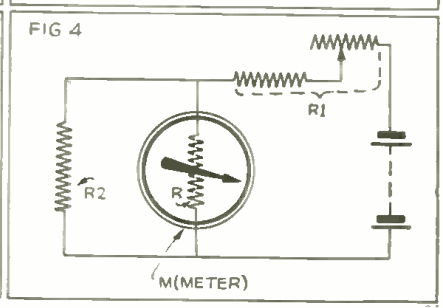
A means of measuring low resistance is found in Fig. 4. In this case the test prods are shorted and the resistance R_1 adjusted to give *exact* full-scale deflection. R_2 is then shunted across the meter as shown, diverting part of the current. The value of R_2 is calculated from the formula $R_2 = \frac{R + I}{I\ max - I}$. In this formula R is the meter resistance, I is the current reading, and I max. is the full-scale deflection current.

It will, of course, be most convenient if a home-made meter of this sort is calibrated against the standard, which will obviate the need of calculations.









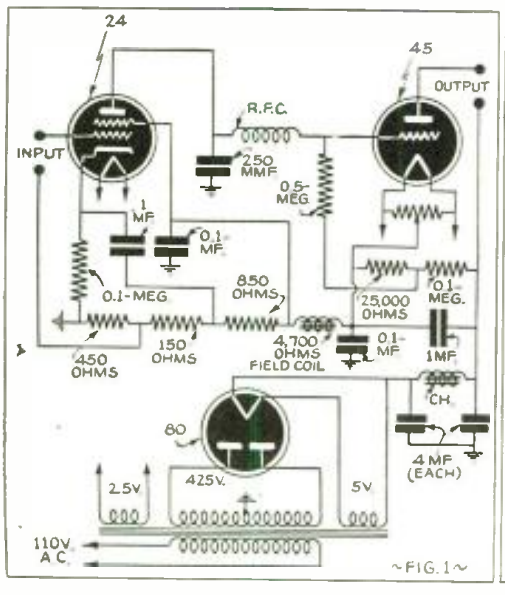
Direct-Coupled Circuits

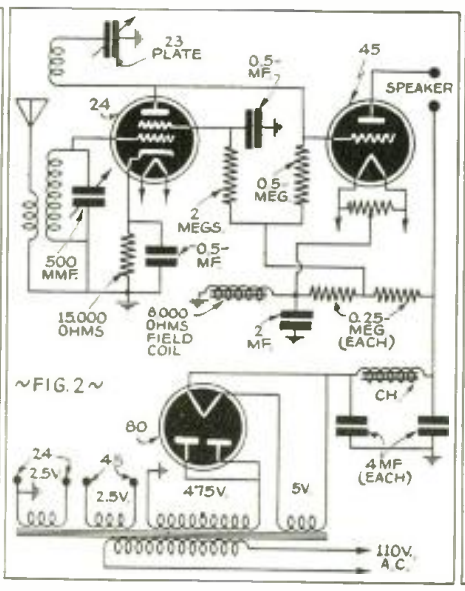
● THE Australians are again turning their attention to direct-coupled circuits such as were popular in the United States some ten or twelve years ago. Fig. 1 shows the old reliable Loftin-White amplifier circuit, which gives such excellent results when carefully built with precision parts—but which caused considerable nervous tension to careless constructors or those who took the circuit components from the junk box which all good radio men possess.

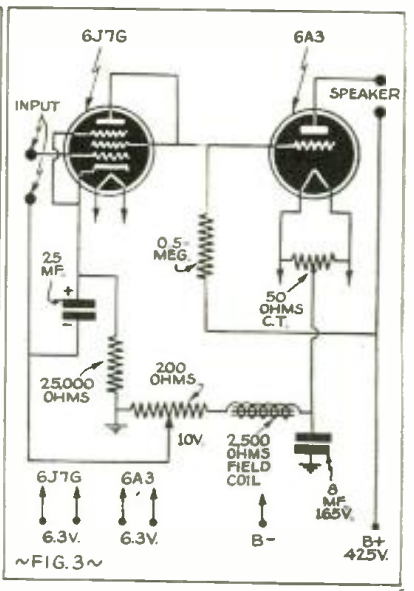
Fig. 2 illustrates a 2-tube direct-coupled receiver which was quite popular in the Antipodes back in 1931.

What is said to be a greatly improved circuit appears in Fig. 3. The author of the article in *The Australasian Radio World* claims that good output is had when a simple tuner is connected across the posts marked input.

Newcomers to radio, who do not recall previous experiments with direct coupling, might like a word as to the theory. Studying the diagrams, you will notice that the grid of each tube is negative in respect to the plate of the same tube, although a positive voltage is applied to the grid. The voltage drop in the coupling resistors caused by the current drawn in the plate circuits affords the desired bias.





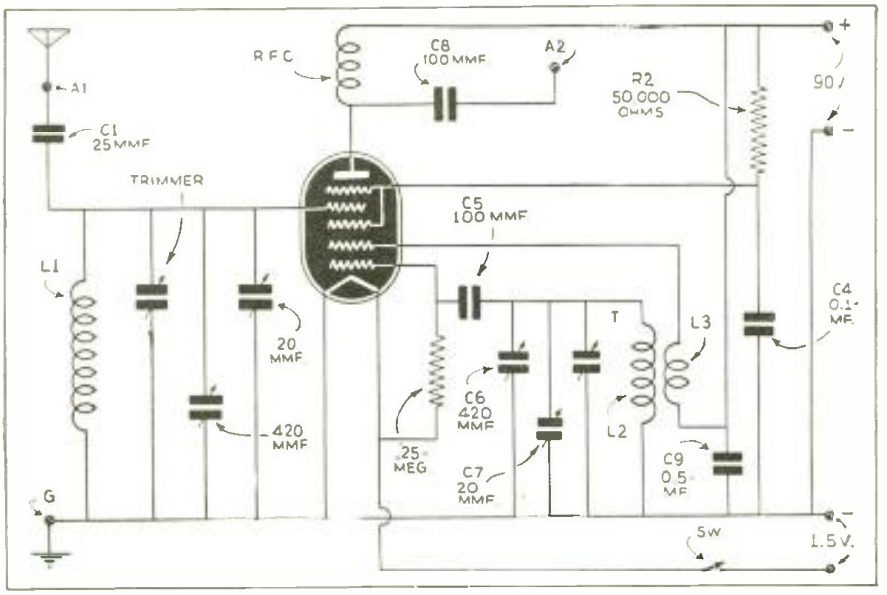


PRE-STAGE AMPLIFIER

● A PRE-AMPLIFIER stage with band-spread, featured for use on short waves, as described in *Popular Radio* of Denmark, is extremely simple in design and construction. The circuit is illustrated in the accompanying diagram.

Coils L1, L2 and L3 may be home wound for whatever wave band is desired. Condensers T and T are trimmers, while the values of all others are given. The pre-amplifier, connected ahead of a short wave receiver, may be fed either from batteries or from a power pack. The 1.5 filament voltage given is for a multi-grid Danish tube and must be varied if necessary to suit the requirements of whatever equivalent American tube is substituted.

Binding post A1 connects to the antenna and A2 connects to the antenna post of the receiver with which the pre-amplifier is used.



DANISH ONE-TUBE CIRCUITS HAVE MANY INTERESTING FEATURES

● DESPITE the war, Denmark still carries on with its radio experimental work and a one-tube circuit, not particularly unusual, but none the less interesting, is shown in *Popular Radio*.

The first, shown in Fig. 1, is a comparatively simple two-circuit non-regenerative receiver which makes use of a dual tube. By taking advantage of the two sets of elements in this tube the set is made to provide one stage of audio amplification in addition to the detector.

Even more efficient is the one-tube circuit shown in Fig. 2. This receiver incorporates regeneration by making use of a 175 mmf. variable condenser controlled feedback. The four element section of the tube is used as an audio amplifier, the three element portion being employed as regenerative detector.

A two-tube circuit, also making use of dual purpose tubes, is seen in Fig. 3.

This circuit provides a stage of R.F. detector and two stages of audio with but two tubes. While the tubes used in these sets were foreign make, their equivalents can be found in the American market without difficulty.

The parts used in the circuit shown in Fig. 1 are as follows:

C1-1000 mmf.; C2-5000 mmf.; C3-100 mmf.; C4-25 mf.; C5-10,000 mmf.; C6-3000 mmf.; C7-16 mf.; C8-16 mf.; R1-1 meg.; R2-175 ohms; R3-.5 meg.

In Fig. 2 the parts are as follows:

C1-1000 mmf.; C2-5000 mmf.; C3-420 mmf.; C4-175 mmf.; C5-100 mmf.; C6-25 mf.; C7-25 mf.; C8-10,000 mmf.; C9-3000 mmf.; C10, C11-16 mf. each; R1-1 meg.; R2-150 ohms; R3-.1 meg.; R4-50,000 ohms; R5-.5 meg.; R6-.2 meg.

Parts used in Fig. 3 are as follows:

C1-1000 mmf.; C2-5000 mmf.; C3-4.0 mmf.; C4, C5, C6-.1 mf.; C7-100 mmf.; C8-500 mmf.; C9-Padding condenser; C10-.1 mf.; C11-500 mf.; C12-10,000 mmf.; C13-25 mf.; C14-100 mmf.; C15-100 mmf.; C16-500 mmf.; R1-300 ohms; R2-20,000 ohms; R3-30,000 ohms; R4-50,000 ohms; R5-.1 meg.; R6-.5 meg.; R7-.2 meg.; R8-1 meg.; R9-175 ohms; R10-.5 meg.

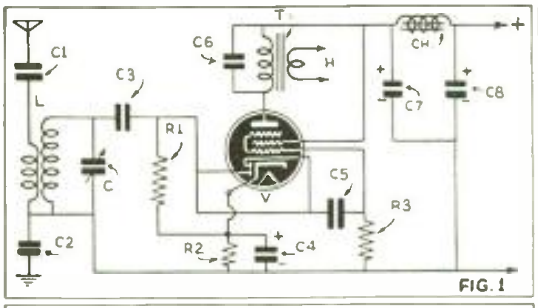


FIG. 1

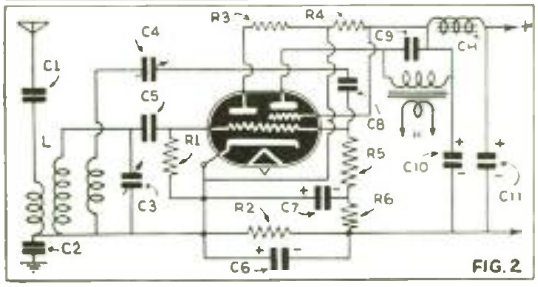


FIG. 2

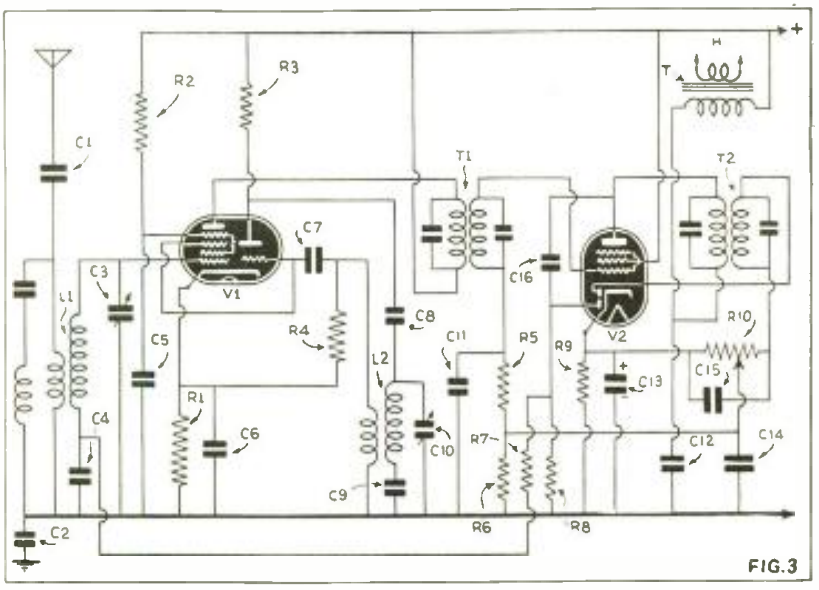


FIG. 3

Can YOU Answer These Radio Questions?

1. How was television used in describing the results of the presidential election? *(See Page 518)*
2. Name two advantages of the radio-trained Army man. *(See Page 522)*
3. Why is it important to use a high fidelity audio amplifier for F-M? *(See Page 532)*
4. How far have 2½ meter signals been heard? *(See Page 538)*
5. What is the meaning of the international "Q" signal—QTH? *(See Page 543)*
6. In a modern television receiver are any of the tubes used for both video and sound reception? *(See Page 548)*
7. What is the average width of the line used in reproducing modern facsimile images? *(See Page 554)*
8. Can you draw a diagram showing how three tubes can do the work of five? *(See Page 564)*
9. Can you explain briefly the principle of the new Goldsmith television invention, which employs a number of small cathode-ray tubes instead of a single large one? *(See Page 568)*
10. Name two companies other than RCA who have recently brought out small camera type portable receivers. *(See Pages 570 and 573)*

This 7-Tube Superhet Rolls 'Em In!

Emmett Brightwell

Here is a super-fine receiver for the Shortwave and Broadcast "fan." Additional sensitivity is provided, when necessary, by the use of a television receiving type tube in the first stage. All of the parts are standard, and can be obtained from the regular sources of supply.

● ALTHOUGH designed primarily for high efficiency on 15 to 50 meters, this seven tuber performs miracles of sensitivity and selectivity on the *broadcast* (200-550 meters) band.

How would you like a set that with normal setting will do better than the average seven tuber, yet by turning a knob you could cut in additional sensitivity comparable to booster stage? That is what we have here. It is obtained by using a *television* receiver tube in the first stage and putting a variable *sensitivity control* in the cathode circuit.

The 6AB7/1853 was chosen because of its remote cut-off characteristic, facilitating the use of AVC in the R.F. and converter stages. This is left off the I.F. stage, first, because it is not needed there; second, because when used on I.F. stages it often is a source of feed-back. And the second consideration in designing this set was to keep it *simple!*

6K8 Is a Superior Converter

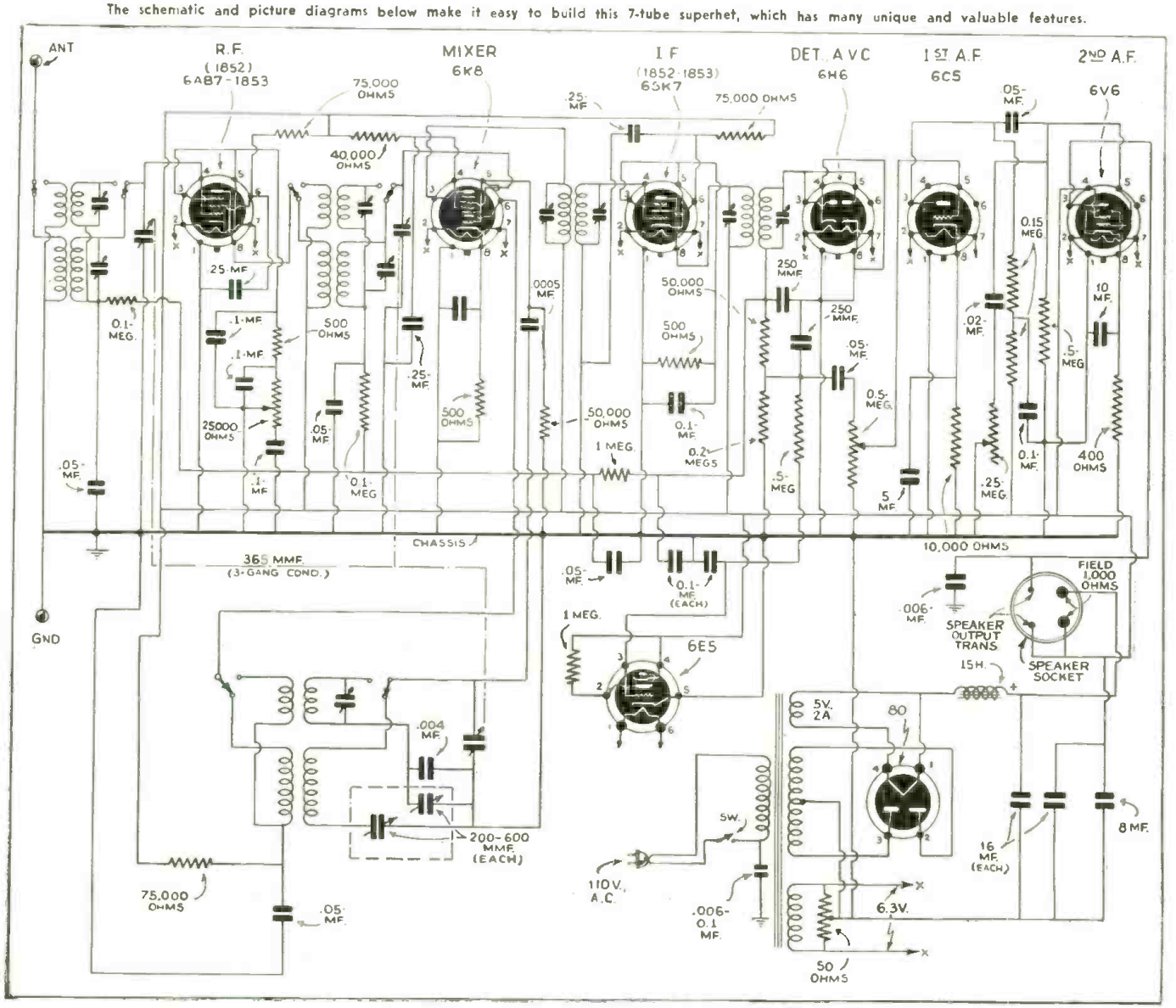
The 6K8 as a converter is the best of them all. It is least subject to oscillator frequency *drift*. It is affected very little by voltage variation. It does not get upset by excessive A.V.C.

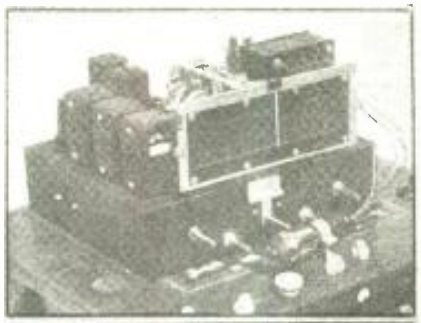
But its oscillator triode demands less voltage than other converters. Most manufactured coils available are designed for the 6A8. That is true of the coils used in this hook-up. They are stock coils regularly included in a kit for home assembly.

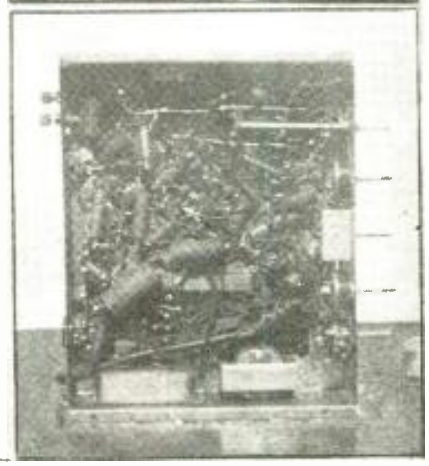
They were adapted to this design simply by reducing the oscillator plate voltage. The same result could have been achieved by removing a few turns from the primary winding of the oscillator plate coil. However, the result is almost the same, whether you remove twenty per cent of the primary winding, or reduce the plate voltage an additional twenty per cent. And resistors are a lot easier for me to figure than inductances.

Before we go into other matters, I should like to say here that I have found the noise

The schematic and picture diagrams below make it easy to build this 7-tube superhet, which has many unique and valuable features.







The photos herewith show the appearance of the 7-tube superhet with loudspeaker; another view —of the chassis removed from the cabinet— and finally, a bottom view of the chassis.

eliminator qualities of the 1853 to be superior to any so-called noise-silencer circuit, and you have no reduction—but *gain*, in signal volume, and no tricky bridging to get out of balance.

Before you start thinking about this set, there are one or two things which I would point out which make it different from any other set you have seen in recent years. *The chassis is not in the circuit at any point.* It is grounded, merely, very efficiently at two points. *The tuning eye is biased for greatest and most sensitive response on the short-wave channels covered.* The shadow angle will overlap on practically any broadcast station, but this does not bother us much, and this shadow will vary appreciably on relatively feeble short-wave signals, which makes it a useful guide to R volume and efficient tuning o: these channels.

This set is free of *dead-spots* on the short-wave channel. Don't understand this to mean that any band will tune with equal ease, at any hour of the day or night. What I do mean is that a generated signal of a given intensity will show almost a level meter reading all the way across the dial from 15 to 50 meters.

Fading Reduced

This set does not eliminate fading completely. It reduces it to a greater extent than any receiver I have ever seen. My reception on it here in San Francisco of European broadcasts is said by listeners (my wife not included) to be as free, or freer, of this fault than the regular rebroadcasts of the chains. And they pick theirs up at Boundbrook, New Jersey!

Because this set's extreme flexibility in tube adaptation with no change in voltage potentials should make it of extreme interest, not only to the fellow who wants to build a real listening set, but to those who like to compare the characteristics of different tubes.

For instance, you may use a 6SK7 in place of the 6AB7/1853. There'll be less gain and more background noise. You may use an 1853 or 1852 in the I.F. stage. If there's feed-back, cut down the plate voltage. But remember the price of one of these television tubes will buy three 6SK7's. Let your pocketbook as well as your curiosity be your guide. That's why I decided, everything considered, that one 1853 was enough! Besides, the gain now is all the output will stand—and *more*, in some cases.

All Parts Standard

It is simple to assemble because the parts are all stock parts purchaseable from any concern which handles standard custom radio devices.

No "tricky" aerial installation is called for. In fact, the set is not designed for use with a *doublet*—just any old kind of single wire and ground—*there must be a good ground!* If you want to use a doublet, you'll have to figure it out yourself. I never have been able to get anything on a doublet, that I could not get on an L or a T or a vertical! My present antenna is a hundred feet of corroded seven-strand wire, that some bygone tenant left tied to the window sill. I thank him, for it links me with the wide world!

How to Build It

First, study the parts list. You may have a lot of them on hand. I used some resistors out of an old 1925 battery set!

Don't substitute coils. It may be necessary to use a larger or lesser resistor in the oscillator plate lead. Better stick to the chassis and tuning condenser specified. This chassis is ready cut and we've got something for every hole.

Mount everything first. Take the mounting plates off the Amphenol sockets and lock them in with the washers. Use the mounting holes for tie points as needed.

Have plenty of these because everything must be fastened rigidly—no resistors or heavy bypass capacitors floating around. That causes trouble on the short waves.

Solder No. 14 busbar to all shell terminals of tube sockets. Use same for B or plate current, extending through unused holes in switch wafers inside.

Use same bus bar for A.V.C. bus, mounting in unused holes of switch wafers on outside next to chassis wall. Run spaghettied bus from aerial terminal on switch to aerial post.

Wire in switch and coils, following diagram supplied with same, except as to condenser and resistor values. As to those, follow instructions in accompanying diagram.

Notice particularly that all *grounds* go finally to a 50-ohm center-tapped resistor, shunted across the filament winding of the transformer. Don't follow any other arrangement.

Use *short* leads, ground to the *ground* bus, then ground the ground bus to the center of the 50-ohm resistor, to which the center tap of the high frequency winding of the power transformer is directly soldered.

Take off leads for pilot lights and tuning eye from the end terminals of this 50-ohm resistor.

Note that when the speaker is disconnected, no B current is admitted to the tubes, which is good.

This choke input filter is designed to be both inexpensive and efficient. The filter condensers are all the card-board case type and mounted beneath. The input choke is mounted on two bolts holding the power transformer. Not a square inch of space is wasted, yet there is no crowding.

Lay out your bypass condensers and resistors so that they fall toward the center of the chassis in an orderly manner, but do not sacrifice short leads and "safety from interaction" to looks.

Keep all carriers of radio frequency as far as possible from power components to prevent hum. Tie down everything that tends to swing or sway. Tie leads to volume control and tone control back as far away as possible from the power-pack.

If you do this right no shielding of any leads will be necessary. Any radio that requires shielding of leads is designed wrong. Shielding of leads introduces degeneration, and should be avoided wherever possible.

To Line Up

The coils used in this set were lined up at the factory for the frequencies involved. After you are sure your wiring is right and every soldered joint is really soldered, plug in the speaker and the power line. Turn the chassis up edgewise and *watch for smoke* as you turn on switch. If there is no smoke, listen for characteristic hum in speaker. Turn volume control, to which switch is attached, full on. Try for stations on the *broadcast* band. Tune in a station as near 1400 kc. as possible, then adjust lower trimmers in R.F. coil cans for loudest volume.

Then tune in station around 600 kc. and adjust oscillator tracking condenser for BC band for loudest volume. Repeat to make sure.

Then trim the I.F. transformers for peak volume. All this will be indicated on the tuning eye. The narrowest shadow will show the most sensitive adjustment.

Now throw band switch to shortwave. Search for station in 20 meter band (at right hand end of dial). Adjust upper trimmers in coil cans for greatest volume. Then do as before with the tracking condenser. There will not be much change here as only ten per cent of this padder is adjustable.

Regardless of conditions on the shortwave section, you will be able to get stations here when you are able to get stations on the B.C. band.

If you have an all-wave service oscillator, proceed as usual.

If it doesn't work now, you probably forgot to ground the chassis to the *ground bus*. Use a strip of thin copper and be sure your iron is hot. If you note hand capacity after chassis is grounded, ground the cabinet also; usually the screws holding the two parts together are sufficient. It was on mine.

You will find that a speaker in a separated cabinet makes for less tendency to motorboat and microphonic feedback.

Don't forget a good grounding strap from ground bus to ground post, *and ground this post to the ground!*

Operating Notes

Now that you have the set working, let's sit down and look it over. You see five control knobs. On the extreme left is the band-switch. Next is the sensitivity control. In the middle is the station finder. Number four is the tone control. On the extreme right is the combined A.C. switch and volume control.

A lot of controls, eh? Okeh—but once set, you don't concern yourself with anything but the *station-finder*.

For all ordinary "fishing" and listening you operate the *sensitivity control* fully retarded. For that dim, distant signal advance it slowly to the point of greatest volume. This sensitivity control is also used for micrometric tuning on the short waves. Tune in with the station-finder, then use this control to line up the signal "on the nose." If advanced too far you will get oscillation in the 1853. A little practice will show you how far to go. This oscillation is due to apparent buildup of the screen voltage on this tube as the control is advanced toward "cut-off."

Listen for Europe from 4:00 p.m. to 3:00 a.m. Listen for Asia and Australia from 3:00 a.m. to 8:00 a.m. The 49-meter band is "hottest" from 6:00 p.m. to 10:00 p.m. The 31-meter band from 4:00 p.m. to 8:00 a.m. The 17- and 19-meter bands from 12:00 m. to 5:00 p.m., while the 25-meter band seems most active from 3:00 p.m. to 8:00 p.m. This is "West Coast" experience.

Parts List

MEISSNER MFG. CO.

No. 11-8213—Chassis for 7-tube A.C.
No. 11-8212—Cabinet
No. 11-8217—Panel
No. 21-5222—3-gang 365 mmfd. T.C.
No. 23-8208—Dial assembly
No. 14-7476—Antenna dual band coil
No. 14-7478—R.F. dual band coil
No. 14-7480—Osc. dual band coil
No. 22-5211—Dual padder
No. 24-8265—3-gang, 2-position band switch
No. 16-5740—Input Ferrocart I.F. transformer
No. 16-5742—Output Ferrocart I.F. transformer

R.C.A.

1 6AB7/1853 metal tube
1 6K8 metal tube
1 6SK7 metal tube
1—6H6 metal tube
1—6V6 beam power output metal tube
1 80 glass rect.
1 6E5 and mounting assembly

JENSEN

1—Electro-dynamic speaker, with at least 6 watts capacity, 1000 ohm field

THORDARSON

1—350-350 V. 100 ma., 6.3 V. 3 amp 5 V. 2 amp (minimum) power transformer
1—15 henry 100 ma., 200-400 ohm input choke
1—Universal output single-end transformer for above speaker (attach V.C. terminals to 4-6)

AMPHENOL PRODUCTS CO

5 Octal sockets
1—Four-prong socket

CENTRALAB

1—10-25 thous. mfd. tapered potent.
1—.5 meg. potent. with shaped A.C. switch
1—.25 meg. potent. (tone control)

1 Center tapped 50 ohm filament shunt
2 75,000 ohm 1 W. resistors
1 40,000 ohm 1 W. resistor
3 .5 meg. ½ W. resistors
2 150,000 ½ W. resistors
1 200,000 ½ W. resistor
2 100,000 ohm ½ W. resistors (series A.V.C.)
2 50,000 ohm ½ W. resistors
1 10,000 ohm ½ W. resistor (cathode bias for 6C5)
3 400-ohm ½ W. resistors (cathode first 3 stages)
1 400-ohm 1 W. resistor (cathode 6V6)

CORNELL-DUBILIER

2 Pasteboard 16-mf. 450 V. filter capacitors
1 Pasteboard 8-mf. 450 V. filter capacitor
4 Paper .25-mf. 450 V. screen bypass capacitors and h. freq.
3 Paper 1 mf. 450 V. cathode bypass R.F. and A.F.
1 Paper .5 mf. 450 V. cathode 6C5
1 Electrolytic 10-25-mf. 35-50 V. cathode 6V6
2 Paper .1-mf. 200 V. decoupler, 1853 and 6C5
4 .05-mf. paper 450 V. A.V.C. bypass and blocking
2—.006-mf. paper 450 V. A.C.
1 .004-mf. mica (padder shunt S.W. band)
2 .00025-mf. mica
1—.00005-mf. (osc. input) (usual .0001 not fast enough here)

47 STATES ON A 1-TUBE TRANSMITTER

Frank Courtney, W4FDX

● THIS little "rig" was built and put on the air in the shack within an hour's time, and was constructed from parts found in the junk box.

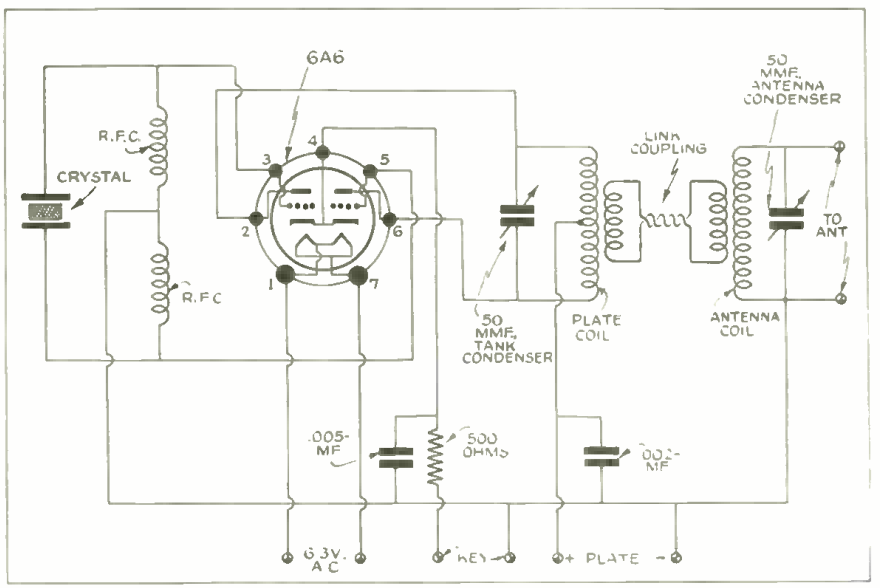
Splendid results have been obtained, having worked 47 states, all Canadian districts (before closing) XE1, K4, CM2 and others on 40 meters. The reports obtained equal those of the regular rig in the shack, which runs 75 watts.

The rig will work well with almost any power-supply; the one used here delivers 250 volts at 100 ma. If strict economy is desired, the transmitter may be constructed "bread-board" fashion. However, the cost of a small metal cabinet is slight, and the appearance of the rig is greatly improved if constructed in one of these.

The rig requires a separate crystal and coil, of course, for each band worked, and performs well on 20, 40, 80, and 160 meters.

No further details are deemed necessary, as the diagram is self-explanatory.

A 0-150 ma. meter may be added in the plate circuit to simplify tuning, if desired, or a Neon bulb or flash light bulb and loop of wire may be used as an indicator.



A one-tube transmitter hook-up which will appeal to the beginner in amateur radio. This rig is suitable for code transmission.

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regular space rates for good construction articles giving novel and original ideas for building such simple radio apparatus as short wave converters, receiving sets, television and frequency modulation receivers, recording equipment, power supplies, simple set and tube testers, facsimile recorders, etc.

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The high-fidelity Jensen loudspeaker and its cabinet is shown in the picture, together with the F-M tuner and audio amplifier on top of it.

A High-Fidelity Amplifier for F-M

Herman Yellin, W2AJL

In the last issue Mr. Yellin described a very efficient "frequency-modulation" tuner. It goes without saying that one must use a good high-fidelity amplifier with such an F-M tuner in order to realize the high quality transmission inherent in this system. Such an amplifier is described herewith.

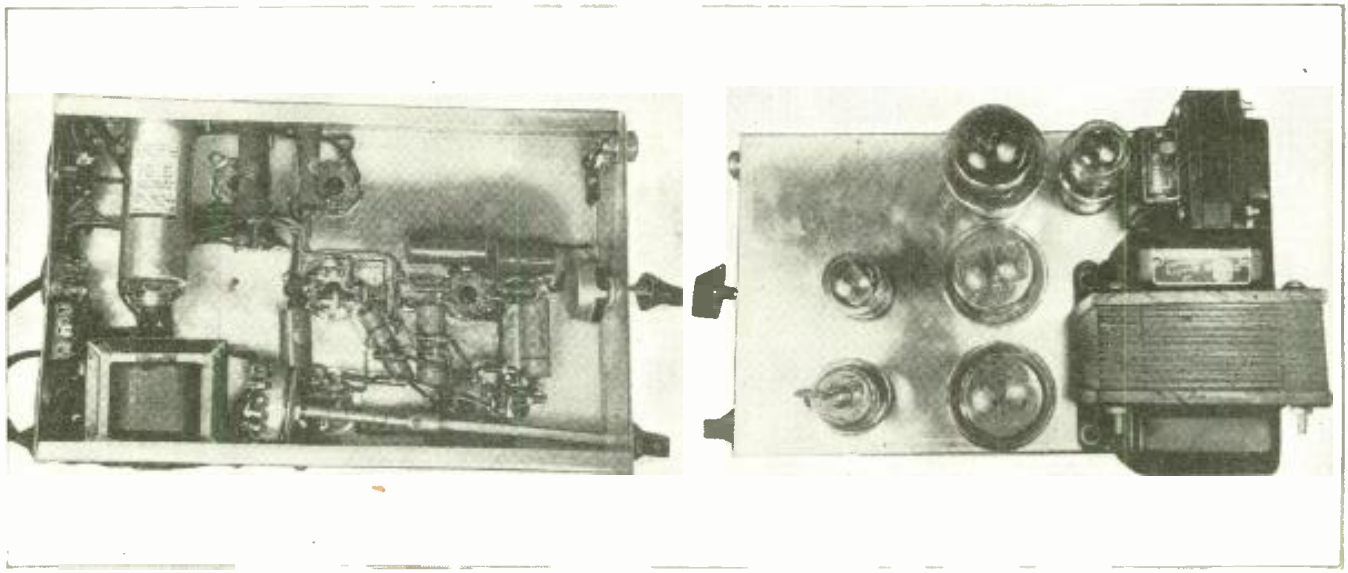
● IF you built the F-M tuner described last month, you will need a good high-fidelity audio amplifier and power-supply to accompany it. An excellent amplifier, specially designed for this purpose, will be described herein. Since the amplifier contains a power-supply capable of supplying filament and plate power, it can also be used for other tuners. A unique method of switching the power from one tuner to the other, mentioned in the F-M tuner description last month, is employed here, and enables the economical design of a power-supply for use with two tuners.

Designed for simplicity and ease in construction, the amplifier consists of three stages: The first stage, using a 6J5 tube, is the *phase inverter*, needed for supplying two out-of-phase voltages to the succeeding push-pull driver stage. This stage employs a 6C8G dual triode and feeds the push-pull 6L6G output tubes. About 18 watts of undistorted audio power is obtained here, more than enough for a good sized home, but the reserve power is assurance of distortion-free operation. A 5X4G is used as a rectifier, while a VR-105-30 voltage regulator tube is optional.

The entire unit was easily accommodated on a 7" x 11" x 2" chassis, even leaving some spare room in one corner. But this may come in handy later on, if it ever becomes desirable to install a high-gain input stage to increase the overall gain, so that low-level microphones can be used. This, with the addition of a modulation transformer, will convert the amplifier quite nicely for use as a modulator. The photos of the top and underside of the chassis clearly show the placement of the various tubes and parts. Besides the tubes and power transformer, only the first filter choke is mounted above the chassis. Inside, mounted on the sides are the second filter choke and filter condenser block. The two five-prong power output sockets are mounted on the rear chassis drop, where the three-terminal output receptacle is also located. The power switch is mounted on a metal bracket fastened to the side of the chassis. An extension shaft allows the switch to be controlled from the front. Besides the switch knob on the chassis front, we also have the volume control and the two input receptacles. It might be desirable under certain conditions of mounting the amplifier to have the input receptacles on the side of the chassis instead of on the front. The constructor should decide for himself as to which will be the more advantageous position.

As we mentioned before, the power-supply is capable of powering an additional tuner, say one for the broadcast band or an all-wave standard amplitude modulation job. The writer intends building such an all-wave tuner and it will probably be described in an early issue. A single six-pole three-position rotary switch serves to take care of switching the power to either tuner and also turns the A.C. supply on and off. Only the filament voltage is switched from tuner to tuner, since no plate current can be drawn by the tubes whose filaments are not heated. If the constructor has no desire

Top and bottom views of the F-M high-fidelity audio-amplifier.



to use the amplifier with any tuner, other than the F-M unit, then he can omit this switch and the second power output receptacle as well as one of the input receptacles.

Although not shown in the diagram, the six sections of the rotary switch have been paralleled to give a 3-pole, three-position switch of increased current carrying capacity. Reference to the diagram will show that the switch is so wired that when it is in the center position, the amplifier is turned *off*; when moved to either side of center the amplifier is *on*, and filament voltage switched to one of the power receptacles. Incidentally, the switch was mounted towards the rear of the chassis to keep the A.C. leads away from the input tubes, necessitating the use of a mounting bracket and extension shaft, but this adds little to the construction.

The *phase inverter* used is of the type in which the out-of-phase voltage is obtained from the cathode circuit. Actually, the 2500 ohm resistor at the ground end of the 6J5 cathode is really part of the plate circuit. Where additional amplifier gain is not needed, this form of phase inverter is preferable (from the standpoint of simplicity) to the double-triode type, and was used for this reason.

Notice the 250,000 ohm resistors connected from the plates of the 6L6G tubes to the plates of the 6C8G tubes. These are the feedback resistors (furnishing negative feedback) which contributes so much to the excellent frequency response, and to the hum-free operation of the amplifier.

This unusual method of feedback was purposely used, so that the constructor would have no trouble in getting the amplifier to operate properly the first time it is tried out. The polarity or magnitude of the feedback voltage is not dependent on the output transformer, so the "fan" need not fear that the amplifier will squeal and howl like a banshee when first turned on. Incidentally, no output transformer was incorporated on the chassis, because the speaker used by the writer has the transformer built onto it. This speaker is the new and already popular dual unit high-fidelity speaker recently developed by Jensen. It consists of two speakers mounted coaxially on a single fifteen-inch diameter frame. A built-in filter network separates the audio frequencies into two bands, with the crossover at 2000 cycles. The larger speaker handles the low frequencies, while the small tweeter unit reproduces the high frequencies. Thus each speaker unit handles the frequencies for which it is best suited. With a response flat between 30 and 15,000 cycles, the speaker and amplifier is a revelation in clarity and lifelike reproduction.

Parts List

BUD

1—7" x 11" x 2" chassis, No. 1193
1—7" x 11" bottom plate, No. 670

I.R.C.

1—600 ohm, ½ watt, type BT½
1—3000 ohm, ½ watt, type BT½
2—2500 ohm, ½ watt, type BT½
1—50,000 ohm, ½ watt, type BT½
4—500,000 ohm, ½ watt, type BT½
4—250,000 ohm, ½ watt, type BT½
2—100,000 ohm, ½ watt, type BT½
1—150 ohms, 10 watts, type AB
1—6000 ohms, 10 watts, type AB
1—megohm volume control, type 13-137

AMPHENOL

2—Octal steatite sockets, type RSS-8
4—Octal sockets, type RS-8T
2—5 prong sockets, type RS-6T
1—5 prong plug, type PM-5TT
1—3 prong receptacle, type 60-F
1—3 prong plug, type 60-M
2—Input receptacles, PC-1M
2—Input connectors, MC-1F

CORNELL-DUBILIER

1—8 x 8 x 8 mf., 450 volt electrolytic, No. KRC 5888
3—.1 mf., 400 volt condensers, No. DT-4P1
2—.05 mf., 400 volt condensers, No. DT-4S5
2—10 mf., 25 volt electrolytics, No. BR-102A
1—10 mf., 50 volt electrolytic, No. BR-105
1—4 mf., 450 volt electrolytic, No. BR-445

(Continued on page 534)

BOOK REVIEWS

THINGS A BOY CAN DO WITH ELECTRO-CHEMISTRY, by Alfred Morgan. Size 5½ x 8 inches, 198 pages, illustrated, stiff cloth covers, published by the D. Appleton-Century Co., New York, N. Y.

Electrochemistry is one of the branches of applied science which at one time or another interests the average young man who has a flair for technical matters. Mr. Morgan, who has written several books of this type, tells in a very popular and entertaining manner about the elementary electrochemistry and many new tools for the chemist. Some of the chapters cover Electrochemical Processes and Products, Some Products of the Electric Furnace, etc. Another section deals with Ions, Traveling Atoms or Groups of Atoms, Electricity Produced from Chemicals including various types of batteries, Latter chapters deal with Electroplating, Experiments with Electrolysis, Storage Cells, the Electrolytic Rectifier, Fixation of Nitrogen, Simple Polarity Indicator, etc.

RADIO AS A CAREER, by J. L. Hornung. Size 5¼ x 7½ inches, 212 pages, stiff cloth covers, published by Funk & Wagnalls Co., New York, N. Y.

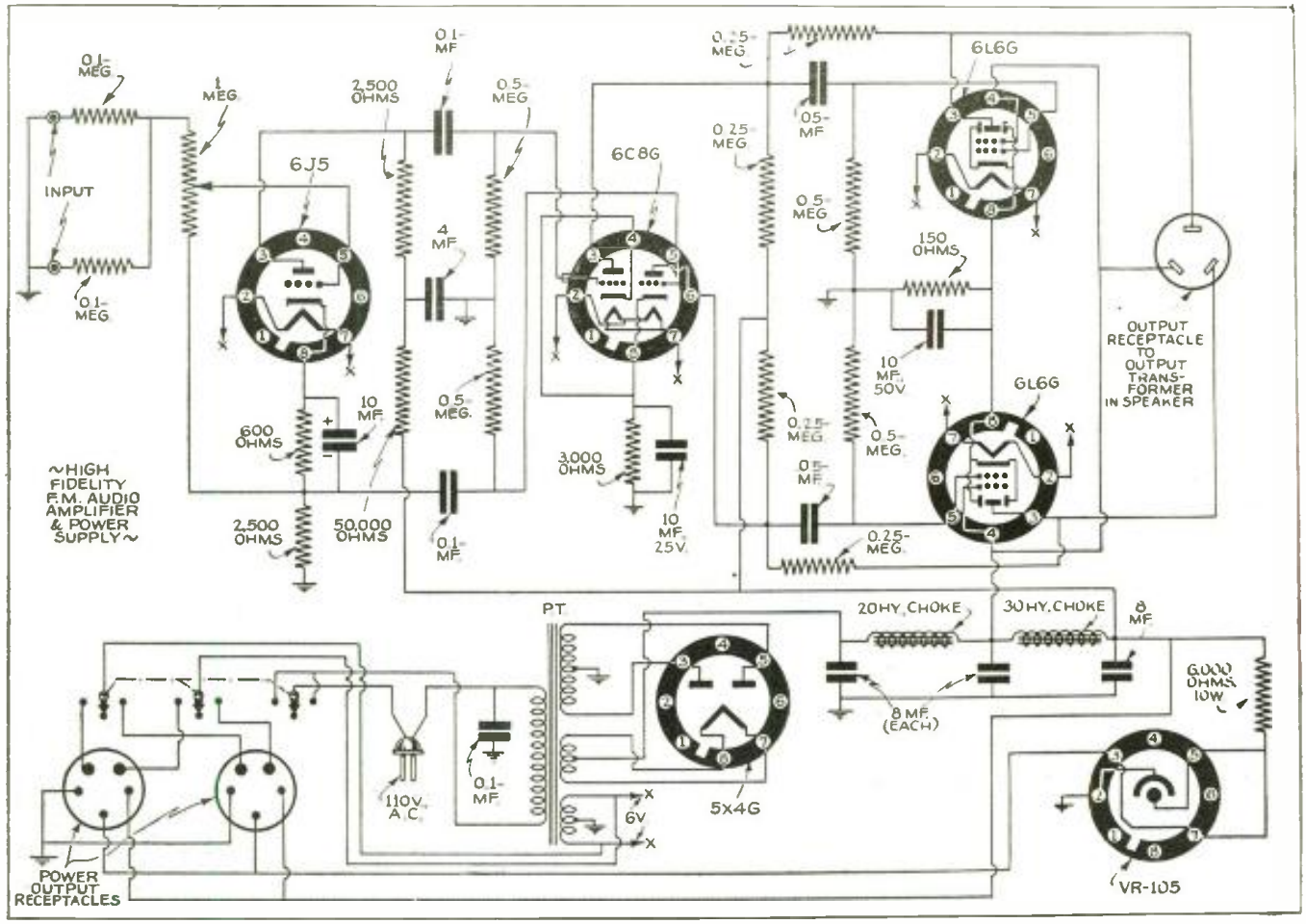
Radio is so important today in the army and navy, and with the tremendous increase in activity in the National defense, young men will be very much interested in what Mr. Hornung has to say on radio as a career. He is a well known authority on the subject and this book forms another in the Kitson career series, edited by Dr. Harry D. Kitson of Teachers' College, Columbia University. Mr. Hornung's book answers such practical questions as—What Does Radio Offer?; Starting in Radio; The Radio Operator and What He Does; Radio Servicing; the Radio Engineer; Broadcasting; Television; Government Radio Service, etc. The latter part of the book deals with the outlines of courses in radio, including the outline of a thorough home-study course; the value of college training in radio engineering; outline of the subjects in such courses, etc. There is a final chapter on "non-engineering" opportunities in radio. An appendix is given at the end of the book containing a list of all the principal engineering schools.

PHOTO RELAYS, THEIR THEORY AND APPLICATION, by F. H. Shepard, Jr. Size 6 x 9 inches, stiff paper covers, 30 pages, published by Allied Control Co., New York, N. Y.

This book will be found of great value to all experimenters and engineers who have to design or build circuits involving the use of photo cells, amplifiers, and relays. Numerous diagrams and graphic curves showing the performance of the various apparatus involved are given in this book, including several novel applications of photo relays.

SERVICE MANUAL OF WIRING DIAGRAMS, by M. N. Beitman. Size 8¼ x 10½ inches, 240 pages, stiff paper covers, published by Supreme Publications, Chicago, Ill.

This book will be found very useful by servicemen and also radio experimenters in general. Aside from its value in servicing sets, it will prove very useful to the general student, who wishes to study the circuits of different commercial radio sets. This manual has been edited under the caption of the "most often needed" radio diagrams and includes circuit diagrams for sets which are the most popular and widely used by the public. The price of the book is nominal and every thorough radio student will want a copy for his book shelf; the serviceman will find it very handy as a workbench companion.



Complete wiring diagram for the F-M "Hi-Fi" audio amplifier here described by Mr. Yellin.

Hi-Fi Amplifier for F.M. (Continued from page 533)

STANDARD TRANSFORMER CO.
1—Power transformer, 675 volts c.t., No. P5059
1—175 ma., 20 henry choke, No. C1410
1—75 ma., 30 henry choke, No. C-1002

MALLORY
1—6 pole, 3 position rotary switch, No. 3263J

NATIONAL UNION
2—6L6G tubes
1—5X4G tube
1—6C8G tube
1—6J5 tube
1 VR-105-30 tube

CORNISH WIRE CO.
Super Corlac hookup wire
5 Wire cable
No. 122 twisted pair lead-in wire (for antenna system)

JENSEN RADIO MFG. CO.
1—15" Dual coaxial loud speaker system

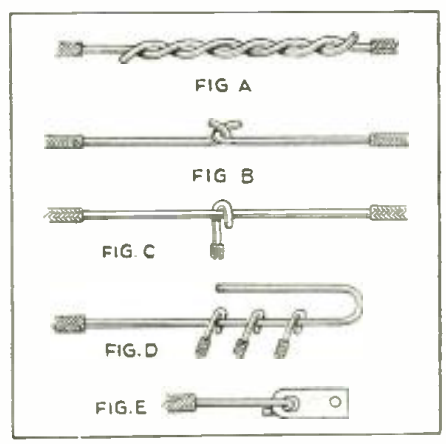
Do YOU Know How to Solder Joints?

FRANK COURTNEY, W4FDX

● BEFORE being used the soldering iron must be well tinned. The tinning process consists of thoroughly cleaning the four sides of the iron tip with a coarse file or rasp. The iron is then heated, after which the four faces are covered with a coating of solder. The tip is then wiped off with a cloth. Acid core solder should never be used, as the acid will corrode, and will result in possible noise or trouble in the completed job. Only rosin core solder should be used when wiring a radio circuit. The iron should be rubbed on a sal-ammoniac soldering brick (obtainable at any hardware store) from time to time, to prevent corrosion of the iron tip, and make the solder flow freely.

Figure A shows how to make a simple twisted connection. If space or the length of the wire does not permit the use of the connection shown in Figure A, an alternative connection may be used as shown in Figure B, known as a hook joint.

To hook one wire to some point on another wire, the connection shown in Figure C may be used, but at least two turns around the wire should be made, not just a sloppy, ineffective hook connection.



To connect several wires to a single wire, the connections shown in Figure D may be used, and two or three turns of each branch wire around the main conductor should be made before soldering.

Soldering lugs are another convenient aid. A common soldering lug is illustrated in Figure E, in which case the wire is simply hooked through the hole in the lug provided for that purpose, and the solder then applied.

In soldering a connection, apply the iron first, then a few seconds later apply the solder to the opposite side of the connection. Allow the iron to remain until the solder has thoroughly covered the joint.

The solder should not be applied by the iron itself, but the connection or lug should be hot enough to itself cause the solder to flow. The soldered connection should be thoroughly wrapped with friction tape if there is any possibility of it making contact with any other wire in the circuit. The use of excessive solder should be avoided.

And finally, don't forget to thoroughly scrape all wires bright before attempting to solder the joint. Twist all joints with pliers so that they are mechanically rigid before soldering them. Don't let the solder be the conducting medium for the current—it will heat up and cause an open or at least a high resistance joint when you least expect it.

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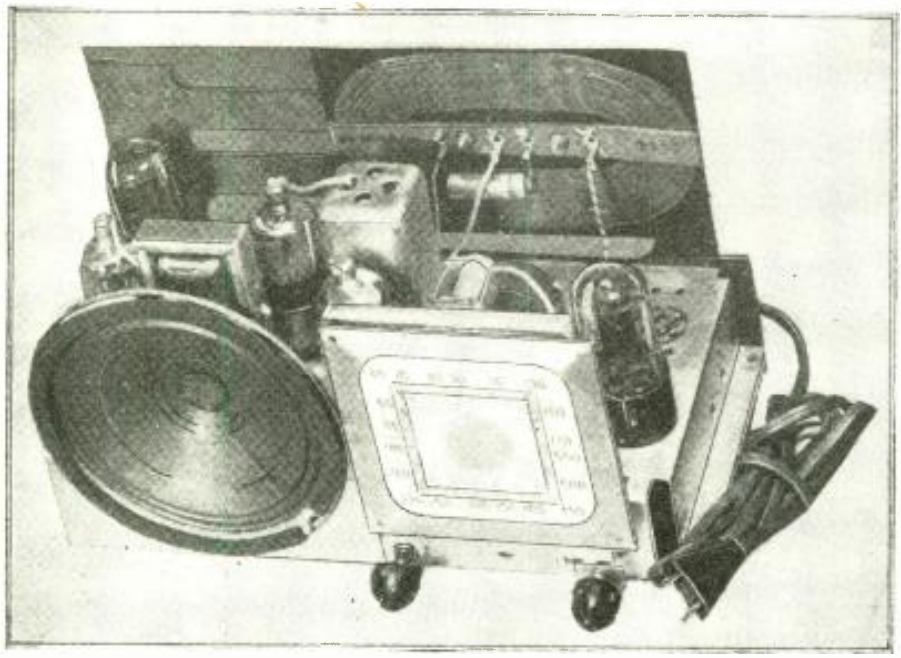


Photo at left shows the 5-tube super-het here described. The set has a built-in loop antenna and it will drive a 5" permanent magnetic speaker.

Simple 5-Tube Super-het

L. M. Dezettel, W9SFW*

● ONE of the latest and simplest of sets for the home constructor is this 5-tube super-het. Easily assembled and wired, it can be made into a factory-like, professional receiver for the home, covering the broadcast band and the popular 1712 kc. police band.

The loop antenna is built in, and ample pickup is realized for local broadcast reception. An extra coupling pick-up is provided on the loop for attaching to an external antenna for DX reception. No ground is required, nor should be used.

The set is designed to operate from 105-125 volts A.C. or D.C., 50-60 cycles.

Five tubes are used, including the *rectifier* tube. A 12A8GT converter tube is used as a combined R.F. amplifier and oscillator, converting the signals to 456 kc. for the I.F. channel. A 12K7GT is used as a high gain I.F. amplifier. A 12Q7GT is used as a combined diode detector and first audio stage. A.V.C. (automatic volume control) voltage is obtained from this tube and fed back to both the 12A8GT and 12K7GT. A 35L6GT beam power amplifier is connected to an output matching transformer for driving a 5" permanent magnet speaker.

Assembly of parts is straight-forward. The location of each part can easily be determined from the diagram. If the punched chassis listed in the parts list is used assembly is made especially easy. Mount the speaker and loop antenna last to avoid damaging them. The output I.F. transformer connecting to the 12Q7GT is in a small shield can and mounts beneath the chassis. Its trimmer condenser (E) is separate and solders directly onto two of the lugs as shown in the pictorial diagram. The input I.F. transformer is in a tall can and mounts on the top side of the chassis. The trimmer condensers (C & D) are built in and are accessible for adjustment through two holes in the top of the shield can. The transparent dial is designed to be mounted to the cabinet listed in the parts list, but may be taped to the dial plate temporarily with transparent scotch tape.

A black string with spring attached is used as a drive belt between the tuning shaft on the right and the tuning condenser gang. This is supplied with the dial. Wrap the spring itself around the shaft of the condenser just in front of the drum, so that the ends of the spring meet under the slit on the drum. Bring the string up over the drum and down to the tuning shaft. Wrap the string around the tuning shaft three times.

Wire the set by following both the pictorial and schematic diagram. Use only as much wire as is necessary for *short, direct* connections. Small condensers and resistors are supported by their own leads and any excess leads other than is required to make the connection, should be clipped off. Tube filaments are wired in series and the connections should be laid close to the chassis. The fifth lug on the oscillator coil is used to mount the coil under the chassis. When the coil is mounted, the fifth lug is automatically grounded.

In the schematic diagram there is a connection shown from one terminal of the oscillator coil up to and around the connection to the grid of the 12A8GT. This is known as a "gimmick." It is not necessary to use this gimmick but its use results in uniform sensitivity across the entire band. It is made by connecting two pieces of insulated wire about 3 inches long, one to each of the terminals on the trimmer condensers on top of the two gang tuning condenser. Twist the two pieces of wire together about three times. The capacity between the two wires (the wires do not touch) gives the effect mentioned above.

Aligning the I.F. Stage

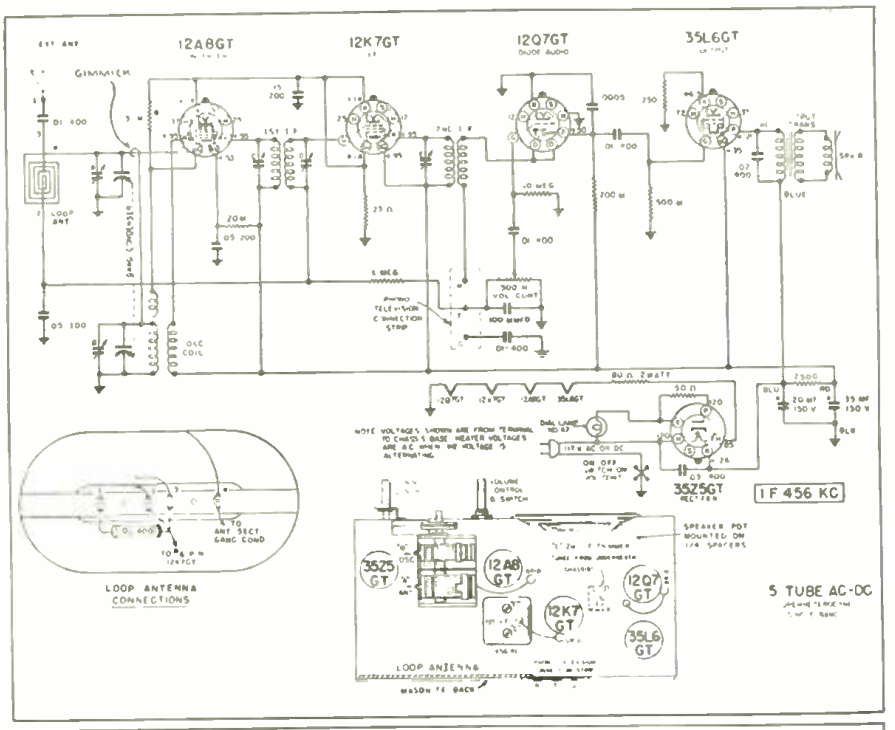
Very little alignment should be necessary, as the design of the coils and condensers are such that stations should be heard immediately, and just a little trimming is all that is necessary. The set is first tuned to a station at the low frequency end of the broadcast band. The pointer is then slipped onto the shaft, so that the frequency of the station corresponds to the pointer setting. Condensers C, D, and E on the I.F. transformers are then adjusted until the station is heard loudest. Now tune the set to a station at the high frequency end of the band. If the frequency setting does not correspond to the station frequency, adjust condenser B on the side of the tuning condenser so that the frequency setting is correct. Adjust condenser A for loudest response, and all your adjustments are completed.

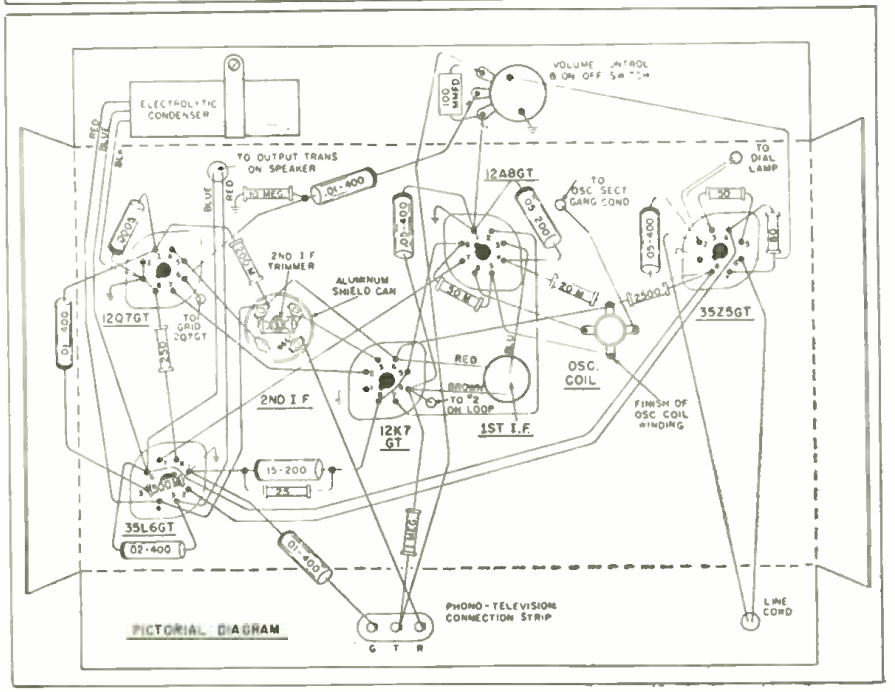
When the set is operated from an A.C. line, you may find that one position of the plug will produce less hum than the other. On D.C. there is only one position of the plug that will operate at all. Reverse the plug if no signal is heard.

The schematic diagram is marked with voltage readings at the terminals of each socket. This is handy information in case of trouble. Measurements are made from the terminals marked, to the chassis with a 1000 ohm per volt D.C. meter, except the No. 2 and No. 7 terminals of each socket. These are A.C. readings, and require an A.C. meter, except when the set is used on D.C.

This set also has terminal connections on the back for phonograph use. For use with any electric phonograph pick-up, remove the connecting link between terminals R and T. Connect the two terminals from the phonograph pick-up to terminals T and G. If one of the terminals from the pick-up is a shield, connect it to terminal G. If both leads are unshielded connect them whichever way gives the least amount of hum.

*Engineer, Allied Radio Corporation.





Above—schematic and picture wiring diagrams showing how to connect the relatively few parts required in constructing this 5-tube superhet. A loop antenna is used for reception and an extra coupling coil is provided on the loop, which permits connection to an external antenna for DX reception. No ground is required.

Parts List

KNIGHT
1—Punched chassis
1—Broadcast band loop antenna
1—Broadcast band dual tuning condenser (must have cut section oscillator condenser for proper tracking)
1—Oscillator coil (designed for cut section condenser)
5—Octal wafer sockets
1—Standard 456 kc. output I.F. transformer

KNIGHT
1—TJ type under chassis I.F. input transformer
1—5" P.M. speaker
1—Speaker matching transformer

KNIGHT
1—Type TJ dial and condenser drive
1—50,000 ohm, ½ watt resistor
1—20,000 ohm, ½ watt resistor
1—25 ohm, ½ watt resistor
1—1 megohm, ½ watt resistor
1—10 megohm, ½ watt resistor
1—200,000 ohm, ½ watt resistor
1—250 ohm, 1 watt resistor
1—2500 ohm, 10 watt resistor
1—50 ohm, ½ watt resistor
1—80 ohm, 2 watt resistor
1—500,000 ohm volume control with switch
4—.01 mf., 400 volt condensers
1—.15 mf., 200 volt condenser
1—.02 mf., 400 volt condenser
1—.05 mf., 200 volt condenser
1—.05 mf., 400 volt condenser
1—20-30 mf., 150 volt dual electrolytic condenser
1—100 mmf., mica condenser
1—500 mmf., mica condenser
1—25-100 mmf., compression trimmer condenser
1—3 connection phono strip
Miscellaneous hardware and wire

ACCESSORIES
1—12A8GT tube
1—12K7GT tube
1—12Q7GT tube
1—35L6GT tube
1—35Z5GT tube

KNIGHT
1—Special Cabinet to fit

Fitting the antenna for the 112-mc. transmitter and receiver onto the airplane used in the tests.

255 Miles on 112 Mc.

A New 2-Way Record

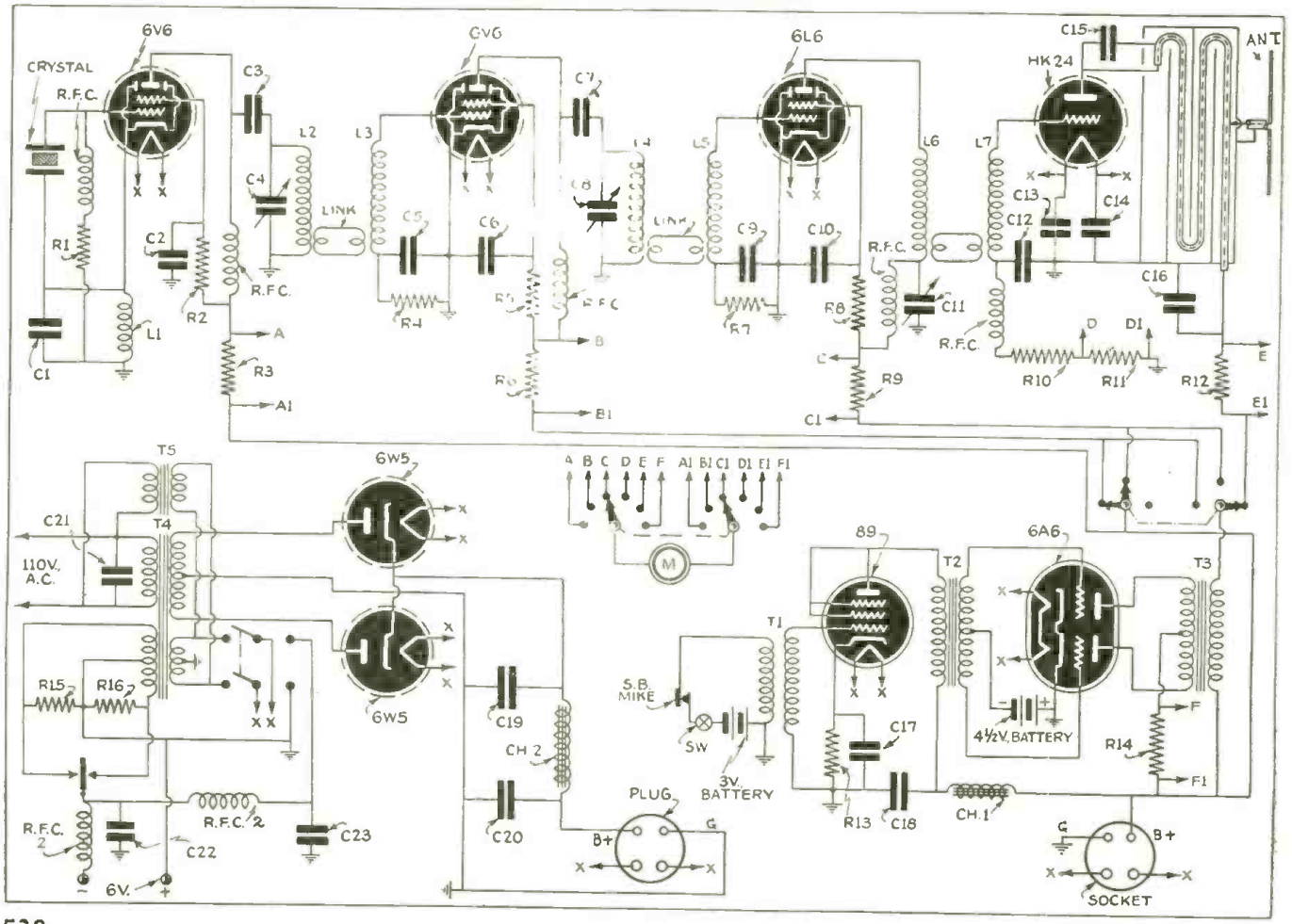
By A. D. Brandon

● LIKE the railroad engineer who spent his vacation riding up in the cab, Gil Laing, announcer-technician at KSRO Santa Rosa, California, took a day off from his regular chores one hot day last July and proceeded to help hang up a new distance record for two-way communication for the 112 megacycle (2½ meter) band. Laing (W6BJI) located one of his brother hams, Al Nuno (W6KIN) atop Mount St. Helena, 4300 feet elevation and loftiest peak in the vicinity, and loaded his own transmitter and receiver in an old Stinson plane. Two-way continuous contact was kept between Laing and Nuno from the Santa Rosa airport to Tulare, California, an airline distance of 255 miles. At this point Laing was unable to hear Nuno's self-excited transmitter, although Nuno, sweltering under 102 degrees Fahrenheit, hung on to Laing's voice for an additional ten miles. Laing then ceased further transmitting and turned back, as he had no means of knowing that he was being heard.

The secret of the record breaking transmission on 112 mc. here recorded lies in the special design of the transmitter. The details of the special co-axial tank circuit used are given.

The unusual construction of Laing's transmitter, built of conventional parts, warrants attention. Starting with an ordinary forty meter crystal, the frequency is put through a series of doublers, eventually emerging as a high-quality medium-powered stabilized signal on 112 megacycles. The crystal oscillator is a 6V6GT in an ordinary Tri-tet circuit with output on 20 meters. This is doubled with another 6V6GT tube to 10 meters. The second doubler, a 6L6G provides output on 5 meters and the final modulated amplifier is an HK24 doubling to 2½ meters.

Diagram of the 112 mc. transmitter.



C13—.001 mf. mica
C14—.001 mf. mica
C15—.001 mf. mica
C16—.001 mf. mica
C17—12 mf. 50 v. electrolytic
C18—8 mf. 450 v. electrolytic
C19—16 mf. 450 v. electrolytic
C20—16 mf. 450 v. electrolytic
C21—.5 mf. 600 v. electrolytic
C22—.5 mf. 100 v. electrolytic
C23—.5 mf. 100 v. electrolytic

TRIPLETT

M—100 ma. meter

NATIONAL

R.F.C.—2.5 mh. R.F. chokes

CARDWELL (Tuning Condensers)

C4—50 mf. Trim-air
C8—50 mf. Trim-air
C11—50 mf. Trim-air

THORDARSON (Transformers & Chokes)

T1—T86A02, mike to grid, transformer
T4—T14R40, Universal power transformer
T5—T73F60, filament transformer
CH1—T13C26, filter choke
CH2—T74C29, filter choke

U.T.C.

T2—S8, driver transformer
T3—S18, Class B plate to load transformer

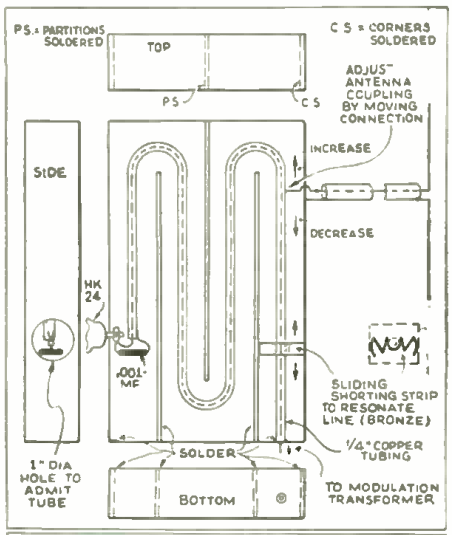
MALLORY

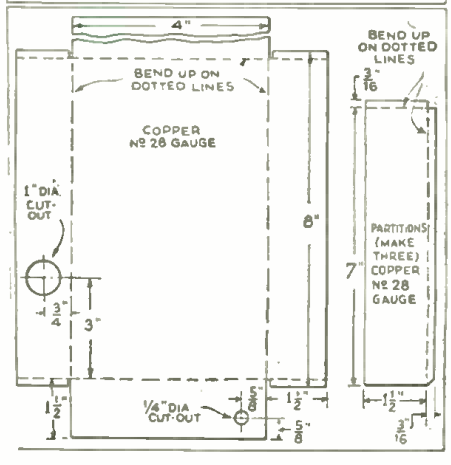
R.F.C. 2—A chokes

COIL DATA

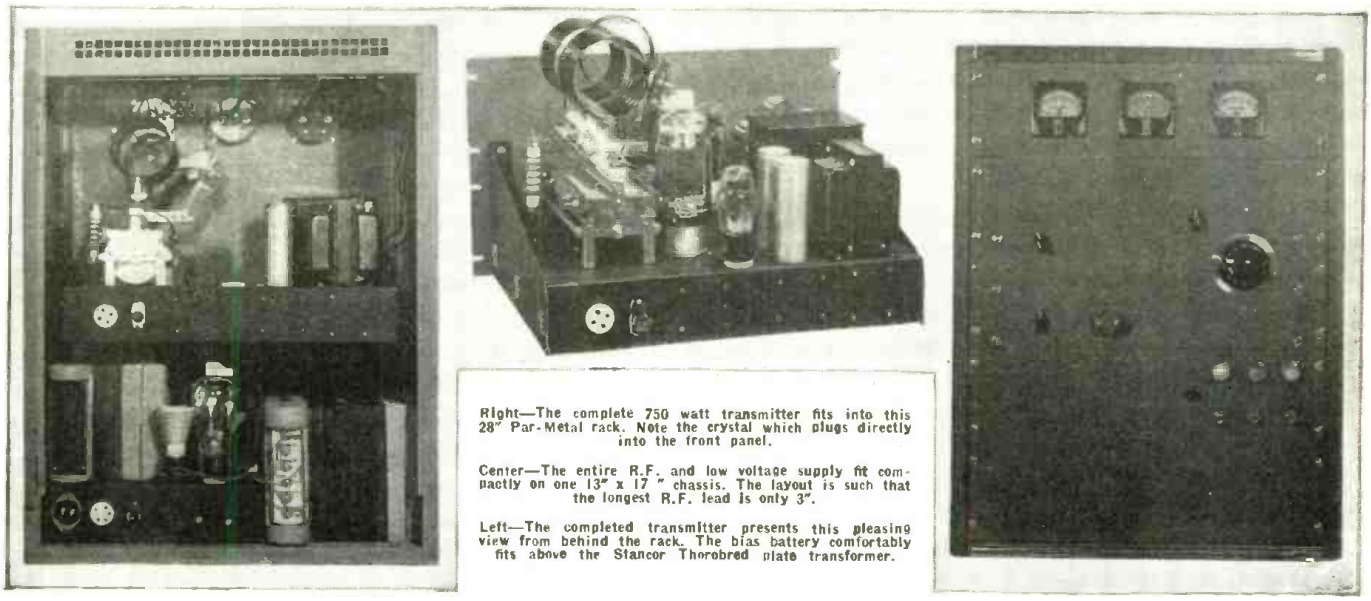
L1—12 turns, three-fourths inch diameter, #14
L2—14 turns, 1 inch diameter, #14
L3—20 turns, five-eighths diameter, #20
L4—8 turns, three-fourths diameter, #14.
L5—15 turns, five-eighths diameter, #20
L6—8 turns, three-quarters diameter, #14
L7—11 turns, three-quarters diameter, #14

Details of the co-axial tank circuit inductance are given below, with dimensions of trough partition.





A TWO-WAY LAMP YOU WILL BE PROUD TO OWN. FREE WITH YOUR SUBSCRIPTION. SEE PAGE 563.



Right—The complete 750 watt transmitter fits into this 28" Par-Metal rack. Note the crystal which plugs directly into the front panel.

Center—The entire R.F. and low voltage supply fit compactly on one 13" x 17" chassis. The layout is such that the longest R.F. lead is only 3".

Left—The completed transmitter presents this pleasing view from behind the rack. The bias battery comfortably fits above the Stancor Thorobred plate transformer.

A Compact *Kilowatt* TRANSMITTER

Larry LeKashman, W2IOP

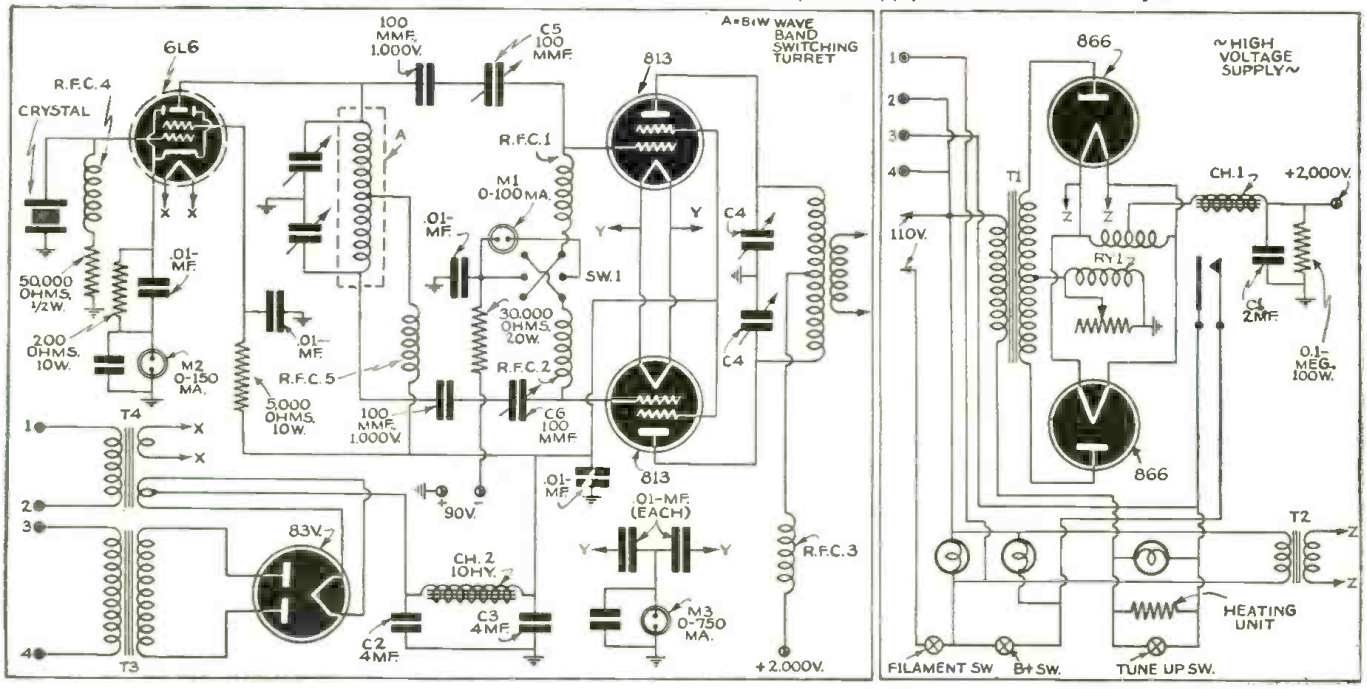
● DID you ever have a dream rig? Probably no normal radio fan has not, at one time or other dreamt of some super layout. Such was the case here, and from our low-cost high-power transmitter of last month we have graduated to this super-streamlined transmitter. This "compact kilowatt" is our dream come true.

No smaller R.F. lineup could exist for general operating, a 6L6 driving a pair of 813's. Actually it isn't a full KW, but 360 mils at 2000 volts is close enough. This particular transmitter, as it stands, is not in its final form. It is not practical to drive the 813's from a tri-tet, which limits the transmitter's operation to fundamental crystal frequencies. Driving the 6L6 from my signal-shifter worked, although generally speaking there was a lack of excitation. It would seem that PP 6L6's might be the answer, with no additional tuning controls. There will appear shortly a follow-up on this article, with our final solution to the excitation problem.

In the design of this transmitter several factors were of prime importance. It must be compact—work at manufacturer's ratings—and have at least 500 watts output. The obvious answer was *beam-power* tubes. While this made short work of the R.F. problem the large high voltage equipment was still a stumbling block. Stancor *Thorobreds* meet the standard of quality I hoped to maintain and their physical dimensions lent themselves admirably, as the photographs illustrate. The large plate transformer was not mounted on a chassis and fit comfortably on the bottom of the rack. Leads were brought out by drilling a hole in the safety covering of heavy celluloid which covers all the terminals.

The B & W coils mount directly on the Cardwell XG 140 XD, making a very neat and highly efficient assembly. The large Millen R.F. choke fits directly into the high voltage connector and likewise makes an excellent unit. The 3000 volt Cornell-Dubilier filter is mounted underneath the

Below, wiring diagram of the transmitter here described; the power supply unit is shown at the right.



chassis portion of the high-voltage supply.

Adjusting the coupling is not very difficult. Both variable condensers, mounted on insulators below the chassis with their shafts protruding, are set at maximum capacity. The 6L6 plate is tuned to resonance and each grid metered, which is made possible by the DPDT switch in the grid circuit of the 813's. This is obviously necessary under these circumstances. The condensers are then adjusted to give equal drive on each tube, usually by decreasing the capacity of the tube with more drive.

By-passing of the meters is very important, particularly in the final stage. While the novice should not attempt it, the by-pass is most efficient inside the meter case. However, directly across the meter terminals will suffice.

One coil to change in a transmitter of this size isn't a bad average. With the Guardian overload relay and tune-up switch the striking simplicity of the transmitter is an outstanding feature. The 600 watt heating element is in series with the HV primary and may be switched in and out at will. Being small it replaces the usual 300 watt electric bulb to good advantage. This transmitter is now doing yeoman duty on 40 and 80 and has already proven itself a worth-while investment.

Compact Kilowatt Parts List

RCA RADIOTRON (Tubes)
6L6G
813's
866's

JAMES MILLEN MFG. CO.
1—10008 tuning knob
2—37001 safety plugs
4—36001 safety caps
2—33004 sockets
1—33005 socket
1—33008 socket
1—77083 hash filter
1—77866 hash filter
3—34100 RFC1, 2, 4, 5
1—34150 RFC3
Type 31001 standoffs
1—33002 crystal socket

IRC (Resistors)
All resistors as indicated on circuit
½ watt, type BT½
10 watt, type ABA
100 watt, type HAA

PAR-METAL (Panels & Chassis)
1—MG 3003 meter panel
2—G3605 front panels
1—DL 2613 rack
2—B4536 chassis
2—SB713 chassis brackets

KENYON
1—T385 813 fil. trans.

BARKER & WILLIAMSON (Coils)
1—BTCT baby turret
1 HDV base assembly
Type HDVL coils

CARDWELL (Condensers)
1 XG 110 XD, C4
2—ZU 100 AS, C5, 6

SIMPSON (Meters)
Model 27 illuminated meters
0-10 ma., M1
0-150 ma., M2
0-750 ma., M3

GUARDIAN
1—Model X-100 overload relay RY1

CORNELL-DUBILIER (Condensers)
(All condensers as indicated on circuit) .01 by-pass may be paper
C1—(HV supply) TQ 30020
C2—TLA 6040
C3—TLA 6040

STANCOR (Transformers & Chokes)
THOROBREDS
1 T8005 plate trans., T1
1 C2313 choke, CH1
1—P8023 HV fil., T2
STANDARD LINE
1—P4081 6L6 plate, HV only, T3
1 P6289 fil. windings only, T4
1 C1421 choke, CH2

E. F. JOHNSON
813 sockets

AMPHENOL
Plugs

TABLE 1. *Abbreviations to be used in radio communications—Q code—Abbreviations to be used in all services*—CONTINUED

Abbreviation	Question	Answer to statement
QTT	Will you give me the position of my station on the basis of bearings taken by the radio direction-finding stations which you control?	The position of your station on the basis of bearings taken by the radio direction-finding stations which I control is . . . latitude, . . . longitude.
QTU	Will you transmit your call signal during 50 seconds ending with a 10-second dash, on . . . kilocycles (*or* . . . meters) so that I may take your radio direction-finding bearings?	I will transmit my call signal during 50 seconds, ending with a 10-second dash, on . . . kilocycles (*or* . . . meters) so that you may take my radio direction-finding bearings.
QTH	What is your position in latitude and in longitude *(or according to any other indication)*?	My position is . . . latitude, . . . longitude *(or according to any other indication)*.
QTI	What is your true course?	My true course is . . . degrees.
QTJ	What is your speed?	My speed is . . . knots (*or* . . . kilometers) per hour.
QTM	Transmit radio signals and submarine sound signals to enable me to determine my bearing and my distance.	I am transmitting radio signals and submarine sound signals to enable you to determine your bearing and your distance.
QTO	Have you left dock (*or* port)?	I have left dock (*or* port).
QTP	Are you going to enter dock (*or* port)?	I am going to enter dock (*or* port).
QTQ	Can you communicate with my station by the International Code of Signals?	I am going to communicate with your station by the International Code of Signals.
QTR	What is the exact time?	The exact time is . . .
QTU	What are the hours during which your station is open?	My station is open from . . . to . . .
QUA	Have you any news from . . . *(call signal of the mobile station)*?	This is the news from . . . *(call signal of the mobile station)*.
QUB	Can you give me, in the following order, information concerning: visibility, height of clouds, ground wind at . . . *(place of observation)*?	This is the information requested:
QUC	What is the last message you received from . . . *(call signal of the mobile station)*?	The last message I received from . . . *(call signal of the mobile station)* is . . .
QUD	Have you received the urgent signal transmitted by . . . *(call signal of the mobile station)*?	I have received the urgent signal transmitted by . . . *(call signal of the mobile station)* at . . . *(time)*.
QUF	Have you received the distress signal sent by . . . *(call signal of the mobile station)*?	I have received the distress signal sent by . . . *(call signal of the mobile station)* at . . . *(time)*.
QUG	Will you be forced to come down on water (*or* on land)?	I am forced to come down on water (*or* on land) at . . . *(place)*.
QUH	Will you give me the present barometric pressure at sea level?	The present barometric pressure at sea level is . . . *(units)*.
QUJ [1]	Will you please indicate the proper course to steer toward you, with no wind?	The proper course to steer toward me, with no wind, is . . . degrees at . . . *(time)*.
QUK	Can you tell me the condition of the sea observed at . . . *(place or coordinates)*?	The sea at . . . *(place or coordinates)* is . . .
QUL	Can you tell me the surge observed at . . . *(place or coordinates)*?	The surge at . . . *(place or coordinates)* is . . .
QUM	Is the distress traffic ended?	The distress traffic is ended.

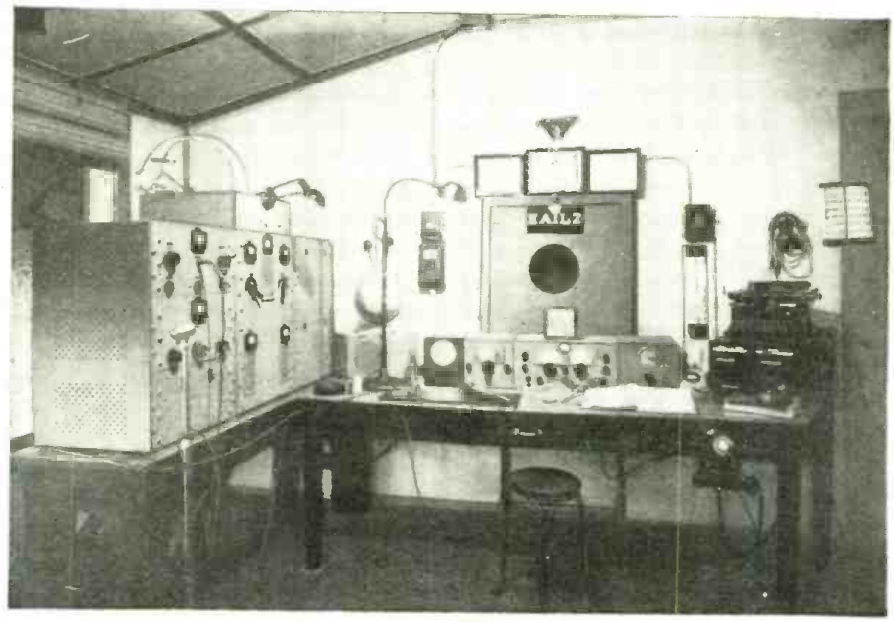
[1] In certain aeronautical services, "true course" and "true bearing" are called "geographic course" and "geographic bearing."

TABLE 2.—*Scale used to express strength or leability of signals*

Strength	*Leability*
QSA 1 = scarcely perceptible.	QRK 1 = unreadable.
QSA 2 = weak.	QRK 2 = readable now and then.
QSA 3 = fairly good.	QRK 3 = readable, but with difficulty.
QSA 4 = good.	QRK 4 = readable.
QSA 5 = very good.	QRK 5 = perfectly readable.

TABLE 3.—*Miscellaneous abbreviations*

Abbreviation	Meaning
C	Yes.
N	No.
P	Announcing private telegram in the mobile service (to be used as a prefix).
W	Word *or* words.
AA	All after . . . (to be used after a question mark to request a repetition).
AB	All before . . . (to be used after a question mark to request a repetition).
AL	All that has just been transmitted (to be used after a question mark to request a repetition).
AS	Waiting period.
BN	All between . . . (to be used after a question mark to request a repetition)
BQ	Answer to RQ.
CL	I am closing my station.
CS	Call signal (to be used in requesting that call signal be given or repeated)
DB	I cannot give you a bearing, you are not in the calibrated sector of this station
DC	The minimum of your signal is suitable for the bearing.
DF	Your bearing at . . . *(time)* was . . . degrees, in the doubtful sector of this station, with a possible error of two degrees.
DG	Please advise me if you find an error in the bearing given.
DI	Doubtful bearing due to the bad quality of your signal.
DJ	Doubtful bearing due to interference.
DL	Your bearing at . . . *(time)* was . . . degrees, in the uncertain sector of this station.
DO	Doubtful bearing. Request another bearing later, or at . . . *(time)*.



"Honor" Plaque Awarded

To *Luigi Zavattero*, KA1LZ

For Best HAM Station Photo

Herewith please find photo of my station KA1LZ. The Xmtr is a kilowatt on phone and CW, either on 20 or 10 meters. Line-up: 6F6G straight crystal oscillator, two 6L6G parallel doublers, into a pair of 35T push-pull buffers, and a pair of 250THs push-pull final amplifier. Final modulation into a pair of 250THs in push-pull.

Modulation with AVC, gain and tone controlled.

Voltage on Final RF: 2500, and on final modulation, 2300 volts (by RX21 rectifiers.)

Antenna: a four element atop 92 foot tower, rotomatic drive.

Countries worked on phone: 94 (on 20 and 10 meters.) USA (States) worked on fone 47 (need only Wyoming). Worked all continents several times, either on phone or CW; also worked Greenland on phone. KA1LZ was the 2nd high score on *phone* in the general results for the DX World-Wide Radio Contest of "Radio", November-December 1939.

Receiver: RME 69-DB20; Oscilloscope—a 3" Dumont type.

Luigi Zavattero, KA1LZ,
100 Manga Avenue,
Manila, P. I.
(Representative of American QSL Bureau in the Philippines)

●

Here is the new "Award of Honor" Plaque which measures 5" x 7" in size. It is handsomely executed in colors on metal, and is framed, ready to hang on the wall. The name of the winner will be suitably inscribed.

●

Note These Important Rules

Attach a brief description not longer than 300 words, describing the general line-up of the apparatus employed, the size, type and number of tubes, the type of circuit used, name of commercial transmitter—if not home-made, watts rating of the station, whether for c.w. or phone or both, etc., also name of receiver.

State briefly the number of continents worked, the total number of stations logged or contacted, and other features of general interest. Mention the type of aerial system and what type of break-in relay system, if any.

Important — Enclose a good photograph of yourself, if your likeness does not appear in the picture!

You do not have to be a reader of RADIO & TELEVISION in order to enter the contest.

Address all photos and station descriptions to Editor, Ham Station Photo Contest, c/o RADIO & TELEVISION, 20 Vesey Street, New York, N. Y.

"CQ"

Larry LeKashman
W2IOP

● AT least there are a lot of fans who are in complete accord with us on the QSL situation. We could start a "lynching party" by giving the calls of the W2 who boasts of his never answering a single QSL out of the 5,000 sent him; or another W2 who wouldn't even let the second district QSL manager send him his 4-foot stack of DX cards. I looked through that pile, just one among thousands of unclaimed *foreign* cards, and saw cards from such stations as MX2B; J8CA; VS6AF; and more in pretty much the same class. So far, the good reason for not QSL'ing hasn't arrived — until it does we, for good or bad, are going to fight for 100% returns on all verification cards — Ham or SWL.

W2MUO almost got into the SS, until W2MXB borrowed his ECO and W2IOP his exciter. W2FLL is now on 14 mc. phone. First night on Marvin worked a K7 and since then hasn't worked out of his backyard. W2IHP plans on getting back on the air, *if* and *when* he gets a new receiver.

W2LNY's new rig, using an 813 final, worked without any "bugs" from the time it was first turned on. R8 in the Canal Zone early one evening on 40 was Ed's first real trick. W9RFA, now permanently located in New York, just came back from a vacation in California. W2MHD is working out very well, using an 807 final and a home-built super. W9DYG is operating portable from the Choate School in Wallingford, Conn. W6QM1/2 reports consistent contacts with the Coast, using an indoor antenna below the ground level.

The first week-end of the SS has passed at this writing, but it is still too early to try and predict winners. Lots of "old-timers," like W3BES; W2GSA, W9VES; W9FS and W1TS were on.

How many of you have ever wondered about the members of the DX Century Club. I started to think about this group of DX men, unconsciously listing the occupations of those I knew personally. The result is this: (Omitting calls) 3 Broadcast Station Operators; 1 Grocery Boy; 1 Movie Producer; 1 Radio Manufacturer; 1 Sales Manager for radio firm; 1 Government Revenue Inspector; 1 Teacher; 1 Policeman; 2 Doctors; 1 Fireman; 1 Lawyer; and 3 College Students.

Remember, if you will, that at this point "CQ" is still your column.

NEW S-W "FAN" CONTEST

● HERE is a new contest for short wave listeners, submitted by the International Short Wave Club, of which Mr. Arthur J. Green is the president. The contest closes July 1, 1941 and a series of valuable prizes including radio sets, globes, foreign stamps, and a number of other interesting and valuable prizes are to be offered. As pointed out by Mr. Green, in spite of the war, there are hundreds of short wave stations still on the air and *willing to verify!* This does not include amateurs, whose stations will be counted in this contest, if you hear them and get their verification. This contest is open to every short wave fan and points will be compiled in groups of 100 for each 100 miles between the listener and the station measured by the shortest possible route. Stations less than 500 miles away will *not* be counted. A station operating on more than one frequency will be counted more than once *only* if verified specifically on more than one frequency. Amateur station verifications must bear proof of mailing (such as postage stamps) and must indicate in some manner that the station was heard using voice.

The contestant having the greatest number of points will win the grand prize. Other prizes will be awarded according to merit. Address all inquiries regarding the contest to—Editor, ISWC Short Wave DX Contest, Care of RADIO & TELEVISION MAGAZINE, 20 Vesey Street, New York City.

Bringing Home the Amateur QSL!

Harold B. Clein

● AMATEURS are different! In my recent article, "Getting That Veri," which appeared in the September and October issues of this magazine, I attempted to describe the best tried methods of reporting signals to a short-wave broadcasting station. Methods that would insure the listener of a high percentage of verifications in return for the reports.

But securing a QSL from an *amateur* ("Ham") station requires an entirely different procedure. The reason for this is simple. The broadcasting station is interested solely in increasing its signal service area, and so any information—the more detailed the better—which will enable the engineers to get a clear picture of receiving conditions in the listener's locality is very much desired, and appreciated. On the other hand, the amateur operator doesn't care what happens to his signal, just so long as a successful contact can be made with another amateur. If an amateur in Chicago is in contact with an amateur in Pango-Pango (American Samoa), the fact that the signals may also be heard in Hoboken is merely incidental!

Unfortunately, the average short-wave listener starts off wrong. The SWL has "listened in" on a conversation between two fellow amateurs, and while the air is free, and there is no law against it, nevertheless the SWL is guilty of *listening in* on a conversation that was not primarily intended for anyone except the two amateurs concerned! Then, as if this effrontery were not enough, the SWL actually has the "crust" to write to the amateur and boast about having listened in! To top this off, the SWL expects the amateur to reward these eavesdropping efforts with a QSL card, which not only costs the amateur money, but takes time and effort to address and mail the card. The amateur certainly doesn't want, or need the SWL report (except in some rare instances) and so looking at the matter in this light, is there any wonder that amateurs refuse to verify listener reports?

It all boils down to this: If the SWL expects a high percentage of QSL card replies in answer to reports, then it is up to the SWL to see that the amateur also gets something out of the deal. This is the secret of the whole business. If you can give the amateur something he wants, then you can be sure that a QSL card will be forthcoming. However, if it is all a one-sided affair, and you are simply begging for a card, and offering nothing in return, you can expect very meager returns for your reports. Think that over! Are *you* giving the amateur something in return for his QSL card?

It is difficult to make hard and fast rules for reporting the signals from an amateur station, but the following information should always be included in every report.

1. Prove beyond doubt that you heard the station.
2. Give a brief but accurate signal report. An SWL card is O.K. if it is complete enough.
3. Enclose your report in an envelope. Never send a card alone.
4. Always enclose return postage. An International Reply Coupon is O.K.
5. Be sure that you have affixed sufficient postage to your letter. If the amateur has to pay a postage-due fine he will not be very friendly towards your report!

Now you must *earn* that QSL card. You have probably proved to the amateur that you actually heard his signals, and as far as the report goes, you are entitled to possess one of the cards. But that is hardly enough to make the amateur sit down and fill out a card for you, is it?

Put yourself in the amateur's place. What would make you send a card? I sit down and write a newsy letter of a page or two, and tell the amateur all about my hobby of listening. I tell him when I started, how many countries I have heard, etc. I also tell him about several of the local amateurs (information he will not get through the usual channels), and the times they are on the air; their frequency, etc. I always enclose a picture postcard with each report. This card is selected with great care, and pictures an interesting local scene. If a camera is available, some unusual snaps could be taken especially for this purpose. A picture of yourself, your equipment, etc., is always interesting to amateurs everywhere. Make your letter so interesting that the amateur simply cannot help sending you a card.

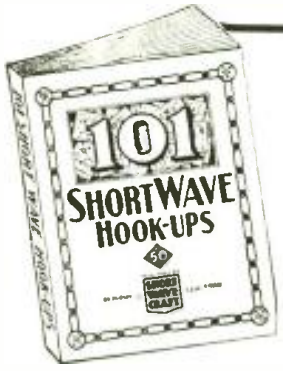
But never send a report if you are in doubt about hearing the amateur. I would like to quote several notes from popular DX amateurs which I have in my possession. One, from VK7PA (Tasmania) "*. . . . Most of my listener reports prove only that the SWL owns a call-book and has an active imagination! These reports are discarded, of course. . . .*" And here is one from a North African amateur who rarely uses phono. "*. . . I received only three correct reports, out of about forty! The rest told me—with amazing accuracy—what I said on phone! . . .*" When reported this amateur was on *CW* talking to a W9 amateur who was on phone!!!

Some amateurs, of course, send a card for almost any kind of a SWL report. Still other amateurs refuse to verify a report, regardless of how excellent it is. In fact, there are actually some amateurs, fortunately in the minority, so discourteous that they will not even send a QSL to their amateur friends who have contacted them. The great majority of amateurs are swell fellows (and girls!) and are happy to send a QSL to those that merit them.

Golden Rule advice is perfect here. If you, the listener, will send the amateur the kind of letter and report that you would like to receive if you were the amateur, a QSL will be delivered by return mail!

.... THESE OUTSTANDING SHORT WAVE BOOKS ARE *Now Available* AT YOUR DEALER!

YOU *buy* parts, tubes, kits, accessories from your local radio dealer—that's what countless thousands of short-wave fans do. Now through a nation-wide distribution service our numerous books are available at your favorite radio dealer—right where you buy other radio equipment. It's more convenient, saves time and you can inspect the books before you buy. *Ask your dealer to show you all the books advertised on this page—they're always in stock.*



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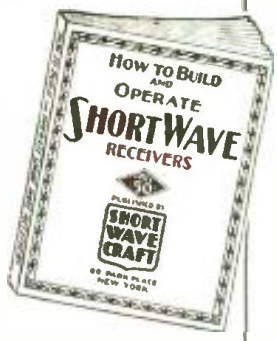

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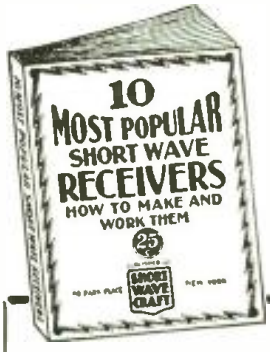

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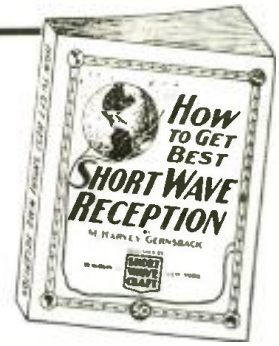

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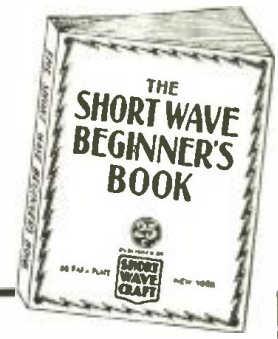

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Radio Wire Television, Inc., Boston
Library Book House, Springfield
Tremont Elec. Supply Co., Boston

MICHIGAN
Rissi Brothers, Detroit

MINNESOTA
St. Paul Book & Stat. Co., St. Paul

MISSOURI
Burstein-Applebee Co., Kansas City
Radio Labs., Kansas City
Walter Ashe Radio Co., St. Louis
Van Sickle Radio Co., St. Louis

NEBRASKA
Radio Accessories Company, Omaha

NEW JERSEY
Radio Apparatus Co., Newark
United Radio Co., Newark
Radio Wire Television, Inc., Newark

NEW YORK
Fort Orange Radio Dist. Co., Albany
Radio Wire Television, Inc., Bronx
Radio Wire Television, Inc., Jamaica, L. I.
Harrison Radio Co., New York City
American News Co., New York City
Baker & Taylor Co., New York City
Blan, the Radio Man, New York City
David Bogen & Co., New York City
Eagle Radio Co., New York City
Federated Purchaser, Inc., New York
Radio Circular Co., New York City
G. E. Stechert & Co., New York City
The Steiger Co., New York City
Sun Radio Co., New York City
Terminal Radio Corp., New York City
Thor Radio Corp., New York City
Try-Mo Radio Co., New York City
Van Riemsdyck Book Stores, New York City
Radio Wire Television, Inc., New York City
H. W. Wilson Co., New York City
Radio Parts & Equipment Co., Rochester
M. Schwartz & Son, Schenectady

OHIO
News Exchange, Akron
United Radio, Inc., Cincinnati
College Book Exchange, Toledo

OREGON
J. K. Gill Co., Portland

PENNSYLVANIA
The 437 Store, Philadelphia
M & H Sporting Goods Co., Philadelphia
Radio Electric Service Co., Philadelphia
Cameradio Co., Pittsburgh

UTAH
Radio Supply, Inc., Salt Lake City.

WASHINGTON
Seattle Radio Supply Co., Seattle
Wedel Co., Inc., Seattle

ARGENTINA
Radio Revista, Buenos Aires

AUSTRALIA
McGill's Authorized Agency, Melbourne

BELGIUM
Emil Arens, Brussels

CANADA
T. Eaton & Co., Winnipeg, Man.
Electrical Supplies, Ltd., Winnipeg, Man.
Wholesale Radio Supply, Winnipeg, Man.
Canadian Electrical Supply Co., Ltd., Toronto, Ont.
Radio Trade Supply Co., Ltd., Toronto, Ont.
Wholesale Radio Co. Ltd., 1133-35 Bay St., Toronto, Ont.
Canadian Electrical Supply Co., Ltd., Montreal, P. Q.

BRAZIL
Agencia Soave, Sao Paulo

CHINA
China News Co., Shanghai
International Booksellers, Ltd., Shanghai

ENGLAND
Gorringe's Amer. News Agency, London

FRANCE
Toute La Radio, Paris

GERMANY
Rehr G.M.B.H. SW15, Berlin NW No. 7

HOLLAND
Radio Peeters, Amsterdam, Z.

INDIA
Empire Book Mart, Bombay

MEXICO
American Book Store, Mexico, D. F.
Central De Publicaciones, S. A., Mexico, D. F.
Jaques Salvo, Mexico, D. F.

NEW ZEALAND
Johns, Ltd., Auckland
James Johnston, Ltd., Dunedin
Te Aro Book Depot, Ltd., Wellington

SOUTH AFRICA
Technical Book Co., Cape Town
Central News Agency, Johannesburg
International House, Johannesburg
South African Radio Publications, Johannesburg

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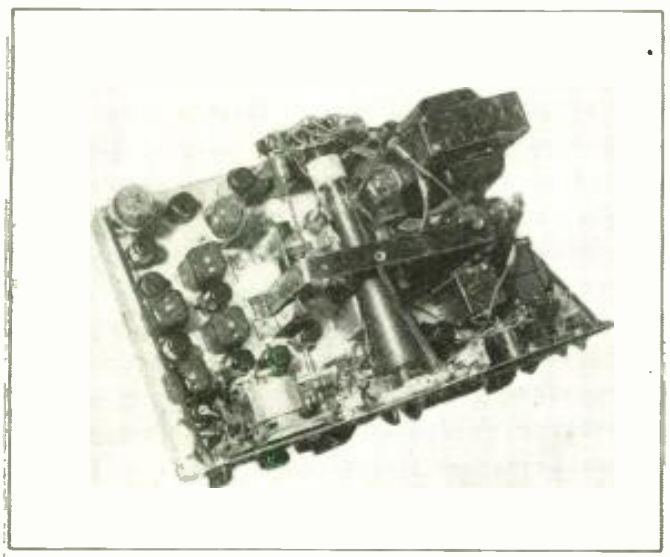
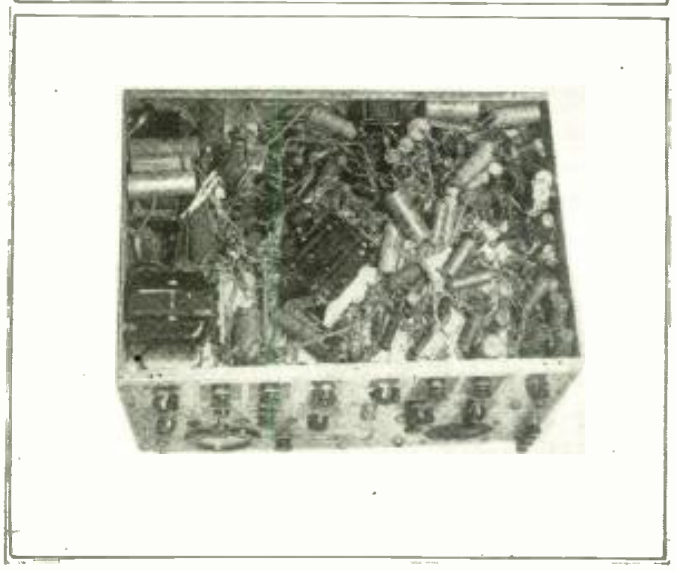
A Semi-Portable Television Receiver

R. H. Horn





● IN the early days, when a customer was interested in a radio set, before buying he wanted to hear how good reception would be in his home; and today it is the same with a *television* receiver. However, the present day television receivers require experimenting in the home with dipole antennas in different positions to get the best results. For that reason I thought it a good idea to carry a small *portable* television receiver to the customer's home and check *local* conditions for actual reception of a *television* program.

When we receive a call to report on reception conditions at a certain locality, it is easy to take this *portable* receiver to make a test in the home for proper installation of the dipole antenna.

Included in the circuit is a field-strength meter circuit, which can be switched in to either the *sound* frequency or the *video* signal at will, to further check the proper location of the antenna for best results.

For those television technicians who would like to build and duplicate this instrument, the following will give complete constructional details.

Looking at the front panel of the receiver—from left to right—beginning at the bottom, first row of controls are: (1) gain for video signal, (2) gain for sound receiver, (3) gain for sound signal in field strength meter, (4) gain in synchronization separator circuit, (5) horizontal sweep, (6) horizontal input, (7) vertical input, (8) vertical sweep. The two knobs above the controls six and seven on bottom row are the *amplitude* controls for *horizontal* and *vertical* sweeps.

Second row: (1) oscillator control in video circuit, (2) gain for sound receiver, (3) intensity control for cathode ray tube, (4) focus control, (5) spot control—right or left, (6) spot control—up or down. Above these are three toggle switches, one for the A.C. line to transformers, one for high voltage to the cathode ray tube and the other to cut in the field-strength meter. On the left of the meter is the 200 ohm potentiometer control, to set the needle of the meter to full scale before proper reading can be taken.

The toggle switch on the top right-hand corner connects the meter to the sound signal and the one below to the video signal; either one can be cut in or out at will. The two jacks below the cathode ray window are for earphones, one plugs in the *sound* output and the other to the *video* output. Up in the left-hand corner are four binding posts, the top two are for the lead-in from the dipole, the one below is for the sound receiver and the fourth is a ground. The third can be connected to the second, instead of using a separate antenna for the sound.

Looking at the chassis layout, on the right can be seen the video section with its I.F. transformers. These transformers and associated tubes must be mounted in a staggered arrangement to limit any magnetic coupling that might exist otherwise and cause unstable operation.

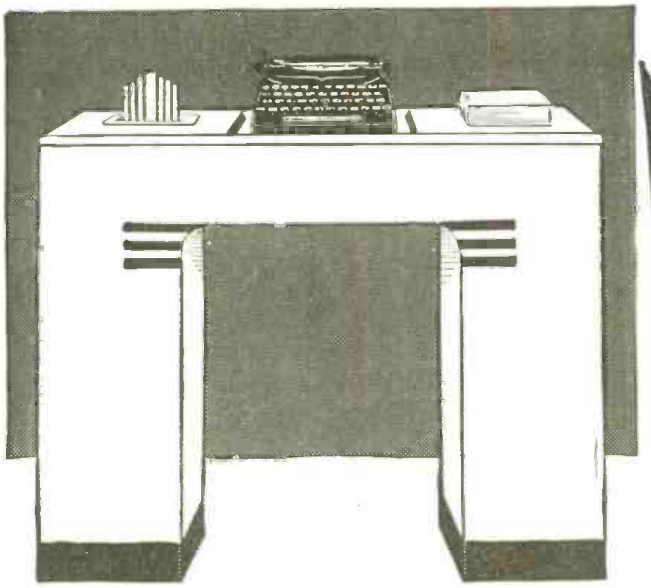
Next can be seen the *sound section* and then the *power-supply*. The power transformer must be of such design that it is capable of delivering plenty of current in the secondaries, without overloading and getting hot. The filament winding must carry at least 11 amps. and the secondary power winding 400 mills. (ma.).

The transformer for supplying the voltages to the cathode-ray tube is mounted underneath the chassis, as well as all the chokes and filter condensers. You will note that the by-pass condensers and resistors have no symmetrical arrangement, they were soldered in position where handy but as close as possible to their individual function of the circuit. No trouble was encountered in balancing the intermediate stages in either the video or sound sections with this arrangement, and when completed it compared in results to commercial receivers, except for the size of the picture. The detail of the picture is very good and any distortion of the incoming video signals, such as ghost images or reflection could be plainly seen on this 3 inch tube.

By necessity the mounting of the cathode ray tube in such close proximity to the power-supply caused distortion in the sweep circuits; this trouble was eliminated entirely by enclosing the tube

●

Three photos at left show front and top and bottom views of the semi-portable television receiver here described by Mr. Horn. This television receiver uses a 3-inch cathode-ray tube and the sound receiver section is also included in the description.



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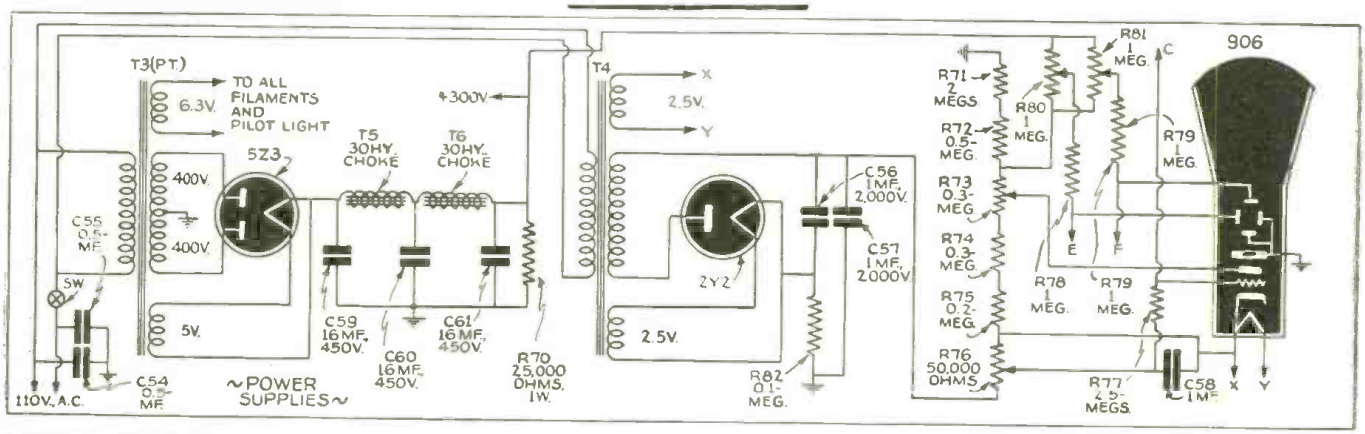
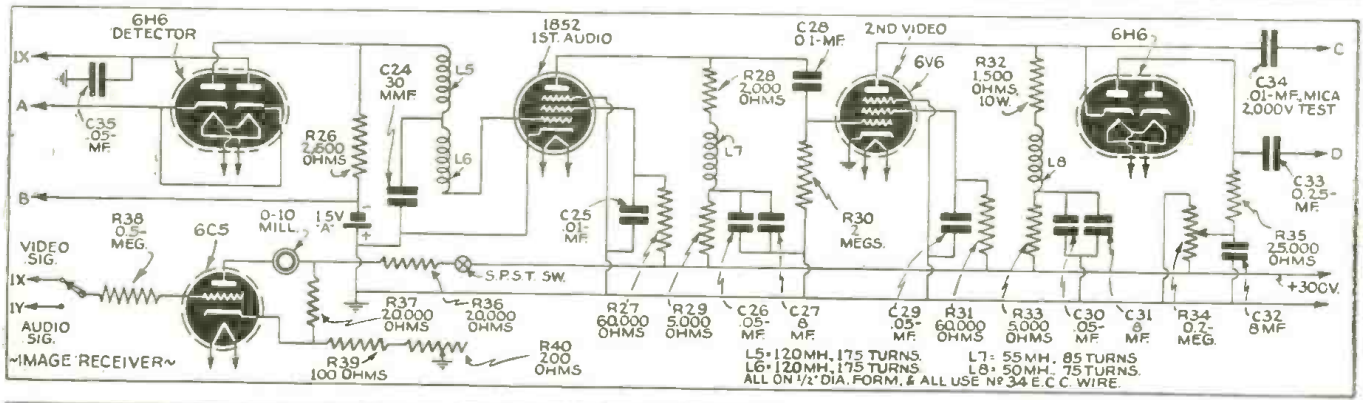
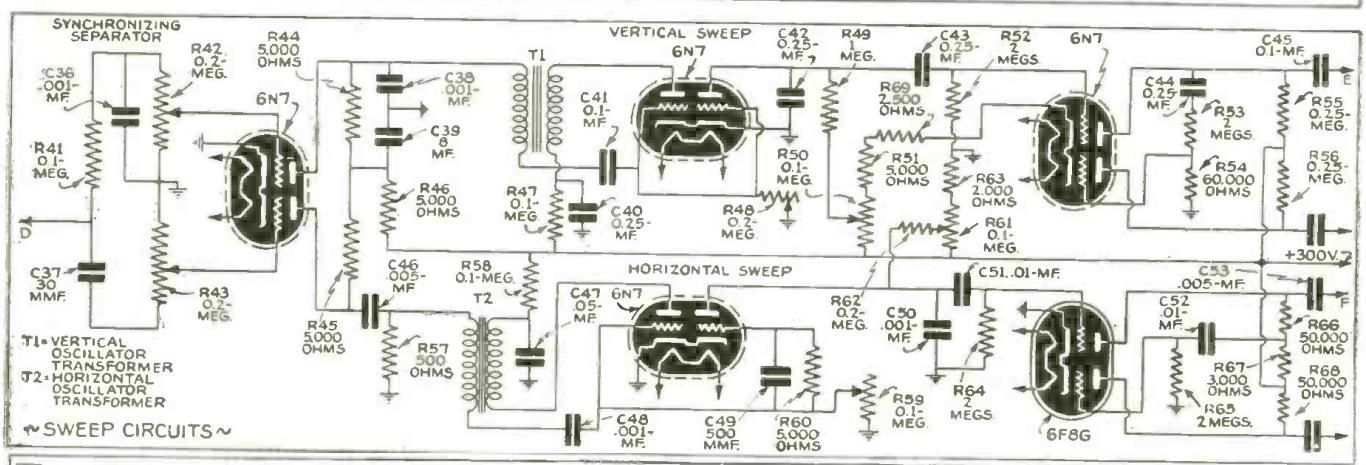
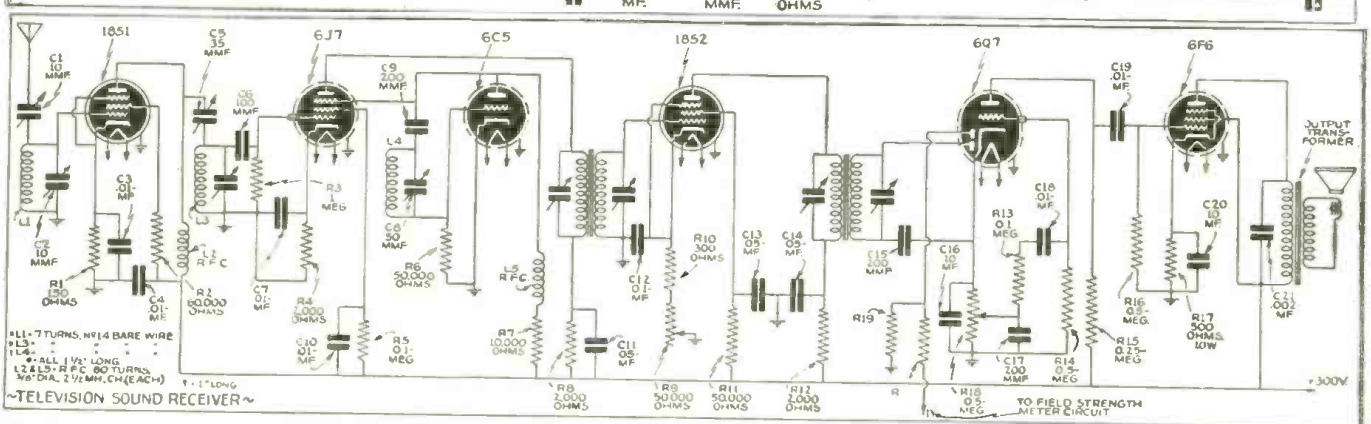
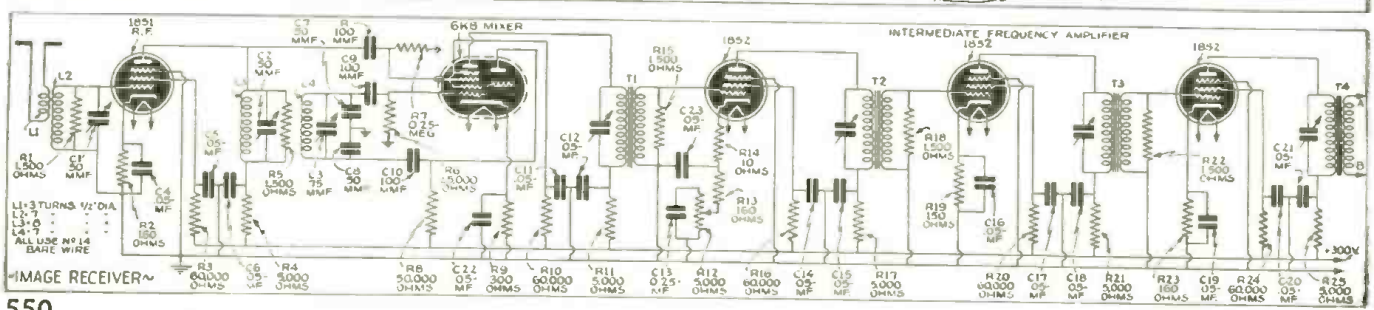










in a quarter-inch thick iron tube. I also found it necessary to extend the spot controls to the rear of the chassis; they are mounted next to the tube socket by extended brackets from the chassis and controlled from the front of the panel by flexible shafts, such as those used in auto radio sets.

On the right of the cathode ray tube window is a green light, to indicate when the power is on; the other lamp on the left side indicates when the high voltage is supplied to the cathode ray tube. The toggle switch used in this circuit is a double-pole, single-throw; one side of the switch is for the six volt circuit, and the other for the high voltage.

The type and make of transformers, chokes, resistors and condensers are left to the builder to decide; however, use nationally known brands.

In the center of the chassis can be seen a metal strap, this strap is fastened securely to the chassis and extended up to the level of the front panel, so that when the chassis is slipped into the cabinet the screws that hold the handle can fasten to this strap, making a very secure job for carrying.

The cabinet is made of half-inch plywood, covered with leather.

The chassis is 17" wide, 12" deep and 3" high. The front panel is 17" x 10" x ¼" dur-aluminum.

It will be noticed that only one plate of each tube in the output of the sweep circuits is used; the push-pull circuit was intentionally constructed, so that at any future date it can be adapted very easily to a cathode ray tube having separate deflecting plates.

Video Receiver

L1—3 turns of 22 D.C.C. wound in between the L2 Coil—(grid end of coil)
L2—7 turns ½" dia. (inside) spaced thickness of wire, which is No. 14 bare
L3—8 turns ½" dia. (inside) spaced thickness of wire, No. 14 bare
C1—Across L2—15 mmf. V.C. (Cardwell ZR-15-AS)
C2—Across L3—35 mmf. V.C. (Cardwell ZR-35-AS)
C3 Across L4—25 mmf. V.C. (Cardwell ZR-25-AS)

Sound Receiver

L1—7 turns, double spaced, ½" dia. No. 14 bare copper wire
L2—7 turns, single spaced, ½" dia. No. 14 bare copper wire—tapped 1½ turns from ground end
L3—8 turns, single spaced, ½" dia. No. 14 copper wire
C1—15 mmf.
C2—20 mmf.
C3—35 mmf. (½" dia.=inside coil dia.)

The manufacturer of the video I.F. transformers is the J. W. Miller Company of Los Angeles. The catalog number is 6105 and they tune around 13.5 megacycles.

D.C. coupling is used in the 1st video stage to improve the low frequency response, by obviating the use of a coupling condenser and cathode-bias by-passing condenser. Grid bias is obtained from voltage drop across the diode load. Proper vertical synchronization pulse amplitude is thus maintained.

The Inca transformers used are built by Phelps-Dodge Copper Products Corporation. Their catalog numbers are: vertical G-31, horizontal G-32. R.C.A. transformers could also be used; their stock numbers are, vertical 32898, and horizontal 32899.

R & T Videophone

Part 3—Conclusion

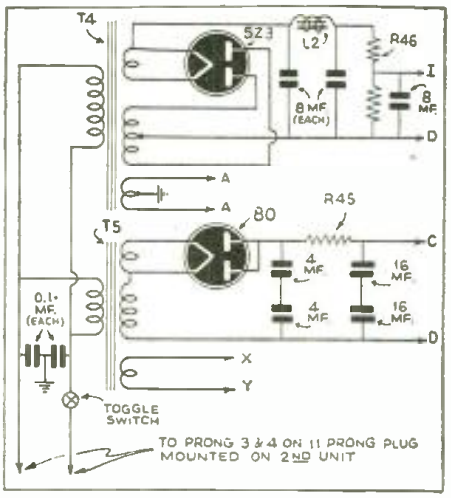
Ricardo Muniz, E.E.,* and Saul Morton Decker**

● IN this final installment of the series describing the RADIO & TELEVISION Videophone, the authors give you the complete socket terminal voltage chart, measured on the 25,000 ohm per volt Triplett 1200-E multimeter; the schematic diagram of the power-supply for operating the second Videophone alone; the parts list corresponding to this circuit; and some hints on adjusting and operating the unit.

SOCKET TERMINAL VOLTAGES: The chart giving the complete analysis of socket terminal voltages as actually read with the unit properly adjusted for its best operation is here shown. This information was given with the idea of assisting the constructor in tracing down any trouble he may encounter. It will serve as a guide in localizing the difficulty. The authors felt that this was the most concrete form in which we could present the information for your use.

This is perhaps a novel way to give pertinent information in a constructional article, but when we were readin' 'em and building from them instead of writing them we found ourselves many a time and oft wishing for just such a chart. Do you like the idea?

POWER-SUPPLY DIAGRAM: The diagram for the power supply shows a power-supply suitable for use with the single videophone. Thus if your idea is to go on amateur television OR if you wish to demonstrate only one-way *seeing telephone*, then use this power-supply circuit. The parts listed in the Parts List accompanying the diagram gives the description of transformers, etc., of somewhat smaller size than those required for the two-way "seeing" telephone. This will result in greater economy. The lettering in the diagram corresponds to the lettering in the diagrams published last month. Thus you will know just how to connect this power-supply to the talking camera.



Power-Supply Hook-up

OPERATING HINTS: After construction has been completed and all wiring carefully checked, insert the tubes—BUT put the 902 cathode ray tube in the place of the 1847 "ike." Adjust the focus (R41) and the beam (R40) intensity with the C-R tube in the "ike" socket. It is not possible to tell, by looking at the ike, whether the beam is focused and of the proper intensity. Adjust these controls until the raster (which will be visible on the screen) is sharp [focus] and quite dim [beam]. *Mark the positions of the knob pointers, so as to preserve this setting*—later it will be an awful nuisance to have to re-insert the CR tube because all the "trappings" (shields, etc.) will have to be taken off the ike to permit its removal. **Now bring the beam current down to a minimum (dimmest). Always, when starting the ike, start from minimum beam and bring up very gradually until the picture begins to appear on the monitor.** When the ike is in its proper socket and you are using the camera, you will find that excessive beam current will cause paralysis of the ike and it will temporarily lose its sensitivity to light. **In the event this happens—shut the whole outfit down—bring the beam control to minimum—start up again—it will have cleared up.**

It will be found that each control has its best operating point. It takes a little time until the best setting of each is found. There are various combinations of "ike" beam and C-R tube beam which will give good pictures. There is a BEST point however. When you have found it—mark the position of the controls so you can re-set the next time to this place. The C-R tube focus control also was found to have an effect upon the quality of the picture, over and above its normal function of focusing. The optimum point for this control should be carefully determined and marked. Naturally there is only one RIGHT point of adjustment for the sweep frequencies, if you are going on amateur television—the *amateur standard*.

*Engineer WNYE, Radio Instructor, B'klyn Technical H. S., Faculty adviser Television Club at B. T. H. S.
**President Television Club and student B. T. H. S.

An *audio oscillator* comes in very handy in setting these to the right place. You want 30 frames per second with 120 lines per frame. With your audio oscillator set at 120 cycles you should get 4 dark bars across the screen of the monitor C-R tube, when the vertical sweep is set right. These *bars* are horizontal. $30 \times 120 = 3{,}600$ lines per second. With your audio oscillator set at 14,400 cycles, you will get four vertical bars on the screen of the monitor when you have the proper adjustment. The most convenient way is to connect the audio signal oscillator to the input of the videos (where the signal electrode goes), for this test. The authors used RCA Audio Beat Frequency Oscillator Model No. 154. It was found very stable and accurate.

The lead from the signal electrode of the "ike" to the first video amplifier was found to be an extremely critical lead. This lead ***can make or break your videophone.*** It must be ***as short as possible.*** It must be as ***straight*** as possible. It must be ***triple shielded throughout its length*** right from socket terminal to connection on ike. Use heavy Amphenol Co-axial line for this lead. Slip over the outside of the insulation of the co-ax copper braid shielding (this is the second shield). Run this in a sheet copper tube about a quarter inch bigger than the lead all around. Keep the lead suspended in the middle of the tubing without touching it. We made insulated support bushings for each end of the tube. This supported the lead without letting it touch the tubing.

Double shield your "ike"! Put shielding *inside* the fibre support light-shield and put shielding *outside* it!

In all parts of the signal electrode—video amplifier grid circuit ***when in doubt—use co-ax -and double shield!!***

The authors will be very glad to hear from constructors of the VIDEOPHONE. They will be glad to answer reasonable questions and to give advice. Address them care of RADIO & TELEVISION Magazine, 20 Vesey St., New York City, and enclose a *stamped* self-addressed envelope. Some post-card inquiries have in the past not been replied to—we regret having to do this. Please cooperate by sending along the stamped envelope.

From time to time as experiences with the *Videophone* bring up points of interest we will publish additional hints—on the *Videophone*.

We have in preparation now a short write-up on hints and kinks for improving the R. & T. F M (Frequency Modulation) Adapter and Receiver described some time ago in this publication. Look for it!

You amateurs—*next month*—a new system of amateur FREQUENCY MODULATION. *Never before published in any publication—nvie principle.* (R. Muñiz with Warren Oestreicher and Donald Oestreicher) Don is a ham—Warren got the idea—together we developed it to a Sensational Unit.

Parts List

THORDARSON (Transformers)

1—Power transformer, T4 (T13R15)
1 Power transformer, T5 (T13R11)
1 Filter choke L2 (T68C07)

CORNELL-DUBILIER (Condensers)

2—4 mf. at 450 v. (KR-504)
2—16 mf. at 450 v. (KR-516A)
2—8 mf. at 450 v. (KR-5888-A)
2 .1 mf. at 400 v. (DT-4P1)

NATIONAL UNION (Tubes)

1 5Z3 rectifier
1 80 rectifier

IRC (Resistors)

1 R45 200,000 ohms 1 watt (BT-1)
1 R46 20,000 ohms, type ES

ICA

1—Toggle switch (No. 1233)

Socket Terminal Voltages as obtained with the Triplett 1200 E Multimeter*

Type Tube & Purpose	Socket Terminal 1	Socket Term. 2	Socket Term. 3	Socket Term. 4	Socket Term. 5	Socket Term. 6	Socket Term. 7	Socket Term. 8
1852 1st Video Amplif.	0	Heater 6.3 V.	Connect to Pin No. 5	Grid	−2.5	−150	Heater 6.3 V.	+225
1852 2nd Video Amplif.	0	Heater 6.3 V.	Connect to Pin No. 5	Grid	−4.2	+160	Heater 6.3 V.	+270
6AG7 3rd Video Amplif.	0	Heater 6.3 V.	0	Grid	+7.2	+150	Heater 6.3 V.	+240
6C8G Vertical Sweep Osc.	NC	Heater 6.3 V.	Connect to Pin No. 5	0	+100	+125	Heater 6.3 V.	+180
6C8G Horizontal Sweep Osc.	NC	Heater 6.3 V.	Connect to Pin No. 5	0	+90	+125	Heater 6.3 V.	+185
5Y4G Low B Rectifier	NC	500+ Heater 5 V.	NC	100 AC	NC	100 AC	NC	Heater 5 V.
80 High B Rectifier	Heater 5 V.	Pins 2 & 3 tied together 650		720 AC Heater 5 V.				
903 Monitor C-R tube	−520	Heater (6.2 V.) 115	Deflection plates, no reading necessary		−44	−82	Heater (6.2V)	NC
1847 Iconoscope	520	Heater (6.2 V.) 115	Deflection plates, no reading necessary		−11	−300	Heater (6.2V)	NC

*115 Volts A.C. on transformer primaries
All voltages are taken from low B or chassis ground, except Heaters, which are taken from across heater pins.
N.C.=No Connection

RADIO BALLS TRACE RIVER

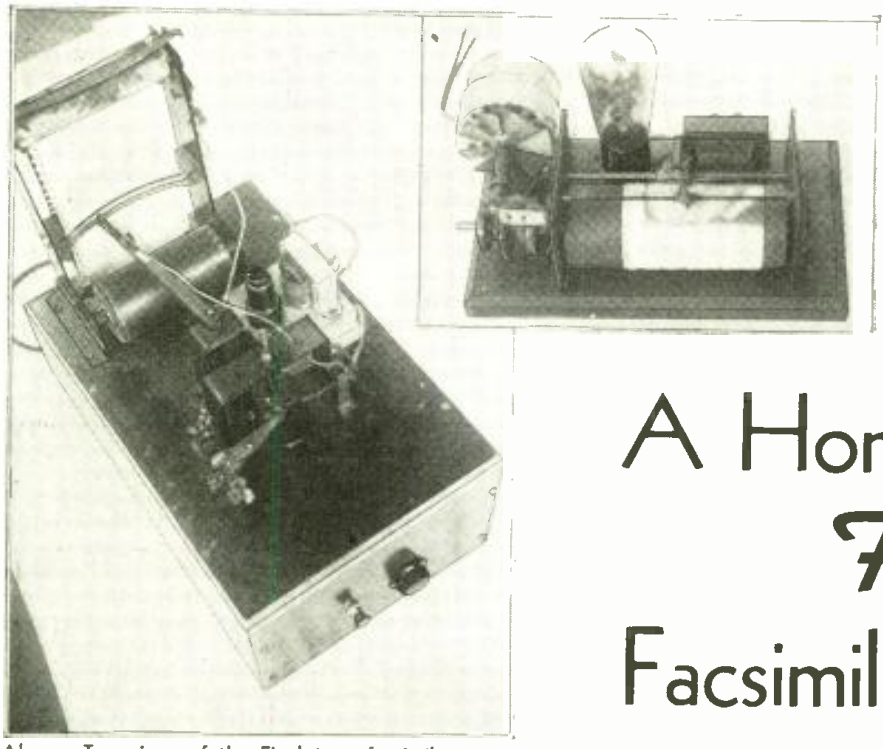
AN 8-inch rubber ball containing a miniature radio transmitter was dropped into a subterranean stream, thereby enabling scientists in Bellevue, Ohio, to trace the course of this waterway for about three miles. The device, invented by Henry B. McFerren, is solving a riddle which has bothered technicians for more than 50 years. Mr. McFerren, who is blind, said that this radio ball was lost after it had taken an unexpected turn at the end of a three mile underground journey. The experiments will be conducted again with more numerous direction finders and a more powerful transmitter in the ball.

BBC ISSUES BROADCAST SCHEDULE

THE overseas service of the British Broadcasting Company will be directed to North America during evening listening hours on the following schedule:

The last mentioned broadcast—49 meters—is on the air only after 9:30 P.M., Eastern Standard Time. Most of the other bands are opened shortly before 6:00 P.M., Eastern Standard Time.

Waveband	*Meters*	*M/cs*	*Callsign*
25-meter	*25.38*	*11.82*	*GSN*
25-meter	*25.53*	*11.75*	*GSD*
31-meter	*31.32*	*9.58*	*GSC*
49-meter	*49.10*	*6.11*	*GSL*



Above—Two views of the Finch-type facsimile recorder, which is here described in sufficient detail to permit the average radio experimenter to build it.

The editors have received hundreds of requests for data on a facsimile recorder of the Finch oscillating arm type. As facsimile is being broadcast from a number of stations in various parts of the country, this facsimile recorder will appeal to our many readers. The special paper used is available commercially.

A Home-Made *Finch* Type Facsimile Recorder

Carl Helber

● ALTHOUGH a *facsimile* recorder is not difficult to construct, it is harder to make than the simple scanner described in the November issue of RADIO & TELEVISION. This article is concerned with a recorder which can be used to receive the signals sent out by broadcast and ultra-short wave stations now using the Finch system. The recorder can also be used with the simple scanner. The total cost need not exceed $10 including a 100-foot roll of dry conductive paper, which may be procured from some of the large wholesale companies handling radio supplies.

The operation of a facsimile set is fairly simple. The material to be sent by means of radio is broken up by means of scanning into a series of lines .01" wide. Each line is composed of light and dark sections, according to its position on the picture. The darker the section the greater the amplitude of the signal sent out by the transmitter. In order for the changes in amplitude to be amplified at the receiver as well as at the transmitter, it is necessary to cause the amplitude changes to modulate a carrier of audio frequency. The present Finch system uses a carrier of about 2000 c.p.s. (cycles per second) for printing and 400 c.p.s. for the syncing impulses. At the receiver the signals are detected and converted into varying audio power. The greater the amplitude of the incoming signal, the greater the power output of the audio amplifier. The power output of the receiver is then sent through an impedance matching transformer and the syncing impulses rectified and used to trip a syncing lever. The 2000 cycle impulses are sent directly to the conductive paper through a small stylus. The stylus is mounted on an oscillating arm which is kept in synchronism with the scanner. Each time a line is received a paper feed draws the paper up .01" in order that the following line will not cover up its predecessor. Each line—including syncing, printing and return of the arm—requires one second; therefore, one foot of facsimile copy requires 20 minutes, or three feet (which constitute the usual nightly broadcast) require one hour.

A typical sample of the facsimile pictures recorded on the instrument here described—this one was sent to us by the author.

Start of Construction

Construction of the recorder was started by making the printer arm and backing bar. The arm is made of a piece of sheet metal about 6½" long and tapering from 1⅛" to ⅞". The sides are bent down ¼" at right-angles, to reinforce the arm. About ½" from the wide end of the arm is drilled a ¼" hole, beneath which is soldered a bushing with a set-screw. At the other end of the arm is mounted the stylus and its holder. The holder is made of ¼" bakelite as shown in the drawing. A phonograph needle may be used as a stylus, but the regular commercial one works better. The backing bar is made of a piece of lead 6" long by ¾" thick by 1¼" deep. A curved section to conform to a template of a radius equal to the distance between the center of the arm shaft and the end of stylus is removed, either by filing or by casting the lead in a mold of the proper shape and then smoothing it with a file and emery cloth. A *gate* to hold the paper on the backing bar is made by bending two strips of tin to conform to the shape of the bar. The bar is fastened to two supports of 1/16" sheet iron cut as shown.

Near the upper section of the supports is mounted the paper feed. For the purpose a piece of ½" pipe is fastened to a ⅜" shaft by pounding slightly overlarge washers into the ends of the pipe, and then drilling the holes out to ⅜". The shaft should fit very snugly to the washers and likewise the washers to the pipe. At the end of the shaft is soldered a 60 tooth gear and meshed with the large gear a 12 tooth pinion gear. The pinion gear is fastened to a small shaft which connects with a 48 tooth ratchet wheel. The gears may be gotten from old toys or clocks. The 48 tooth gear was made from the largest gear of an old alarm clock, the teeth being filed so as to allow a pawl to slide over easily in one direction, but catch in the opposite direction. The pawl is loosely fastened to a metal strip which is in turn fastened loosely to the same shaft which holds the ratchet wheel. The lower end of the strip is connected to a stiff wire rod which is fastened loosely to the printing arm.

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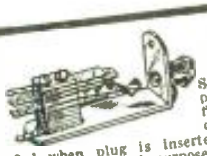
NEVER BEFORE, in the 11 years' history of the magazine, have we offered such worthwhile premiums. All of these radio parts and accessories can be used to good advantage by the "ham" or constructor in his daily experiments.

TELEPHONE JACK



Substantial long frame phone jack. 2-circuit filament control type, opens 2 circuits, closes 3rd when plug is inserted. Can be used for variety of control purposes in radio and telephone work. 2⅝" long. 1" high. Ship. weight 4 oz.

Premium No. 1 (3 Pts.) Val. 35c.

PUNCHED CHASSIS

Heavy plated steel chassis with holes punched for 11 tubes, power transformer, speaker plug and tuning dial. Great for large experimental sets, transmitters, etc. Reinforced construction. 13"x7⅞"x2½". Ship weight 3 lbs.

Premium No. 2 (5 Pts.) Val. 25c.

TWO GANG POTENTIOMETER

Well-made Yaxley 2 gang wire wound potentiometer. 2 units are insulated from each other. One is 5000, the other 15,000 ohms. Used as dual action volume control (antenna and bias in broadcast receivers). Also useful in experimental circuits. Ship. weight 1 lb.

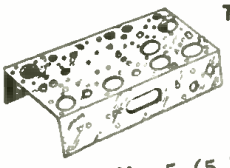
Premium No. 3 (5 Pts.) Val. 25c.

ALLOY CHASSIS

Medium weight alloy metal chassis punched for power transformer and 8 tubes as well as numerous mounting holes. Easily drilled metal. Open ends. well made 10⅜"x6⅝"x2½". Ship. weight 2 lbs.

Premium No. 4 (5 Pts.) Val. 25c.

7 TUBE CHASSIS



Alloy metal chassis punched for 7 tubes, condensers, etc. Ideal for building small sets or simple apparatus. Metal is easy to drill. Size 10⅛"x5⅜"x2". Shp. wgt. 2 lbs.

Premium No. 5 (5 Pts.) Val. 25c.

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Unusually well made Philco 8 foot, 5 wire cable with spade terminals at one end and terminal block with 8 positions at other end. Wires color coded. Well insulated. May be used for remote control or battery connections, etc. Terminal block 3"x3"x3¼". Ship. weight 1 lb.

Premium No. 6 (6 Pts.) Val. 35c.

LOUDSPEAKER UNIT

Kellogg magnetic loudspeaker unit for use with horn speaker. Has adjustable diaphragm. May be used as pillow speaker or attached to acoustic phonograph. Also useful as sensitive microphone for voice reproduction. Threaded (⅞" diam.) throat. Size 2½" diam., 1⅝" deep. Shp. wgt., 2 lbs.

Premium No. 7 (10 Pts.) Val. 75c.

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Name ..... Address .....

City ..... State .....

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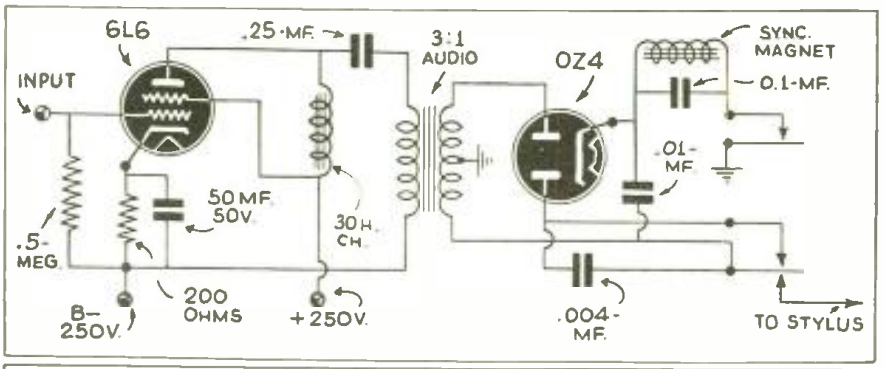
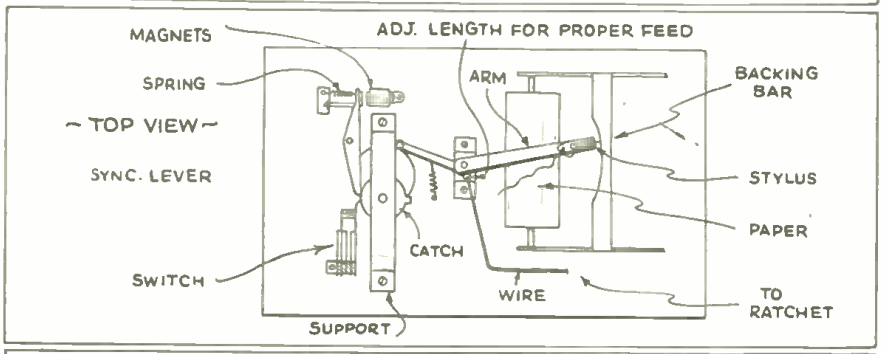
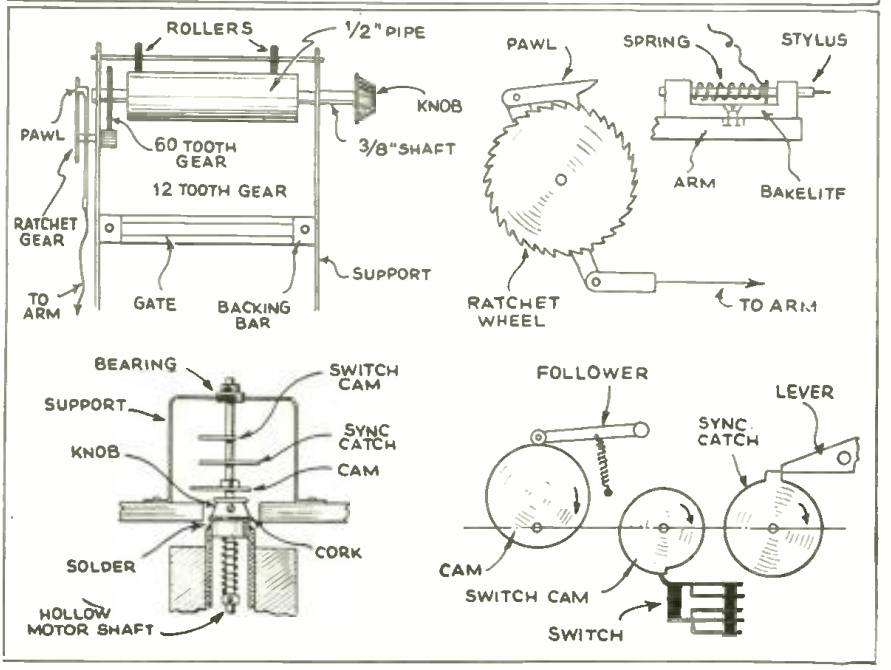






Wiring diagrams and other details of the facsimile recorder are given in the drawing above.

Mounting the Stylus Arm

The next step in the construction consists of mounting the arm. To do this it is necessary to make a metal support as shown in the drawings. The support must be placed in such a position that the stylus moves across the paper with fairly even pressure. The arm is made to oscillate by means of a rotating cam and follower arrangement. The size of the cam will depend upon the length of the stylus arm, the length of the follower, and the cam offset. A little experimentation will be necessary to give the stylus a sweep of about 4" on the paper. The author used the following sizes as a beginning approximation and with a bit of filing was able to cut the cam stroke to very nearly 4". The cam was a circle of 1/16" sheet iron, 2" in diameter; the offset from the center of the cam was ½"; the length of the follower was 2 3/16", and the length of the stylus arm 6⅛".

The shaft holding the cam is connected to a variable speed phonograph motor of the induction disc type through a cork clutch. Cork, apparently, is about the best clutch material available. All attempts to use felt failed to give good results. Details of the clutch are shown in the drawings. A synchronizing catch and a switch cam are mounted on the same rod as the cam. The positioning of these devices will be discussed later. The syncing lever is operated by two magnets taken from an old loudspeaker unit.

Electrical System

The electrical system consists of a rectifier and a switch arrangement. The syncing impulses are rectified by an 0Z4 (used full

wave) and are sent to the syncing magnets. Proper positioning of the switch-cam and the syncing catch are necessary for best results. The switch cam should be arranged so that the switch is in a position to receive the syncing impulse when the stylus arm is at its maximum distance to the left of the paper. At this point the syncing catch should also engage the syncing lever. As soon as the syncing impulse releases the lever, the switch should snap into printing position and remain so until the arm is about half-way back on its return stroke. The paper feed is arranged so that the paper is lifted up .01" on the return stroke of the arm. Adjustment of the syncing lever for proper engaging of the syncing catch and for proper spring tension are necessary for good performance. The syncing lever should engage only enough to stop the stylus arm at the left of the paper when no syncing impulse is coming through. The most efficient printing density was obtained by using only one-half of the secondary of a 3:1 push-pull audio transformer. With this arrangement the impedance ratio between the primary and one-half the secondary is 1:9 (assuming that the ratio of primary turns to total secondary turns is 1:6). The average printer paper resistance is about 18,000 ohms; therefore, the primary of the transformer reflects about 2000 ohms. A single 6L6 with 250 volts on the plate and screen and –14 volts on the grid will deliver about 6.5 watts into a 2500 ohm load. This means that slightly less than 6 watts will be delivered to the paper. Three watts is about the least power that will print satisfactorily. Capacitive coupling between the 6L6 plate and the transformer is used to keep the high plate current of the tube out of the primary. The entire electrical system is wired with shielded wire and the shield grounded. Shielding is necessary in order to keep interference out of the antenna of the receiver.

Operation

To operate the set it is necessary to tune in a facsimile program and turn up the gain on the set until the syncing lever trips with each sync impulse. The motor speed is then reduced until the syncing lever just tips the catch. A speed of about 61-62 r.p.m. is satisfactory.

This set was built about a year ago and has given very satisfactory results. Programs have been received from many parts of Eastern United States. WHK, the local Finch outlet in Cleveland, can be picked up on Sunday mornings from 1:30-2:30 A.M. Facsimile DXing is very interesting. Programs from WHO, Des Moines, Iowa, were received Saturday mornings from 1:00-1:30 A.M. WOR can be received from 1:00-3:00 A.M. on Saturdays; WGN, Chicago, 2:30-3:30 A.M. Saturdays; and WOKO, Albany, from 1:30-2:00 A.M. Saturdays. All these stations have been received on the facsimile set just described. The receiver used was a five-tube superhet of the A.C.-D.C. variety.

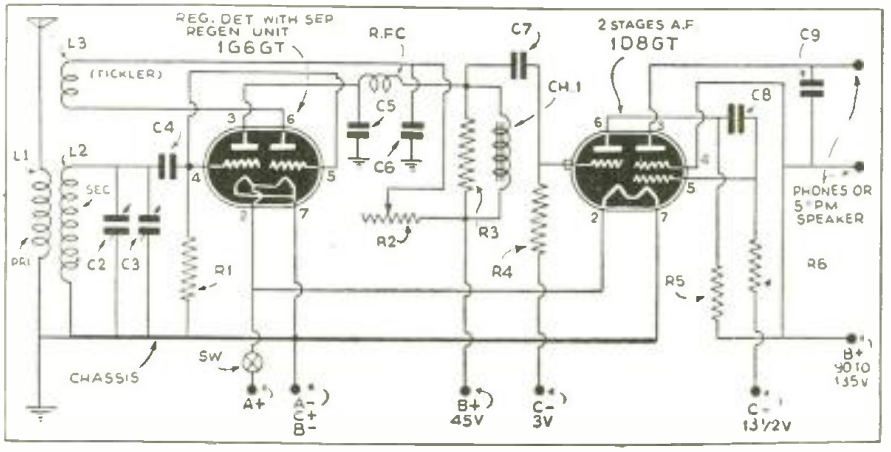
Don't miss "Pull-Pull" F-M article on amateur Transmitter and Receiver in the next issue.

Diagrams of Interest

This is a new department. If you have a new Hook-Up, send it along; a pencil diagram will do. Be sure to include a brief description.

All diagrams and descriptions accepted and published will be paid for at regular space rates. Diagrams may be for receivers, adapters, amplifiers, etc. Send them to Hook-Up Editor, RADIO & TELEVISION, 20 Vesey St., New York City.

SEPARATE REGENERATION TUBE HOOK-UP



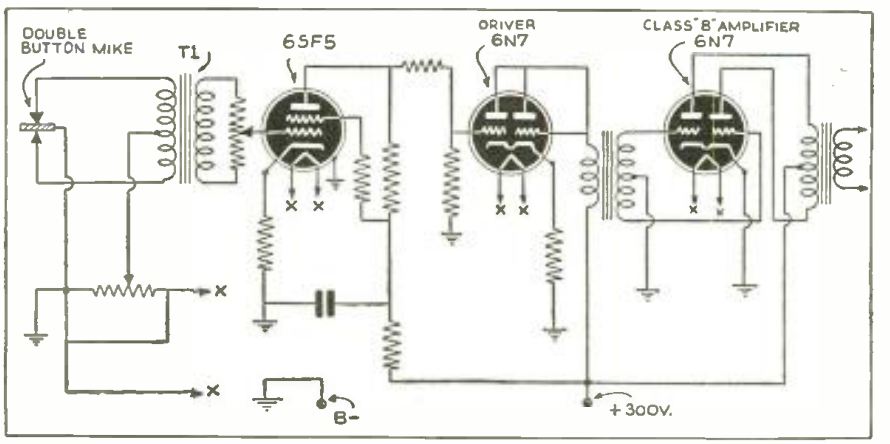
● "HERE is a circuit I have tried with very favorable results," says Ernest B. Miller of New York City. One section of the 1G6GT is used as a regeneration control and the other section as a grid-leak detector; this circuit has proved to be very smooth, he says. The 1D8GT has a triode used as an impedance-coupled A.F. stage; the pentode is used as a resistance-coupled A.F. output stage. The values of C and R are as follows:

C2—100 mmf. Var. Cond. Tuning
C3—35 mmf. Var. Cond. Band-Spread
C4—100 mmf. Mica
C5—.005 mmf. Mica
C6—.005 mmf. Mica
C7—0.1 mf. Paper 400 volt
C8—0.1 mf. Paper 400 volt
C9—.003 mf. Mica 400 volt
L1-2-3—6 prong Coils
R.F.C. = R.F. Choke
R1—3 meg. Resistor
R2—50,000 ohm Potentiometer
R3—0.25 meg. Resistor
R4—0.5 meg. Resistor
R5—50,000 ohm Resistor
R6—0.5 meg. Resistor
CH—500 to 700 henry A.F. choke for Sec. of A.F. Trans.)
SW—S.P.S.T. Switch

NOTICE TO CIRCUIT HOUNDS!!

● Come on fellows, send us along some of your interesting 1- 2- and 3-tube hookups, whether they are *Parlor-Transmitters, Receivers* or what not—just so long as they are good "working" circuits which you have tried out. The diagrams should be drawn in ink but do not have to be finished drawings as we redraw all circuits for publication purposes. Be sure to include a brief description, giving the good points about the circuit and what it does—100 to 150 words is usually sufficient, including your name, address, and in the event that it is not published please include a 3c stamp for return.—Editor

WHAT'S WRONG WITH THIS DIAGRAM?



Be honest with yourself and study the diagram above for at least 3 minutes before turning to the answers on page 576.

to the Radio Experimenter

112 MC (2½ Meter) Transceiver

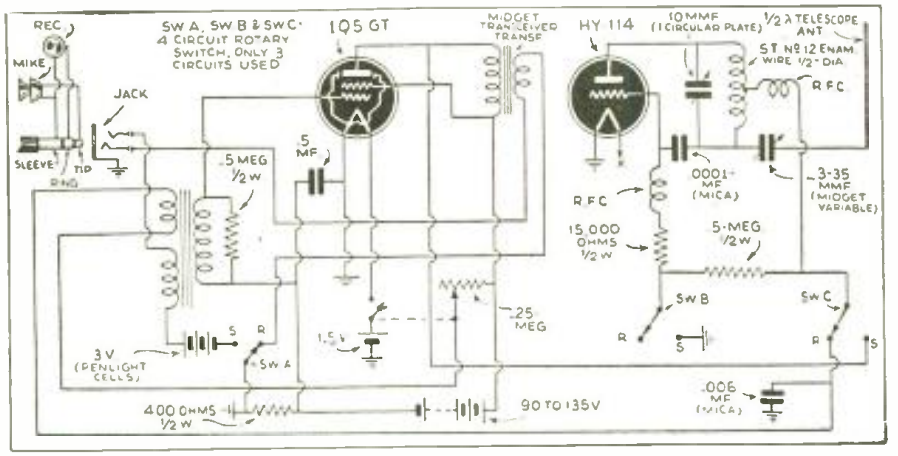
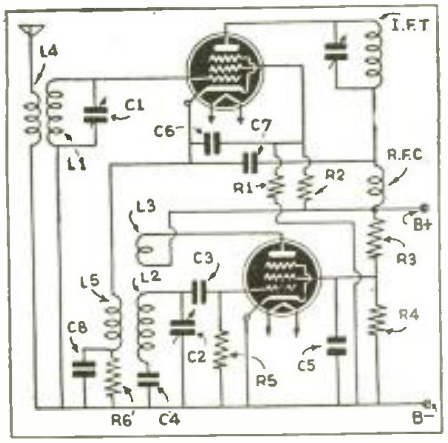


Diagram above was submitted by J. Roy Wolfskill of Reading, Pa., and shows a transceiver hook-up which he has been using on 112-114 mc. for the past year; he states that it works very satisfactorily. The whole unit including "A" and "B" batteries are carried in a metal cabinet 5 x 6 x 9". Telescoping half-wave antenna is used.

IMPROVED "MIXER" CIRCUIT



● THIS is the circuit (left) of a "mixer" which I find superior to many others. Here the oscillator voltage is injected into the cathode circuit of the mixer, but there is no detector reaction. Besides the "pulling" is quite negligible.

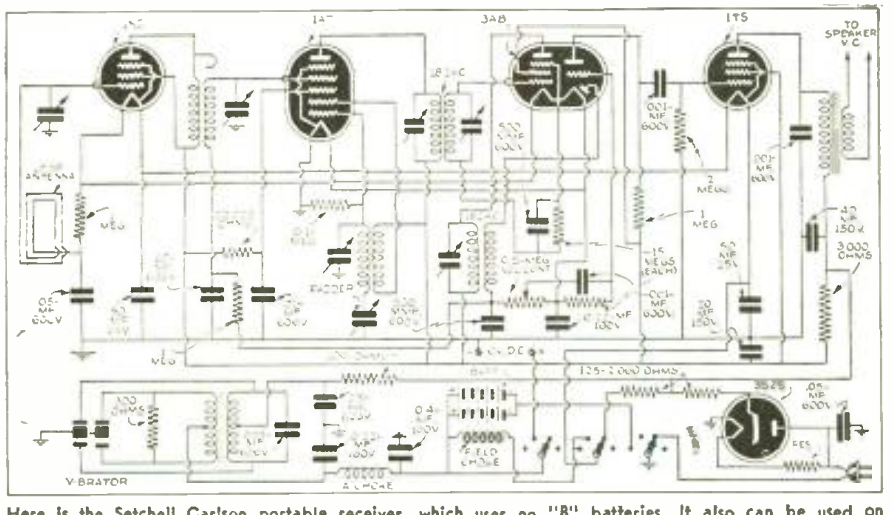
Coupling between L3 and L2 must be tight. Also, the detector-tube components must be grouped closely around the socket, so that it will not be necessary to shield the leads going to this tube.

Although the capacity across L3 seems large, yet the coil L3 can be so small that this capacity in no way affects the performance. Of course, any conventional tube could be used in the oscillator circuit, not only a pentode. Note that all the by-passes of the mixer are made to cathode.

Parts values:
R1—40,000 ohms
R2—40,000 ohms
R6—10,000 ohms (or 400 ohm for 1852 or 1851)
C6—.01 mf.
C7—.01 mf.
C8—.01 mf.
RFC—2.5 mh. chokes

Otto Meinkolf,
118 Route des Soeurs,
No. 9, Apt. 4,
Shanghai, China

PORTABLE RECEIVER HOOK-UP USES NO "B" BATTERIES

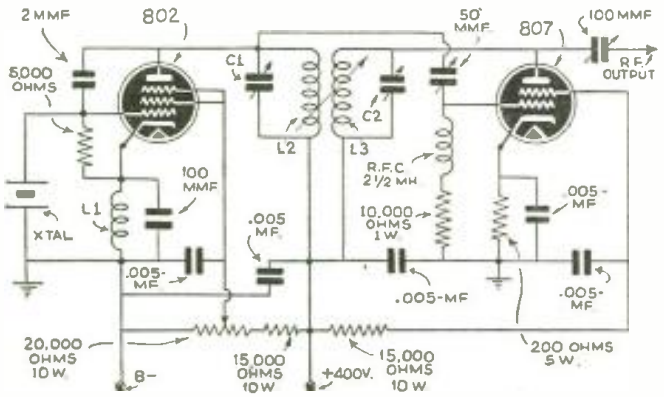


Here is the Setchell Carlson portable receiver, which uses no "B" batteries. It also can be used on 110 volts A.C.-D.C. or 6 volt car battery.

Harmonic Generator

Can you print a diagram of the Reinartz harmonic generator?

A. The Reinartz harmonic generator is a two-tube exciter unit, capable of supplying appreciable power output on frequencies as high as the eighth harmonic of the crystal frequency. Inductance sizes will be dependent on the frequencies used. L-1 in conjunction with its 100 mmf. fixed mica condenser, should tune to one-half the crystal frequency. C-1 and C-2, when tuned to the operating



Circuit for simple harmonic generator of the Reinartz type. No. 1243.

frequency, should contain about 1 mmf. per meter—for example, about 40 mmf. on the 40 meter band. L-2 should tune to the crystal frequency with its tuning condenser, while L-3 is tuned to the desired output frequency, which can be as high as the eighth harmonic of the crystal frequency. Power output can be controlled by the variable 100 mmf. condenser. Note that L-3 and L-2 are inductively coupled and that the coupling should be adjusted for maximum output.

How to Squash "Midnight" Radio

Please publish a means of producing BCL-QRM of sufficient intensity to cause a midnight offender to turn down his volume sufficiently for the neighbors to sleep.—A. Ellsworth, Albany, N. Y.

A. It is unlawful to deliberately interfere with *broadcast* programs. Since your efforts to persuade the offender to operate his radio at a lower level have failed, it seems that the only recourse would be to complain to the local police. In many sections of the country, loud playing of a radio at late hours has been held to create a nuisance, and as such within the authority of the local police. You might also try getting up a delegation of "suffering neighbors" and pay the offender a "social" visit.

Adding a Noise-Limiter

Please show me how to add a noise-limiter *to my Hallicrafter "Sky-Buddy."—W. Heller, Holy City, Calif.*

A. The diagram shows a modified Dickert type of *noise-limiter* which can easily be added to your receiver. It is of the automatic type and therefore requires no adjustment for different signal levels. The tube used should be of the high mu type, such as the 6N7, 6A6, 6Y7 or 79 with both triodes connected in parallel. The unlabeled components are the parts already in your receiver. This *limiter* can be applied to other receivers having the same general type of duo-diode triode second detector.

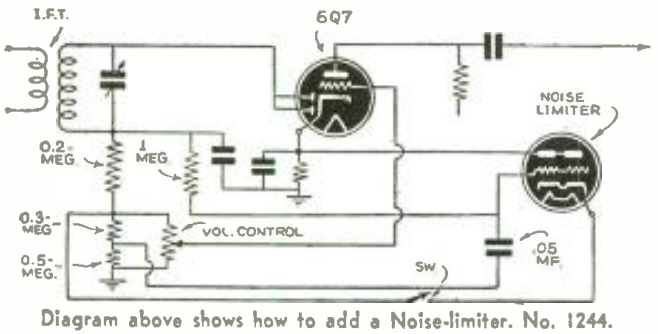


Diagram above shows how to add a Noise-limiter. No. 1244.

Condenser Markings

I have a mica condenser without any capacity markings on it, but with three colored dots along an arrow—red, green and brown. What is its capacity?

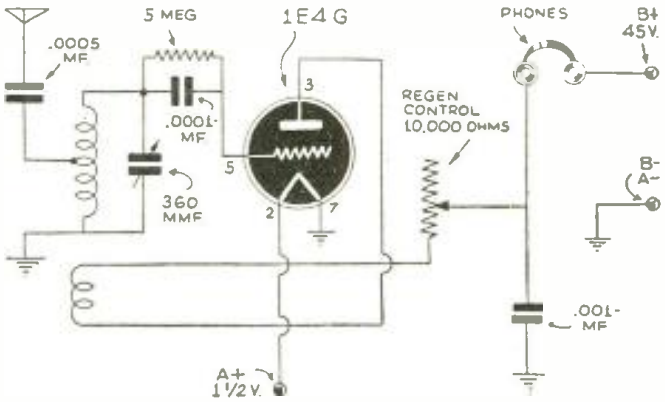
A. Condensers are frequently color-coded in the same manner as resistors. In this system, the condenser is marked according to its value in micro-microfarads, and takes the form of three colored dots arranged along an arrow. The first color represents the first number, the second dot represents the second digit, while the third colored dot represents the number of zeros after the first two digits. The colors, listed below, represent the same numbers as in the R.M.A. color code used in resistors. Thus the colors red, green and brown stand for 250 mmf.

Black	0	Brown	1	Red	2	Orange	3	Yellow	4
Green	5	Blue	6	Violet	7	Grey	8	White	9

1-Tube Receiver

I would like to build a simple one-tube, battery-operated receiver that could be used on the short-waves, *as well as on the* broadcast *band.*

A. The simple receiver diagrammed uses a 1E4G tube with plug-in coils. Use of a 360 mmf. condenser necessitates only one coil to completely cover the *broadcast* band. Tuning will be somewhat sharp on the short waves. To provide for band-spread on the high frequencies, a small 25 mmf. variable condenser should be connected in parallel with the main tuning condenser. If regeneration cannot be obtained, and reversing the connections to the tickler doesn't help, try increasing the number of turns on the tickler.



A handy 1-tube receiver for use with head phones. No. 1245.

Coil Winding Data

Broadcast band—grid coil—105 turns No. 28 S.C.C. Tickler 40 turns

200-75 meters: grid—38 turns No. 20 S.C.C.; tickler 15

75-40 meters: grid—13 turns No. 18 spaced to 1"; tickler 8 turns

40-15 meters: grid—7 turns No. 18 spaced to 1"; tickler 5 turns

All coils wound on 1¼" diameter forms. Ticklers (plate coils) wound with No. 28 S.C.C. at ground end of grid coil.

Troubles with "Doerle"

I recently built the Doerle 12,500 mile receiver, but have experienced some difficulty with it. After tuning in a station and removing my hand from the dial, the station disappears and another station is heard instead. Also, I cannot apply more than 45 volts to the plate; when 90 volts is used a strong whistle appears. Can you suggest anything to eliminate these?—D. Parce, Letcher, S. D.

A. The station detuning is caused by *hand-capacity* effects and can be eliminated by shielding the panel. You can do this by applying some thin sheet copper or aluminum to the back of your panel and grounding it. Make sure that the rotary plates of the tuning condenser are grounded.

To eliminate the whistle with high plate voltages (90 volts) you can do one of two things. You can decrease the number of turns of the tickler coil, until normal control of regeneration is obtained, or you can apply the full 90 volts to the audio tube only and supply 45 volts to the detector tube.

Receiver Won't Work

I have attempted to build the one tube portable shown in your April, 1940, issue without success. My trouble seems to be that the set will not operate without a ground and even then the signals are so weak as to be barely audible in the earphones. By attaching a 90 foot length 110 foot high aerial to the set, I receive no signal at all, but if I attach a two-foot piece of wire to a water pipe and attach that to the 140 mmf. condenser I can obtain faint signals. On one spot of the regeneration condenser, there is a sharp whistle which goes out if I move the condenser just a little. It is not the usual regeneration whistle. Is it possible to operate the set without a ground, and could you tell me why I receive faint signals by attaching the ground wire to the aerial post, but receive no signal from a 90 foot aerial? I have a regular short-wave set that I use on this aerial and receive signals from all over the world, so the aerial must be OK. I have bought a complete new supply of fixed condensers and fixed resistors because I thought something may be wrong with them, without result. I have completely torn down the set four times and rebuilt it with the same results. The tubes and the coils test OK.—E. J. Love, San Francisco, Calif.

A. Your difficulties probably are the result of improper phasing of the coils. Try reversing the connections to the tickler or plate coil. This should result in the receiver being able to regenerate. Incidentally, the two coils (grid and plate) should both be wound in the same direction. Is your plate voltage normal, that is about 90 volts? Try using a different tube—frequently tubes check OK in a tube-tester but will not operate in a receiver.

If none of the above suggestions result in proper operation, try increasing the number of turns in the plate coil. The receiver should operate without a ground. Make sure the tuning and regeneration condensers all have their rotors connected to the common ground line.

Antarctic Station Data

Can you furnish me with information of stations KC4USA and KC4USB?—J. Woulfe, New York City.

A. These stations are operated on the amateur bands by the Byrd Antarctic Expedition. KC4USA is at the west base, while KC4USB is at the east base. A third station KC4USC is located on the mammoth snow cruiser.

Coil Winding Data

Please print winding information for two winding coils to be used on the broadcast band. They will be tuned by a 140 mmf. condenser.—C. L. Scary, Winnipeg, Man., Canada.

A. Using a 140 mmf. tuning condenser, you will have to use two coils.

185-360 meters—125 turns No. 28 S.C.C. wire, wound on 1¼" dia. form.

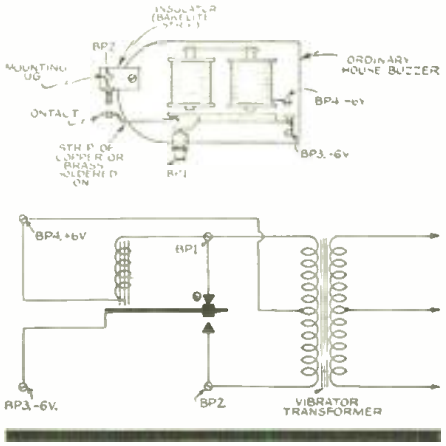
350-560 meters—185 turns No. 30 S.C.C. wire wound on 1¼" dia. form.

The primary windings should consist of 10% the number of the above grid coil turns, wound at one end of the coil form.

First Prize

EMERGENCY SUPPLY

If the vibrator of an automobile-type power supply is out of order, here is an



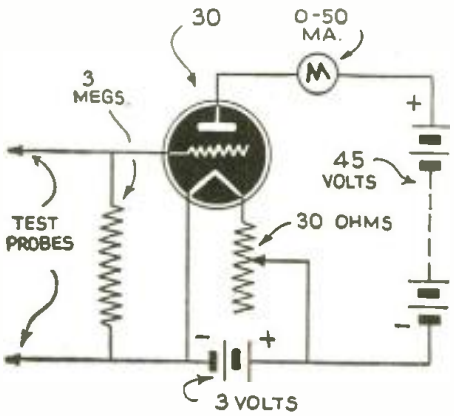
easy-to-make emergency vibrator. An ordinary buzzer is procured and a strip of bakelite bolted on. Mount an angle bracket on one end of the strip and insert a mounting lug as a contact (BP2). A strip of copper or brass is then soldered on to the vibrating strip of the buzzer, with a contact on one end made of iron or steel. The buzzer should then be adjusted until it gives the most voltage.

Figure 2 shows how the converted buzzer is connected to the vibrator transformer. —*Charles Mancri.*

LOW-COST VACUUM-TUBE VOLTMETER

This cheap, but efficient little testing instrument may be constructed from parts found in the average radio junk-box, or if desired, new parts may be used at a cost of little more than a dollar. The low-cost vacuum-tube voltmeter will render tests otherwise impossible without the aid of an expensive instrument, and will fill the needs of the average Ham or experimenter.

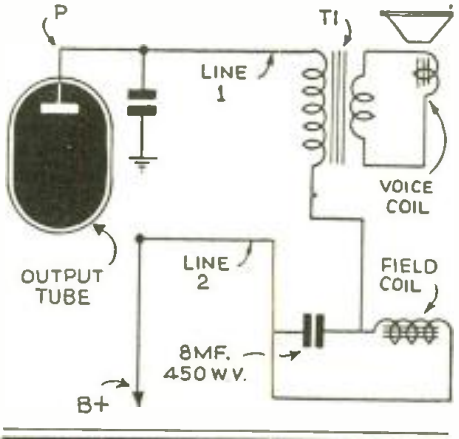
Construction may be made in a small steel cabinet with batteries self-contained, or breadboard fashion will prove equally satisfactory, so far as performance is concerned.



This little instrument will fully repay the experimenter for the time and small outlay for its construction, and will prove a valuable addition to the work bench.—*Frank Courtney.*

EXTENSION SPEAKER LINE

Here is the answer to that old problem of running a three-wire or four-wire line to an extension dynamic speaker. The



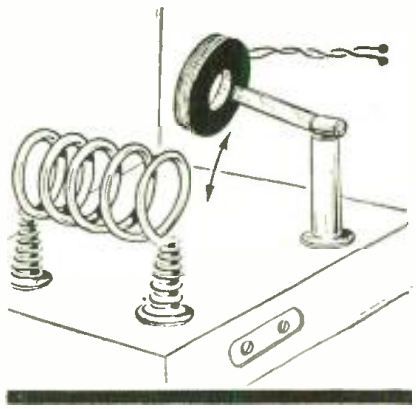
method I use eliminates the necessity of using a separate field current-supply, or a different type of speaker, and will work with almost any dynamic speaker and amplifier. By shunting the field coil of the speaker with an 8 mf., or 10 mf., 450 w.v. electrolytic condenser, and connecting the output transformer primary in series with the field coil, one may operate a dynamic speaker at any reasonable distance from the amplifier, using only a two-wire line to the speaker. The only precaution which must be taken is to see that the proper polarity of the condenser is observed. The resonant action of the field coil-condenser combination does not appreciably affect the performance of the speaker, because it has a filtering effect on only the very low frequencies.—*Bruce L. Meyer.*

VARIABLE COUPLING

An inexpensive variable link coupling can be obtained from the variometer assembly used in some of the old RCA Radiola models, such as the Radiola 20.

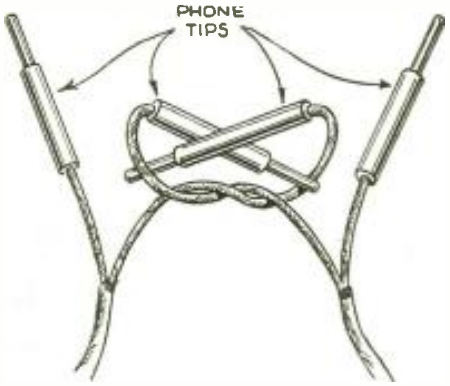
After cutting the link from the variometer to the "Sensitivity" dial, dismount the assembly and strip off the tickler winding. Rewind with No. 20 D.C.C. wire for about three or four turns. Then take the leads and bring them through the insulation block. Fasten them there and connect a twisted lamp-cord to the antenna, or antenna tuning unit.

This coupling is versatile, because of the fact that it can either be mounted at the "cold" end of an oscillator tank coil, or at the center of an "air-wound" amplifier tank coil.—*Donald Mead, W1MLB.*



CONNECTING PHONE CORD TIPS

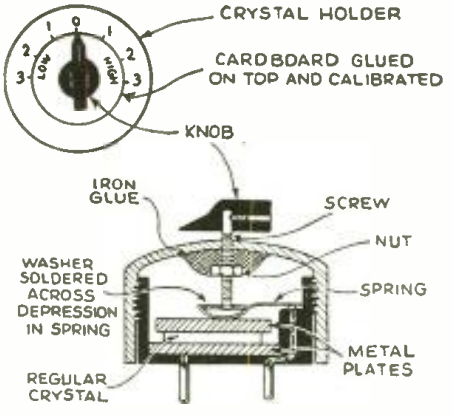
This simple kink will prove valuable many times when Ham or fan visitors come



to the shack and you want to hook up an extra pair or two of head-phones so that they can listen in too. One phone cord tip from each pair of phones is tied with a cord tip from the second pair of phones in a knot like that shown, and the metal tips are thus held in contact so as to complete the circuit through the two pairs of phones instead of one. The same trick may be used to connect tips from a second and third pair of phones, so that three sets of head phones may be joined up in this fashion if desired. When you are through listening, simply undo the knot and you have no wire or tape bindings to undo.—*A. Munro.*

CRYSTAL FREQUENCY SHIFTER

I have been a constant reader of your Radio Kinks Department for fourteen months and I think it is about time I sent you one. The picture shows the method I have employed to shift the frequency on a 160 meter phone rig, even as much as 4 kc. on 1876 kc., which frequently proved to be all that was needed to carry on a QSO that would have been impossible otherwise. The drawing makes the arrangement clear.—*W. Miller.*

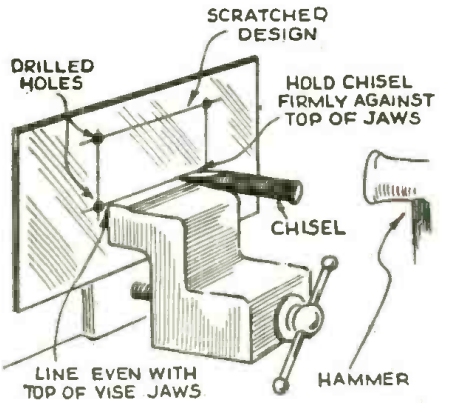


RESTORING WHITE LETTERS

Frequently the white indented lettering on test apparatus and other electrical instruments becomes dim with use. A good method of restoring these letters to their original condition is to procure a bottle of white writing ink, sold in most drug stores. This quick drying ink may be rubbed into the indentations of the letters and left to dry; when dry, wipe off the excess ink with a cloth and you will find your lettering as good as new.—*Robert R. Schultz.*

CUTTING HOLES IN SHEET METAL

In cutting sheet metal it is easier and more accurate to cut panels with a hammer and chisel, than the usual method of cutting with a hack saw. Even square holes in the center of a panel are possible with ease and accuracy. First scratch the desired design on the piece of metal with an awl. Next place the work in the vise in such a way that the undesired metal to be cut away is protruding above the vise jaws, *even* with the scratch made. Then with a hammer and chisel, cut the metal, using the vise jaws as a guide. In cutting corners and square holes it is best to first drill small holes in the corners to facilitate a cutting start and a good job.



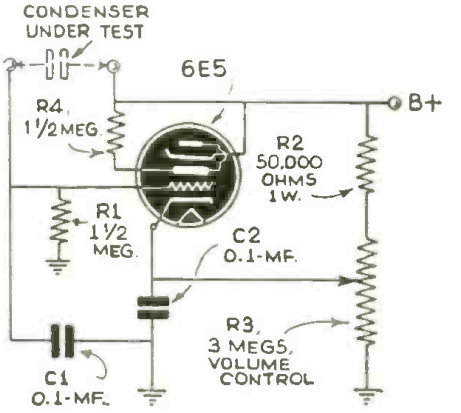
In making awl scratchings on sheet metal, they may be made easier to see by applying a solution of copper sulfate (more commonly known as blue vitriol) and sulphuric acid (oil of vitriol) to the sheet of metal by means of a cotton wad. This leaves a coat of copper on the metal and when a scratch is made the steel shows up through the thin layer of copper. The proportions are not critical, however, use only a few drops of the acid per pint. CAUTION—the concentrated acid is very corrosive—so handle with care! In fact the solution works well even without the acid—it isn't absolutely necessary. One point is important. Clean the metal free of grease and dirt or there won't be any results. Proportions can be: Copper sulphate, 7-10 teaspoonfuls; water, 1 pint. Optional (sulphuric acid, 10 drops).—*Jos. E. Budovec.*

CODE HINT

Many times code students wish to copy code, but have no receivers to pick up code. A solution to this problem is to take an ordinary broadcast set and connect a small fixed condenser in parallel with each tuning condenser. This will enable long wave code signals to be heard. A little experimenting will determine just what capacity is best for the desired frequencies.—*Giles Phelps.*

MAGIC-EYE TESTER

Recently I had reason to test some condensers and also some circuits, but having no instruments on hand I threw this little affair together, and it sure comes in handy around the shack. It consists of a 6E5 magic tuning-eye tube and a few condensers and resistors. The 3 megohm volume controls set the eye at a closed position. When the test prods are shorted together, the eye will open. Thus if the condenser is bad, the eye will open. This rig is also very handy in checking circuits to find a short, etc. The 1½ megohm resistor is built right into the tube socket.—*J. E. Coxon.*



3 Tubes = 5

The Battery Receiver for the Experimenter and Beginner

By H. W. S.

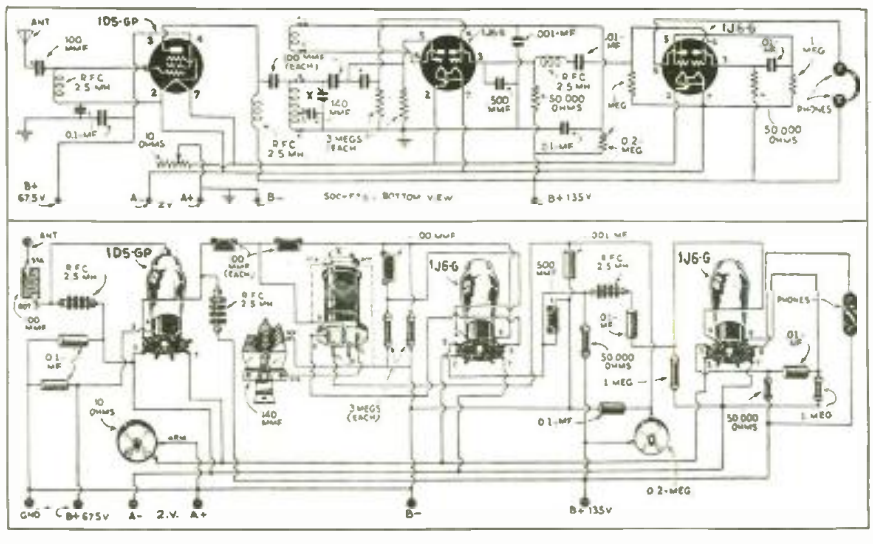
● A 2-VOLT battery receiver using two tubes of the dual type, which gives results equal to five tubes, is here illustrated. The first tube, a 1D5-GP serves as a radio frequency amplifier. An exceptionally smooth and positive control of the regeneration is obtained, utilizing one of the triode sections of the first 1J6-G tubes; the second triode of this tube serves as a detector. A second 1J6-G tube acts as a 2-stage audio amplifier of the resistance coupled type. This circuit is a very good one for the short-wave listener and experimenter; the 200-550 meter *broadcast* band may be tuned in by using coils with a sufficient amount of wire on them, or by using larger tuning condensers. This circuit can be very nicely built up into a portable style receiver, with self-contained batteries. The plate circuit requires 135 volts for best results. The sensitivity of this receiver has proven to be very high; anyone who has tuned the average regenerative set will be surprised at the very smooth way in which this receiver behaves so far as the regeneration control is concerned. The regeneration in this circuit is controlled by means of a 200,000 ohm variable resistance inserted in the tickler coil circuit.

By using an untuned radio frequency stage, any undesirable reaction from the antenna circuit is eliminated; also there is a notable absence of dead-spots and the tuning is remarkably smooth and stable. The third tube serves to give a better quality signal with less tube noise.

The tuning and regeneration controls are simple to handle; on the front panel of the set the tuning dial is found at the center, with the regeneration control knob on the left. The control knob at the right is the filament control rheostat. The front panel, of aluminum or other metal, may be about 7 x 10 inches while the base measures about 7 x 8 inches and 2 inches deep.

For the plug-in coils a 5-prong socket is provided. In the original receiver the Na-Ald shortwave broadcast *band-spread* coils were used, with an excellent band-spread tuning effect. For tuning in the *amateur shortwave* bands, band-spread coils covering the desired bands were employed. If one desires to tune over the whole short-wave spectrum, from 15 to 200 meters, then the 5-prong *general coverage* coils may be used. All of these tuning range possibilities may be tried out without making any changes in the wiring.

Above—Appearance of the receiver. Below: Wiring diagram.



This set is very economical on the batteries and as the plate drain is only about 15 ma. at 135 volts, one of the newer type small-size B batteries may be used. If desired, a 90 volt "B" battery may be employed, but stronger signals are of course obtained with 135 volts. A battery supplying the filament potential of 2 volts may comprise two #6 dry cells, the cells being connected in series. The current drain here is about ½ ampere. Where the set is to be used over quite a lengthy period, it will be desirable to use either a small storage battery or a heavy duty 3 volt "A" battery. Any type of single wire antenna may be used with this set, and it is suggested that a wire about 100 feet long and as high as possible be used, together with a ground connection to water pipe or other good ground.

The circuit diagram shows the set to be really very simple to build and extremely economical, so far as parts are concerned. The R.F. stage used a small R.F. choke in the grid circuit and the antenna is coupled directly to it through a small condenser which can be adjusted to reduce broadcast band harmonics on the 160 meter coil. The output of the R.F. stage feeds through three condensers before it gets to the grid of the detector tube. In this case there is no danger of any of the plate voltage of the R.F. tube getting onto the grid of the detector. The plate of the 34 is shunt-fed through a 2.5 mh. R.F. choke.

In the detector stage we have the two triodes operating, one as the detector and the other as the feed-back tube. Two grid condensers are connected in series and the grid of the regeneration tube connects to the mid-point. The grid-leaks of both tubes are returned directly to the "A" plus lead instead of across the condensers. A high resistance rheostat is connected in series with the plate supply of the regeneration tube in order to vary the voltage and thus control the amount of feed-back

Alden Plug-in Coil Data

Meters Wave-length	*Grid coil turns*	*Tickler turns*	*Distance between coils*
200-80	52 T. No. 28 En. Wound 32 T. per inch.	19 T. No. 30 En. Close wound (C. W.)	⅛"
80-40	23 T. No. 28 En. Wound 16 T. per inch.	11 T. No. 30 En. C. W.	⅛"
40-20	11 T. No. 28 En. 3/32" between turns	9 T. No. 30 En. C. W.	⅛"
20-10	5 T. No. 28 En. 3/16" between turns	7 T. No. 30 En. C. W.	⅛"

Coilform—2⅛" long by 1¼" dia. C. W. = Close wound

Parts List for Separate Reg. Set

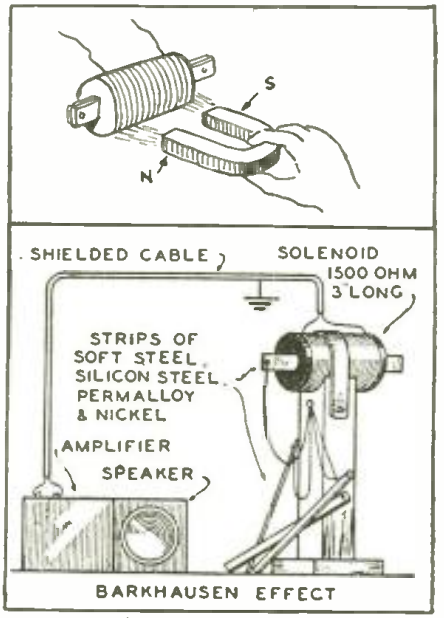
1—metal chassis and panel, see text
1—set of 5 prong plug-in coils, Na-Ald
3—2.5 mh. R.F. chokes
3— 1 mf. by-pass condensers
2—.01 mf. by-pass condensers
1—.001 mf. mica condenser
1—.0005 mf. mica condenser
3—.0001 mf. mica condensers
1—140 or 150 mmf. tuning condenser
2—3 meg. resistors, Ohmite
2—1 meg. resistors, Ohmite
2—50,000 ohm resistors, Ohmite
1—200,000 ohm variable resistor (potentiometer can be used)
1—10 ohm rheostat
1—4 prong Isolantite socket
1—5 prong Isolantite socket
1—6 prong Isolantite socket
1—6 prong Bakelite wafer socket
1 antenna ground terminal strip
1—phone terminal strip
1—6 wire battery cable
1—type 1D5-GP tube, RCA Radiotron
2—type 1J6-G tubes, RCA Radiotron
1—dial (Vernier)
1—tube shield

Demonstrating the Barkhausen Effect

● WITH this simple equipment you can hear the elementary magnets of iron, steel, permalloy and other magnetic materials turn over within the metal and align themselves. As each sub-microscopic group of magnets turns over, a slight current is induced in the coil and this is sufficient to produce a loud rasping sound in the speaker connected with the amplifier. The construction of the needed equipment is inexpensive and will require but a short time to assemble.

As will be observed in the diagram above, a small solenoid is made. This consists of winding upon a ¼" I. D. micarta or other insulated tube (a glass tube may be used) sufficient turns of wire to make a coil with a resistance of about 1,500 ohms. Nos. 38 to 40 enameled silk-covered, or enameled cotton-covered wire may be used. The length of the coil should be such that it will fit between the poles of a powerful magnet. The magnet, which will be needed for the demonstration, may be obtained from an old telephone magneto. This coil is connected to the input terminals of an audio amplifier through a paired shielded conductor, the shield of which should be grounded. Thin strips of the metals specified in the diagram are made long enough to extend beyond the coil for a distance of an inch or so.

When a horseshoe magnet is made to approach the metal strip in the solenoid a sound will be produced in the loudspeaker which will vary with the speed of approach and also with the nature of material introduced into the solenoid. Then, turning the horseshoe magnet in the hand, the spectator will hear the elementary magnets as they turn over and realign themselves.—*Courtesy of Science Observer.*

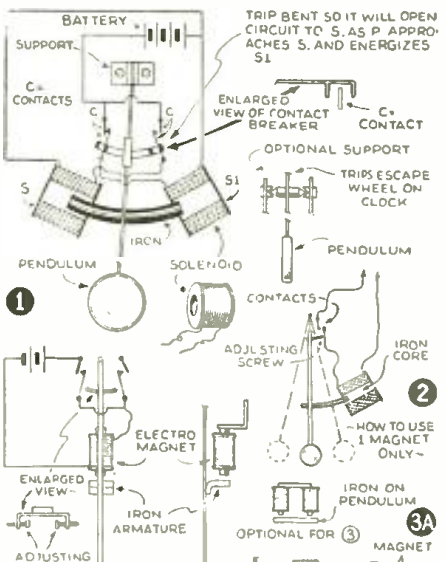


With the simple apparatus shown above, the Barkhausen effect can be demonstrated.

Simple Electric Clocks

● MANY experimenters have an old pendulum type clock lying in the attic and the pictures herewith show several ways in which such a clock may be electrified. A curved iron core or armature may be arranged to move into either one or the other of the two solenoids, the windings of the solenoids being placed on brass spools or bobbins. As the pendulum swings back and forth it is caused to open and close a pair of spring contacts, so that one magnet or the other is energized at just the proper moment. The pendulum, of course, simultaneously operates the escapement mechanism of the clock movement.

Fig. 2 shows the use of one solenoid and iron core only, and a more balanced arrangement of the single magnet principle is shown at Fig. 3. In this case the contact should be arranged so that the swinging pendulum opens it just before the iron armature fastened on the pendulum reaches the magnet. A stronger magnetic pull may be obtained by using a double magnet as shown in 3a, and a very good design used on some clocks is that shown on Fig. 4. Here the iron armature secured to the pendulum is attracted by the magnet poles and passes through the air gap at each swing of the pendulum.



Several different types of electric clock movements are illustrated above, these will appeal to the experimenter.

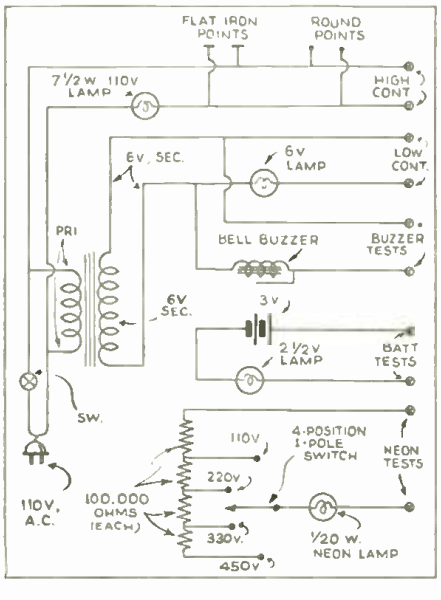
ELECTRICAL EXPERIMENTERS wanted! Be sure to send the editor a rough sketch, together with a typewritten or neatly written description of 200 words or so describing your favorite electrical experiment. Here is the place to tell the other fellows about your electrical experiment, so that all may profit by their adaptation. All experiments accepted and published will be paid for at regular space rates.—Editor

SMALL CONTINUITY TESTER

● THIS little continuity tester was constructed for an electrician repairman, electrician, or a radio experimenter, in which some parts could be omitted. The small tester was built of ¼" plywood and has a slanting panel. A small wooden cover is hinged to the lower part.

The different tests are: 1. *High Continuity*, into which is fed direct 110 volts A.C. (or D.C.) through a small 7½ watt, 110 volt lamp bulb. It is used for testing motor fields, sweepers, heating pads, lamps, switches, iron elements, and electric griddles. Also tapped behind the 7½ watt bulb, are two iron points, round and square, in which an iron cord can be plugged and tested for broken wires. For radio it can be used for a point-to-point test, and for testing *open* or *shorted* condensers, by using the charge and discharge method.

2. *Low continuity* test current is taken from the secondary of a small 6 volt radio transformer. It has many uses, such as—testing 6 volt bulbs, bells, buzzers, 6 volt and 32 volt irons, and in radio can be used for testing 6 volt filaments, coils, switches, etc.



3. The *aural buzzer test* is for the electrician, where signals by sound are wanted for continuity tests, and on new or old house wiring, where switches and a general check-up is needed. Leads about 30 ft. long were used here, with jack tips for long distance tests. It may also be used in radio for making continuity sound tests on low change apparatus.

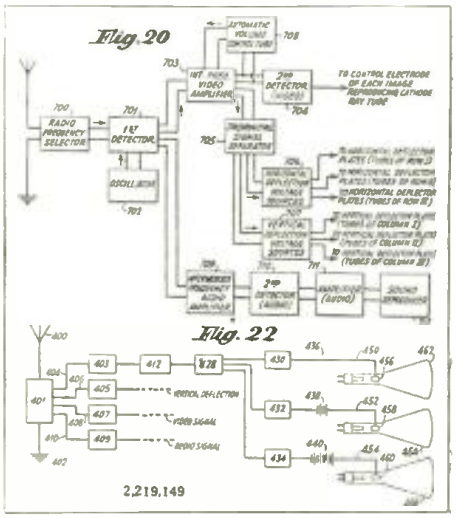
4. The battery test was supplied with two 1½ volt flashlight cells, clipped to the baseboard. Use for point-to-point tests, where electricity is not available.

5. The neon tube tests are useful for finding different voltages in which several 100,000 one watt resistors are in series with 1/20 watt neon bulb. This test can be used for determining which side of line is *hot* and which neutral. One may determine approximate voltages upon using tester regularly. Be careful and always start at high voltage setting so as not to damage the neon tube. This has many uses in radio testing for *open* condensers, voltage, etc. —*Homer L. Davidson.*

Digest of Recent Radio Patents

LARGE SCREEN TELEVISION

● AS the loudspeaker replaced headphones, so may the new television system recently granted patent No. 2,219,149, invention of Dr. Alfred N. Goldsmith, permit any standard television receiver to be converted to *large screen* reproduction. Economy is one of the prime factors in Dr. Goldsmith's invention, for he believes that it is far more practical to use a multiplicity of cheap tubes and projection lenses rather than one highly expensive tube and a costly lens.



In Dr. Goldsmith's system, the usual cathode-ray tube (the largest of which in general use have an area of about 100 square inches), is replaced with several small projection tubes, each of which will cover a portion of the picture. One of the objects of his invention is to have each portion of the picture covered by a separate projection tube which, due to its small size, can operate at lower voltages and should therefore have increased life as well as lower production cost. He states that picture areas will thus possibly be measured in square feet—or tens or even hundreds of square feet—rather than in the present square inches.

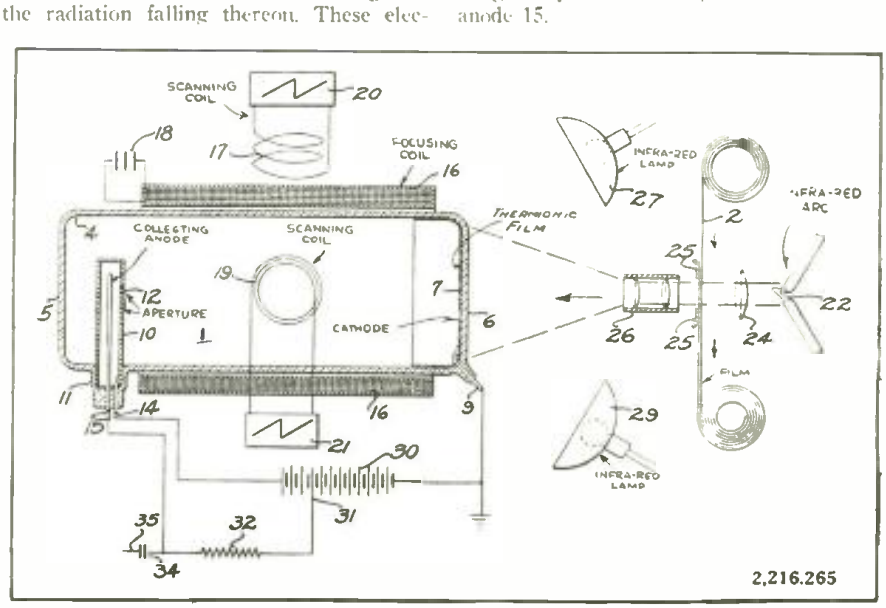
The patent also covers a similar system for use in studio pickup, to permit more efficient program transmissions. The patent has 37 drawings (two of which are reproduced herewith) and covers 38 pages of small print. It is well worth reading by anyone who is interested in the latest advance in the art of television.

INFRA-RED IMAGE DISSECTOR

● PHILO T. FARNSWORTH has been busy again with his television inventions and the drawing herewith, taken from his patent No. 2,216,265, shows a new type of his image dissector particularly designed to televise motion picture film and operable by infra-red radiation. In this invention Mr. Farnsworth uses as a cathode a thermionically responsive material instead of photo-electric material.

In operation, the infra-red source 22 projects an image, focused by lens system 26, of the film 2 upon the back of cathode 7, which thereupon creates an electron image of film 2 by emitting electrons from its entire surface, corresponding in number at each element of area to the strength of the radiation falling thereon. These electrons are attracted toward the anode elements 10 and 15 by the high positive potential thereon. The negative charges on all the elements of the moving stream tend to spread it out, but the magnetic field created by solenoid 16 counteracts the tendency and causes the intensity of each elementary area of the electron image to remain unchanged as the stream passes along the tube toward the anode.

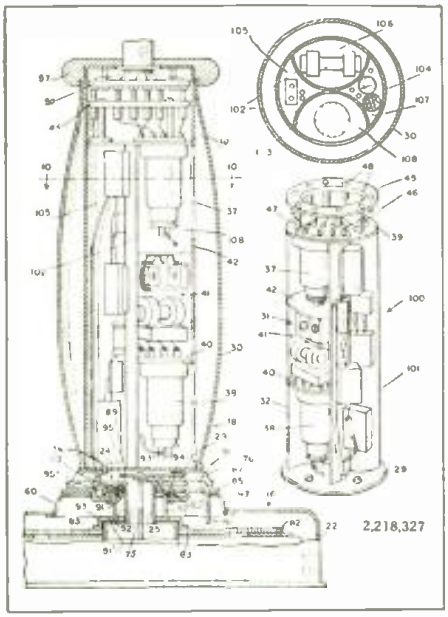
The entire electron stream is deflected by the currents set up in scanning coils 17 and 19 by the saw-tooth oscillators 20 and 21 so that each element of the electrical image may in turn pass aperture 12, and the electrons constituting such elements of the image may enter the aperture and strike anode 15.



LAMP AND RADIO SET

(Cover Feature)

● DANIEL J. CROWLEY of Grosse Pointe, Mich., invented this ingenious table lamp and radio receiver for which he was awarded U. S. patent No. 2,218,327. Very clever arrangements of the radio receiving set tuning coils and condensers are



shown in the various drawings accompanying the patent, only one of which is here shown. Round ring members at the base of the lamp and accessible from all sides, control the switch and volume control, also the tuning condensers. The loudspeaker is mounted on top of the lamp shade. One of the principal objects of this invention is the easy access provided to the parts in the base and pedestal of the lamp.

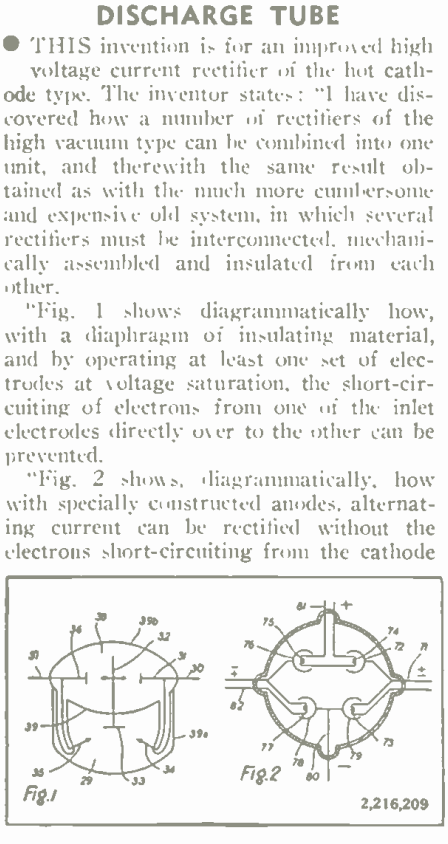
DISCHARGE TUBE

● THIS invention is for an improved high voltage current rectifier of the hot cathode type. The inventor states: "I have discovered how a number of rectifiers of the high vacuum type can be combined into one unit, and therewith the same result obtained as with the much more cumbersome and expensive old system, in which several rectifiers must be interconnected, mechanically assembled and insulated from each other.

"Fig. 1 shows diagrammatically how, with a diaphragm of insulating material, and by operating at least one set of electrodes at voltage saturation, the short-circuiting of electrons from one of the inlet electrodes directly over to the other can be prevented.

"Fig. 2 shows, diagrammatically, how with specially constructed anodes, alternating current can be rectified without the electrons short-circuiting from the cathode of one inlet terminal to the anode of the other inlet terminal.

"Fig. 1 shows two ways of preventing electrons from passing directly or short-circuiting for example from the cathode of one of the inlet terminals to the anode of the other inlet terminal. One way is to place the inlet cathode and anode in compartments separated by a septum or partition of dielectric material as here; the anodes 31 and 36 are on one side of the partition 39, and the cathodes 34 and 35 are on the other side of it. Therefore, instead of a direct discharge from cathode 35 to anode 31, or from cathode 34 to anode 36, the discharge must first be between cathode 35 and anode 33, then from cathode 32 to anode 31, or from cathode 34 to anode 33, and from cathode 32 to anode 36; the current flowing in the outside circuit from anodes 33 to the cathodes 32 is then unidirectional." (No. 2,216,209)

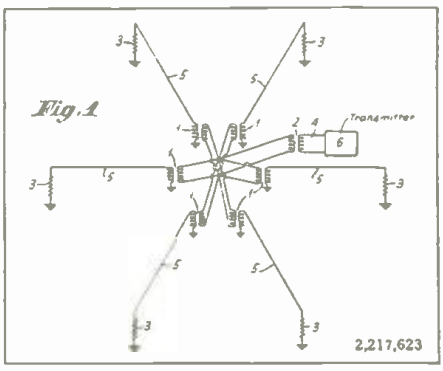


ANTENNA SYSTEM

● THIS invention, patented by Harold O. Peterson (No. 2,217,623), relates to antenna systems and, more particularly, to transmitting antennas for radiating power at broadcast frequencies.

[One common cause of interference at a receiver results from the recombination of waves arriving at a receiver over paths of different lengths, such as the earth path and the sky path. In the earth path are components of the wave which are transmitted horizontally, while in the sky paths are components which are transmitted at a high angle of elevation and reflected back to the earth by the Heaviside layer. It has heretofore been proposed to overcome this interference by radiating waves at a low angle to the earth by employing one or more vertical transmitting antenna doublets, each having a length equal to half the length of the communication wave. At broadcasting frequencies, however, in the range of wavelengths of 200 to 600 meters, it is impractical both from an expense standpoint and because of the great height involved to build a half wavelength vertical doublet.]

The present invention overcomes the foregoing difficulties and provides a transmitting antenna system which gives relatively low angle radiation without using structures of great height. More especially, the antenna of the invention comprises a plurality of horizontal wave antennas which are disposed radially with respect to a central point, and which have a length at least as long as half the length of the communication wave. These antennas are at a relatively short distance above the earth and are designed each to produce maximum radiation in one direction, that is, in the direction away from the feeding point. Such wave antennas radiate vertically polarized waves, and maximum radiation occurs at relatively low angles with respect to the earth.



New Apparatus of Interest to All

Pocket Radio

● THE accompanying picture shows the new G.E. battery-operated portable radio receiver, which is complete in every detail with a self-contained loop aerial built in the hinged lid. When the switch controlling the set is pushed to the *on* position, the lid automatically opens up. This set uses a four-tube superheterodyne circuit, using the newest type miniature tubes, which give a minimum battery drain. The back cover of the cabinet opens up on a hinge, so that all the batteries can be replaced in a jiffy. *Made by General Electric Co.*

The tuning knob is very cleverly designed and gives a vernier tuning effect. When through using the set, the lid is closed and the switch pushed to the *off* position, thus opening the battery circuit. A second knob controls the volume. In an actual test this set gave very good quality on the broadcast stations and showed particularly fine pickup. It was tried in a steel frame building as well as in many other locations, and gave a very satisfactory all-around performance. It is designed to operate on the broadcast band from 540 to 1600 kilocycles.

18-Tube, 5-Band Chassis

● HERE is a new Midwest 18-tube 5-band radio chassis. The new chassis represents a real contribution to the field of radio because its advanced and ingenious circuit design incorporates many new features and advantages such as 25 watts power output, organ tonic filter, dual speakers,

fidel-a-stat (tone adjustor), adjustable loop antenna, stat-omit (static reducer), microphone provision, etc.

The organ tonic feature is said to mark an important advancement, because multiple resonant acousti-chambers deliver the round rich tones of all the instruments being reproduced. Organ type pipes of proper size and shape directly connected to the rear of the speaker absorb peaks and produce clear concert realism, according to its sponsors.

Of particular interest to those interested in securing foreign distant reception is the fact that this new 18-tube set offers 25 watts power output. This unusual amount of power offers plenty of reserve to faithfully reproduce crescendos and loud passages in music even when played at home levels. It is this reserve power which aids in bringing in far distant overseas stations with the clarity of locals.

Volume Expander

LLOYD SAMPSON*

● WITH the phonograph record sales during 1939 well over the 36,000,000 mark, it is reasonable to expect that improved methods of reproduction be devised, that will guarantee the greatest possible satisfaction in listening pleasure. The New Bogen volume expander is a decisive step in this direction as it has been expressly designed to recreate in the playing of the record the original composition in its full dynamic range.

At the time of recording, it was necessary to compress to some extent this dynamic range due to physical limitations. This new expander or "expressionator" actually expands or amplifies these compressed passages to a point where they incorporate the actual proportions that were in evidence at the original rendition. Previous types of expanders offered many difficulties in their operation. Their function was not swift enough to compensate for the swiftly changing tempos of some compositions, resulting in the necessity for a timing control, and when this was not properly operated, there was a noticeable time lag in the expansion or in some cases a "chopping effect" took place that was apparent. The David Bogen Co. new Model VE2 expander demonstrated that it could operate perfectly, regardless of changes in tempo, and functioned equally well on symphonic and dance records.

The Model VE2 is a single compact unit, including its own built-in power supply and a special attenuator network on its input, to compensate for the various output voltages of different pick-ups. The expander connects between the pickup and the phono input of any amplifier or radio receiver. It has only one control, which varies the amount of expansion desired. They are excellent for music appreciation classes in schools and music groups. For home use they may be readily connected to any radio or phono combination.

Needle Scratch Minimized. Because the expander does not affect the softer portions of the record and only increases the volume of loud passages, the needle scratch will be considerably reduced.

Operation. The attenuator network of the expander is connected through a marked *terminal board* for pickup connection. The expander has three tubes: a 6SA7 or control tube, one 6C8G used as an amplifier and rectifier, and one 5W4 used for the D.C. power-supply. The signal from the pickup is fed simultaneously to the signal grid of the 6SA7, and also to the input grid of the 6C8. From this signal grid, the impulses are amplified and then through the remaining half of the tube are rectified, providing a D.C. potential that is directly proportional to the A.C. input from the pickup. This D.C. voltage is further affected by two time-delay networks that determine its speed of acceleration and decay of the expansion. The D.C. voltage is then varied by the expansion control, which regulates the amount of D.C. potential impressed up on the control grid of the 6SA7, which in turn varies the amplification factor of the tube, or the degree of amplification of the signal previously impressed on the signal grid of this tube. This resulting signal strength is coupled from the plate of the 6SA7 through a capacitor to the phono input of any amplifier or radio receiver.

*Harvey Radio Co.

New Code Practice Equipment

● BUD RADIO, INC., is now offering a complete new line of Code Practice Oscillators and accessories containing many new, convenient and desirable features. These new items are designed to facilitate both individual and class-room code practice, and are especially timely in view of the emphasis our National Defense Program is placing upon the necessity of having available a large number of trained radio operators.

An Earphone Model Code Practice Oscillator (CPO-122) capable of handling up to twenty pairs of earphones or up to five small magnetic speakers is offered. It has a variable volume control and a variable pitch control, so that both the volume and tone may be adjusted to suit individual needs. This oscillator is housed in a sturdy streamlined metal case, finished in grey crackle enamel. A neat red name plate is provided to identify the various controls.

Model CPO-124 (above) is like CPO-122 but it is provided with a built-in loud-speaker. Provision is also made to operate up to twenty pairs of earphones or up to five small magnetic speakers. Both the tone and volume are variable.

CPS-123 is a three-inch magnetic speaker housed in a grey crackle enamel case. This speaker is intended for use with the CPO-122 and the CPO-124.

CPO-127 is a Key and Phones Outlet Box and is designed to provide a convenient means for terminating key and phones connections in a class-room or group practice. Two appropriately marked jacks are housed in a bakelite box which can be fastened to the bench at each student's position. Each outlet box is then wired to the master oscillator.

New National NC-200 Receiver

● THE new NC-200 National communications receiver has a range of 490 to 30,000 kilocycles with six general coverage ranges; four amateur ranges with uniform band-spread are provided, and all ranges have definite accurate calibration. Positive signal-dial control is provided. The chassis is very substantial and the parts are carefully designed so as to be "temperature-compensated" and thus avoid oscillator drift, etc. Other features are automatic voltage specialization, series-valve-noise-limiter, a new flexible crystal filter, loudspeaker supplied in matched cabinet, etc.

The sensitivity of the NC-200 is particularly high, an input signal of only 1 microvolt providing 1 watt of audio output. New R.F. coupling circuits have made possible the maintenance of full sensitivity up to the highest frequencies covered by the receiver.

A striking proof of the efficient R.F. circuit design is the signal-to-image ratio at 10 meters. This ratio is better than 30 db., a figure higher than that found in many receivers employing two-stage preselectors.

Another outstanding feature of the new NC-200 is the stability of the high frequency circuits. A new high frequency oscillator design eliminates the exasperating detuning effect of the R.F. gain control and the even more undesirable motorboating or fluttering which occurs in most receivers when tuning in strong high frequency signals. Perhaps the best way to prove the exceptional performance of the new circuit is in the 10-meter band where a line voltage shift from 90 to 125 volts produces less than 1000 cycles change in tuning. This is a variation of less than .003 per cent!

Frequency drift has been reduced to a minimum through the use of temperature compensating condensers, not only in the high frequency oscillator circuits, but in the R.F. and first detector circuits as well. In connection with the high frequency circuit design, it should be noted that the 6K8 first detector tube is separately excited by the high frequency oscillator circuits, which utilize an individual 6J5 and are not, therefore, a part of the conventional 6K8 converter circuit.

A self-balancing phase inversion circuit is used to couple the detector-limiter to the output tubes.

Other important features include an AVC system that holds audio output constant to within 2 db. when the signal input varies between the limits of 10 and 100,000 microvolts; a push-pull audio output stage employing beam power tubes and delivering 8 watts of undistorted audio power to a 10-inch permanent-magnet dynamic speaker, and a calibrated signal strength meter which provides an accurate reading on any signal from below 1 microvolt to 10,000 microvolts.

New All-Around Oscillograph for F.M., A.M., and Television

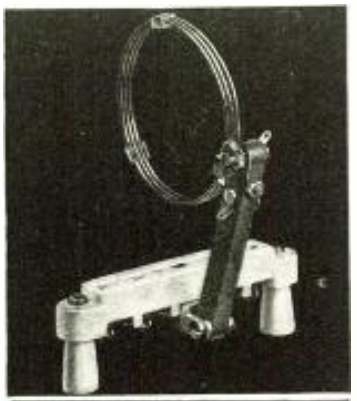
● THIS up-to-the-minute Hickok Oscillograph for complete visual analysis is designed for frequency modulated, amplitude modulated and television servicing. It offers single or consecutive stage by stage trouble shooting from antenna post to speaker. It has self-contained Wide Band F.M. Oscillator for F.M. and Television Receivers and Narrow Band F.M. Oscillator for Amplitude Modulated Receivers. Also, Demodulator, Video Amplifiers, Signal Tracer, and Visual A.C. Vacuum Tube Voltmeter 0.2 to 1000 volts.

The wide band frequency modulated oscillator can be modulated from external sources such as phonograph pickup, microphone or audio frequency oscillator to provide a "frequency modulated" transmitter for your own laboratory checks.

New James Millen Products

● ONE of the accompanying illustrations shows a new flexible coupling link developed by the James Millen Mfg. Co.; it is particularly useful in building Ham transmitters. This apparatus provided a swinging link and also a pin socket for plug-in inductance. The insulation used is of the new high frequency low-loss type. Suitable forms or mounting strips with corresponding arrangement of pins, are provided by the manufacturer for supporting air insulated coils.

The other picture shows two new designs of

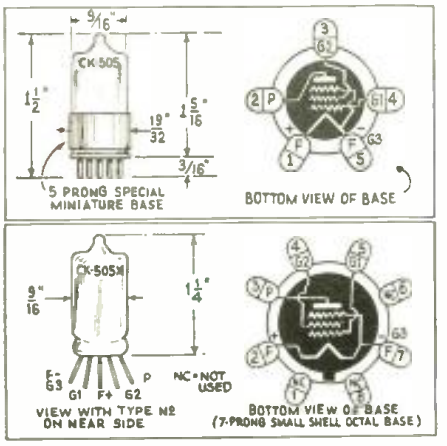


Steatite bushings of great value to the radio amateur. These insulators of the bowl type are used to bring in the high voltage connection from the antenna to the transmitter. A novel feature of the insulator rod is the screw-driver head provided at each end, to permit holding it while tightening the nuts.

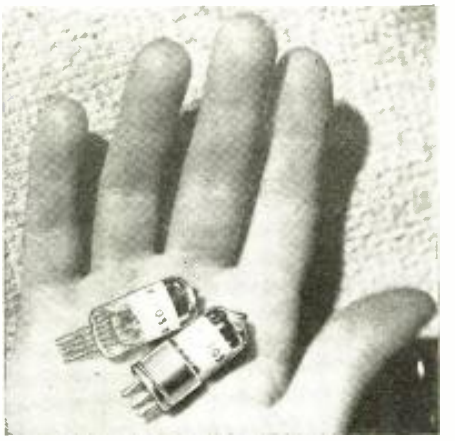
Transmitter Kits

● SIX new transmitter kits, engineered and designed in the Thordarson laboratories and characterized by modern simplified construction, and efficient operation are now available. Kits consist of a 20 Watt CW Beginners Transmitter, 35 Watt Phone or CW unit, 12 Watt Universal for portable and emergency service, 55 Watt Phone-80 Watt CW unit, 12 Watt Mobile Transmitter for operation on 5 and 10 meter bands, and a 50 Watt 5 and 10 Meter Phone Transmitter.

Free bulletin SD-464, completely illustrates and describes these fine units.



Socket wiring diagrams for the new miniature pentode amplifier tubes.



Note the extremely small size of the new Raytheon pentode amplifiers.

New Miniature Pentode Voltage Amplifiers

● THE new Raytheon CK-505 and CK-505X tubes are miniature pentode-type amplifier tubes designed for use as voltage amplifiers in applications where extremely small size and low battery drain are the primary tube requirements, such as in hearing aids, etc.

The CK-505 is equipped with a special miniature base. The CK-505X has tinned copper leads for direct soldering and is supplied with a removable standard octal base to facilitate retesting.

A pair of these tubes in a resistance coupled amplifier using their suggested circuit values has a voltage gain of about 225 at 30 volts of B battery. The total B drain for both tubes is 54 microamperes and the total A drain for the two tubes in series is 30 milliamperes at 1.25 volts.

In addition to hearing aid application these tubes may be used where extremely small size and low battery drain are the primary tube requirements.

DIRECT INTERELECTRODE CAPACITANCES (Approximate)

Grid to Plate	0.25 μμf
Input	2.5 μμf
Output	3.5 μμf

RATINGS

Max. Fil. Voltage (Dry Battery Supply)		
Volt. Must Never Exceed	0.78	volts
Mean Filament Voltage	0.625	volts
Maximum Plate Voltage	45	volts
Maximum Screen Voltage	45	volts

TYPICAL AMPLIFIER OPERATION—CLASS A

	Impedance Coupled		*Resistance Coupled*	
Filament Voltage*	0.625 d-c	0.625 d-c	0.625 d-c	volts
Filament Current	0.030	0.030	0.030	amp
Plate Voltage	30	45	30‡	volts
Screen Voltage	30	45	30‡	volts
Grid Bias†	0	−1.25	0	volts
Plate Resistance (Approx.)	1.1	2.0	–	megohms
Transconductance	140	150	–	umhos
Plate Current	0.17	0.2	.020	ma
Screen Current	0.07	0.08	.007	ma
Voltage Amplification			15	—

*The filaments of two tubes may be operated in series directly from a single small flashlight cell. If larger cells are used or if other factors cause the mean battery voltage to exceed 1.25 volts computed over the normal battery life, a series filament resistor should be used to reduce the mean filament voltage to 1.25 volts for the two tubes in series.

†Grid Circuit returned to negative filament. The d-c resistance in the grid circuit should not be less than 5 megohms.

‡Supply Voltage. Plate Resistor: 1 megohm. Screen Resistor: 2 megohms by-passed with 0.01 μf. Coupling Condenser: 0.01 μf.

Preferred Tubes Reduced from 36 to 31

● THE RCA Preferred Type Tube Program passes its first anniversary this month with the announcement that the number of receiving tube types it covers has been reduced from 36 to 31, and that two other types have been replaced to coincide with today's receiver design trends.

L. W. Teegarden, Manager of the RCA Tube and Equipment Division, made the announcement after pointing to the program's first year of fulfilled promises of greater economy and higher quality, to its reception by a total of 19 radio set manufacturers, and to its direct benefit to tube jobbers and servicemen.

Three types, 1G4G, 1G6G and 6N7G, have been eliminated from the preference list as the result of a swing away from type "B" audio systems by design engineers throughout the radio industry. Type 2A3 is becoming less and less popular with engineers, too, so that it has been dropped. The fifth deletion was accomplished by the program itself. It was found necessary to include both types 6J5 and 6J5GT in the original list because of a price difference. Increased volume of orders for the 6J5 has made possible manufacturing economies to bring its cost into competition with the 6J5GT, which has been deleted from the list.

Two changes of types on the list were caused by a growing tendency in the A.C.-D.C. set field for seven and eight tube receivers. The tube complement for such a receiver, if drawn from 150 milliampere tubes on the preference list, adds up to a greater heater voltage than the normal line voltage. So 6.3 volt 300 milliampere tubes must be substituted, although there have been no power output and rectifier types on the preference list useful for this purpose. Thus it is that types 25L6GT and 25Z6GT have been substituted on the list for types 12SJ7 and 12C8.

"Some order has come out of the chaos in the tube industry in the past year," Mr. Teegarden declared. "Nearly a score of radio manufacturers have supported the RCA Preferred Type program by designing their receivers around the preferred type tubes. Results have been important in lowered costs all along the line, and in better and more uniform tubes."

Mr. Teegarden said that currently nearly three quarters of all receiving tubes produced by RCA are concentrated in the preference list. Tube parts are now produced by mass production methods never before possible, and such parts as bases, shells, heaters, and cathodes have been standardized to effect further economies. In addition, manufacturers endorsing the program have watched their own costs go down substantially as they were able to standardize on tube sockets and other component parts.

●

Table at right shows the new "preferred" tube list recommended by RCA. The adoption of this preferred tube schedule has permitted the speeding up of production and also the reduction of basic costs, as compared to "unlimited" schedules.

RECEIVING TUBE TYPES

PREFERENCE LIST

Rectifiers	*Indicator Tube*	*Converters*	*Voltage Amplifiers Single*	*Twin*	*with Diode(s)*	*Diode Detector*	*Power Amplifiers*
		1A7-GT	1N5-GT		1H5-GT		3Q5-GT
5U4-G	6U5 6G5	6SA7	6AB7	6SC7	6B8-G	6H6	6F6-G
5Y3-G			6J5		6SQ7		6K6-GT
6X5-GT			6SF5		6SR7		6V6-GT
			6SJ7				
			6SK7				
25Z6-GT		12SA7	12SK7	12SC7	12SQ7		25L6-GT
35Z5-GT							35L6-GT
							50L6-GT

Hi-Fi Speaker for Communications Radio

● THE utility of RCA's new Communication Receiver (Model AR-77) for amateur radio enthusiasts and ardent radio fans of every stripe, has been heightened by the development of a new "extended range" loudspeaker designed especially for use with the receiver.

New high-fidelity loudspeaker and cabinet, which is ideal for use with "communications" type receivers.

The new loudspeaker has an extended audio range with large power handling capabilities, giving full expression to the performance of the AR-77. It is available in an attractive walnut cabinet which serves as a support for the receiver, and is styled for use in the living room or the short wave listener's den. The same speaker mechanism is also available in a plain, gray-finished cabinet, for use in the amateur's station.

The loud-speaker has a frequency range of from 60 to 5,000 cycles. Power handling capacity is 10 watts, and voice coil impedance is 2.3 ohms at 400 cycles. The speaker cabinet stands 32" high, 24" wide and 14-1/3" deep.

The AR-77 provides amateur, foreign and broadcast band reception of unusual quality. It meets the exacting requirements for amateur and foreign reception with its high signal-to-noise ratio, unusual selectivity and fine stability. A higher fidelity audio system assures quality musical reproduction, while a band-spread dial makes foreign tuning easy.

Its performance as a standard broadcast receiver far surpasses the usual type of broadcast receiver. A high-gain R.F. stage reduces image response and greatly increases the signal-to-noise ratio. Two I.F. stages insure ample gain and sensitivity while negative feedback applied to the audio system greatly reduces distortion and improves fidelity.

New F-M Translator for Standard Receivers

● A NEW frequency-modulation "translator," by the use of which the owner of a conventional amplitude-modulation radio receiver can enjoy the new F-M broadcast programs if they are available in his service area, has been developed by the radio and television department of the General Electric Co., and will be ready shortly. Used in conjunction with an A-M set, it brings in the high-fidelity and relatively static-free F-M programs, thus protecting an owner's investment in his present radio equipment.

The translator, housed in a well-styled walnut cabinet standing 9 inches high, 15½ inches wide, and about 8 inches deep, is provided with a shielded cable for connection to a conventional radio. Terminals are located at the rear of the cabinet for antenna and ground connections. A special dipole antenna is recommended for best results, although in many locations an ordinary antenna will operate satisfactorily. The translator has its own dial scale, with a tuning range of 42 to 50 megacycles, and six tuning keys conveniently located below the illuminated dial. In practice, the translator would be placed in operation by pressing the F-M key on the "parent" radio, or by otherwise tuning the latter set to a point where there is no station interference, as is done with an ordinary record player attachment. Once in operation, the translator keys and manual tuning control are used for station selection in the F-M field. The manual tuning control has a friction drive which is automatically disengaged when one of the station keys is pressed down. The translator may be attached directly to a public address system, if desired, so that F-M programs can be fed directly into an external amplifier and loud-speaker. In ordinary operation, the speaker equipment of the A-M receiver is utilized.

New G-E frequency modulation "translator" which permits the reception of FM programs on a conventional radio receiver of the AM type.

A plug-in connector on the back of the translator chassis permits easy attachment of a *television picture* receiver. A wired-type of record player may also be used in conjunction with the translator. These two features are provided so that either of the other two uses to which an ordinary modern radio is put—television sound or record playing—can be carried on just as always, despite the fact that the F-M translator is connected permanently into the parent set. A manual control to facilitate such operation is supplied on the face of the small cabinet.

The new translator (model JFM-90) has a power consumption of approximately 55 watts, and a tube complement consisting of first and second converter, oscillator, two I.F. amplifiers, two cascade limiters, detector, and rectifier.

Knight Tube Tester Modernizer Kit

● OLD tube testers can now be easily modernized to test new tubes, Allied Radio Corporation, Chicago, has just placed on the market a new Knight Tube Tester Modernizer Kit, B11680. This kit permits testing the new high voltage filament tubes with the older type tube testers. It provides the following filament voltages: 25-30-35-50-70-85 and 117 volts. These voltages are selected by means of an Amphenol rotary tap switch which can be conveniently mounted on the panel or in a spare socket hole of the tube tester. Installation is very simple, there being only two wires connecting the kit with the tube checker. Transformer size is 3¼" x 1⅞" x 1¾". It may be mounted under the panel of the tube checker or in the tool compartment. Full instructions are supplied with the kit.

Multi-Unit Chassis Simplifies Television Set

● BY breaking down the intricate details of television reception into several units which go to make up the complete receiver, the assembly, testing and servicing are greatly simplified, according to Dr. Thomas T. Goldsmith, Jr., director of research for the Allen B. Du Mont Laboratories, Inc.

In the latest Model 195 Du Mont television receiver utilizing the giant 20-inch teletron, points out Dr. Goldsmith, there is a five-unit chassis construction. The first unit is the power unit, consisting of a 300-volt supply operating the receiving tubes in both sound and video channels; a full-wave rectifier providing 1500 volts at low current for operating the final amplifiers for the sweep deflection; a half-wave rectifier supplying 4000 volts negative from ground, operating the electron gun; and a half-wave rectifier supplying 4000 volts positive from ground to operate the intensifier ring.

The second unit is the R.F. tuner, a small assembly with local oscillator and mixer tube, together with their associated R.F. resonant circuit. Provision is made for five channels at present, but the structure is such as to permit different or additional channels without obsoleting the remaining assembly.

The third unit is the picture intermediate-frequency assembly with four stages of I.F. amplification and a detector, designed for I.F. operation from 8.75 to 12.75 mc., with an overall band pass of 4 mc.

The fourth unit is the sound I.F. and A.F. chassis, containing two stages of I.F. amplification at 8.25 mc. Phonographic attachment facilities are provided.

The fifth unit is the cathode-ray control assembly, containing the final stages of the video amplifier, the coupling circuits and the D.C. re-insertion circuit to the grid of the cathode-ray tube. It also contains the synchronizing separator tubes which pick off the peaks of the video signals and, through suitable frequency discriminating networks, apply them to sweep oscillator tubes.

Double Tuned I.F. Transformers

● AFTER considerable research, the Radex Engineering Department has developed three new double-tuned I.F. transformers which will duplicate electrically any I.F. transformers used in the majority of receivers. Provision has been made to bring the grid lead out from either the bottom or top of the shield can of the transformer. This new design also offers another good feature in that mounting is possible either above or below the chassis.

This new design will enable the serviceman to replace I.F. transformers of practically every description with a much lower investment. Only three different I.F. transformers are needed to cover practically any I.F. frequency and may be used as either input, interstage, or output transformer. The frequency ranges are as follows: 150-200 kc.; 240-300 kc.; 430-500 kc. Manufactured by the Radex Corp.

New Stancor Super Pack

● THE Model 132 Super-Auto Demonstration Pack is now offered by the Standard Transformer Corporation, Chicago.

It is a well filtered unit, delivering 12.5 amperes at 3 to 6 volts with a minimum of ripple. It will operate the largest auto radio set all day for but a few cents. It is also very useful to the servicemen to test auto radios. The industrial and special users, too, will have many uses for this unit.

It has many applications in the plating field when small lots are being required.

The Super Pack is housed in a modern, streamlined case. The meter indicates the correct voltage on the output. A tapped switch on the primary of the transformer gives variations to the output voltage. This feature is useful, particularly in testing auto radios or in plating where different voltages are required. A fuse in the primary circuit protects it against any shorts in the transformer. An overload relay in the output protects the rectifier and other components against injurious load.

New Table-type Radiocorder

● CAREFUL engineering has made it possible for Lafayette to produce in its JS-176 Model a table unit which combines the functions of radio, phonograph, recorder and public-address system. Here is a partial list of features: 9-tube, 3-band superheterodyne receiver; tangent-arm crystal phono pick-up; separate crystal recorder head and arm; constant-speed, heavy-duty motor and 10-inch turntable; built-in, adjustable loop antenna; crystal microphone and 1-stage preamplifier; recording level indicator, etc.

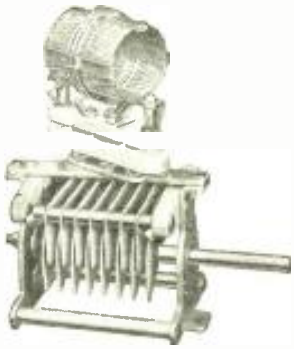
The radio portion covers the complete broadcast range to 1680 kc. and short-wave ranges of 2.25 to 7.0 and 7.5 to 24 megacycles and includes an 8-inch dynamic speaker, tuning "eye," push-pull 6K6GT output tubes, automatic bass compensation,

manual tone control, and other features. The recorder provides for blanks up to 10 inches, records from microphone or "off the air," and proper recording volume is indicated by a neon dual-glow lamp. Because an extra preamplifier tube is employed in the microphone circuit it is not necessary to raise the voice in making speech recordings. Records, both commercial and home-made, up to the 12-inch size, are accommodated for playback, the tangent-arm crystal pick-up insuring good reproduction quality and reduced record wear.

This Table Combination is housed in a walnut cabinet 21⅛ inches wide, 13¾ inches high and 14¾ inches deep.

New Notional TMK Condenser

● THE accompanying illustration shows the new National TMK condenser with swivel coil. This condenser is available in all the standard sizes in capacities ranging from .75 mmf. up to 250 mmf.

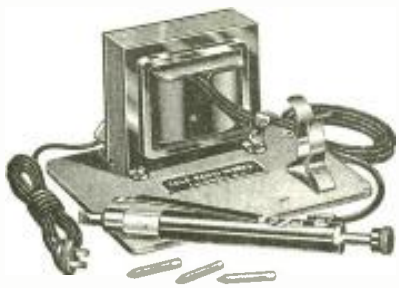


Some of its features are extra compact construction, panel or standoff mounting, swivel coil mount (coil mounts at top or rear), makes use of AR-16 coils or XR16 forms, low-loss construction and aluminum plates.

Novel Soldering Iron

● THE "Instansolder" principle employs a small "arc" of low voltage and comparatively high current, instead of the resistance wire heating element used in ordinary irons. A carbon electrode, supported on the movable center rod, contacts the upper end of the copper soldering tip directly, and produces soldering temperatures almost instantly. Both the "off and on" condition and control of temperature are provided by the side switch, enabling difficult soldering to be accomplished.

A bright, clean soldering tip is a most important requirement for good soldering. Since no current is used and no heat is developed until the switch is depressed, and since the iron heats up in a matter of seconds, the tip does not have time to "burn." "Half and half" radio wire solder is melted in 17 seconds from cold state of the iron —in less time after the iron has been used recently.



There is almost never any need to file the tip of this iron.

The wear is taken by the carbon electrode, which will give many months of service. A new electrode can be inserted without tools in half a minute. As current is used only when actually soldering, power cost is far less than with ordinary irons.

The "iron" itself has a bakelite shell, with isolantite insulator supporting the soldering tip. Diameter only ⅝ inch. Soldering ability about equal to 75 watt electric iron. The special power transformer is built for this one use.—Made by the Cole Radio Works.

Acoustic "Tone Guard" Improves Reproduction

● A RADICAL new treatment of the acoustical problem presented by record surface and mechanical noises present in all phonographs, has been developed by RCA engineers at Camden, and incorporated in the new Victrola home entertainment instruments.

Astonishingly simple in its operation, the new method has been christened "Tone Guard" because of its remarkable effectiveness in guarding the purity of tone reproduced from records.

The "Tone Guard" is a simple system of grooved wells around the inside edge of the phonograph compartment directly beneath the lid. It does not attempt to block out extraneous sounds, but to capture them. It is actually a tuned acoustical filter.

Two grooved wells, one considerably larger than the other, capture sound in the audio frequency range where objectionable mechanical noises exist. When the lid is closed these objectionable sounds enter the space between the cabinet lid and the grooves. A large percentage of them fall into the first groove, where their energy is spent. The balance push forward into the larger groove and are likewise destroyed. Each of the grooves is scientifically designed to destroy objectionable sound frequencies.

The "Tone Guard," together with automatic tone compensation, makes it possible for the first time to reproduce records faithfully at low volume, free from objectionable noises or distortion of the original tone.

Another essential part of the "Tone Guard" system is a special soundproof cover which is built in beneath the whole turntable motor and automatic record playing assembly. Thus all mechanical sounds are completely sealed in the record playing compartment.

New RCA Tube

5W4-GT

FULL-WAVE HIGH-VACUUM RECTIFIER

For use in A.C. Receivers having relatively low current requirements.

(Tentative Data)

Filament Voltage (A.C.)	5.0	Volts
Filament Current	1.5	Amperes
Maximum Overall Length		3⅜"
Maximum Seated Height		2-13/16"
Maximum diameter		1-5/16"
Bulb		T-9
Base		Intermediate Shell Octal 5-Pin
Mounting Position		Vertical*
	Full-Wave Rectifier	
Peak Inverse Voltage	1400 *max.*	Volts
Peak Plate Current per Plate	300 *max.*	Milliamperes
With Condenser-Input Filter:		
A-C Plate Voltage per Plate (RMS)	350 *max.*	Volts
Total Effective Plate-Supply Impedance per Plate†	25 *min.*	Ohms
D-C Output Current	100 *max.*	Milliamperes
With Choke-Input Filter:		
A-C Plate Voltage per Plate (RMS)	500 *max.*	Volts
Input-Choke Inductance	6 *min.*	Henries
D-C Output Current	100 *max.*	Milliamperes

* Horizontal operation permitted if pins 2 and 8 are in a horizontal plane.

† When a filter-input condenser larger than 40 mf is used, it may be necessary to use more plate-supply impedance than the minimum value shown to limit the peak current to the rated value.

PIN CONNECTIONS

Pin 1—No Connection	Pin 4 Plate #2
Pin 2—Filament	Pin 6—Plate #1
Pin 8—Filament	

(Pin numbers are according to RMA system)

"Rolindex" Chart for Tube Tester

● THE incorporation of a roll-type tube chart as a built-in feature of some of the newest tube testers greatly increases their businesslike appearance, in addition to speeding up tube testing and avoiding the use of separate charts, often soiled and torn from constant handling.

These same advantages can be provided for many older tube testers through the introduction by Radio City Products Co. of their new "Rolindex" tube chart which, mounted in its own neat hardwood case, can be easily attached to existing tube-testing equipment.

The "Rolindex," with case measurements of 11" x 3¾" x 3", consists of a highly developed mechanical movement driving the roller chart and actuated by a knurled disc projecting edgewise through the front panel. Set into this panel is a window of transparent plastic with a hairline engraved across its center to make it easy for the eye to follow across the columns of test-control settings.

The chart roll is easily replaced by up-to-date charts which will be available from R.C.P. as new tube types require. Suitable charts are now available for a number of the older R.C.P. tube testers and for more recent models which do not incorporate the roll chart as a built-in feature.

"Commuter" Camera-Type Radio

● THE Crosley Corporation announces the "Commuter," a new camera-type portable radio. It comes in a stylish aluminum case, patterned after the design of a jewel case. It is equipped with a handy gray leather carrying handle. Streamlined, the case has a polished trim, hinged snap cover, which when raised turns the set on and places the loop in operating position. The set weighs only three pounds and five ounces, complete with batteries. Dimensions are 8 in. wide, 4¼ in. deep and 2⅞ in. high.

The receiver uses a small standard 1.5 volt "A" battery, with an average life of 4 hours, which can be purchased at any drug, hardware or 5-and 10 store, and a new 67.5-volt "B" battery which has an average life of 40 hours.

The set covers the American broadcast range from 550 to 1600 kilocycles (187 to 550 meters).

Another personal radio set—very compact and complete, with self-contained batteries and loop antenna.

NEW RADIO CATALOGS

Test Equipment Added to RCA Parts Catalog

● THE most complete showing of test equipment yet compiled is presented in the 1941 edition of the RCA Radio and Television Test Equipment Catalog (No. 1051). Several outstanding new radio and television test equipments, and phonograph modernization assemblies, are included.

The catalog of 28 pages printed in two colors—opens with a presentation of the popular Dynamic Demonstrator, which dramatizes radio circuit theory and action to show how complicated circuits operate. It concludes with another new feature a listing of transmitting and special purpose tubes. The new test equipment items include the Junior VoltOhmyst, lowest electronic voltmeter-ohmmeter; a De Luxe Tube Tester and Pre-heater; the newly-styled 3-inch Cathode-Ray Oscillograph, No. 155; and the A-C Test Oscillator, No. 107.

Another new feature is the inclusion of a complete series of transmitting-tube sockets, coinciding with the announcement of substantially lower prices on six popular types.

Most notable addition to the pages devoted to parts and accessories is a home recorder and automatic record player unit designed for phonograph modernization. In addition, the popular replacement parts guide, included in the 1940 catalog, has been brought up to date.

The catalog also shows microphones, radio, FM, and television antennas, radio and television parts and accessories, and devotes a full page to the new AR 77 Communication Receiver, designed for amateur and general communication services.

New Resistor Catalog

● A NEW Koolohm wire-wound resistor catalog specifically designed for industrial users and illustrating many of the unique economies and design opportunities made possible by this exclusive resistor type has just been issued and may be obtained from the manufacturer, Sprague Products Company.

Due to the fact that every bit of their wire is insulated *before* winding with a special moisture-resistant and heat-resistant (1,000° C.) material, Koolohm resistors are distinctly different in design and construction and smaller in size. Layer windings are used for greater resistance in less space, heat dissipation is more rapid than that of any other resistor of equal size and rating and larger wire sizes provide an extra factor of safety. Moreover, these resistors lend themselves to simplified mounting, while providing still further economy in the fact that there is no cement or vitreous coating to chip, peel or crack.

New Sprague Condenser Catalog

● NEW apparatus include the Type LM condensers with universal lugs for either vertical or horizontal mounting; new Atom condenser kits; new high voltage dry electrolytics; new high voltage fixed micas; various new Television condenser types; new interference locator; new de luxe Tel-Ohmike and various others.

Stancor's New Complete Catalog No. 140-B

● ONE of the newest catalogs received shows the Stancor's entire line of transformers for the amateur service man, and industrial user. Other apparatus covered in this catalog includes transmitter kits and a complete line of power packs. A numerical index is included and complete technical as well as mechanical data is given on each unit. Copies of the catalog can be obtained without charge from the Standard Transformer Corporation. The various pieces of apparatus are illustrated and every ham and set-builder should have this catalog in his file.

FREE CATALOGS and INFORMATION

By carefully reading the advertising columns, you will find many offers to furnish literature containing valuable technical information that will help you in your work. Use this list freely.

Firm	Business	Offer	No.	Cost	Adv. Page
ABC Radio Laboratories	Set Mfr.	Information		Free	537
Acme S. W. Radio Co.	Kit Mfr.	Circular		Free	537
Aerovox Corporation	Parts Mfr.	Catalog		Free	531
		Research Worker		Free	
Allied Engineering Institute	Kit Mfr.	Circulars		Free	533
Allied Radio Corp.	Mail Order	1941 Radio Catalog		Free	529
		New Radio Dictionary		10c	
American Radio Institute	Radio School	Booklet		Free	551
Ayers, Automatic Code Machines	Code Machines	Information		Free	540
Bliley Electric Co.	Parts Mfr.	Circular	D-2	Free	544
		Engineering Bulletin	E-6	10c	
		Bulletin	E-7	Free	
		Circular	A-7	Free	
Bridge, Harry P.	Stamps	Information		Free	558
Bud Radio, Inc.	Parts Mfr.	Catalog		Free	541
Burstein-Applebee Co.	Mail Order	1941 Catalog	57	Free	553
Candler System Co.	Code Course	Book of Facts		Free	541
Cannon, C. F., Co.	Parts Mfr.	Folder	T-19	Free	540
Chartered Institute of American Inventors	Inventors Organization	Booklet		Free	569
Cowell, R. A.	Publisher's Rep.	Information		Free	551
Dodge's Institute	Radio School	Catalog		Free	551
Goldentone Radio Co.	Set Mfr.	1941 Bargain Catalog		Free	551
Gold Shield Products	Mail Order	Catalog		Free	553,53, 59,64,6'
Hallicrafters, Inc.	Set Mfr.	Literature		Free	B. C.
Hammarlund Mfg. Co.	Set & Parts Mfr.	"HQ" Booklet		Free	545
		"Super-Pro" Booklet		Free	
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Howard Radio Co.	Set Mfr.	Information		Free	525
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Instructograph Company	Code Machine	Information		Free	541
Kenyon Transformer Co.	Parts Mfr.	Catalog		Free	539
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Mass. Radio School	Radio School	60-Page Catalog		Free	551
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Millen, J., Mfg. Co., Inc.	Parts Mfr.	Catalog		Free	540
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Nelson Co.	Used Courses	72-Page Catalog		Free	541
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Radio Corp. of America	Radio &Television	Literature		Free	516
Radiocrafters	Parts Mfr.	Catalog		Free	544
RCA Institutes, Inc.	Radio School	Catalog		Free	551
RCA Manufacturing Co., Inc.	Set & Parts Mfr.	Literature		Free	I.B.C.
Record-O-Vox, Inc.	Set Mfr.	Information		Free	546
Remington Rand	Typewriter Mfr.	Catalog		Free	549
Sprayberry Acad. of Radio	Radio School	52-Page Book		Free	515
Sun Radio Co.	Mail Order	Sound Booklet, Test Instrument Bulletin		Free	558
Teleplex Co.	Code Machines	Booklet	S-1	Free	551
Triplett Electrical Inst. Co.	Parts Mfr.	Catalog		Free	553
Wholesale Radio Labs.	Dealer-Mail Order	Map		Free	535
		Catalog		Free	

What Do YOU Think?

From Chief Engineer of WJBO

Editor,

As a constant reader of your fine magazine, RADIO & TELEVISION, allow me to add my name and support to the great list of "R. & T." boosters. It is truly "Radio's Complete Magazine." Your articles by Mr. Ricardo Muniz on FM and Television are the tops. Mr. Herman Yellin does his part by keeping the amateur radio end up to par.

WILBUR T. GOLSON,
Chief Engineer,
Broadcast Station WJBO,
Baton Rouge, La.

(WJBO is a 1000 watt broadcast station, with unlimited time.—Editor)

Likes "Test Set" R. & T. Described

Editor,

Just a short note letting you know I have put the Experimental Test Set together. It's a honey!

I had everything needed, but the neon tube. I borrowed it till I could get into town to buy one. Am I tickled to have the test set! I would like to write to Terrence Genes, and thank him personally.

Now, gentlemen, you have outdone yourselves. "R. & T." for October is the most comprehensive number yet. This winter we on the west coast are planning much and "R. & T." will be our authority. I have the honor of being head of a local radio club; a small group, junior high school age, but my boys are good workers. We meet in my garage.

M. E. VAN NATTAN,
Long Beach,
Calif.

R. & T. Diagrams Appreciated

Editor,

I think your magazine is swell, because of the following reasons:

My buddies and I of our Physics Radio Club at Lafayette High *read and devour* every bit that we can, because of its enjoyable and practical style.

I and my friends are beginners, having acquired our interest in radio, we are yet to really get started. I think there are many such fellows, who need some sort of publication which would devote some time and space in giving certain articles to aid us.

Such articles may consist of radio fundamentals, formulas and elementary building "kinks." These articles can also help those advanced because of their practical applications.

I enjoy your "Radio Kinks" and save all issues for future reference. Your diagrams are well liked because they cover a wide range of subjects, and can be relied upon to supply accurate information.

73 and keep up the good work!

DANIEL EKSTEIN,
2337—85th St.,
Brooklyn, N. Y.

A Good Suggestion

Editor,

While I'm at it here's some "This and That." Congratulations on your last issue.

The earliest number of what is now RADIO & TELEVISION, I find in my files is the April-May *Short Wave Craft*—1931.

Many years ago the radio technician or engineer did not hesitate to say "I don't know." Today he answers most any difficult question with the formula

$$\frac{\text{Decibels}^2 \times \text{Amplitude}}{\text{cgs} \times \text{Kva} - 100{,}000{,}000}$$

which very probably means about as much to him as to the poor bird that listens to it.

And that was leading up to a kick in the pants for your construction article writers.

We all know that the usual run of resistors and capacitors vary (yes very) widely from their marked ratings. We also know that unless we can reproduce conditions we can't duplicate the original design. But there is a simple way in which we could.

Every construction article should be considered incomplete unless it contains a complete table of current and voltages for each element of each tube. Then a builder could have something to aim at.

As I understand it you take a finished set into your laboratory and try it out. If it works satisfactorily and you have reports from other locations where the same set has been tried, you slap on your stamp of approval. Sure that set is good, but it's a lot better than an even bet that your readers can't duplicate it.

And now what do you think?

H. L. KIDWELL,
128 Barilla Pl.,
San Antonio, Tex.

(Thank you very much for your letter and we think your suggestion of placing the voltages of the different terminals throughout the circuit in the diagrams a very good one. We will endeavor to follow up this point as soon as possible.—Editor)

(Continued on page 576)

THE FINEST
RADIO BOOK WE EVER OFFERED
With $1.00 subscription to RADIO & TELEVISION
FREE TO YOU! — *1940-41 Radio-Television Reference Annual*

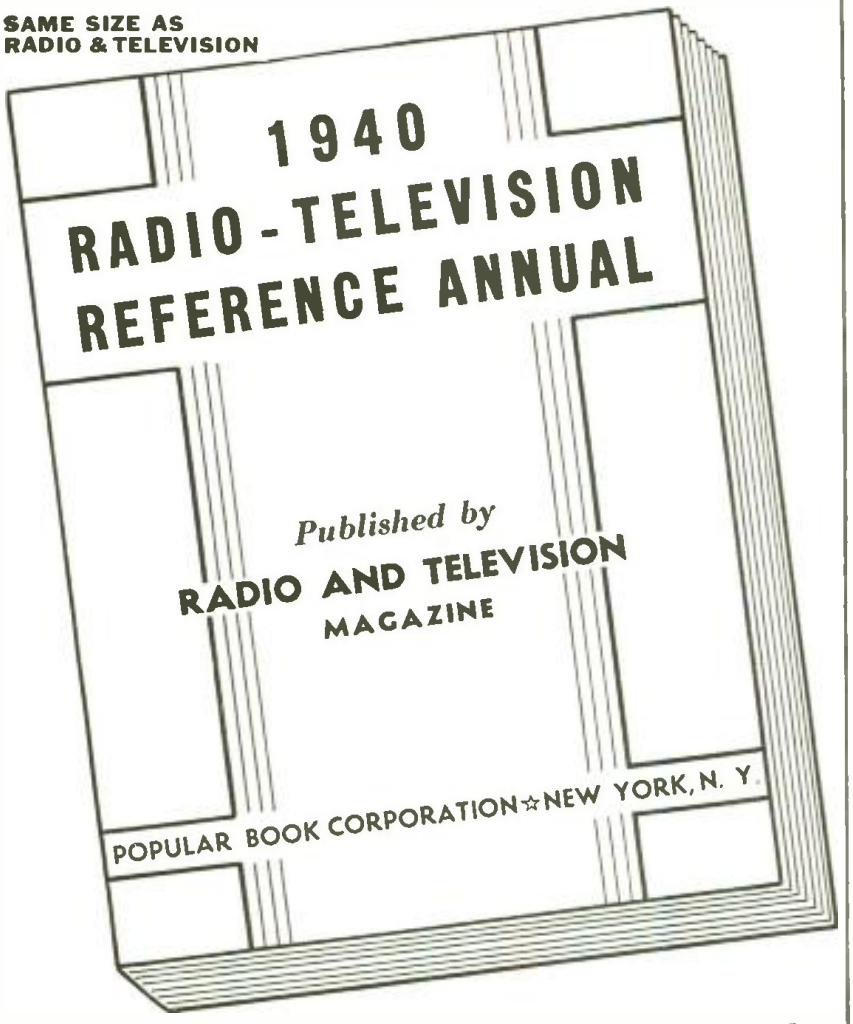
WITH our compliments, we want to send a copy of the 1940 RADIO-TELEVISION REFERENCE ANNUAL to you FREE, if you will simply take advantage of RADIO & TELEVISION magazine's special subscription offer NOW. This offer is being made for a limited time only.

The 1940 RADIO-TELEVISION REFERENCE ANNUAL has 68 pages, large size 8½ x 11½, with over 170 illustrations. The contents of this book has never appeared before in handy book form. Its pages cover practically every branch of radio sound, public address, servicing, television, construction articles for advanced radio men and technicians, time and money-saving kinks, wrinkles, useful circuit information, "ham" transmitters and receivers, and a host of other data.

The Annuals have always been regarded as a standard reference work for every practical branch of radio operation and service. This 1940 edition ably sustains this reputation. Every radio man wants a copy of this valuable book. Just as this book will be of unquestionable value to you, so, too, will every monthly issue of RADIO & TELEVISION. This magazine brings you big value every month. It keeps you intelligently informed about new developments in radio and television. You want the news, want it fully but concisely, want it first—that is why you should read RADIO & TELEVISION regularly.

This very special offer is made for just one purpose—we want you as a regular subscriber. The Annual, whose contents appears at the right, is not sold, but a copy is FREE to you if you subscribe now.

SAME SIZE AS RADIO & TELEVISION



THIS COUPON BRINGS YOU THE ANNUAL

Read the summary of contents in this FREE BOOK!

THE 1940 RADIO-TELEVISION REFERENCE ANNUAL contains a collection of the best and most important articles. Covering as they do nearly every branch of radio, they form a handy reference works. In addition, many time and labor-saving kinks, circuits and wrinkles, tried and tested by practicing Servicemen, experimenters and radio fans have been included. **This book cannot be bought anywhere at any price.** Yet it is yours by merely subscribing. Use the convenient coupon below.

BEGINNER'S SIMPLE INEXPENSIVE CONSTRUCTION ARTICLES

Beginner's Breadboard Special - a 1-Tube High-Gain All-Wave Receiver- Wiring Pointers for Radio Beginners—A Watch Charm Size 1-Tube Set—Beginner's Simple Volt-Milliammeter—Making a 1-Tube Broadcast Loop Receiver—A.C.-D.C. Power Supply for Battery Portables—A 1-Tube Short-Waver with Band Coil Switching.

MORE ADVANCED SET CONSTRUCTION

The "High-Seas 4" Broadcast Lamp Radio—How to Build a 6-Tube 1.4-Volt Short-Wave Superhet for the "Ham" or Short-Wave Fan—Build the "Lunch Box 5" Super Set - a Broadcast Battery Portable—How to Build a Plug-Together 8 Tube Broadcast Set—The "7-in 4" All-Wave Radio for A.C. Operation—An Easily-Built 3-Tube Midget Broadcast Superheterodyne Receiver.

THE SERVICEMEN'S SECTION

Bass Tone Control—Simplified Variable Selectivity—Practical Servicing Pointers—Servicing Universal A.C.-D.C. Receivers—Killing the "Intermittent" Bug—A Service Shop A.C.-to D.C. Power Supply—Sideline Money for Servicemen—Adding A.V.C. to any Screen-Grid T.R.F. Receiver—Iron Particles in Speaker Air Gap

TEST INSTRUMENTS

A Useful Neon Lamp Tester—An Inexpensive Output Meter—Making Milliammeter Multipliers—Home-Made Frequency Modulator—The Busy Servicemen's V.T. Volt-Meter.

PUBLIC ADDRESS AND AMPLIFIERS

Build this Combination A.C.-D.C. Radio and Inter-Communicator—Speaker Placement In P.A. Work—The Design and Construction of an Inexpensive All-Push-Pull 10-Watt Amplifier—Obscure Sources of Hum in High-Gain Amplifiers—How to Build a High-Fidelity 5-Watt Versatile Amplifier.

"HAM" SECTION

Ultra-High Frequency Antennas—The Beginner's Low-Cost Xmitter- Modulator Meter—Phone Monitor—The Beginner's "Ham" Receiver—2½ Meter Acorn Transceiver.

TELEVISION

How to Build a 441 Line T.R.F. Television Receiver—Useful Notes on Television Antennas.

MISCELLANEOUS

Simple Photo-Cell Relay Set Up—Making a Burglar Alarm—How to Build A.C.-D.C. Capacity Relay—How to Make a Modern Radio Treasure Locator.

USEFUL KINKS, CIRCUITS AND WRINKLES

Making a Flexible Coupler—Two-Timing Chime—A Simple Portable Aerial—An Improvised Non Slip Screw-Driver. NOTE: The book contains numerous other useful Kinks, Circuits and Wrinkles, not listed here.

(approximately)
45 ARTICLES
(approximately)
170 ILLUSTRATIONS
68 BIG PAGES

RADIO & TELEVISION • 20 VESEY STREET • NEW YORK, N. Y.

Gentlemen: Enclosed you will find One Dollar for which enter my subscription to RADIO & TELEVISION Magazine for Eight Months. Send me ABSOLUTELY FREE and POSTPAID, my copy of 1940 RADIO-TELEVISION REFERENCE ANNUAL.

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RADIO & TELEVISION
20 VESEY STREET
NEW YORK, N. Y.

A Voice from Australia!

Editor,

I have been reading your magazine since Jan., 1938 (it was then *Short Wave & Television*) and think it is 100% F.B.

My first S.W. set was the "Switch Coil Two," described in the February 1938 issue of *Short Wave & Television* and I worked quite a lot of DX with this little set. I am now using the 6J7 and 6C5 with a 6K7 and 6B7 in a superhet.

There seems to be quite a lot of squabbling concerning Hams QLSing SWL's over there. I am happy to say that I have not found any trouble in getting replies from any of you Hams or SWL's over there, and I myself QSL 100% to any one who would like to drop a line. So what do you say, fellows?

R. H. ROCHE,
15 Tuscolum St.,
Potts Point, Sydney,
N.S.W., Australia.

Picture Contest for SWL's

Editor,

I have been reading your "F.B." magazine since it was called *Short Wave Craft* and have no reason to kick yet! I would like to see a picture contest for SWL's, similar to the one you are now conducting for Hams. Also how about some "radio fiction," such as you used to publish.

I QSL 100% with all Hams and SWL's; so let's have some mail coming my way.

CHARLES MOURMOURIS,
2121 So. Washington St.,
Denver, Colorado.

"Radio Kinks" Started Him in Radio!!

Editor,

Last August while visiting a magazine stand, I happened to glance at one of your RADIO & TELEVISION magazines. I had just begun radio several months ago. I was one of those fellows who had a hard time catching on to radio. I was looking for a magazine which had simple diagrams that I could read and understand. From the radio kink page I have built several gadgets like a code oscillator, a test socket and other things. I was surprised how much I used them. From simple diagrams like this I was surprised how fast I picked up the fundamentals and how to read large radio diagrams.

Glancing at the last page in your magazine I noticed the SWL exchange. I had just had some QSL cards printed and I had been QSLing amateurs. Seeing that I did not get many returns I quit this idea. Noticing the three names in your exchange at that time I thought I would send them my card. I did so and received 100% returns. I gradually picked up SWL stations and found that nineteen out of twenty are 100% QSLers. Within the two and a half months I have been doing this, I have received cards from twenty-nine states and seven countries. I have now started a club for all SWLs who QSL 100%. If anybody would be interested in swapping QSL cards, letters or joining my club, just drop me a line.

JOHN CHIPPS,
2719 Pershing Ave.,
San Bernardino, Calif.

ANSWERS TO PUZZLE DIAGRAM ON PAGE 558

1. No battery is shown in the microphone and filament supply circuit.
2. Secondary winding of transformer T1 not grounded.
3. No bypass condensers shown on either grid bias resistor.
4. The 6SF5 tube has no screen-grid, although one is shown in the diagram.
5. The 6N7 tube shells are not shown grounded, as they should be.
6. The plate and grid members of the 6SF5 and the 6N7 are coupled by a resistor instead of a condenser; also this creates a short-circuit across "B" plus and "B" minus, and would burn out the plate supply unit.
7. The second grid of the first 6N7 tube should be connected to the first grid, and not to the high voltage plate-supply wire.
8. Single filaments are shown in both 6N7 tubes, instead of double filaments.

Index to Advertisers

(While every precaution is taken to insure accuracy, we cannot guarantee against the possibility of an occasional change or omission in the preparation of this index.)

CONTINUOUS POPULARITY IS WON ON RESULTS

RCA-809

HIGH-MU TRIODE

D-C Plate Voltage
1000 volts maximum

Plate Input
100 watts maximum

Grid Driving Power
3.8 watts (approximate)

(Class C Telegraphy, ICAS Ratings)

$2.50 amateur net

MORE POWER / LESS $$ = *Economy*

Announced 3 years ago to the month—a winner in the 9th ARRL SS Contest—most used transmitting triode by winners of the 10th ARRL SS Contest—RCA-809 continues to ride the tide of fame.

Employed for amateur use under the ICAS Ratings, the RCA-809, priced at only $2.50 net, provides you with a tube that competes, with ample safety factor, with the "big fellows". For example, one 809 in class C telegraph service will handle 100 watts input. Two 809's in class B modulator service will modulate 100% an r-f stage up to 290 watts input! The tube has a high amplification factor of 50. (It requires, therefore, a bias of only −10 volts at a d-c plate voltage of 1,000 volts in class B modulator service.) Furthermore, the tube will operate at its maximum rating all the way up to 60 Mc and at reduced ratings up to 120 Mc!

Other features include the new, low-loss Micanol base, the largest anode in its class for real durability under temporary overloads, special ceramic insulation—the same as used in tubes selling for many times the price of the 809—and the famous RCA thoriated-tungsten filament. And don't forget that the filament voltage rating is 6.3 volts—a feature not to be overlooked in emergency work for efficient transmitter operation direct from a storage battery.

LOW-MU RCA-1623. *Similar to the 809, the RCA-1623 has an amplification factor of only 20. Like the 809, it is excellent for use as an r-f power amplifier, frequency doubler, class B modulator, or oscillator. Unaffected by ordinary plate-load variations and grid-excitation changes, this tube is an extremely stable oscillator. It performs smoothly at wavelengths as low as 2½ meters!*

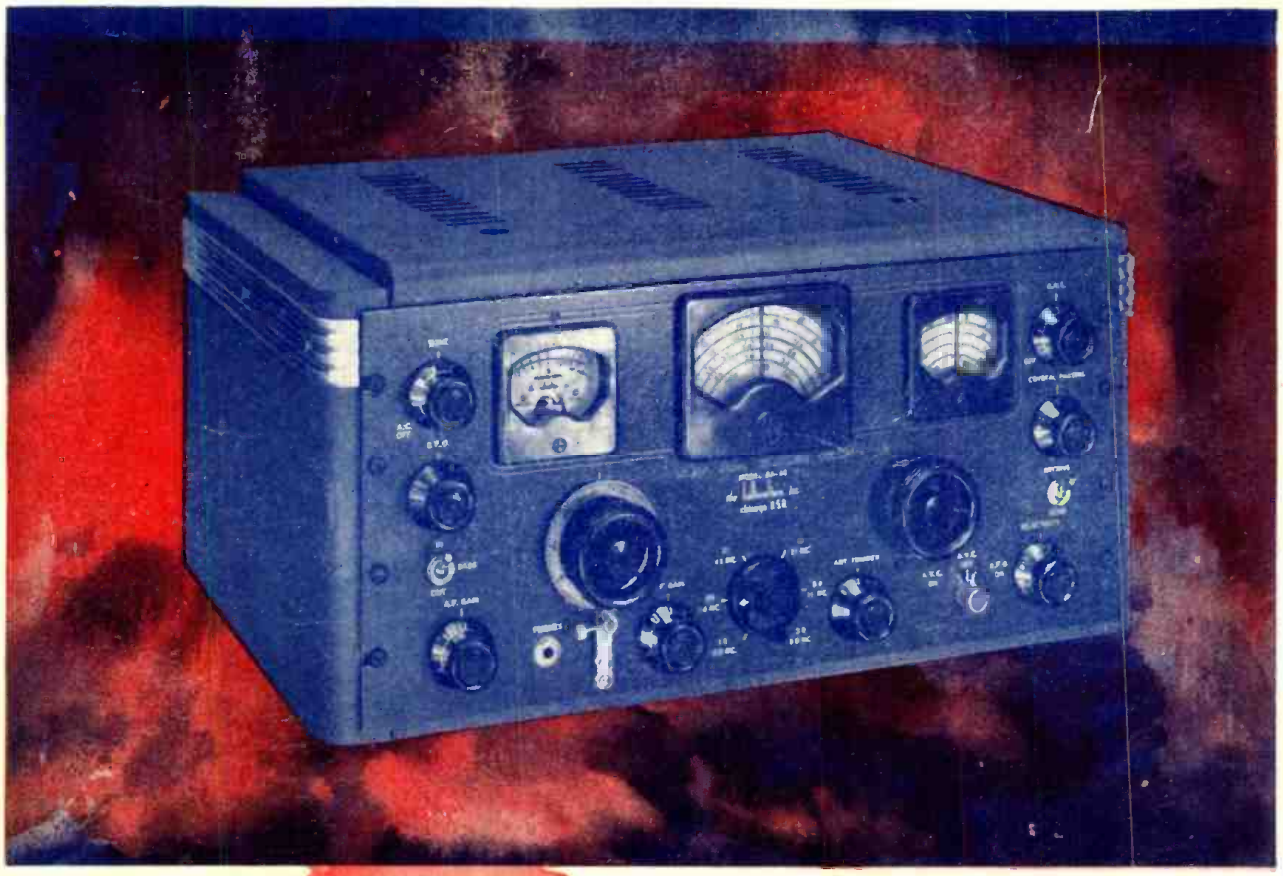
RCA-1623 . . . AMATEUR NET PRICE, $2.50

RCA

Transmitting Tubes

PROVED IN COMMUNICATION'S MOST EXACTING APPLICATIONS

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



ONCE again Hallicrafters lead the amateur communications field with quality and performance in one of the greatest values ever offered. The New 1941 15-Tube Super Skyrider, "the best selling quality communications receiver," gives you *all* the features, even the ones usually found on higher priced receivers, including electrical band-spread over entire range of the receiver.

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